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About The Book

This book comprises of two parts, Health Management and Disease Management. While each book can stand alone, for the Lifestyle Medicine student, taken together, they form a good treatise on the concept of “from Illness to Wellness”

Part 1 of the Book deals with Health & Wellness Management, & covers not only individual health but also, Population Health, Occupational Health, Corporate Health Environmental Health, & also Alternate Medical Therapies

Part 2 of the Book, deals with Disease Management & covers the whole range of ailments from communicable & infectious diseases, to the more modern Degenerative & Non Communicable Diseases.

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Part I: Health Management

Introduction to Health Management

The health and lifestyle series has been written for the Preventive and Promotive health care student with the aim of making available knowledge of the various aspects of good health. The biggest killer in the world today, accounting for over 80% deaths worldwide, is not war, infection or natural calamities, or even infectious disease, the biggest killer is modern lifestyle.

Lifestyle factors such as lack of physical activity, obesity, a high fat diet, stress and tension, alcohol and smoking innocently manifest themselves as High Blood Pressure, Diabetes, Hypercholesterol and other ailments, and then with out warning, strike fatally as Heart Attacks (which accounts for approximately 60% of deaths) and Cancer (which accounts for 20% deaths). Other lifestyle killers include Accidents and even AIDS, which results due to lack of safety compliances.

This book is aimed at enhancing our understanding of modern degenerative disease and learning about their lifestyle connection.

The importance of **Health Management** has been acclaimed worldwide. Health is an invaluable asset for personal, social and national advancement and progress.

In this book we combine two important aspects of health, namely the lifecycle health of an individual from birth to death and the health of community as a whole.

This book brings forward the complexity of human development that grows out of the interaction between the changing person and his changing environment, and the health impact throughout his entire lifespan. On the other hand, we also look at the health of the community, the relationship between the community and its environment, and the effect that the community has on the environment.

Finally, we conclude this part of the book with the various forms of medicine that contribute towards health for all, under the alternative medicine chapter.

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CHAPTER 1:

HEALTH, DIMENSIONS & SCOPE

DIMENSIONS OF HEALTH

It is now universally known that health is multidimensional. The WHO definition envisages three specific dimensions, the physical, the mental and the social. Many more may be cited, like the spiritual, emotional, vocational and the political dimensions. As the knowledge base grows, the list just keeps on expanding. Although these dimensions function and interact with one another, each has its own nature, and for descriptive purposes are treated separately.

I. PHYSICAL DIMENSION

The physical dimension of health is probably the easiest to understand. The state of physical health implies the notion of “perfect functioning” of the body. It conceptualizes health biologically as a state in which every cell and every organ is functioning at optimum capacity and in perfect harmony with the rest of the body. However, the term “optimum” is not easily definable.

The signs of physical health in an individual are: “a good complexion, a clean skin, bright eyes, lustrous hair with a body with firm flesh, not too fat, a sweet breath, a good appetite, sound sleep, regular activity of bowels and bladder and smooth, easy, coordinated bodily movements. All the organs of the body are of unexceptional size and function normally; all the special senses are intact; the resting pulse rate, blood pressure and exercise tolerance are all within the range of “normality” for the individual’s age and sex. In the young and growing individual there is a steady gain in weight and in the future this weight remains more or less constant at a point about 5 lbs (2.3 kg) more or less than the individual’s weight at the age of 25 years.

This state of normality has fairly wide limits. These limits are set by observation of a large number of “normal” people, who are free from evident disease.

Modern medicine has evolved tools and techniques which may be used in various combinations for the assessment of physical health. They include,

- Self assessment of overall health
- Inquiry into symptoms of ill health and risk factors
- Inquire into medications
- Inquire into levels of activity
- Inquire into use of medical services (e.g. the number of visits to a physician, number of hospitalizations) in the recent past

- Standardized questionnaires for diseases
- Clinical examination
- Nutrition and dietary assessment
- Biochemical and laboratory investigations

At the community level, the state of health may be assessed by such indicators as death rate, infant mortality rate and expectation of life. Ideally, each piece of information should be individually useful and when combined should permit a more complete health profile of individuals and communities

II. MENTAL DIMENSION

Mental health is not merely the absence of mental illness. Good mental health is the ability to respond to the many varied experiences of life with flexibility and a sense of purpose. More recently, mental health has been defined as “a state of balance between the individual and the surrounding world, a state of harmony between oneself and others, a coexistence between the realities of the self and that of other people and that of the environment”.

A few short decades ago, the mind and body were considered independent entities. Recently, however, researchers have discovered that psychological factors can induce all kinds of illness, not simply mental ones. They include conditions such as essential hypertension, peptic ulcer and bronchial asthma. Some major mental illnesses such as depression and schizophrenia have a biological component.

Although mental health is an essential component of health, the scientific foundations of mental health are not yet conclusively clear. Therefore we do not have precise tools to assess the state of mental health unlike physical health.

Assessment of mental health at the population level may be made by administering mental status questionnaires by trained interviewers. The most commonly used questionnaires seek to determine the presence and extent of “organic disease” and of symptoms that could indicate psychiatric disorder; some personal assessment of mental well-being is also made.

One of the keys to good health is a positive attitude. Unfortunately, our knowledge about mental health is yet far from complete

III. SOCIAL DIMENSION

Social well-being implies harmony and integration within the individual, between each individual and other member of society and between individuals and the world in which they live. It has been defined as the “quantity and quality of an individual’s interpersonal ties and the extent of involvement with the community”.

The social dimension of health includes the levels of social skills, social functioning and the ability to see on self as a member of a larger society. In general, social health takes into account that every individual is part of a family and of the wider community and focuses on social and economic conditions and well-being of the “whole person” in the context of his social network. Social health is rooted in “positive material environment” (focusing on

financial and residential matters), and “positive human environment” which is concerned with the social network of the individual

IV. SPIRITUAL DIMENSION

Proponents of holistic health believe that the time has come to give serious consideration to the spiritual dimension and to the role this plays in health and disease. Spiritual health in this context refers to that part of the individual which reaches out and strives for meaning and purpose in life. It is the intangible “something” that transcends physiology and psychology. As a relatively new concept, it seems to defy concrete definition. It includes integrity, principles and ethics, the purpose in life, commitment to some higher being and belief in concepts that are not subject to a “state of the art” explanation

V. EMOTIONAL DIMENSION

Historically the mental and emotional dimensions have been seen as one element or as two closely related elements. However, as more research becomes available a definite difference is emerging. Mental health can be seen as “knowing” or “cognition” while emotional health relates to “feeling”. Experts in psychobiology have been relatively successful in isolating these two separate dimensions. With this new data, the mental and emotional aspects of humanness may have to be viewed as two separate dimensions of human health

VI. VOCATIONAL DIMENSION

The vocational aspect of life is a new dimension. It is part of human existence. When work is fully adapted to human goals, capacities and limitations, work often plays a role in promoting both physical and mental health. Physical work is usually associated with an improvement in physical capacity, while goal achievement and self-realization in work are a source of satisfaction and enhanced self-esteem.

The importance of this dimension is apparent when individuals suddenly lose their jobs or are faced with mandatory retirement. For many individuals, the vocational dimension may be merely a source of income. To others, this dimension represents the culmination of the efforts of other dimensions as they function together to produce what the individual considers life “success”

VII. OTHERS

A few other dimensions have also been suggested such as,

- Philosophical dimension
- Cultural dimension
- Socioeconomic dimension
- Environmental dimension
- Educational dimension
- Nutritional dimension

- Curative dimension
- Preventive dimension

A glance at the above dimensions shows that there are many “non-medical” dimension of health, e.g., social, cultural, educational, etc. These symbolize a huge range of factor to which other sectors besides medical must contribute if all people are indeed to attain a level of health that will permit them to lead a socially and economically productive life.

POSITIVE HEALTH

Health in the broad sense of the world does not merely mean the absence of disease or provision of diagnostic, curative and preventive services. It also includes as embodies in the WHO definition, a state of physical, mental and social well-being. The harmonious balance of this state of the human individual integrated into his environment constitutes health, as defined by WHO.

The state of positive health implies the notion of “perfect functioning” of the body and mind. It conceptualize health biologically, as a state in which every cell and every organ is functioning at optimum capacity and in perfect harmony with the rest of the body; psychologically, as a state in which the individual feels a sense of perfect well-being and of mastery over his environment, and socially, as a state in which the individual’s capacities for participation in the social system are optimal. These ideas were widely ventilated some years ago but now appear slightly ridiculous.

Recently, a broader concept of health has been emerging – that of improving the quality of life of which health is an essential component. This at once brings to focus that positive health depends not only on medical action, but on all the other economic, cultural and social factors operating in the community.

An earlier approach to positive health conceptualizes health not as an ideal state, but as a biologically “normal” state, based on statistical averages. For example, a new-born baby in India weighs 2.8 kg on an average compared to 3.5 kg in the developed countries, and yet compares favourably in health. The height and weight standards vary from country to country, and also between socio-economic groups. Thus health is a relative concept and health standards vary among cultures, social classes and age-groups. This implies that health in any society should be defined in terms of prevailing ecological conditions. That is, instead of setting universal health standards, each country will decide on its own norms for a given set of prevailing conditions and then look into ways for all to achieve that level

CONCEPT OF WELLBEING

The WHO definition of health introduces the concept of “well-being”. The question then arises: what is meant by wellbeing? In point of fact, there is no satisfactory definition of the term “wellbeing”.

Recently, psychologists have pointed out that the “wellbeing” of an individual or group of individuals has objective and subjective components. The objective components relate to such concerns as are generally known by the term “standard of living” or “level of living”. The subjective component of well-being (as expressed by each individual) is referred to as “quality of life”.

Let us consider these concepts separately.

1. Standard of living

The term “standard of living” refers to the usual scale of our expenditure, the goods we consume and the services we enjoy. It includes the level of education, employment status, food, dress, house, amusements and comforts of modern living.

A similar definition, corresponding to the above, was proposed by WHO. Income and occupation, standards of housing, sanitation and nutrition, the level of provision of health, educational, recreational and other services may all be used individually as measures of socio-economic status, and collectively as an index of the ” standard of living”.

There are vast inequalities in the standards of living of the people in different countries of the world. The extent of these differences are usually measured through the comparison of per capita GNP on which the standard of living primarily depends.

The parallel term for standard of living used in United Nations documents is “level of living”. It consists of nine components,

- Health
- Food consumption
- Education
- Occupation
- Working conditions
- Housing
- Social security
- Clothing
- Recreation and leisure and human rights.

These objective characteristics are believed to influence human wellbeing. It is considered that health is the most important component of the level of living because its impairment always means impairments of the level of living.

2. Quality of life

Much has been said and written on the quality of life in recent years. It is the “subjective” component of wellbeing. “Quality of life” was defined by WHO as, “the condition of life resulting from the combination of the effects of the complete range of factors such as those determining health, happiness (including comfort in the physical environment and a satisfying occupation), education, social and intellectual attainments, freedom of action, justice and freedom of expression”.

A recent definition of quality of life is as follows, “a composite measure of physical, mental and social wellbeing as perceived by each individual or by group of individual’s that is to say, happiness, satisfaction and gratification as it is experienced in such life concerns as health, marriage, family work, financial situations, educational opportunities, self-esteem, creativity, belongingness, and trust in others.”

Thus, a distinction is drawn between the concept of “level of living” consisting of objective criteria and of “quality of life” comprising the individual’s own subjective evaluation of these. The quality of life can be evaluated by assessing a person’s subjective feelings of happiness or unhappiness about the various life concerns.

People are now demanding a better quality of life. Therefore, governments all over the world are increasingly concerned about improving the quality of life of their people by reducing morbidity and mortality, providing primary health care ad enhancing physical, mental and social well-being. It is conceded that a rise in the standard of living of the people is not enough to achieve satisfaction or happiness. Improvement of quality of life must also be added, and this means increased emphasis on social policy and on reformulation of social goals to make life more livable for all those who survive.

As things stand at present, this important concept of quality of life is difficult to define and even more difficult to measure. Various attempts have been made to reach one composite index from a number of health indicators. The “**physical quality of life index**” (**PQLI**) is one such index. It consolidates three indicators, viz. infant mortality, life expectancy at age one, and literacy. These three components measure the results rather than inputs. As such they lend themselves to international and national comparison.

For each component, the performance of individual countries is placed on a scale of 0 to 100, where 0 represents an absolutely defined “worst” performance, and 100 represents an absolutely defined “best” performance. The composite index is calculated by averaging the three indicators, giving equal weight to each of them. The resulting PQLI thus also is scaled 0 to 100.

It may be mentioned that PQLI has not taken per capita GNP into consideration, showing thereby that “money is not everything”. For example, the oil-rich countries of Middle East with high per capita incomes have in fact not very high PQLIs. At the other extreme. Sri Lanka and Kerala state in India have low per capita incomes with high PQLIs. In short, PQLI does not measure economic growth; it measures the results of social, economic and political policies. It is intended to complement, not replace GNP. The ultimate objective is to attain a PQLI of 100

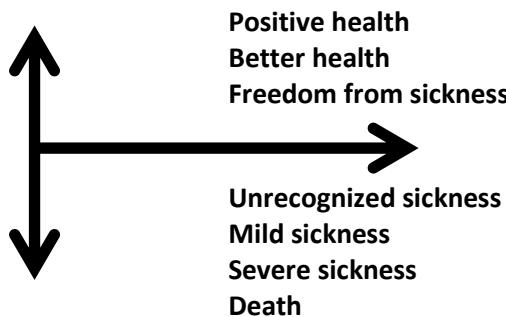
SPECTRUM OF HEALTH

Health and disease lie along a continuum, and there is no single cut-off point. The lowest point on the health-disease spectrum is death and the highest point corresponds to the WHO definition of positive health. It is thus obvious that health fluctuates within a range of optimum wellbeing to various levels of dysfunction, including the state of total dysfunction, namely death. The transition from optimum health to illhealth is often gradual, and where one state ends and the other begins is a matter of judgment.

The spectral concept of health emphasizes that the health of an individual is not static, it is a dynamic phenomenon and a process of continuous change, subject to frequent subtle

variations. That is, a person may function at maximum levels of health today, and diminished levels of health tomorrow. It implies that health is a state not to be attained once and for all, but ever to be renewed. There are degrees or “levels of health” as there are degrees or severity of illness.

The Health Sickness Spectrum



DETERMINANTS OF HEALTH

Health is multifactorial. The factors which influence health lie both within the individual and externally in the society in which he or she lives. It is a truism to say that what man is and to what diseases he may fall victim depends on a combination of two sets of factors – his genetic factors and the environmental factors to which he is exposed. These factors interact and these interactions may be health-promoting or deleterious. Thus, conceptionally, the health of individuals and whole communities may be considered to be the result of many interactions. Only a brief indication of the more important determinants or variables can be given here; they are:

- Heredity
- Environment
- Life-style
- Socio-economic conditions
- Health and family welfare services
- Other factors

1. Heredity

The physical and mental traits of every human being are to some extent determined by the nature of his genes at the moment of conception. The genetic make-up is unique in that it cannot be altered after conception. A number of diseases are now known to be of genetic origin, e.g., chromosomal anomalies, errors of metabolism, mental retardation, some types of diabetes, etc. The state of health, therefore depends partly on the genetic constitution of man.

Thus, from the genetic stand-point, health may be defined as that “state of the individual which is based upon the absence from the genetic constitution of such genes as correspond to

characters that takes the form of serious defect and derangement and to the absence of any aberration in respect of the total amount of chromosome material in the karyotype or stated in positive terms, from the presence in the genetic constitution of the genes that correspond to the normal characterization and to the presence of a normal karyotype”.

The “positive health” advocated by WHO implies that a person should be able to express as completely as possible the potentialities of his genetic heritage. This is possible only when the person is allowed to live in healthy relationship with his environment – an environment that transforms genetic potentialities into phenotypic realities.

2. Environment

It was Hippocrates who first related disease to environment, e.g., climate, water, air, etc. Centuries later, Pettenkofer in Germany revived the concept of disease-environment association.

Environment is classified as “Internal” and “external”. The internal environment of man pertains to “each and every component part, even tissue, organ and organ-system and their harmonious functioning within the system”. Internal environment is the domain of internal medicine. The external or macro-environment consists of those things to which man is exposed after conception. It is defined as “all that which is external to the individual human host”. It can be divided into physical, biological and psychosocial components, any or all of which can affect the health of man and his susceptibility to illness. Some epidemiologists have used the term “microenvironment” (or domestic environment) to personal environment which includes the individual’s way of living and lifestyle, e.g., eating habits, other personal habits (e.g., smoking or drinking), use of drugs, etc. It is also customary to speak about occupational environment, socioeconomic environment and moral environment.

It is an established fact that environment has a direct impact on the physical, mental and social well-being of those living in it. the environmental factors range from housing, water supply, psychosocial stress and family structure through social and economic support system, to the organization of health and social welfare services in the community.

The environmental components (physical, biological and psychological) are not water-tight compartments. They are so inextricably linked with one another that it is realistic and fruitful to view the human environment in toto when we consider the influence of environment on the health status of the population. If the environment is favourable to the individual, he can make full use of his physical and mental capabilities. Protection and promotion of family and environmental health is one of the major issues in the world today.

3. Lifestyle

The term “lifestyle” is rather a diffuse concept often used to denote “the way people live”, reflecting a whole range of social values, attitudes and activities. It is composed of cultural and behavioural patterns and lifelong personal habits (e.g., smoking alcoholism) that have developed through processes of socialization. Lifestyles are learnt through social interaction with parents, peer groups, friends and siblings and through school and mass media.

Health requires the promotion of health lifestyle. In the last 20 years, a considerable body of evidence has accumulated which indicates that there is an association between health and lifestyle of individuals. Many current-day health problems especially in the developed

countries (e.g., coronary heart disease, obesity, lung cancer, drug addiction) are associated with lifestyle changes. In developing countries such as India where traditional lifestyles still persist, risks of illness and death are connected with lack of sanitation, poor nutrition, personal hygiene, elementary human habits, customs and cultural patterns.

It may be noted that not all lifestyle factors are harmful. There are many that can actually promote health. Examples include adequate nutrition, enough sleep, sufficient physical activity, etc. in short, the achievement of optimum health demands adoption of healthy lifestyles. Health is both a consequence of an individual's lifestyle a factor in determining it.

4. Socio-economic conditions

Socioeconomic conditions have long been known to influence human health. For the majority of the world's people, health status is determined primarily by their level of socioeconomic development, e.g., per capita GNP, education, nutrition, employment, housing, the political system of the country, etc. Those of major importance are:

- **Economic status:** The per capita GNP is the most widely accepted measures of general economic performance. There can be no doubt that in many developing countries, it is the economic progress that has been the major factor in reducing morbidity, increasing life expectancy and improving the quality of life. The economic status determines the purchasing power, standard of living, quality of life, family size and the pattern of disease and deviant behaviour in the community. It is also an important factor in seeking health care. Ironically, affluence may also be a contributory cause of illness as exemplified by the high rates of coronary heart disease, diabetes and obesity in the upper socioeconomic groups.
- **Education:** A second major factor influencing health status is education (especially female education). The world map of illiteracy closely coincides with the maps of poverty, malnutrition, illhealth, high infant and child mortality rates. Studies indicate that education, to some extent, compensates the effects poverty on health, irrespective of the availability of health facilities. The small state of Kerala in India is a striking example. Kerala has an estimated infant mortality rate of 17 compared to 80 for all-India in 1990. A major factor in the low infant mortality of Kerala is its highest female literacy rate of 86.93 per cent compared to 39.42 per cent for all-India.
- **Occupation:** The very state of being employed in productive work promotes health, because the unemployed usually show a higher loss of income, and status. It can cause psychological and social damage.
- **Political system:** Health is also related to the country's political system. Often the main obstacles to the implementation of health technologies are not technical, but rather political. Decisions concerning resource allocation, manpower policy, choice of technology and the degree to which health services are made available and accessible to different segments of the society are examples of the manner in which the political commitment. System can shape community health services. The percentage of GNP spent on health is a quantitative indicator of political commitment. Available information shows that India spends about 3 per cent of its GNP on health and family welfare. To achieve the goal of health for all, WHO has set the target of at least 5 per cent expenditure on each country's GNP on health care. What is needed is political commitment and leadership which is oriented towards social development, and not merely economic development. If

poor health patterns are to be changed, then changes must be made in the entire sociopolitical system in any given community. Social, economic and political action are required to eliminate health hazards in people's working and living environments.

5. Health services

The term health and family welfare services cover a wide spectrum of personal and community services for treatment of disease, prevention of illness and promotion of health. The purpose of health services is to improve the health status of population. For example, immunization of children can influence the incidence prevalence of particular diseases. Provision of safe water can prevent mortality and morbidity from water-borne diseases. The care of pregnant women and children would contribute to the reduction of maternal and child morbidity and mortality. To be effective, the health services must reach the social periphery, equitably distributed, accessible at a cost the country and community can afford and socially acceptable. All these are ingredients of what is now termed "primary health care", which is seen as the way to better health.

Health services can also be seen as essential for social and economic development. It is well to remind ourselves that "health care does not produce good health". Whereas, there is a strong correlation between GNP and expectation of life at birth, there is no significant correlation between medical density and expectation of life at birth. The most we can expect from an effective health service is good care. The epidemiological perspective emphasizes that health service, no matter how technically elegant or cost-effective, are ultimately pertinent only if they improve health.

6. Other factors

Other contributions to the health of populations derive from systems outside the formal health care system, i.e., health related systems (e.g., food and agriculture, education, industry, social welfare, rural development) as well as adoption of policies in the economic and social fields that would assist in raising the standards of living. This would include employment opportunities, increased wages, prepaid medical programmes and family support systems.

In short, medicine is not the sole contributor to the health and wellbeing of population. The potential of intersectoral contributions to the health of communities is increasingly recognized

INDICATORS OF HEALTH

A question that is often raised is. How healthy is a given community? Indicators are required not only to measure the health status of a community, but also to compare the health status of one country with that of another, for assessment of health care needs; for allocation of scarce resources; and for monitoring and evaluation of health services, activities and programmes. Indicators help to measure the extent to which the objectives and targets of a programme are being attained.

As the name suggests, indicators are only an indication of a given situation or a reflection of that situation. In WHO's guidelines for health programme evaluation they are defined as variables which help to measure changes. Often they are used particularly when these changes cannot be measured directly, as for example health or nutritional status. If measured sequentially over time, they can indicate direction and speed of change and serve to compare different areas or groups of people at the same moment in time.

There has been some confusion over terminology, health indicator as compared to health index (plural: indices or indexes). It has been suggested that in relation to health trends, the term indicator is to be preferred to index, whereas health index is generally considered to be an amalgamation of health indicators.

Characteristics of indicators

Indicators have been given scientific respectability; for example ideal indicators,

- Should be valid, i.e., they should actually measure what they are supposed to measure
- Should be reliable and objective, i.e., the answers should be the same if measured by different people in similar circumstances
- Should be sensitive, i.e., they should be sensitive to changes in the situation concerned, and
- Should be specific, i.e., they should reflect changes only in the situation concerned.

But in real life there are few indicators that comply with all these criteria. Measurement of health is far from simple. No existing definition (including the WHO definition) contains criteria for measuring health. This is because health, like happiness, cannot be defined in exact measurable terms. Its presence or absence is so largely a matter of subjective judgement. Since we have problems in defining health, we also have problems in measuring health and the question is largely unresolved. Therefore, measurements of health have been framed in terms of illness or lack of health.

Further, health is multidimensional, and each dimension is influenced by numerous factors, some known and many unknown. This means we must measure health multidimensionally. Thus the subject of health measurement is a complicated one even for professionals. Our understanding of health therefore cannot be in terms of single indicator; it must be conceived in terms of a profile, employing many indicators, which may be classified as:

- Mortality indicators
- Morbidity indicators
- Disability rates
- Nutritional status indicators
- Health care delivery indicators
- Utilization rates
- Indicators of social and mental health
- Environmental indicators
- Socio-economic indicators
- Health policy indicators

- Indicators of quality of life
- Other indicators

1. Mortality indicators

a) Crude death rate: This is considered a fair indicator of the comparative health of the people. It is defined as the number of deaths per 1000 population per year in a given community. It indicates the rate at which people are dying. Strictly speaking, health should not be measured by the number of deaths that occur in a community. But in many countries, the crude death rate is the only available indicator of health. When used for international comparison, the usefulness of the crude death rate is restricted because it is influenced by the age-sex composition of the population. Although not a perfect measure of health status, a decrease in death rate provides a good tool for assessing the overall health improvement in a population. Reducing the number of deaths in the population is an obvious goal of medicine and health care, and success or failure to do so is a measure of a nation's commitment to better health.

b) Expectation of life: Life expectancy at birth is "the average number of years that will be lived by those born alive into a population if the current age-specific mortality rates persist". Life expectancy at birth is highly influenced by the infant mortality rate where that is high. Life expectancy at the age of 1 excludes the influence of infant mortality, and life expectancy at the age of 5 excludes the influence of child mortality. Life expectancy at birth is used most frequently. It is estimated for both sexes separately. An increase in the expectation of life is regarded, inferentially, as an improvement in health status. Life expectancy is a good indicator of socioeconomic development in general. As an indicator of long-term survival, it can be considered as a positive health indicator. It has been adopted as a global health indicator. A minimum life expectancy at birth of 60 years is the goal of Health for all by 2000AD.

c) Infant mortality rate: Infant mortality rate is the ratio of deaths under 1 year of age in a given year to the total number of live births in the same year; usually expressed as a rate per 1000 live births. It is one of the most universally accepted indicators of health status not only of infants, but also of whole populations and of the socioeconomic conditions under which they live. In addition, the infant mortality rate is a sensitive indicator of the availability, utilization and effectiveness of health care, particularly perinatal care. The global strategy of health for all has suggested an infant mortality rate of not more than 50 per 1000 live births by 2000 AD.

d) Child mortality rate: Another indicator related to the overall health status is the early childhood (1-4 years) mortality rate. It is defined as the number of deaths at ages 1-4 years in a given years, per 1000 children in that age group at the mid-point of the year concerned. It thus excludes infant mortality. Apart from its correlation with inadequate MCH services, it is also related to insufficient nutrition, low coverage by immunization and adverse environmental exposure and other exogenous agents. Whereas the IMR may be more than 10 times higher in the least developed countries than in the developed countries, the child mortality rate may be as much as 250 times higher. This indicates the magnitude of the gap and the room for improvement.

e) Under-5 proportionate mortality rate: It is the proportion of total deaths occurring in the under-5 age group. This rate can be used to reflect both infant and child mortality rates. In

communities with poor hygiene, the proportion may exceed 60 per cent. In some European countries, the proportion is less than 2 per cent. High rate reflects high birth rates, high child mortality rates and shorter life expectancy.

f) Maternal (puerperal) mortality rate: Maternal (puerperal) mortality accounts for the greatest proportion of deaths among women of reproductive age in most of the developing world, although its importance is not always evident from official statistics. There are enormous variations in maternal rate according to country's level of socioeconomic status.

g) Disease-specific mortality: Mortality rates can be computed for specific disease. As countries begin to extricate themselves from the burden of communicable diseases, a number of other indicators such as deaths from cancer, cardiovascular diseases, accidents, diabetes, etc have emerged as measures of specific disease problems.

h) Proportional mortality rate: The simplest measures of estimating the burden of a disease in the community is proportional mortality rate, i.e., the proportion of all deaths currently attributed to it. For example, coronary heart disease is the cause of 25 to 30 per cent of all deaths in most western countries. The proportional mortality rate from communicable disease has been suggested as a useful health status indicator; it indicates the magnitude of preventable mortality. Mortality indicators represent the traditional measures of health status. Even today they are probably the most often used indirect indicators of health. As infectious diseases have been brought under control, mortality rates have declined to very low levels in many countries. Consequently mortality indicators are losing their sensitivity as health indicators in developed countries. However, mortality indicators continue to be used as the starting point in health status evaluation.

2. Morbidity indicators

To describe health in terms of mortality rates only is misleading. This is because, mortality indicators do not reveal the burden of illhealth in a community, as for example mental illness and rheumatoid arthritis. Therefore morbidity indicators are used to supplement mortality data to describe the health status of a population. Morbidity statistics have also their own drawback; they tend to overlook a large number of conditions which are sub clinical or in apparent, that is, the hidden part of the iceberg of disease.

The following morbidity rates are used for assessing illhealth in the community.

- Incidence and prevalence
- Notification rates
- Attendance rates at out-patient departments, health centers, etc.
- Admission, readmission and discharge rates
- Duration of stay in hospital and
- Spells of sickness or absence from work or school.

3. Disability rates

Since death rates have not changed markedly in recent years, despite massive health expenditures, disability rates related to illness and injury have come into use to supplement mortality and morbidity indicators. The disability rates are based on the premise or notion that health implies a full range of daily activities. The commonly used disability rates fall into two groups: (a) Event-type indicators and (b) person-type indicators.

- **Event-type indicators:**

- Number of days of restricted activity
- Bed disability days
- Work-loss days (or school loss days) within a specified period

- **Person-type indicators:**

- Limitation of mobility: For example, confined to bed, confined to the house, special aid in getting around either inside or outside the house.
- Limitation of activity For example, limitation to perform the basic activities of daily living (ADL)-e.g., eating, washing, dressing, going to toilet, moving about, etc; limitation in major activity, e.g., ability to work at a job, ability to housework, etc.

Sullivan's Index: This index (expectation of life free of disability) is computed by subtracting from the life expectancy the probable duration of bed disability and inability to perform major activities, according to cross-sectional data from the population surveys. For example, the expectation of life at birth for all persons in the USA in 1965 was 70.2 years, and the approximate expectation of life free of disability worked out to be 64.9 years. Sullivan's index is considered one of the most advanced indicators currently available.

4. Nutritional status indicators

Nutritional status is a positive health indicator. Three nutritional status indicators are considered important as indicators of health status. They are.

- Anthropometric measurements of preschool children, e.g., weight and height, mid-arm circumference;
- Heights (and sometimes weights) of children at school entry; and
- Prevalence of low birth weight (less than 2.5kg)

5. Health care delivery indicators

The frequently used indicators of health care delivery are:

- Doctor-population ratio
- Doctor-nurse ratio

- Population-bed ratio
- Population per health / subcentre
- Population per traditional birth attendant

These indicators reflect the equity of distribution of health resources in different parts of the country, and of the provision of health care.

6. Utilization rates

In order to obtain additional information on health status, the extent of use of health services is often investigated. Utilization of services – or actual coverage – is expressed as the proportion of people in need of a service who actually receive it in a given period, usually a year. It is argued that utilization rates give some indication of the care needed by a population, and therefore the health status of the population. In other words, a relationship exists between utilization of health care services and health needs and status. Health care utilization is also affected by factors such as availability and accessibility of health services and the attitude of an individual towards his health and the health care system. A few examples of utilization rates are cited below;

- Proportion of infants who are “fully immunized” against the 6 EPI diseases
- Proportion of pregnant women who receive antenatal care, or have their deliveries supervised by a trained birth attendant.
- Percentage of the population using the various methods of family planning.
- Bed-occupancy rate (i.e., average daily in-patient census/average number of beds).
- Average length of stay (i.e., days of care rendered/discharges).
- Bed turn-over ratio (i.e., discharges/average beds).

The above list is neither exhaustive nor all-inclusive. The list can be expanded depending upon the services provided. These indicators direct attention away from the biological aspects of disease in a population towards the discharge of social responsibility for the organization delivery of health care services.

7. Indicators of social and mental health

As long as valid positive indicators of social and mental health are scarce, it is necessary to use indirect measures, viz. indicators of social and mental pathology. These include suicide, homicide, other acts of violence and other crime; road traffic accidents, juvenile delinquency; alcohol and drug abuse; smoking; consumption of tranquilizers; obesity, etc. To these may be added family violence, battered-baby and battered-wife syndrome and neglected and abandoned youth in the neighbourhood. These social indicators provide a guide to social action for improving the health of the people.

8. Environmental indicators

Environmental indicators reflect the quality of physical and biological environment in which diseases occur and in which the people live. They include indicators relating to pollution of air and water, radiation, solid wastes, noise, exposure to toxic substances in food or drink. Among these, the most useful indicators are those measuring the proportion of population having access to safe water and sanitation facilities, as for example, percentage of households with safe water in the home or within 15 minutes walking distance from a water stand point or protected well; adequate sanitary facilities in the home or immediate vicinity.

9. Socioeconomic indicators

These indicators do not directly measures health. Nevertheless, they are of great importance in the interpretation of the indicators of health care. These include:

- Rate of population increase
- Per capita GNP
- Level of unemployment
- Dependency ratio
- Literacy rates, especially female literacy rates
- Family size
- Housing: the number of persons per room
- Per capita “calorie” availability

10. Health policy indicators

The single most important indicator of political commitment is “allocation of adequate resources”. The relevant indicators are: (i) proportion of GNP spent on health services (ii) proportion of GNP spent on health-related activities (including water supply and sanitation, housing and nutrition, community development) and (iii) proportion of total health resources devoted to primary health care.

11. Indicators of quality of life

Increasingly, mortality and morbidity data have been questioned as to whether they fully reflect the health status of a population. The previous emphasis on using increased life expectancy as an indicator of health is no longer considered adequate, especially in developed countries, and attention has shifted more toward concern about the quality of life enjoyed by individuals and communities. Quality of life is difficult to define and even more difficult to measure. Various attempts have been made to reach one composite index from a number of health indicators. The physical quality of life index is one such index. It consolidates three indicators, viz. infant mortality, life expectancy at age one, and literacy. Obviously more work is needed to develop indicators of quality of life.

12. Other indicators

- Social indicators: Social indicators, as defined by the United Nations Statistical Office, have been divided into 12 categories: population; family formation, families and household; learning and educational services; earning activities; distribution of income, consumption, and accumulation; social security and welfare services; health services and

nutrition; housing and its environment; public order and safety; time use; leisure and culture; social stratification and mobility.

- Basic needs indicators: Basic needs indicators are used by ILO. Those mentioned in “Basic needs performance” include calories consumption; access to water; life expectancy; deaths due to disease; illiteracy, doctors and nurses per population; rooms per person; GNP per capital.
- Health for all, indicators: For monitoring progress towards the goal of Health for all by 2000 AD, the WHO has listed the following four categories of indicators.

Indicators selected for monitoring progress towards Health for All

(1) Health policy indicators:

- Political commitment of Health for All
- Resource allocation
- The degree of equity of distribution of health services
- Community involvement
- Organizational framework and managerial process

(2) Social and economic indicators related to health:

- Rate of population increase
- GNP or GDP
- Income distribution
- Work conditions
- Adult literacy rate
- Housing
- Food availability

(3) Indicators for the provision of health care:

- Availability
- Accessibility
- Utilization
- Quality of care

(4) Health status indicators:

- Low birth weight (percentage)
- Nutritional status and psychosocial development of children
- Infant mortality rate
- Child mortality rate (1-4 years)
- Life expectancy at birth
- Maternal mortality rate
- Disease specific mortality
- Morbidity – incidence and prevalence

Disability prevalence

The search for indicators associated with or casually related to health continues. It will be seen from the above that there is no single comprehensive indicator of a nation's health. Each available indicators reflect an aspect of health. The ideal index which combines the effect of a number of components measured independently is yet to be developed. While the search for a single global index of health status continues, the use of multiple indicators arranged in profiles or patterns should make comparisons between areas, regions and nations possible. In the last decade, attention has shifted from reliance on economic performance (e.g., GNP or GDP) towards other ways of measuring a society's performance and quality of life

CHAPTER: 2 LIFE CYCLE HEALTH

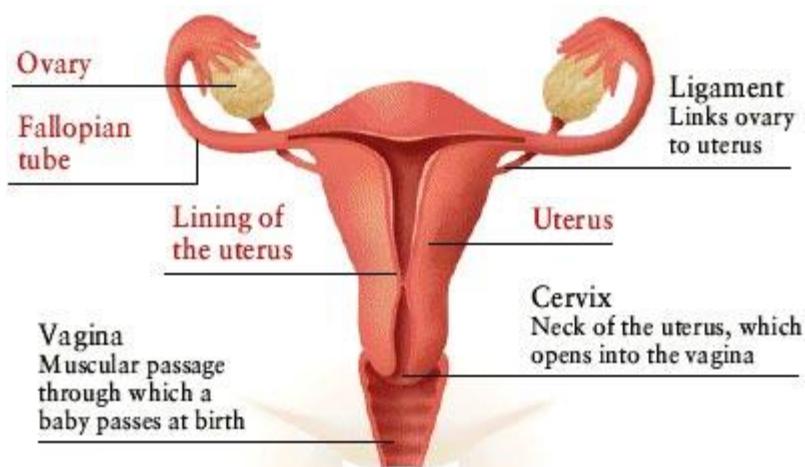
(A) Conception, Birth & Infancy



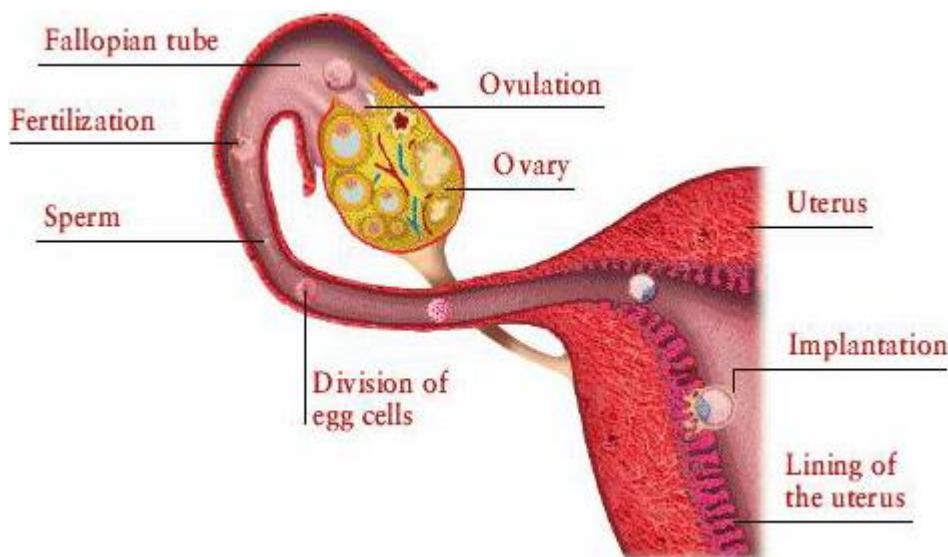
The events of conception, gestation and childbirth have always fascinated us and it is easy to understand why. Until recently, conception and gestation were mysterious processes, and remain so in many societies; childbirth, too, was surrounded with secrecy but at least a large number of people knew something of what went on, even if they preferred not to share their limited knowledge. The outcome of gestation was, and still is, uncertain; babies differ in sex, in constitution and in health. But the outcome is clearly important. All parents-to-be want their child to be physically perfect. In societies less developed, the sex and the health of the child may be of enormous economic importance; at some points in history, it has been a matter of life or death for the mother or child.

These three factors—lack of knowledge, uncertainty of outcome and importance of outcome—are exactly those conditions which foster the development of myths and folklore. Beliefs about childbearing differ from culture to culture and change only very slowly in the face of scientific knowledge. We now have greater control over these processes than was believed possible even forty years ago. Recent scientific advances have raised important ethical issues at every stage of childbearing from pre-conception (should couples be encouraged to choose the sex of their child?) to conception (what is the legal status of an AIDS child?), gestation (under what circumstances should foetuses be aborted?), birth (how much control should the mother have over the place and manner of birth?), and post-birth (what efforts should be made to keep handicapped children alive?). Perhaps because of the speed of scientific progress, these issues have only recently become topics of public debate; we are as yet nowhere near resolving them.

CONCEPTION



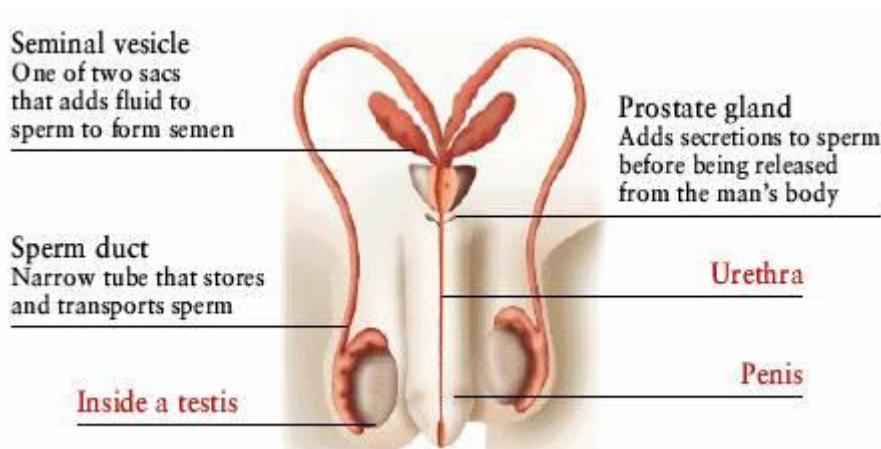
None of us can predict how our lives will end, but at least we can be certain how they began – as a single cell formed by a female ovum (egg) fusing with a male sperm. This process of fertilization is the culmination of a complex series of biological events. For the mother these begin with the release of a ripened ovum or egg (ovulation) somewhat around the fourteenth day of the menstrual cycle. The egg is transported from the ovaries through one or other of the Fallopian tubes, each of which is about 4 in (10 cm) long. It is carried downwards by contractions within the tube and by a current formed by the beating of tiny, hair-like structures called cilia. The egg will be available for fertilization for only about 12-24 hours immediately after ovulation



In the father's body, production of sperm cells is a continuous process – as many as 500 million sperm mature daily. From the testes, sperm pass into the epididymes (storage tanks consisting of some 20ft (6 m) of coiled tubes) and it is here that the sperm mature. From each epididymis, the mature sperm cells move into one or other of the two 16 in (40 cm) tubes known as the vasa deferentia. From here, the sperm cells move into the seminal vesicles, which not only store sperm, but also produce fluids, sugars for nourishing the sperm, and prostaglandin. The prostate gland contributes acids, trace elements and enzymes to the sperm to form a thick milky fluid – the semen.

At the climax of sexual intercourse, the seminal vesicles pour semen into the urethra for ejaculation. The urethra expands to two or three times its normal width, producing an explosive feeling, while powerful muscular contractions propel the semen out of the penis in a series of about half a dozen surges.

In a single ejaculation, there may be as many as 350 million sperm deposited around the cervix or neck to the womb. These sperm face a formidable journey, thousands of times greater than their own length.

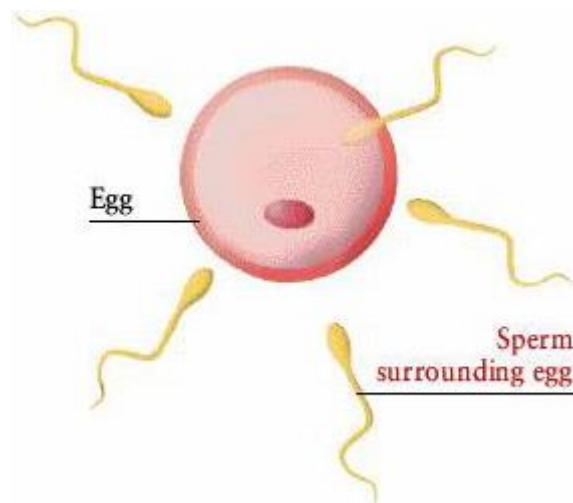


Not surprisingly, the task they face is reflected in their structure. Each sperm is about 1/500 in (0.05 mm) long and is divided into five parts: head, neck, mid-piece, tails and end-piece. The head is packed with chromosomes, which potentially make up half the genetic component of the new life formed; the rest of the structure is designed to propel the sperm cell towards the egg. The cylindrical neck is believed to account for the long whip-like movements of the tail that keep the sperm mobile. The mid-piece contains the mitochondria, tiny powerhouses which release the energy necessary for movement.

The first task for the sperm cells is to penetrate the cervix, and there will be many casualties at this stage. The “successful” cells swim forwards at a speed of about 1/10 in (3 mm) a minute, by contracting in length, first along one side of the tail, then along the other. Sperm differ in their speed and strength of movement, so that perhaps only 200 000 or so will eventually reach the Fallopian tubes. Of these, about 100 000 will enter the wrong tube, and of those which enter the tube containing the egg, only about 100 may reach it.

A sperm may spend several hours in the female before it is able to penetrate and fertilize the egg. During this time it undergoes changes which make penetration possible. These include the shedding of the acrosome, the thin cap encasing the head of the sperm cell. The acrosomal

cap is believed to contain an enzyme which dissolves the protective outer cover of the ovum, making sperm penetration easier. This cap-shedding is not only restricted to the sperm which eventually penetrates the egg, but also affects the doomed sperm around the egg. This act of self-sacrifice is not without purpose. The enzyme from just one cap would be insufficient to break down the ovum membrane, but the enzyme from many thousands produces a strong concentrated enzymes mass. Contrary to popular opinion, it does take more than one sperm to produce a baby. - But only one sperm fertilizes the egg.



It could be said that the process of fertilization leaves a great deal to chance. There is no mechanism to guarantee contact between sperm and egg; new life hangs quite literally in the balance of random movement of sperm and egg in the Fallopian tube.

The first cell

The solitary cell formed by fertilization contains all the material necessary for the creation of a new human being. The control center of this process is the cell nucleus, where the blueprints for life are stored in the form of 46 chromosomes – a large collection of genes – arranged in 23 pairs of different shapes and sizes. There are many thousands of genes within a cell – exactly how many is in dispute – and every body cell which eventually arises from this single cell contains the same set of genes.

The developing foetus

Fertilization takes place in one of the Fallopian tubes and the fertilized egg spends several days there before implanting itself in the wall of the uterus. During this time, the cells divide steadily. About 30 hours after fertilization the ovum divides into two cells; a second division occurs some 20 hours later, giving four cells and by the time of implantation there are about 150 cells. At this stage, the embryo is called a blastocyst and a series of changes affecting its outer layer brings about the formation of the placenta, the organ which provides the embryo with nourishment from the mother's bloodstream.

This is a hazardous time for the embryo. Many embryos do not develop normally, about 10 per cent fail to implant, and of those that do about half are aborted spontaneously, usually without the mother knowing. Most of these losses are attributable to abnormalities in the embryo or in its nutritive and protecting environment.

The role of genes

We have seen that every body cell carries exactly the same information in its nucleus as 23 pairs of chromosomes. Within a muscle cell, for example, there are instructions for the construction of a blood cells or a nerve cell – in fact for every cell. But the muscle cell ignores every instruction but its own.

Because genes control the behaviour of cells, they also control physical appearance which is, after all, the result of cells behaving in certain ways. The whole process of cell division and differentiation, of determining the structure and function of cells, is masterminded by the genes on these chromosomes, which are made of deoxyribonucleic acid.

Each parent may have contributed half of the genes within the cell nucleus, but the new baby will almost certainly look more like one parent than the other, or like neither. The reason is that genes, like people, can be described in comparative terms as “good”, “bad”,

The developing foetus

As the foetus develops, the uterus stretches and becomes more muscular in preparation for birth. The embryo is surrounded by a sac containing amniotic fluid and enclosed by two membranes, the amnion and the chorion. It is joined to the placenta on the uterus wall by the umbilical cord. Here the mother's and the foetus's blood streams are in close proximity, but separate, and the foetus makes use of the mother's organs of respiration, digestion and excretion. The cervix is sealed by a mucous plug". Everyone carries some genes which have not found expression in themselves, but which may have been expressed in their parents or grandparents and may subsequently be expressed in their children.

Brown-eye genes, for example, are dominant over blue-eye genes; a brown-eyed parent may carry the genes for blue eyes as well as brown, but a blue-eyes parent cannot carry brown-eye genes. Two blue-eyes parents, therefore, can expect to have only blue-eyes children, but if one parent has two genes for brown eyes and the other two genes for blue eyes, their children will have brown eyes. Two brown-eyes parents, however, might both possess the recessive blue gene and are likely to have one blue-eyed child in every four.

Inheritance of characteristics determined by a large number of genes is much more complicated. Children tend to be more average than their parents. For example, most children of very tall parents tend to be tall, but less so than their parents. On the other hand, a child of two short parents may be quite tall-provided both parents are carrying some of the many genes for tallness.

The genes contributed by the mother and father at conception form the new baby's genotype. However, the environment – including the uterine environment- has a profound effect on how this genotype will eventually be expressed, so the term phenotype is used to refer to the physical and psychological characteristics that the person actually displays. Your phenotype is the expression of only a small part of your genotype.

Detecting abnormalities

Many abnormalities in the growing foetus can be detected by examining the cells taken from it. Body cells are constantly dying and being replaced. Some cells in the intestinal lining, for example, live for only one and a half days, white blood cells survive only a few days, while

oxygen – carrying red blood cells survive for about four months. Dead cells from the growing foetus are discarded into the fluid (the amniotic fluid) which surrounds it in the womb.

The process known as amniocentesis consists of inserting a very fine needle into the mother's abdomen, drawing off some of this fluid and examining the foetal cells it contains. Over 100 abnormalities, including spina bifida and many chromosomal abnormalities, can be detected or ruled out by this process. It does not guarantee that the baby will be 100 per cent healthy, as not all abnormalities can be detected from cell examination. The process does, of course, reveal the baby's sex by detecting the XX or XY chromosomes, but most parents prefer to be kept guessing till the birth.

Smoking and alcohol

Because everything consumed by the mother during pregnancy will eventually reach the foetus via the placenta, there is special concern about the effects of drugs on the developing baby. Nicotine and alcohol are two examples of substances which affect the baby's development. Smoking in pregnancy, for example, can reduce full-term foetal weight by, an average, 5 oz (142 g) and causes a 30 per cent rise in perinatal deaths (deaths within 24 hours of birth). Why smoking in pregnancy should reduce birth weight is not fully understood, but it may affect placental blood flow and foetal nutrition.

Concern about the effects of alcohol on foetal development can be traced to the time of Aristotle, who noted that drunken women often bore feeble-minded children. The effects of excessive alcohol consumption during pregnancy are now recognized by the label foetal alcohol syndrome, a collection of features, which includes poor development of parts of the upper lip, nose and eyes, and mental retardation. One problem in determining the effects of alcohol per se on the foetus is that heavy drinking is often associated with other factors such as poor nutrition, smoking and stress, which themselves may have deleterious effects on the growing baby both before and after birth. It is now thought that even small amounts of alcohol can harm the foetus, especially if taken on a regular basis, and that there is no safe level of alcohol consumption during pregnancy.

Premature babies

Traditionally, for want of a better method, foetal age is usually counted from the first day of the menstrual period before conception on average two weeks before fertilization. The most frequent "age" at birth is 280 days or 40 weeks (38 weeks of true foetal age), but there is considerable variation, with babies born between 259 days (37 weeks) and 293 days (42 weeks) being regarded as normal.

Babies born earlier than 37 weeks are known as pre-term babies and, until recently, all babies weighting less than 5 ½ lb (2500 g) at birth were termed premature regardless of their physical health or length of gestation. Now babies who are less than 5 ½ lb (2500 g) are known as low birthweight babies. Take the cases of baby A and baby B. Baby A, born at 36 weeks, weighed 5 ½ lb (2500 g), a perfectly normal weight for his gestation age. Baby B also weight 5 ½ lb (2500 g) but he was born at 40 weeks and his weight was below the normal range for his gestational age.

Babies such as A, will catch up perfectly well without showing any adverse effects from their earlier exposure to the outside world. However, so-called "small for dates" babies B, may not

fully catch up with babies in the normal range, though they will close the gap a little. Some fail to grow as tall as full-term babies and may also be mentally impaired to varying degrees.

Ultrasound

The worst time for small-for-dates babies is the tail end of pregnancy when growth should be rapid. Many doctors are now recommending induction of such foetuses at 36 or even 34 weeks. But how can such babies be identified?

The most effective method is to use ultrasound. This technique can be used to determine growth trends at any stage of pregnancy. Very high frequency sound waves – so high that they cannot be heard- are beamed at the foetus and echoed back. The time taken for the echo to return is measured. The size of the foetal head can be measured by scanning with a number of beams and feeding the findings into a computer. Similarly, though with less accuracy, ultrasound is used to measure foetal abdominal circumference and length from head to buttocks. More than 90 per cent of small-for-dates babies could be detected if all babies were measured from head to buttocks between the ages of 6 and 12 weeks, for head width between 13 and 20 weeks, and abdominal circumference at 32 weeks.

Multiple births

About one in every 80 pregnancies results in twins. They are either identical or, more frequently, fraternal. Identical twins develop from the segmentation of one zygote (fertilized ovum) and are genetically identical, while fraternal twins develop from two separate zygotes and are no more alike than brothers and sisters generally. The likelihood of giving birth to twins is partly determined by heredity; and fathers and mothers in their thirties are more likely to produce twins. Twins are more likely to be miscarried than are single babies, and difficult births are more common

CHILD BIRTH

How does a baby react to the process of birth? There is no single simple answer to this question. We can look, first, at the physical and psychological effects of the birth process itself and, second, at the influence of events of the immediate post-birth period on the baby's later development.

The birth process

Strange as it may seem to us in the outside world, birth, as far as some of the new-born's physiological functions are concerned, is an incident without special significance. It is merely part of a steadily changing sequence of events regulated by biological clocks. For example, the maturation of the nervous system seems to be unaffected by birth, judging by brain-wave activity as measured by an electroencephalograph. The electroencephalogram, or EEG, of a baby born at 30 weeks will be much the same five weeks later as that of a baby born at 35 weeks.

Similarly, the experience of pre-term birth does not precipitate any switch over from foetal haemoglobin to adult haemoglobin (haemoglobin is the pigment which gives blood its red Colour and is the means by which oxygen is carried from the lungs to the cells; foetal and adult haemoglobin have different molecular structures). This switch usually occurs in about the 36 th week in preparation for birth, but it is not triggered by birth.

Cardiovascular and respiratory systems are the ones most altered by birth. Failure to breathe normally in the crucial period just after birth is a common cause of neonatal death or brain damage. However, contrary to popular opinion, newborn infants are better able to withstand oxygen deprivation than are children or adults. Many neonatologists now think that failure to start breathing may arise from pre-existing brain damage.

Certain obstetric interventions may carry some risk to the baby. Painkillers or anaesthetics taken by the mother during birth all pass through the placenta to the baby. This may result in a baby who is irritable, or less alert or responsive to particular stimuli. Forceps delivery, which occurs five times as often in induced as in natural births, carries a slight risk of brain damage, but it has to be weighed against the damage that might result if the birth were not helped along.

It is always difficult, however, to separate out the effects of events at birth from other factors known to affect a baby's development. Mothers who do not prepare well for the birth by, for example, attending antenatal classes, may require more painkillers, be less able to co-operate or more likely to be delivered by forceps. These same mothers may also have looked after themselves less well.

The new born

The psychological effects of birth. Some psychologists and psychiatrists have suggested that the birth experience – with its connotations of crushing and suffocating, and sudden exposure to external stimuli – is one of life's most traumatic events and that it profoundly affects a person's future psychological wellbeing. There is very little evidence, however, to support this point of view; indeed it is difficult to know what kind of evidence would support it. Perhaps we should expect babies born by Caesarian section, who are taken directly from the womb by surgery, to be better adjusted. Adults who claim to relive their birth under hypnosis seem to be responding more to their idea of what birth might be like than to any true memory of their birth.

This is not to say that the birth experience should not be as calm and relaxed as possible, for both mother and baby. The advantages of a relaxed birth, however, may lie in the fact that less obstetric intervention may be needed for the mother and baby may be more responsive to each other.

The mother – infant bond

Is there a natural or instinctive bond between a baby and its mother? And does early disruption of the bonding process affect a baby's development? There is certainly evidence from animal experiments and natural observation that, in some species, if the young are removed from their mother for a short period soon after birth, she rejects them completely when they are returned to her. Obviously, this does not happen with humans, but it does seem that early separation of mother and infant influences the quality of care the baby receives.

In a classic study, a group of mothers were given a period of unlimited contact with their babies immediately after birth. The mothers laid their babies on the bed beside them so that they could look into their eyes. Then, talking to their babies softly, the mothers began to explore them gently with their hands. They were doing this more lovingly than mothers whose babies had been removed from them in standard American fashion. It still remains to be shown that the babies derive some lasting benefit from this early extra care, particularly as

a replication of this study in England showed that early differences in the quality of care disappeared after six months.

An important way in which the infant can quickly gain resistance to infection is by being put to the mother's breast immediately after birth. A study by Klaus and Kennel showed that, given complete freedom, many mothers do this naturally. Unless the baby is depressed by painkilling drugs given to the mother during labour, he or she will often suck vigorously for a time. Milk will not be present in the breasts yet, but the baby will receive colostrum, a clear and slightly sticky fluid containing proteins, which transfer some immunity to infection from mother to baby. This early sucking stimulates the production of milk in the breast and may well be important for the baby in "fine tuning" of the sucking actions.

There are, moreover, sound physical reasons why early contact between mother and infant should be encouraged. Our skins are covered by a rich flora of bacteria and yeast's. Technically these are infections, but they are harmless-indeed, they are probably beneficial. A baby is born without flora, but rapidly acquires it by contact with adults. If the baby's first contacts are with the mother and father, it will be from them that the skin flora comes. If, however, this early contact is prevented or curtailed, the flora will come from whoever handles the baby; doctors or nurses, for example, may be carrying disease-causing bacteria. Early contact with parents protects against such infections, because once the skin is colonized it is more difficult for new, and possibly damaging, kinds of bacteria to be admitted.

Newborn babies, then, have already been exposed to a considerable amount of environmental stimuli before, during and immediately after birth. How these will affect what the babies achieve and the kind of people they become remains to be seen; human powers of adaptation, however, are impressive and there is a great deal of evidence to suggest that what happens later – even much later – in life will profoundly influence future wellbeing

INFANCY

Is he developing normally? Shouldn't she be walking by now? Questions like these are common and often reflect distressing parental concern. Parents may worry about a less-than-average rate of physical development or be proud about rapid development in one area. But different rates of progress do not necessarily signify much-every normal child gets there in the end. Growth is a target-seeking process. The passage of an infant along his or her "growth curve" is comparable to that of a missile directed at a distant target. Just as two missiles may follow slightly different paths and both hit the target, two children may have slightly different courses of growth but both end up with almost the same physique.

Differences in the rate of maturation are apparent even before birth. Some children play out their growth quickly, others moderately, a few slowly. It seems that heredity is to a large extent responsible for setting the metronome but environmental influences, especially nutrition, also play a part.

Does growth occur in spurts or is it a smooth, continuous process? Except during adolescence, development is more continuous than sporadic. This applies as much to motor development as to mental ability. This is why it is unwise to set hard and fast standards of growth and development.

The wise parent, while paying attention to any signs that may spell danger for the child, accepts that his or her relationship with the infant is not subject to hard and fast rules, but will vary from the so-called “norm”. Parenting is not so much a matter for doing things by the book, but rather playing it by ear – improvising our lines as we go along. After all, this is a new relationship in which both players are inexperienced.

Feeding

Feeding is a central activity with a new baby, so it is hardly surprising that a great deal of attention has been devoted to how it “should” be done. Most of the controversy about infant feeding can be reduced to two basic questions: should the baby be breast – or bottle – fed, and what pattern of feeding should the new mother adopt?

Unfortunately the answers that are often given to these questions are determined more by fads and fashions than by good supporting evidence. All too often the answers are also dogmatic, and hint at the possibility of dire consequences for the baby’s future if one or other method and pattern of feeding is not adopted. Conversely, many books on child care hedge their bets on the subject of feeding, often giving highly equivocal advice such as “breast is best but the bottle is just as good”. Given that no two mothers will face the same set of problems, the best approach is, perhaps, to give information rather than advice, so that every mother can make up her own mind and choose what she thinks will be best for herself and her child.

Breast versus bottle

There is little doubt that breast milk is ideally suited to the needs of the human infant. For the first few days after birth, babies live off their own fat stores. Around the fourth or fifth day, they often go through a period of restlessness and crying, which marks the time they first become hungry. As one might expect, natural selection has arranged things so that those demands for food are met by the production of breast milk.

Human milk is a very complicated mixture of fats, proteins, sugars, minerals and water that can satisfy all the baby’s food requirements for the first year or so of life. However, breast milk does more than this: both milk and the colostrum produced by the breasts in the first few days after the baby’s birth are rich in antibodies that help protect the baby against infection. Breast milk also makes the alimentary canal a very hostile environment for bacteria. The iron contained in breast milk is bound in special protein, which ensures that almost all of it is absorbed into the baby’s bloodstream, leaving too little in the alimentary canal to sustain harmful bacteria. Bottle milk, by contrast, contains larger amounts of iron, but in a form that is poorly absorbed, so that most of it passes straight through and is eliminated in the faeces. As a result, breast-fed babies tend to be more resistant to illnesses.

Babies who are not breast-fed may become sensitive to cow’s milk. Their immune systems react to some of the proteins in the milk passing through the wall of the gut into the bloodstream. This permeability to “foreign” proteins disappears after the first few weeks, but before that even a single formula feed can cause problems in the small minority of babies that are affected. Research has also linked asthma and eczema to bottle-feeding. For asthma, it has been shown that symptoms can be relieved by putting the child on a diet free of cow’s milk.

Over the 50 or so years that cow’s-milk formulae have been available, their composition has changed, so that they now resemble human milk more closely. Long experience has shown that they do provide adequate food for a baby, but their composition is not identical to that of

human milk. Fierce arguments still continue about the importance or otherwise of these differences. The most important probably concerns the risk of infection which, with modern sterilizing techniques, is minimal in industrialized countries. On the other hand, for the poor and malnourished of the third world, bottle-feeding amounts to a death sentence for many babies. However, although bottle-feeding may not introduce infection, it provides no extra protection against it. As we have seen, the addition of an iron supplement to cow's milk formula may even encourage bacterial growth in the gut.

The behaviour of mothers of both bottle-and breast-fed babies plays an important part in determining the composition of their baby's food. The composition of breast milk varies with what the mother eats. Because many drugs-including nicotine and alcohol-and environmental contaminants that the mother takes in will reach the baby, breast milk is not always as natural and wholesome, as it seems. A breast-feeding mother should always get her doctor to check that any drug prescribed for her is safe for the baby.

When powdered milk is used to make up a bottle feed, it is vital that instructions about diluting the powder with water are followed carefully. Samples of bottle milk made up by nurses and mothers in English maternity hospitals have shown that there is a strong tendency to put in too much powder on the assumption that, if two scoops are good for a baby, three must be even better. However, just the opposite is true. The problems are that milk contains salts, and to get rid of these through the kidneys the baby must have water. An over-concentrated feed does not provide enough water, and so the excess salts accumulate in the body.

This process, if it continues too long, can have serious consequences. The first sign of hypernatremia, the technical name for a condition, in which the baby becomes fretful and cries a lot. If this is misinterpreted as hunger, and the baby is given more over-concentrated food, the problem gets worse. It is always worth remembering that babies, especially if bottle-fed, may be thirsty as well as hungry, particularly if the weather is hot, or the house warm.

Much has been said and written about the importance of the close physical relationship of breast-feeding for the emotional development of children. However, research evidence has repeatedly failed to support this assumption. Although a great deal may be gained by a close physical relationship between infants and their parents, this is neither ensured by breast-feeding nor precluded by bottle-feeding. Both breast-and bottle-feeding mothers can make feeding a time of physical closeness with their babies.

It has been suggested that breast-feeding mothers show more affectionate behaviour towards their babies, but to suggest that these differences have to do with breast-feeding per se is to ignore the fact that mothers differ enormously in their overall attitude and behavior towards their children; the decision to breast-feed may be a consequence rather than a cause of a more affectionate attitude towards the baby. A mother who for good practical reasons decides to bottle-feed need not feel that she is depriving her child of affection.

Feeding patterns

The composition of milk from various mammals varies quite widely, depending not only on the diet of the mother but also on the feeding patterns and growth rate of the infant. Tree shrews, for example, feed their young every 48 hours, and rabbits every 24 hours; and the milk of these species has a high protein and fat content. Young tree shrews and rabbits also suck very fast, ensuring nourishment in minimum time.

Human milk contains a much lower amount of protein and fat-identical amounts, in fact, are found in the milks of anthropoid apes. Human infants also suck relatively slowly, suggesting that both the mother's milk and the baby's sucking are adapted to a pattern of very frequent feeding.

This pattern is found in pre-agricultural or hunter-gatherer societies such as the Bushmen of the Kalahari and the Australian Aborigines, and even amongst many agricultural and pastoral societies. Observations of mothers in the Kalahari, for example, have shown that their babies suck at the breast about every 20 minutes. This pattern of continuous feeding is, of course, only possible if mother and baby are in almost constant contact.

In our society, by contrast, parents are more distant from their babies and our idea of meals eaten at set times is applied to babies from the moment they are born. Being very adaptable, babies can accustom themselves to restricted feeding, but there are limits to this. For most babies and mothers, feeding less frequently than every three hours, with one feed missed at night, makes the establishment of breast-feeding very difficult.

Frequent feeding is especially important in the first week or two of lactation, firstly because it can avoid the period of restlessness and crying when the baby first becomes hungry, secondly because it avoids the sometimes painful engorgement of the breasts which occurs when the milk comes in, and thirdly because the level of production of milk is set to some extent by the demands of the baby. With too infrequent feeds, the production of milk may never rise to the level required to sustain the very high growth rate of a young baby.

Forming a habit

Sometimes mothers are reluctant to provide very frequent feeds for fear that they will set a pattern which may be difficult to cope with later. They may also feel that unrestricted feeding may not be in the infant's best interest; the unfortunate phrase "demand feeding" tends to reinforce this idea, with its implication that the infant is trying to exert its authority and make unreasonable demands. Given the speed with which adults try to satisfy their own food demands, this seems rather unfair. In any case, even with total demand feeding, the frequency of feeds soon begins to decline.

Artificial feeds are more concentrated than breast milk. This makes it possible to bottle-feed satisfactorily-at least from a nutritional point of view-every four hours, which would be too widely spaced for breast-feeding.

Like most things to do with babies' lives, the "right" patterns of feeding is the one that the mother and baby work out between themselves to suit their own style of living. Parents should distrust anyone, however eminent, who is dogmatic on this subject.

Weaning

Sometime in the first year, parents will begin to give solid foods to their baby. As with everything else to do with infant feeding, this topic has been beset with controversy and rapidly changing fashions. A few years ago, some professional advice suggested that babies should begin eating solid foods in the first couple of weeks after birth. Today, the recommendation is for solid foods to be started at three or four months. Breast milk, in fact, provides a perfectly adequate diet for a baby for the whole of the first year, and the same is probably true for the artificial milks.

When solids are introduced, these need not be the bland and sometimes rather tasteless commercially available baby foods. Parents may find these much more troublesome and expensive than giving a baby some of the food from their own meals. Babies 'chewing' powers are rather limited, so it is wise to ensure that any food given is either put through a blender or sieved. There is no good reason for assuming that the taste perception of infants is any different from that of adults. Parents should experiment with the variety of the foods that they themselves enjoy. Babies will quickly spit out anything that does not give them pleasure.

The idea that the experience of weaning is a psychologically traumatic one for the infant originated with Freud. Like assumptions about the importance of breast-feeding, research has failed to substantiate these claims. Abrupt weaning might come as something of a surprise to the infant and be distressing if it is accompanied by a reduction in close physical contact. However, weaning is usually a gradual process, and parents can easily ensure that they continue to maintain a high level of physical contact with their baby.

Sleeping & Crying

Throughout the first year, the commonest complaint of parents is that their baby wakes frequently and cries a lot. It is hard for parents not to feel that they are somehow causing the crying. And as their own sleep gets disturbed, worry can be compounded by exhaustion.

Perhaps the first point to establish is: how much do babies sleep? Probably less than is commonly thought. On average a newborn baby sleeps for about 14 to 18 hours in each 24 and this drops to 10 hours or less by the end of the first year. These are average figures; there is a good deal of variation and many babies sleep more than this or less.

Sleep is not evenly distributed through the day and night. Within a week or so of birth a circadian (more or less 24-hourly) pattern begins to develop, so that sleep is most likely between midnight and 6 am – a trend that most parents encourage.

Many babies are particularly fretful between 6 pm and midnight. No satisfactory explanation has been given for this evening colic. Even though it is important that adults find time for themselves, it may be better, given a wakeful baby, to aim for, say a 9 o' clock bedtimes rather than one at 6 or 7 o' clock. If babies are placed in infant seats, where they can see what is going on, they will often be quite content to sit and watch people move around them. Daily routines are very much an individual matter and everybody needs to work out their own system, making the best balance they can between the needs of all the household members.

The habituation process

It is noticeable that babies become quiet when their attention is caught by an interesting sound or object. Unless especially interesting, new objects lose their novelty after a few minutes and babies are likely to become more restless and to scan with their head and eyes for new things to look at. This gradual loss of apparent interest in things as they become familiar is known as habituation. It is a very important process, because it allows us to respond selectively to the world around us, rather than being overwhelmed by the multitude of stimuli we face.

Most babies are capable of habituation right from birth – and probably before birth. You can see this for yourself with a simple experiment. If a baby is awake, a sharp noise usually produces a startle response – a jerk of all or some of the limbs. but if you continue to make a

noise-say, snapping the fingers-about every 10 or 15 seconds, the response will gradually decline and disappear. When it has disappeared, it will return in response to another sound, showing that the effect is not simply due to tiredness. Similar experiments can be done with other senses of sight, feel and taste.

A baby who spends large amounts of time on his or her back, with only the ceiling or the sides of the cot to look at, will quickly habituate to these stimuli and become restless. In those cultures where infants are in almost continuous contact with the mother, they are faced with an every-changing array of visual, auditory and tactile stimuli. Parents can easily increase the amount of visual stimuli to which their infant is exposed not only by moving the baby around, but also by introducing pictures (even on the ceiling), mobiles, or other patterns which are visible from sitting and lying position. Changing patterns of auditory stimulation can be provided from the radio, adult speech or just everyday household noises.

The capacity to amuse oneself

Babies very quickly become aware of the effect of their own actions on the physical and social world. This will be considered in more detail later, but the simplest form of the process is worth mentioning now; in everyday terms, it is the capacity to amuse oneself. A number of experiments demonstrate this capacity in infants. In one series, babies were provided with foot panels which operated a switch when they were kicked. This was linked to a mobile which moved when the foot panel was kicked. This set-up provided hours of amusement for babies who repeatedly kicked the panel to set the mobile moving.

Babies live in a world that is full of things that can be acted on in just the same way and, indeed, provide much more exciting possibilities than the simple feedback loop of the kicking panel and mobile. Hands can be moved to hit rattles hanging in the cot, or to make shadows on its side. Kicking can move blankets or shake the cot, producing interesting sounds.

Sucking is soothing

Babies will often quieten and soothe themselves by sucking. Feeding often has this effect. But sucking a thumb, a fist, the teat of an empty bottle or a dummy can be equally effective.

Often babies choose a particular blanket or toy which they hold or stroke while comfort-sucking. A favourite blanket may be reduced to a small shred of frayed material before it is finally abandoned by a toddler. Mothers may try to withhold these objects for fear that the baby's attachments to them is abnormal, but this is rarely the case.

Rocking the cradle

Perhaps the most widely used means of calming a baby in our culture is through movement – not surprising, as it is an extremely effective means of soothing, and of inducing a “quiet alert” state. Until the present century, most cradles in Britain were made with crescent-shaped rockers so they could be moved from side to side. For some reason, despite their effectiveness, these are seldom seen today except in museums or antique shops. A small fortune probably awaits the manufacturer who copies one of these old designs. Rhythmic sounds are also soothing for infants. Most lullabies have a slow rhythm which is similar to the frequency with which cradles are rocked.

Rhythmic sounds are also effective. Light or classical music – or even the purring of a vacuum cleaner – can have a marked calming effect.

Another calming technique that has more or less completely disappeared from industrialized societies is swaddling. Until the eighteenth century this was used in almost all societies in temperate, but not tropical, regions and even today it persists in a good many cultures – in the Middle East and among some American Indians, for instance. Many paintings of the Virgin and Child illustrate how it was done. The basic principle is to wrap up the baby tightly, with the legs together and the arms held by the baby's side.

Used with care, swaddling can be employed advantageously with babies in industrialized societies. By being tightly wrapped in a sheet or blanket, a fretful child can be helped into a peaceful sleep. For the technique to be effective, it seems important to start using it in the first few weeks of life. An older child, unused to such restriction, may fight against it. Swaddling with a thin sheet is very effective if a baby is restless in very hot weather, probably because it cuts down body movement.

One effective means of calming an unswaddled baby is to vary the texture of bed covers. Recently the effects of laying pre-term babies on lambswool fleeces, rather than on cotton sheets, have been studied. Lambswool is soft, and a baby can sink into it, so getting more skin contact than hospital sheets offer. The change of bedding had quite marked effects. Crying and movement were reduced and growth rates increased.

Baby and parents in the same bed

As living standards have risen, babies have increasingly been placed in rooms of their own. Some parents have reduced this segregation by having their babies sleep with them. This arrangement does not suit every parent, but the advantages are obvious, especially if the baby is being breast-fed. Fears about the baby witnessing sexual intimacies between the parents are often rationalized by statements about the dangers of lying on or smothering the baby. In fact, these dangers are minimal and a baby may be safer in the parents' bed than say, on the living room floor or shut up in a room alone.

Sleep problems

Several surveys have indicated that more than 20 per cent of one-year-olds regularly wake at night. Exhausted and short-tempered parents can suffer an ever-widening circle of problems that can have very serious consequences. What can be done? Perhaps the first step is to find out just how much the baby is sleeping. It may be that the total amount of sleep is average, but the timing out of step with the parents' routine. Both the baby's and the parents' routine may have to be changed so that a compromise between their sleep patterns is reached. However, the most crucial factor is what sleep-problem babies do when they wake. Babies and adults wake at intervals during the night, stir a bit, and go back to sleep. Sleep problem babies cry when they wake.

Most babies cry during the night on some occasions. During teething, for example, this may happen much more often. However, it seems that babies who regularly wake at night have been fretful as newborns and active and responsive throughout their first year. The problem therefore is unlikely to have arisen through parental mishandling-a common professional assumption. It is worth noting, however, that in older infants prolonged crying may be a result of the parents having delayed their response to the infant's crying in the first six months.

A bored baby is a fretful baby

The usual advice given to parents whose babies continue to wake and cry at night is to give either more or less feed at night on the often unfounded assumption that the babies wake from hunger or “colic”.

If we are right in thinking that the real problem is not a failure to sleep enough, but more a question of what babies do when they wake up, it may be more useful to think of some of the techniques already mentioned for calming a baby. He or she may be given some means of self-quieting-a suitable object to suck, for instance, or a more interesting visual and tactile world in his or her cot.

The root of night waking may lie with the kind of society we have constructed. Babies vary, and some infants have probably always shown the behavioural features that characterize night wakers

Communication and Games

The basic of human communication, both verbal and non-verbal, is a series of social rules by which we interact and understand a multitude of cues and signals. During infancy, by definition, we cannot speak, but we can communicate many of our needs and intentions quite clearly and can play our part in games and other fairly complicated social interchanges.

Getting the right response

Infants discover their social world by observing the responses they receive to their actions. Responses tell babies what their actions means to those people around them and allow them to modify their actions to produce more desirable responses. Even an apparently simple link between action and effect is quite complex and rich in learning opportunities.

A baby cries. What happens? Nothing, perhaps, because the “caretaker” decides that the cry is not one of hunger or serious distress. The most likely responses is for the parent to pick up the baby and feed it. But the chances of being picked up depend on the length of time since the last feed. Soon after a feed, a baby is likely to be picked up because the parent thinks it is still hungry or has wind. Three-and-a-half to four hours later, it will be picked up because the parent thinks the crying represents hunger. The chances of parental response are also much higher in the daytime than at night. So even this simple example shows how much babies can potentially learn about their social world from the way in which their cries are or are not responded to. Other research shows that infants will reliably increase or decrease responses such as crying, smiling, sucking, moving and vocalizing, depending on how and in what pattern their parents react.

Crucial timing

Timing is a vital characteristic of all social communication. Right from birth an infant’s behaviour has a rhythmical structure, and the caretakers’ actions are built round this, so providing the beginnings of the mutual timing structure seen in all social encounters. For example, a baby does not suck continuously, but in a series of bursts separated by pauses. The behaviour of a breast-feeding mother seems to fit around this rhythm: she is much more likely to talk to the baby in the pauses between bursts of sucking. This kind of interaction provides the infant with an opportunity of learning the first rules of communication.

Playing games

From these first coordinated activities, social interaction quickly develops and becomes more complicated. Around six or eight weeks, infants begin to smile more frequently, and then go on to build their smiling into more complicated social exchanges. A typical game is for an adult to sit face to face with an infant and get him or her to smile and laugh by moving the head towards and away from the baby. The baby looks intently at each approach and eventually smiles. Then the baby often turns away from the adult for a little time before turning back to signal readiness to begin a few sequences. It is easy to show that the infant has an expectation of what is going to happen next by changing the sequence in some way. At a few months of age, in situations like this, babies show a clear sense of surprise. Indeed, this is a common component of games such as peek-a-boo. In these social games, an infant needs both familiarity with the games partner to provide predictability and an element of novelty and surprise which eventually leads to more complex sequences. Parents provide this variability by changing their games as the infant gets older.

Learning the rules

We can divide the things that infants learn in their social encounters into two categories. Firstly, there are rules and conventions known to all members of the culture, such as the expression of emotion, and the meaning of words and gestures – in fact, all the social knowledge we need to behave appropriately in varied social situations. Secondly, there are all the private and particular shared means and rituals of behaviour that go on between two people who know each other well.

At first, the infant is restricted to familiar relationships and to learning individual idiosyncrasies. But by moving between several familiar relationships and by encountering strangers, the common features begin to merge and so knowledge of the culture begins to be built up. Over-exclusive mother-infant relations impede this development and it is notable that shyness is often marked and prolonged in infants who have social experience of few adults.

Imitation

Much adult behaviour – probably more than most people suspect – is a product of imitation. This is a far from simple reaction. You must perceive what another person is doing and translate this into a parallel action of your own. There have been long disputes among psychologists about the age at which babies begin to imitate. In the first few months, quite a lot of imitation occurs in adult-infant interactions, but most of this is the adult imitating the baby. The early imitations produced by infants are restricted to the limited range of actions that are in a baby's social repertoire. Thus, it is fairly easy to train a baby of a few months to stick out its tongue when you do, but it is impossible at this age for a baby to imitate your blinking, or other complex motor movements. These early imitative actions, however, are the prologue to a process which will eventually result in children whose gestures, speech, movements and manners are remarkably like those of people around them.

The limited value of games

The social games of infancy emphasize the ways in which infants are able to use widely differing experiences to reach the same developmental goals. In spite of their varied social experience, most children develop the major social skills at roughly the same time. One

reason for this is that the routine caretaking to which every infant is exposed involves social interaction and games. It may be less fun, but a situation in which a baby is being persuaded to take food is as valuable for social learning as any of the games described earlier.

Learning to move and think

Newborn babies are largely observers, albeit active ones, of the world around them, dependent on other people to move them around. By the close of infancy, however, most youngsters can walk, hold and manipulate objects and are becoming increasingly independent. The development of physical and mental capabilities is closely related, but, as we shall see, both of these take place within a social context.

Average age for motor milestones

Pre-war American development psychologists spent much of their time examining large numbers of children to establish the average age at which various points in development, the so-called motor milestones, were reached. The results of these studies gave the impression that the milestone represent a constant progression: sitting unsupported at six months; standing supported by furniture at eight-and-a-half month; walking alone at eleven-and-a-half months, and so on.

However, there is great variability in the ages at which each stage is reached and even in the sequence of the stages. Walking, for instance, is quite normal at any time between 9 months and 18 months.

The effect of stimulation

That specific encouragement and opportunity for movement can accelerate motor development was demonstrated in the United States by Dr Myrtle McGraw. She worked with a series of twins, providing stimulation for only one of each pair. As the films she made testify, not only did the stimulated twin always reach the motor milestones earlier, but she was able to produce quite remarkable physical skills and competence at very early ages. One of her more dramatic film sequences shows a two-years-old roller skating with an assurance and skill that many adults never achieve.

Similarly, some cultures, in East Africa for example, have been found to have accelerated motor development compared to the norms in Europe and America. These cultures tend to place a good deal of emphasis on physical development. At the other extreme, we have the example of Navajo children, who spend much of their first year strapped to a cradleboard, yet walk independently at a slightly earlier age than white American children. These experiments are yet another illustration of the adaptability of the human infant. Infants are provided with varying opportunities for physical exercise, yet all of them, except those with rare abnormalities, successfully walk.

With specific instruction and practice, however, physical skills which are not universally developed can be taught at surprisingly early ages. Swimming is a good example. Newborns will make “dog paddle” movements if suspended in water and will raise their hands to keep their noses clear to the water. If given frequent practice, it is possible to get children swimming quite effectively by the second half of the first year. If swimming is encouraged at this time, the pleasure derived from water usually persists throughout childhood. However, if

swimming practice is not given during the first year, a fear of water seems to set in and it is then often difficult to teach children to swim until they are six or seven years old.

Reaching and grasping

The finer-grade hand and finger movements involved in grasping and reaching follow the same kind of pattern of development as locomotor movements. Under suitable conditions, newborns can orientate their arms towards an interesting object. Hands and fingers often point quite accurately towards an object, and crude hitting movements may be made. But at this age a baby can only grasp an object if it is placed in the palm of his or her hand.

Controlled reaching and grasping of objects does not usually occur until towards the middle of the first year, but frequent practice seems to accelerate development of control. However, by the second half of the first year, reaching does become important, not least in social games. Offering and exchanging objects with social partners become a very significant part of an infant's social encounters. Such games help to focus the attention of the infant and adult on the same object, and this may be important in the first stages of speech, because it ensures that both are "talking" about the same thing

HANDICAPPED INFANTS

Where a baby is born with a known handicap, informed guesses about possible futures can be made on the basis of the knowledge of development in similar children. However, it should not be thought that just because a diagnostic label can be given to a child, a very accurate prediction about outcome can be made. The huge variety of factors which influence normal children also affect the development of those with abnormalities. In fact, outcome is more variable for handicapped children partly because, for them, specific teaching may be necessary to learn what normal children achieve by their own efforts in any reasonable environment. Sidney Bijou, an American developmental psychologist, has shown clearly how the natural consequences of a handicap—say, being unable to walk—interact with the reactions of those around the child in a circular way, with the result that the child acquires far fewer social and intellectual skills than he or she might, in theory, have done. There is an unfortunate tendency among both parents and professionals to attribute all such deficits to the handicap. Indeed, it is only relatively recently that the term "ineducable" was dropped as a description of some mentally handicapped children.

Children who are born blind or who become blind as young infants about. These children often show delayed and abnormal speech patterns which, research has suggested, stem from the limited social interaction these children often have in infancy. Blind babies tend to be rather unresponsive and do not provide as much pleasure for parents and others as normal children: in popular jargon, they don't turn their parents on. However, if parents understand these processes and have plenty of emotional support in their very difficult situation, many of these effects can be avoided and the child's speech will be relatively normal.

Handicapped children vividly demonstrate, by default, just how active a part infants play in their own development, in the creation of their own psychological world. If a child is damaged, these active development processes are interrupted; special steps have to be taken to provide what infants cannot create for themselves.

Early intervention

In recent years, systems of developmental assessment have been set up in mainly communities. These are designed to identify those children who might benefit from some kind of intervention or special education. In some cases, early assessment may prevent the development of abnormalities which, once entrenched, are very difficult or impossible to correct. Deafness is a good example. As deaf children cannot hear speech, they cannot learn to speak themselves. However, the ease of language acquisition after the provision of a hearing aid depends greatly on age. If an aid is given before a year of 18 months, speech may well develop relatively normally. But if the aid is given later, speech may show many peculiarities which can persist for a lifetime. It appears that there is a sensitive period for the acquisition of language, after which learning becomes much more difficult.

This idea is supported by studies of children who have suffered brain injuries. The long-term effects of even quite severe injuries suffered in the first two years of life may be fairly mild, whereas the same injury at a later age can cause more serious impairment. At the earlier age, the brain is still plastic: intact areas can to some extent take over the functions of injured areas. However, as development proceeds, the brain becomes set in its patterns, and compensatory processes become less and less efficient.

This early ability to recover from injury emphasizes once again that infants, despite their apparent vulnerability, are very resilient, and that developmental processes can reach common goals in alternative ways. As adults, we may be better at using our wits to minimize the effects of damage or hostile environments, but our capacities for biological compensation are more limited than those of babies; gradually, one facility takes over from the other as we age

THE DEVELOPMENT OF MOVEMENT AND LANGUAGE

Motor development, Lifts head and chest when lying face down; weight supported on wrists and elbows; reflex actions gradually disappearing but not immediately replaced by voluntary control.

Vocalization and language, Responds to being spoken to or touched by smiling and making sounds known as cooing, vowel-like sounds given out in 15-20 second phases; crying is less than in earlier weeks; listens intently to sounds other than speech such as bells, rattles, musical toys.

16 weeks

Motor development, Head self-supporting when lying or held in a sitting position; rolls over and kicks; grasping without control of thumb.

Vocalization and language, Follows sounds with head and eyes; increased response to speech; sounds emitted include laughing and chuckling noises as well as continued cooing.

20 weeks

Motor development, Sits up with support at first.

Vocalization and language, Vowel sounds of cooing interrupted by sounds with the character of consonants (m, ng, s, f) but vocalization as yet bears no direct relationship to adult speech.

6 months

Motor development, Sits up without support, will reach forward and take weight on hands; direction of reaching is confined; gaining control of hands in grasping and letting go; when held up will put some weight on feet but cannot stand.

Vocalization and language, Cooing develops into babbling, vowels and consonants mixed in single syllables (ma, mu, di); no apparent pattern in the recurrence of sounds within the flow of babbling.

8 months

Motor development, Crawls and will stand holding on to a person or stable object; grasping becoming more refined, using fingertips and thumb.

Vocalization and language, Syllables repeated (ma-ma, ba-ba-ba) frequently in babbling; utterances acquire some intonation and are used as signals of feelings or requirements; tone and general meaning of words such as yes, no, 'bye and understood.

10 months

Motor development, Pulls up to standing position and can step sideways when holding on to a support; hand and eye co-ordination rapidly developing.

Vocalization and language, Sound play, such as clicking or bubbling, interspersed with previous forms of vocalization; some attempts to imitate sounds and differentiate words and syllables; attempts to imitate words are rarely successful.

12 months

Motor development, Walks independently or held only by one hand; sits down on floor from standing position. Vocalization and language, Repeated syllables used in forming words (mama, dada, baba) and some words are more or less successfully imitated; one or more recognizable words uttered; simple sentences, requests and commands understood.

18 months

Motor development, Walks confidently but with a stiff and impulsive gait; climbs stairs holding support; grasping ability fully developed, able to handle spoon, cup and so on in feeding.

Vocalization and language, Vocabulary increasing but still combined with babbling, now gaining complexity in intonation and variety of sound-also called jargon, apparently used as conversation but meaningless; words used singly; pictures of familiar objects named; sound games enjoyed, with attempts to join in; understanding still well in advanced of speech.

24 months

Motor development, Moves easily between sitting and standing; can run, with a tendency to fall suddenly; walks up and down stairs putting same foot forward at each step.

Vocalization and language, Vocabulary of 50 or more words, now sometimes combined in simple two or three word sentences spontaneously created; interest in language and communication increases-words heard are repeated and stories are listened to with attention.

30 months

Motor development, Good command of balance, able to jump, stand on one foot, walk on tiptoe; in control of independent finger movements and can use hands efficiently in playing.

Vocalization and language, New words learned every day and vocalization used to convey definite communications; adult speech well understood; sentences put together using a basic grasp of grammatical rules, not by imitating adult phrases

Learning to speak – the end of infancy

Though the beginnings of speech mark the end of infancy, it is during that period that the foundations of this remarkable achievement are laid.

It would be an exaggeration to say that we understand how children learn to speak, but the recent flurry of activity of developmental psychologists and linguists seems to have established the broad line of what is involved.

Our first assumption has to be that babies have a predisposition to learn to speak, just as they are predisposed to walk or to become members of a social species within a culture. We do not know all that is involved in this predisposition, but the ability to relate to other people is likely to be at the heart of it. At first, the structure of social interaction is provided by the parents. They respond in predictable ways to infant behaviour, but gradually the infants begin to play a more active part and some of the initiative passes to them. This is possible because they begin to try to make sense of their social world by searching out the rules and regularities. Even in apparently simple day-to-day interactions such as feeding and dressing, the foundations of language are already being laid. Not only do they involve relearning, but paying attention to speech and responding to speech sounds that adults make. This selective attention to speech sounds is another part of the human potential for language learning. Of course, infants do not understand what is being said, but they learn, by association, the meaning of particular tones of voice and inflections. For example, quite young babies become upset and cry if people around them become angry and raise their voices.

Baby talk

When people, including even young children, talk to infants, their speech changes in characteristic ways. They use short, simple sentences, and often repeat words and phrases. The pitch of the voice is higher, and intonation is more varied, there are several probable reasons for this. An obvious one is that we do not have a lot to say to babies. Often we are simply affirming our presence as social partner, communicating for the sake of it, rather than transmitting a vital message.

This is the cradle of communication in which infants begin to learn about their social world. The modified-simplified and exaggerated-speech to infants is an ideal teaching device and shows several parallels with body-language, which also shows simplifications and exaggerated features when directed at infants. Notification seems to make rule-learning easier, while the exaggerations and emphasis hold the infant's attention.

First words

As the end of their first year approaches, infants produce their first recognizable word. Very often this is the name of one of the more significant figures in their social world and is usually uttered in their presence. At first, words are produced as if they were an optional extra to the social understanding that is created by gesture and non-language sounds. But words are important to the adult, who usually sees them as a landmark, and they serve as a great stimulus for further social exchange. Gradually, infants begin to refer to things that are not present. Though their command of language is still extremely limited, they have taken the first faltering steps as members of their culture. They have used language to extend their communication beyond the here and now.

Interpreting words

At the single-word stage, the meaning a child attaches to a word may be very different from the conventional one. "Cat" may mean any animal with fur and four legs. "Mama" is offered to any adult who might offer assistance. Knowing what a baby intends when it utters a word is a complex question. If the word is "cat", is the baby saying "there is a cat" or "where is the cat?" The adult may recognize the meaning from the context or from their joint past experience. In fact, it may be a mistake to look for a precise meaning in what an infant says. As with earlier non-verbal communication, the point may be more to enter into social exchange than to convey a precise wish. However, increasingly, speech is used for specific effects-a repeated cry of "milk, milk" may not cease until some milk is forthcoming.

Conveying a meaning

Even though the grammatical complexity of what children say does not seem to change for some months, their understanding of words and of social encounters increases steadily. Quite complex verbal instructions such as "Your bottle is on the table" are understood and acted on by the child long before the child says things of similar complexity. However, even with single words and some help from the parents, children can convey most effectively what they want. An object is stuck in the opening of the letter box at the front door; pointing to it is often enough to have it removed. Action such as this emphasize how much the infant's social understanding has advanced. Soon two words will be combined, and then more to form simple sentences.

Which comes first-thought or language?

There is a long-standing debate among psychologists about whether thought precedes language or vice versa. The answer seems to be that the two go hand in hand. Without thought you cannot speak. At least, without the capacity to hold mental images of the world in your head, speech is impossible. But at the same time the advent of speech seems to allow more complicated thought and the ability to solve problems without acting them out on objects in the world. Imagination only flowers after language acquisition has proceeded some way, or so it appears. But appearances may be a bit deceptive. Watching children at the one-

word stage you cannot but be impressed by their understanding of the world. In a familiar environment with familiar people they seem to detect quite subtle changes in mood of those around them and play complicated games.

Time to move on

By 18 months or so, the newborn becomes a toddler and so leaves infancy and enters the next stage of childhood. Never again in a lifetime will the rate of change be so fast or new skills and abilities arrive so quickly. As their child leaves this first phase, parents are likely to have mixed feelings. They newly found expressiveness and autonomy bring new possibilities and rewards in daily life and the endless days and nights of unremitting cleaning and feeding begin to retreat a little as they are relieved by moments of almost adult-like behaviour. But at the same time most of us have some feelings of regret. There is very deep satisfaction for most parents in being able to hold and (occasionally) comfort and entirely dependent baby. But we have to move on with our own children though the experience of those first weeks and months always stays with us.

With the mastering of language, a whole new range of means of expression come to the child without resorting to childish babble

HEALTH PROBLEMS IN INFANCY

Illness is described as either acute or chronic. An acute illness is one which is sudden, intense, usually brief and not necessarily serious, e.g., the common cold. A chronic illness is one which lasts for some time without any rapid developments.

Health problems which arise before birth are known as congenital disorders. These include inherited conditions (such as haemophilia and sickle-cell anaemia) and conditions which develop in utero (e.g., various heart disorders) or at birth (e.g., brain damage). Rather less serious problems may arise from the baby's eating and sleeping routines

ILLNESS	SYMPTOMS	TREATMENT/ACTION
Cystic fibrosis	Found in one in 1000 live births. All mucus-secreting glands are malfunctioning. It affects the digestive system by causing diarrhea and weight loss; and the respiratory system where excessive lung mucus can lead to bronchitis or pneumonia.	Antibiotics used against infection. Breathing can be aided by physiotherapy. Treatment still being developed.
Hemophilia	Lack of substance called Factor VIII, which promotes blood clotting, can lead to internal bleeding or to prolonged bleeding from a slight external injury. Only males suffer from it, and most die prematurely.	Sufferers are given transfusions of plasma containing Factor VIII.
Muscular dystrophy	Duchenne muscular dystrophy affects the pelvis, shoulders,	A degenerative disease which cannot be cured. Later, a wheelchair will be

	trunk and later the limbs. It is first noticed when the child begins to walk.	necessary.
Phenylketonuria	An absence of enzymes that metabolize certain toxic phenyls in the bloodstream. If untreated can lead to severe mental retardation.	If detected soon after birth, can be dealt with by diet containing proteins from which phenylalanine is removed. The diet is continued until adulthood and resumed during pregnancy.
Sickle-cell anaemia	Red blood cells become sickle-shaped when deprived of oxygen and they impair circulation. Over-exertion leads to severe pain in abdomen and joints.	Blood transfusions may be needed, but this condition is often fatal.
Celiac disease	Fats cannot be digested. Diarrhea and weight loss.	The cause of this disease is unknown. A gluten-free diet is necessary.
Cleft palate and hare lip	The two sides of the roof of the mouth fail to join before birth, leaving a gap in the nasal cavity. Usually occurs together with a hare lip-a split between the two halves of the upper lip.	Surgery improves and often cures both conditions. A cleft palate can be operated on at 15 months and a hare lip at three months.
Club foot	One or both feet are twisted out of position by a malformation of bones or a stretching or shortening of muscles and tendons.	Mild cases will respond to manipulation. Special shoes, exercises and sometimes surgery may be necessary.
Down's syndrome (Mongolism)	A chromosomal disorder which causes mental deficiency and certain physical characteristics	None available.
Heart deformities: hole in the heart, blue babies	A hole in the heart is often due to foetal development stopping too soon. Maldevelopment of the circulatory system leads to deoxygenated blood flowing into vessels that should carry only oxygenated blood (hence the 'blue' appearance).	A hole in the heart often closes of its own accord. Surgery has improved the survival rate for 'blue' babies
Hip dislocation	The thigh bone is out of the hip socket at birth. It is more common in girls.	Can be corrected by wearing a special splint. Surgery may be necessary

Spina bifida	One or more vertebrae are open at the back. In severe forms the spinal cord is deformed or damaged before birth, producing paralysis in the lower body. most mild cases go unnoticed.	For severe cases an operation only sometimes succeeds. Physiotherapy and special treatment are necessary.
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Other problems of infancy

Birthmarks

Many mothers are alarmed by the appearance of birthmarks on newborn infants, but most are temporary. Of the rest, the “strawberry” mark (a red, raised spongy area of skin) may enlarge and then disappear; if not, it can be shrunk by injections or removed surgically. “Port wine” stains (dark red, flat areas on face and neck) can be treated to make them less noticeable and concealed by special cosmetics. Vitiligo (an area of white skin) can be concealed but not treated. “Liver spots”, dark patches, come to look like large freckles.

Crying

Crying is the baby’s only means of communication and parents soon learn to distinguish between different reasons for crying. Frequent causes of crying are hunger, wind, teething pains, discomfort or loneliness. These situations are easily dealt with but other reasons for crying may be more difficult to resolve, for example colic, a severe abdominal pain which is hard to treat. Or the child may be hypertonic – a condition in which he or she is tense and is disturbed by even the slightest noise. If crying is persistent or in any way unusual, a doctor should be consulted.

Feeding

Feeding problems which occur while the baby is being weaned are usually brought about by his or her reactions to the novelty of the experience. Conscious swallowing has to be learned and this may take time, so do not force or trick the child into eating.

Sleeping

Most children go through a phase of refusing to settle when put to bed. Sometimes this is due to anxiety about being left alone or fear of the dark. This is usually remedied easily by parental reassurance and use of a nightlight or leaving the door ajar. For severe bedtime crying a doctor may prescribe a mild sedative for short term use. Early waking may be a problem for parents; children can be encouraged to play in their bedrooms in the early morning. Walking during the night may be caused by disturbance from noise elsewhere, so it is best not to accustom a child to complete silence while he or she sleep. Alternatively, a child may need less sleep, and a later bedtime or cutting out a daytime nap should adjust the balance. Nightmares are often a sign that the child has developed the ability to think on a symbolic level and invent imaginary characters. He or she needs to be calmed and reassured before returning to sleep.

(B). CHILDHOOD



Through many processes of learning and over a period of years, children will make their way towards the world of niches, roles and games that is adult society. How should they travel? What must happen to our two-years-olds to enable them to become inhabitants of that larger world in which adults live? First, they must learn to communicate. Many adults spend their days in a constant process of spoken, written and electronic communication with each other. Initially, this learning process will be haphazard. However, when children enter school, they begin the long, deliberate and challenging task of learning to read and write. We now expect all children to obtain in a few years skills in literacy and numeracy that it took adult society thousands of years to develop. Secondly, children must learn to see the world from an adult viewpoint. The world around us does appear marked off in inches, miles, hours, days and months. Adults have developed such sophisticated ways of cutting the world into segments. Thirdly, our children must learn a bewildering variety of social norms and conventions which allow us to relate to each other with varying degrees of intimacy. And they will learn to accept responsibility and impose self-discipline.

Children spend their pre-school years in what more than one commentator has likened to the Garden of Eden. Long sunny days, a big beautiful world to be explored and mastered. But this is a kind of romantic myth-making that some adults like to engage in. Of course, pre-school children experience much less scheduling and conflict of will now than they do in the later years of childhood. It may take 20 years or more to grow up, to finish training and take a free-standing place in the adult world. Once, not so long ago, it took a dozen years for most children. In modern societies, there are a great variety of ways to be an adult. But all of them require much learning and personal growth.

Health problems

LLNESS	SYMPTOMS	TREATMENT/ACTION
Asthma	A chronic disorder of the bronchial tubes, causing breathing difficulties. It may be due to infection, or inherited. Allergic asthma is stress related.	Antibiotics are used against infection; injections can control allergic reactions; an attack can be controlled with an inhaler. Breathing exercises are helpful.

Chickenpox	An infectious viral disease accompanied by aching and shivering and a rash of dark red pimples on which blisters develop. Spots are found on face, scalp and chest. Scars can result from scratching.	Rest; a lotion to soothe the itching.
Infantile convulsions (unrelated to epilepsy)	Febrile convulsions lasting a few minutes, followed by sleep.	Child must not be left because of the risk of inhaling vomit. Call a doctor after the child has fallen asleep.
Leukemia	Diseases characterized by the proliferation of abnormal white cells, leading to anemia, infection and bleeding.	No known cure. Drugs, including steroids, are used to try to prevent the white cells from reproducing.
Measles	Begins with fever, a cough and conjunctivitis. After five days a rash merging into blotches appears behind the ears and spreads to the trunk.	Rest, cough syrup, light diet and protection from cold, damp and bright light.
Mumps	Chill and fever, headache, swollen glands.	Rest, light diet, aspirin
Parasites 1. fleas, body lice, head lice, mites	1. Fleas cause severe irritation; some animal fleas also live on humans. Body lice live and lay eggs in clothing—bites may spread infection. Head lice lie on the scalp. Mites cause scabies, infectious groups of scabbed pimples.	1. Fleas and body lice can be controlled by strict cleanliness. Head lice can be banished by the frequent use of a special shampoo and a fine-toothed comb.
2. threadworms, roundworms, tapeworms, hookworms.	2. Threadworms are common in children, causing stomach pains, nausea and itching. Roundworms invade the liver, lungs and intestine. No symptoms until a large number blocks the bile duct. Tapeworms attach themselves to the intestine. Hookworms suck blood; symptoms are anemia, malnutrition, constipation and diarrhea.	2. Threadworms and roundworms: treatment is straightforward, but consult your doctor. Tapeworm: drugs are needed to clear it. Hookworms: drugs, high protein diet and extra iron.

Urinary tract problems	Infections anywhere in the urinary tract are common in young children.	Resulting fevers are treated with antibiotics. See a doctor early
Whooping cough	Convulsive cough with typical whooping breathing. Vomiting	Hospitalization for serious cases. Antibiotics, mild sedatives, rest, fresh air.

Many childhood diseases are now comparatively rare in industrialized countries; for example, rickets, and vitamin deficiency. Widespread vaccination against smallpox, diphtheria and tuberculosis has saved thousands of lives. However, there are links between whooping – cough vaccines and encephalitis (inflammation of the brain) and this has greatly worried some parents and doctors. Some of the symptoms of childhood illnesses can seem alarming, but many have trivial causes.

MENTAL DEVELOPMENT IN CHILDHOOD

Piaget's theory of cognitive development

In 1919, Jean Piaget, a young zoologist and naturalist, went to the Paris laboratory of Theophile Simon to work on the then very new business of testing children's mental development. In the years since 1919 until his death in 1983, Piaget and his collaborators produced some 50 books and a multitude of articles about children's thinking processes.

Piaget's early training as a zoologist profoundly influenced the kind of theory he developed about human thinking and his choice of method for the study of cognitive development. Many of his early ideas in fact came from his detailed observations of his own children, from their first days of life. Later, Piaget collected most of his data by devising tasks for children, observing how they carried out each task and questioning them about what they had done.

Intelligence as adaptation

The question which concerned Piaget was "How do animals adapt to the environment?" As he noted, human beings have an outstanding capacity for adaptation. Not only do we rapidly change our behaviour in the face of new environments, we change our environments to suite our behaviour. Unlike non-human animals, we can also deal in possibilities and abstractions, and reflect on our own thought processes. Obviously, not all humans can do this. Infants cannot. Piaget was therefore concerned with describing and explaining how these cognitive changes, between infancy and adulthood, come about.

Piaget's theory of cognitive development is very complex and, at times, some would say very loose. This makes it very difficult, even for those who are extremely familiar with the theory, to know exactly what Piaget was saying. However, his theory has been profoundly influential not only in psychology but also in education. Because of this, it is important that those concerned with the education of children, whether parents or teachers, should understand something of the theory and its problems.

Assimilation and accommodation

For Piaget, the process of coming to terms with the environment is an active one. The human organism can deal with the environment by making the latter fit its own existing capabilities. Piaget called this part of the adaptive process assimilation. However, the organism also needs to alter its behaviour to deal with the properties of its environment. The process is called accommodation. Piaget used the example of the make-believe play of the young child ("this box is really a racing car") as an example of assimilative behaviour. Imitation, on the other hand, is almost totally accommodatory.

The two processes, however, can rarely be separated out. Both go on together. Through them, the organism can achieve continuity, variability, growth and change. It has been suggested that learning is maximized when the child's environment creates some tension between assimilation and accommodation. A very basic example of this is the use of pureed foods between liquids and solids. They cannot be sucked, but they do not have to be chewed.

Stages of development

Piaget emphasized that development is continuous, but he talked of it occurring in a series of stages. Transition from one stage to another indicated that some very fundamental cognitive reorganization was taking place. Piaget's use of the term "stage", and the way in which it has been used by later writers, is very important in understanding the weaknesses of his theory and the problems of applying it to education. This point will be mentioned again later.

The first 18 months or so of life constitute what Piaget called the sensori-motor period. This period was discussed in "Infancy"; in this section we are interested in the stages which span the childhood years. Piaget divided this period into two stages – the concrete operational (spanning roughly 18 months to 11 years) and the formal operational (11 to 15 years). The age boundaries here are, of course, very approximate and Piaget attached no significance to age per se. The concrete operational stage is divided into two parts: the first of these lasts until about age seven and is called the pre-operational stage. It is during this period that the "concrete" operations are being prepared for. They are established and consolidated during the concrete operational stage.

During the pre-operational stage, the operations are being "prepared": children are laboriously learning that items can be combined by addition or separated by subtraction, but their understanding of what they are doing is precarious. When children pass into the concrete operational stage, however, they are able to perform many mental "acts", but only with actual physical objects (hence the term "concrete" operational period). In the formal operational period, however, children can perform these operations with verbal propositions-they do not require the actual objects to work with. They can deal with propositions and abstractions ("supposing x is equal to twice y ...").

Piaget attempted to capture the difference between concrete operations and formal operations in the following example: Edith is fairer than Susan. Edith is darker than Lily. Who is the darkest? Many children of 9 or 10 find this problem extremely difficult. If, however, they were asked to work it out using three dolls, they could do it quite easily.

Going back to where you started

For Piaget, one of the most important mental operations which children learn to perform is reversal-understanding that, in principle, every act is reversible: things that have been added

can be taken away again, and things that have been taken away can be added, leaving the original state of affairs intact.

Suppose you and a friend are in a pub. Both of you ask for sherry. Yours comes in a long, narrow glass, while your friend's comes in a large, round glass. Your friend's drink will obviously come much less far up the side of the glass than will yours, but he doesn't make a scene and claim that you have more sherry than he. Why? Because he understands that both drinks came from the same measuring glass and that, if poured back, would be shown to be equal.

Very young children, however, have difficulty in coming to grips with reversibility. For Piaget, the ability to make use of this principle was one of the main signs of having reached the concrete operational stage. He devised a number of tasks which he claims tell us whether or not a child understands the principle of reversibility and, thus, whether he or she reached the concrete operational stage.

These are usually referred to by psychologists as conservation tasks. One of the best-known and simplest involves presenting the child with two sticks of equal length arranged thus. The child agrees with the experimenter that the sticks are of equal length. The experimenter then pushes the sticks out of alignment thus, and repeats the questions: "Are the sticks the same length?" Many very young children will now claim that the sticks are unequal. When questioned, they will usually say that one of them (pointing) sticks out more than the other. According to Piaget, such children have not yet reached the concrete operational stage: they cannot carry out the crucial operation-reversal-required in this task. In other words, they do not grasp that the sticks could easily be pushed back into alignment, thus restoring the original state of affairs.

What these findings seem to indicate is that for young children the difficulty is not understanding reversibility, but freeing themselves from the context and cues of the experiment. In order to answer correctly, they must attend solely to the question being asked and nothing else. Imagine how the standard Piagetian task might appear to a very young child. The experimenter arranges things in a certain way and asks the child a question. She then takes the trouble to rearrange things, in front of the child, and asks the same question. It seems reasonable to suggest that many children take this as a cue that their answer should be different. If however, the original question is omitted or the rearrangement made to look accidental, then the children are not misled into thinking that they should change their answer. In other words, some of the children are paying too much attention to the social context of the experiment and not enough to the task itself.

As we saw in "Infancy", all early learning takes place within a social context. Children first start to understand language by observing that certain things are said in certain situations. It should not surprise us that pre-school and early-school-age children pay such close attention to social cues. It seems that one of the goals of school education is, necessarily, to free children's thinking from this dependency and enable them to think about problems in a more abstract manner.

Going to school

Both non-industrialized and industrialized societies assume that children change between the ages of five and seven. By seven, so the received wisdom goes, they have minds, can reason, will remember what you tell them, know right from wrong, should be held accountable for

what they do, should be taught courtesy and respect, have lost a certain innocence and magic and have become faintly sexual.

However, whereas from this age onwards a child in a non-industrialized society begins to work in a limited way at adult tasks, a child in an industrialized society begins schoolwork. In the former, children move towards adult life and company; in the latter, if anything, children move away from it, spending their days and much of their spare time among their peers.

Early care and education

Early childcare through nursery schools, day-care center and kindergartens is growing everywhere, though no country yet authorizes and provides early care for all its children. A child usually attends one of these facilities from three, or three-and-a-half, until school age. Childcare before the age of three is expensive and, where it is available, not all parents find it acceptable. In no country do more than 10-15 per cent of all children attend such facilities.

Care for the under-threes: loss or gain

It has been argued, notably by the British psychoanalyst John Bowlby, that infant under three who are cared for outside the home may suffer because of the separation from their mothers. Not surprisingly, some people have concluded from Bowlby's work that children should not be subjected to day care before the age of three because of the parental separation it entails. There are several arguments against such a conclusion.

Firstly, Bowlby's theory about the effects of early separation was based on observation of delinquents, many of whom had apparently suffered early "maternal deprivation". They had also, however, suffered other deprivations to which Bowlby paid less attention.

Secondly, common sense tells us that day care would not be so widespread today if parents, caretakers or paediatricians found that children had problems with it. Thirdly, in the last decade, there have been a number of careful American studies of children in day care. They have uniformly reported that the experience has a neutral or slightly positive effect on children's development.

Whatever the long-term effects, parents sometimes find the immediate effects difficult to deal with. Children under three are likely to protest at leaving their parents and show unhappiness. At the age of three-and-a-half, almost all children find the transition to nursery school easy, and this is undoubtedly why more and more parents make use of childcare at this time.

The pre-school experience

The most common reason for the use of nursery schools is to provide social support for the parents and the child. With families living in cities and with women working, nursery schools provide an attractive environment for children during the day.

A very secondary reason until now for putting children into nursery school has been to provide them with formal training or education. In the broadest sense of the term, of course, any absorbing experience the child has – with other children, with games, toys, clay or paints – is educational. All nursery schools provide an informal educational environment, and most of them stress the need to give breath to a child's experience.

Formal pre-school education maybe said to exist when specific and stated changes in children are sought through training. In the United States, the nursery school has traditionally been a place where children engage in free play in an environment that is friendly and undemanding, but encouraging. The Soviet Union has a formal kindergarten curriculum, but there are probably wide variations in the extent to which it is followed in different parts of the country. Other countries (Belgium, France, the Netherlands, Sweden) have nationally organized systems, but not national curricula. West Germany specifies goals nationally, and the regions are responsible for their implementation. Italy and the United Kingdom do not have centrally directed systems. There is, in short, no international consensus that formal pre-school education ought to exist, that children's development ought to be turned or modified in specified directions before they enter formal schooling.

This is quite in contrast with elementary school education, of which all modern countries have similar expectations. Everyone agrees that children in primary schools should learn how to read, write and do arithmetic. Any debate is about means, not ends, or else it is about what the elementary grades should include over and above the basics.

When it comes to pre-school education, there are no generally accepted "basics". Debates are about ends, not means. Should pre-school education be formal? Who is to have it? What kind of changes in a child should one try to bring about? Formal pre-school education could aim at one or more of the goals outlined below.

Speeding up the development of thought

Whether or not Piaget's ideas are used as a basis for activities, the assumptions embedded in this approach are that there is one main line of development for children, that it is useful to think of differences among children as due to their having reach different points along that line and that it is beneficial to accelerate children's progress. At the High / Scope Foundation in Ypsilanti, Michigan, the curriculum put together by David Weikart and his associates is an example of a plan specifically designed to speed up the course of a child's cognitive development.

Teaching specific skills

Two psychologists, Carl Bereiter and Siegfried Engelmann, developed in the early 1960s a curriculum for nursery-school children. It focused specifically on the skills needed for successful performance in later schoolwork. Their approach, which was based on the belief that nursery schools cannot offer the disadvantaged child the varied stimulation of a middle-class home, achieved some success.

Raising IQ

It is questionable whether any nursery school has ever accepted raising IQ as its basic purpose. Nevertheless, in the United States this goal has been much discussed for educational pre-schools as a group. In the early 1960s, when a child's IQ score was taken as an index of his or her destiny, two writers, J.McV. Hunt and Benjamin Bloom, argued that IQ is modifiable in infancy and "hardens" later. A pre-school, it seemed, might perhaps change a child's destiny. But since then there has been growing skepticism as to whether the IQ score is a fair statement of children's intelligence.

Increasing attention and self-directedness

In 1907 in Italy, Maria Montessori established her “children’s houses” for three-to seven-year-old children from slum tenements in Rome. Her curriculum was carefully organized and skill-oriented, not unlike that of Bereiter and Engelmann. Montessori’s children did sensory exercises, carried out practical activities such as sewing or table-setting and received training in reading and writing. Montessori was shrewd at observing children and inventive at devising techniques. But her greatest strength, probably, was that she saw the social design of her children’s houses as a form of curriculum. Children lived in a free and mobile environment. With their training routines, teachers helped children to sustain their own attention and action.

The modern approach that most resembles that of Montessori is that of the American Bank Street College of Education. The Bank Street teacher allows the children to select their own activities. She then moves in with highly structured training routines intended to support the children in elaborating their own activities. Bank Street uses very different teaching and psychological concepts from Montessori. Nevertheless, it sustains her important idea that the medium is part of the message of early education.

Ready for school?

Industrialized societies know how old a child is and put him or her in school promptly at the legal age. Non-industrialized societies often do not know how old a child is. When the British set up schools in colonial Africa, one of the methods used to judge whether children were ready for school was to ask them to reach their right arm over their head and touch their left ear. If the children could reach their ears, they were old enough for school. The method depends on the fact that very young children’s heads are large in relation to their bodies and the bodies catch up as the children grow.

Testing “readiness”

American schools today often use what are called “readiness tests” to decide whether a child is fit for conventional schooling. However, the tests pose certain serious problems. Firstly, they are not very good at predicting how a child will perform in the future. Secondly, they constitute one of those instances, all too common in the case of children, where adults make a “diagnosis” without being sure they have a treatment. Reading test generally assume that schooling ought to be slowed down for immature children. Yet schooling today is rather strictly paced. Standardized national achievement tests, standardized curricula in elementary schools, parents’ expectations, slowly built up around tests and curricula – all these act to determine far too strictly what to expect from children year by year. If children get off the train and walk for a while, they have real trouble catching up again.

A third problem with readiness tests is that they are developed to detect a hypothetical maturity whose form is unknown. It is not too hard to guess that a child who is visibly growing on the outside must be changing on the inside. It is quite another thing to estimate what those internal changes are and what they imply for the child’s learning.

Current tests are generally based on the assumption that “reading readiness” depends on perceptual and intellectual skills. But they do not all test the same range of abilities. Each test is divided into subtests, and each subtest tests a specific ability (for example, auditory discrimination, following directions, copying or giving the names of letters). These subtests are even poorer than the tests as a whole at predicting ability, so that extreme caution should be exercised in making judgements based on them.

Biological changes

Children's mental development goes hand-in-hand with the biological process of maturation. It would be an oversimplification to say that these biological changes cause the changes we can observe in children's cognitive skills. There is good reason to believe that the amount of environmental stimulation which children receive, the challenges they face, can affect the nature and amount of biological change, which in turn allows further behavioural development.

Brain structure

One index of physical maturation is myelinization, the process whereby certain nerve fibres become sheathed in myelin, a grey, fatty substance. The study of myelinization in the brains of deceased children has made it possible to estimate how fast different areas of a child's brain develop. Myelinization is important because myelin, which covers only the nerves of the human "higher" brain centers, is known to speed up the rate at which messages are transmitted along these nerves. At birth, myelinization is incomplete. It advances rapidly during the first few months of life, but is still taking place in several areas of the brain at the age of 10 and may even be detectable as late as 30. What is interesting is where in the brain myelinization is found.

In the years 6 to 10, myelinization of the corpus callosum is completed. The corpus callosum is a major bridge of nerve fibres connecting the right hemisphere of the brain with the left. In the 1970s, many claims were made about the different functions of the left and right hemispheres of the brain. The left hemisphere was claimed to be responsible for logical and analytical thinking and for any ability, including language, which depends on linear sequences. The right hemisphere was claimed to govern spatial and geometric abilities—anything which deals with patterns rather than an orderly succession of items. In fact, the evidence for this differentiation of functions between left and right hemispheres is much weaker than many over-enthusiastic writers would have us believe. It is still impossible for us to draw any conclusions about what changes in children's behaviour we would expect from the myelinization of the corpus callosum.

Between the ages of 6 and 10, myelinization is generally also completed in the parietal and frontal areas of a child's cortex (outer layer of the brain). If you look at a child's right ear and imagine a line running straight north, and another north-west, then the right parietal lobe is the area of the surface of the brain between those lines. The left is the equivalent area on the other side. The frontal cortex is the area situated between the north lines and the forehead. It appears to be implicated in the planning and execution of behaviour sequences and in the control of extraneous behaviour.

David Rose of Tufts University believes there is a link between the frontal cortex and the hippocampus in children which is completed at the age of about four-and-a-half. The hippocampus is part of the limbic system, which seems to be connected with the feeling and expression of emotion. Studies of the hippocampus in animals have suggested that its maturation plays a role in bringing an end to "juvenile", the free and frisky behaviour generally found in young animals and in ushering in the more sober, staid behaviour of the adult. We have no way of knowing if the same is true of humans. But it may be that the link between the frontal cortex and the hippocampus which David Rose has studied is involved in the changes in young children's memories and in their increasing ability to control their impulses.

Brain waves

Brain waves are detected from the electrical activity on the scalp and are measured in frequencies (cycles per second). Frequencies vary according to the activity being undertaken. For instance, people will have much faster (higher frequency) brain waves when they are solving a problem than when they are asleep. What interests us is that the faster frequencies appear more and more often in children up to adolescence and are probably associated with the characteristic speeding-up of their reactions. Some theorists believe that when it comes to children's thinking processes, speed equals power—that is, the ability to calculate rapidly determines the complexity of the problems they can deal with.

Control of fine muscles

One particular maturational feature is more conspicuous than those we have dealt with so far. Nursery-School children as a group are slightly awkward in their movement, which is one reason why they tend to be accident-prone. Children of elementary school age are much more competent with their bodies. This change in physical competence has been attributed to the fact that neuromuscular development progresses from the trunk outwards to the limbs and finally to the hands and feet. Most nursery-school children do not throw a ball very well, because they use only the large arm and shoulder muscle, and do not involve the smaller muscles controlling the wrist and fingers. School-age children are able to coordinate their musculature more completely and may take an active part in sports. They improve all the way to adolescence, becoming quicker and better coordinated as well as stronger.

Reading and writing call for many precise movements of fine muscles, including those of the eye. In recognition of their limited abilities, children are given small quantities of large type to read in their first years at school, and when they write they print in large letters.

Soft signs

The term "soft sign" comes to us from neurology. It refers to an old behaviour or reaction pattern that is not quite clear enough to point to a recognizable neurological disorder—in which case it would be a "hard sign"—but which may indicate trouble somewhere. All children show a high incidence of soft signs in the nursery-school years, because of the immaturity of their nervous systems.

Ask a nursery-school child to hold both hands in front, palms down, and to spread the third and fourth fingers of his left hand away from the rest, and he will often spread the fingers of his right hand as well. Ask a child to bend her ankles and walk on the outer edges of her feet, and she will often arch her wrists and hold her hands in imitation of her feet as she does so. These are "associated" or "reflected" movements, a kind of soft sign. The children do something on the left side and unconsciously echo it on the right side or they echo with the upper part of their bodies something they are doing with their lower limbs as young children exhibit soft signs, the incidence of which declines as they grow older. But a high incidence may be associated with learning problems in the early years at school.

Early learning disability

An enormous amount has been written about the problem of "learning disability" in the early school years, and the reviews express severe scholarly frustration. How common is the problem? Reasonably informed sources have estimated the incidence as anywhere between 2

per cent and 40 per cent. Standards adopted in applying the label vary, although it is usually applied when children have obvious problems in making headway in the lower classes. Some authorities apply the label only when there are some soft signs of neurological problems—clumsiness or uncoordination, tremors, twitchiness, pathological reflexes or brainwave abnormalities—any of which may be linked with reading difficulties. The incidence goes downwards, towards 2 per cent, when this kind of standard is applied.

However, one cannot draw a line separating the children whose reading problems are neurologically based from those whose problems are clearly not neurological. Recognizing this, some have argued that learning disability should be defined simply as poor reading. If one approaches the problem this way, the incidence rockets towards 40 per cent.

What's in a name?

If the estimates of the incidence of learning problems vary, so too do the labels used—learning disability, reading disability, educational handicap, hyperactivity, minimal brain damage, minimal brain dysfunction, perceptual disability, attention deficit syndrome, dyslexia and many others. These labels tend to give a spurious impression of being informative, when in fact some of them are simply statements of the problem and other unvalidated inferences—the term minimal brain damage, for example, is applied to children who show no real evidence of brain damage, the term “minimal” signifying that the hypothetical damage cannot be detected. And since various school systems and treatment services couch their regulations in different terms, a child may have to be labeled “educationally handicapped” in one place or “minimally brain damaged” in another before he or she can qualify for help.

Adult misconceptions

Both of these approaches are based on the superficially valid assumption that the tasks facing the new schoolchildren should be made as simple as possible and that errors should be reduced to a minimum. There are two problems with these assumptions. One is that “simplicity” is defined from an adult point of view and, as we have seen, may be based on false ideas of children’s abilities. The second is that the idea the errors are a “bad thing” is also an adult notion. Indeed, it is not unreasonable to suggest, at least as far as early school learning is concerned, that errors are only a bad thing for a child because adults say they are and make a fuss about them.

Margaret Donaldson has suggested, contrary to this view, that error can play a highly constructive role in the development of cognitive skills. She points out the widely held belief that children must not be told the complexities of, for example, the phonetic system, to begin with, because they could not cope with such complexities. She suggests that what underlies this mistaken assumption is the failure to distinguish between understanding the nature of a system and mastering all the individual patterns of relationship. Children will obviously take many years to master the intricacies of the system. The question is simply whether they will do this more successfully if they are correctly informed of what to expect.

In practice, many teachers will use a variety of schemes to help children learn to read and, when failures occur, will explore any possibility which seems to work. This would seem to be the best approach, as it is extremely unlikely that any one scheme will suit the needs of all children. The point here, however, is that educational, even non-traditional educational theories are still largely adult-centred. Is it then fair to regard children as having a problem when they cannot cope?

There are two possible solutions to this problem. One is for educators and psychologists to become more aware of the extent to which educational methods are based on assumption, as yet unproven, about how children learn. On the other hand, there is now a voluminous literature on the psychology of learning which has never been widely applied in the classroom. Programmed instruction, for example, is based on tried and tested principles of learning. But it has not found favour in many classrooms partly because of the (unproven) belief that it might damage the relationship between teacher and child.

A second solution, of more relevance to the day-to-day business of home and classroom, is for parents and teachers to encourage a child to state how he sees the problem, to say what he does not know or understand, rather than, as usual, what he does know. It has been shown that pre-school children rarely ask for clarifying information when they are given an inadequate message. However, it is only by finding out how the problem looks from where the child (and not the adult) is standing, what difficulties it presents to him or her, that we can begin to build up an educational system that is truly child-centred that is of true benefit to the child.

Refusing to go to school

At one time or another, most schoolchildren invent excuses which will keep them away from school, or exaggerate small illnesses to get an extra few days at home. A small number of children, however, do this so often that they miss large amounts of schooling or, finally, do not attend at all. It may be some time before parents realize what is going on; indeed the idea that there are certain children who could be called "school refusers" or "school phobic" is itself a relatively recent one.

One of the first writers about school refusal described the problem in these terms.

The child is absent from school for periods varying from several months to a year. The absence is consistent. At all times the parents know where the child is. It is with the mother or near the home. The reason for the truancy is incomprehensible to the parents and the school. The child may say that it is afraid to go to school, afraid of the teacher or say that it does not know why it will not go to school. When at home it is happy and apparently carefree. When dragged to school it is miserable, fearful and at the first opportunity runs home despite the certainty of corporal punishment. The onset is generally sudden. The previous school work and conduct have been fair.

In the last 30 years, some of the details of this problem have been filled out, but the broad outline described above remains valid. It is difficult to determine the scope of the problem, but the Isle of Wight study described estimated it to be present in about three per cent of all children with some kind of psychological problem. Several American studies have noted that black children rarely figure among school refusers and a British study noted the same about West Indian children living in London. It is still not clear why this should be the case.

In order for a child to establish a pattern of school refusal and remain at home, it is obvious that the mother or father, usually the mother, must cooperate. This may be done actively – by rewarding the child for staying at home with play, attention and so on, by reassuring the child that he does not have to return to school until he is "ready", or even by making arrangements for home tuition. Or the cooperation may be passive, as in the mother who is genuinely concerned about the problem, who attempts to take the child to school or tries to persuade him to go but who, in the end, gives way and allows him to stay at home. The child, of

course, may be able to bring considerable pressure to bear and it is often difficult for a mother to resist her child's obvious distress.

Help for school refusers

Successful intervention must also involve the home and school. It is important to establish, first of all, what factors in the school might make the child reluctant to attend and secondly, what factors in the home are encouraging non-attendance. In different children, the balance between these two elements will vary. Information about the school can be obtained from the teacher, the parents, the children themselves or even classmates. Problems which often come to light include difficulties with schoolwork, lack of friends among classmates, teasing or bullying. These last are related. Children who are teased or bullied are also likely to lack friends. Whether they remain friendless or become victims of bullying will depend on factors connected with the school rather than with the children. It may be that problems at school can be alleviated by cooperation between teachers and parents; it may be that the children need help in learning the skills of making friends, or it may be that a change of school is necessary.

Even if these factors can be dealt with, it is usually still necessary to help such children overcome the considerable amount of anxiety which will now be connected with attending school. This may be done by teaching mind what will happen at school until they can do this without fear, or by gradually re-exposing them to the school situation by, for example, traveling increasingly close to the school each day, standing at the school gates or attending school for longer and longer periods of time each day. In any case, the class teacher will have the major responsibility of coping with a child's reappearance in the classroom. Some therapists introduce external rewards for school attendance (or gradual approximations to it), such as outings, books or toys, but these are usually withdrawn as soon as the child has settled down at school, although verbal praise and encouragement will continue. All therapists emphasize, however, that an important part of the intervention is to convey to the children that, in the end, they simply must reattend school. This may be particularly difficult to do if, for example, a mother has been in the habit of taking her child to school, but allowing him to return home in the middle of the day.

The function of school is not only an educative one in the academic sense, important though this is. It is also where most children make their friends and learn other skills such as sport, drama or music which they are unlikely to learn at home. Children who are afraid to attend school, and spend most of their time at home with their mothers, will miss all this and will also develop a negative attitude to dealing with life's problems-which is likely to cause them further difficulties as they grow up

MEASURING IQ

At some point in their school career, many children will find themselves at the receiving end of an "intelligence test". Some of the basic ideas in IQ testing come out of a "measuring scale of intelligence" put together by Frenchmen Alfred Binet, a psychologist, and Theophile Simon, a psychiatrist, in 1905. Their test has had a large influence, for better or worse, on the way in which we now think about human intelligence (although, in fairness, we do not know that the two authors would have wholeheartedly endorsed many of the ideas that were built up around their measuring scale).

Binet and Simon designed their test at the behest of the French Government to provide a uniform and objective method for screening out poor learners ("subnormals") in schools.

From that day to this, many people have identified intelligence, ability or merit it children solely with the ability to perform well at school. IQ, or intelligence quotient, is derived from the following:

Mental age

IQ = $100 \times$

Chronological age

Consistency of performance

There is much evidence that IQ depends a good deal on what is going on around him or her. When the environment change, the IQ is likely to change too. Often if we look at the lives of children whose IQs have shown a change, we can find events that may account for it.

What's wrong with IQ tests?

In the last decade, some American states and cities have placed formal restrictions on the use of IQ tests. They claim, for example, that the tests are not even-handed in their assignment of IQ scores to children of different cultural backgrounds. This is because the sample on which the test was standardized (on which the average performance was worked out) may be very different from that on which the test is used. And because performance on the tests may be influenced by familiarity with certain things and ideas which may be common place in one culture but not in another, the tests cannot be applied outside the range of their standardization sample.

The many faces of intelligence

Paradoxically, IQ tests have contributed evidence against one of the assumptions that launched them: that there is one generalized human talent determining how well a child does in a range of tasks. It now seems likely that human "intelligence", even that restricted portion of it that applies to performance at school, is not one grand talent. On IQ tests, certain items tend to cluster together: a child who does well on one item of the cluster will tend to do well on the others.

A number of educational reformers have argued forcefully that traditional mental tests and school practices favour the verbally gifted child. Children with visual and spatial skills are passed over in schools, it is said, and all children are somewhat deprived of opportunities to develop visually-based fo

Health problems in childhood

ILLNESS	SYMPTOMS	TREATMENT/ACTION
Asthma	A chronic disorder of the bronchial tubes causing breathing difficulties. It may be due to infection, or inherited. Allergic asthma is stress related	Antibioticd are used against infection; injections can control allergic reaction; an attack can be controlled with an inhaler. Breathing exercise are helpful
Chickenpox	An infection viral disease accompanied be a rash of dark red pimple on which blisters develop. Spots are found on face, scalp and chest. Scars can result from scratching	Rest; a lotion to soothe the itching
Infantile convulsions (unrelated to epilepsy)	Febrile convulsions lasting a few minutes, followed by sleep	Child must not be left because of the risk of inhaling vomit
Leukemia	Diseases characterized by the proliferation of abnormal white cell, leading to anemia, infection and bleeding	Call a doctor after he or she has fallen asleep
Measles	Begins with fever, a cough and conjunctivitis, After five days a rash merging into blotches appears behind the ears and spread to the truck.	No known cure, Drugs including steroids, are used to try to prevent the white cells from reproducing
Mumps	Chill and fever, headache, swollen glands.	Rest, cough syrup, light diet and protection from cold, damp annd bright light
Fleas, Body lice, Head lice, Mites, Threadworms, round worms, tapeworms, hookworms	1. Fleas cause severe irritation; some animals fleas also live on humans . Body lice live and lay eggs in clothing bites may spread infection. Head lice lie on the scalp. Mites cause scabies, infectious group of scabbed pimples	1. Fleas and body lices can be controlled by strict cleanliness. Head lice can be banished by the frequent use of a special shampoo and a fine toothed comb

	2. Thread worms are common in children, causing stomach pains, nausea and itching. Round worms invade the liver , lungs and intestine . No symptoms until a large number blocks the bile duct. Tapeworms attach themselves to the intestine. Hookworms sucks blood ; symptoms are anemia , malnutrition, constipation and diarrhea	2. Threadworms and roundworms treatment is straightforward , but consult your doctor. Tapeworms ; drugs are needed to clear it. Hookworms ; drugs , high protein diet and extra iron.
Urinary tract problems	Infections anywhere in the urinary tract are common in young children	Resulting fevers are treated with antibiotics. See a doctor early
Whooping cough	Convulsive cough with typical whooping breathing. Vomiting	Hospitalization for serious cases. Antibiotics, mild sedatives, rest , fresh air

Many childhood diseases are now comparatively rare in industrialized countries; for example, rickets, and vitamin deficiency. Widespread vaccination against smallpox, diphtheria and tuberculosis has saved thousands of lives. However, there are links between whooping – cough vaccines and encephalitis (inflammation of the brain) and this has greatly worried some parents and doctors. Some of the symptoms of childhood illness can seem alarming, but many have trivial causes

(C) ADOLESCENCE

Over the centuries, no period in life has been more celebrated – and condemned – than adolescence, by poets, philosophers and politicians. It is easy to recognize some contemporary views in those irritably stated by Aristotle, 23 centuries ago the young, he said, are “passionate, irascible, and apt to be carried away by their impulses, especially sexual impulses... in regard to which they exercise no self-restraint. They are too fickle in their desires, which are as transitory as they are vehement...If the young commit a fault, it is always on the side of excess and exaggeration...They carry everything too far, whether it be their love or hatred or anything else. They regard themselves as omniscient.”

However, there is a more favorable view of youth, for which poets have had memorable kind words and on which old people look back with regret and loss. Somewhere between the excess and the ecstasy lies the real human experience.

What does lie behind this long-standing fascination with adolescence? In part it is recognition that young people are our links with the future, our guarantee of continuity for our species, our own vicarious triumph over death and failure. But there is also a more personal side to our preoccupation with youth. For most of us, adolescence is remembered as the time when our identities began to crystallize, when our potential was at its height; when, whatever the pains, we lived most intensely.

Adolescence can be a time of irrepressible joy and seemingly inconsolable sadness and loss, of gregariousness and loneliness, of altruism and self-centeredness, of insatiable curiosity and boredom, of confidence and self-doubt. But, above all, adolescence is a time of rapid change—physical and emotional changes within adolescents, and environmental changes in the nature of external demands placed by society on its developing members.

At no other time, from the age of two onwards, does the individual undergo as many changes as during the period surrounding puberty. Small wonder that so many adolescents, faced with an ever-changing physical image in the mirror, conscious of new—and sometimes strange—feelings and thoughts, ask themselves “what is that person all about?”

Developmental “Tasks” of adolescence

The changes of puberty are much the same everywhere, but the developmental “tasks” young people are expected to master may vary widely from one society to another, both in kind and degree of difficulty.

In non-industrialized societies, the tasks to be mastered may be relatively simple and few in number, and represent only a gradual emergence from earlier stages of development. Unlike youth in many Western countries, there is usually no societal or familial expectation that a boy will leave home and obtain an unfamiliar job, if necessary in a strange community. By the time a girl reaches puberty, she may already have been chosen as a wife by her future husband’s parents and will have gradually learned to assume the daily responsibilities of a household. Although her partner may not be the man of her choosing, she will have been prepared by the older women for the changes that she is about to experience, and will have been able to adjust to them over a long period of time.

In modern industrialized societies such as our own, however, adolescents are expected to master far more complex developmental tasks, and there is a much more rapid shift from childhood dependence, with its relative lack of responsibility. In the years between puberty and nominal adulthood, adolescents may be expected to achieve independence from their parents, to establish new kinds of social and working relationships with peers of both sexes and with adults, and to adjust to increasing sexual maturity and changing roles. This will include a consideration of the possibilities and demands of marriage and parenthood, or alternative relationships. In addition, adolescents will be under pressure to decide on personal education and their job future, and to prepare for the responsibilities of active citizenship.

Identity crisis

We are familiar with the expression “adolescent identity crisis”, but we tend, misleadingly, to use the term “identity” as if it denoted something a person has. In fact, the use of the term as a psychological concept is a peculiarly Western idea. Were we to pose the question “Who are you?” to a member of, say, a New Guinea tribe, the answer would be quite straightforward: “I am X, son of Y of tribe Z”. The question “Who am I” would be met with incomprehension or taken as indicating that the speaker was suffering from amnesia.

Rather than looking at identity as a quality of the individual, it is perhaps more useful to examine the way the term is used in Western societies and see if this helps explain why it should so consistently surface whenever adolescence is mentioned.

People use the term “identity” in a variety of ways. First of all, it is used to denote the separateness of individual people, that they are defined in terms of their own personal attributes and not just as “a schoolgirl” or in relation to someone else. The period of adolescence may mark an individual’s first experience of this kind of anonymity: the move from a small elementary school where everyone knew everyone else to a large secondary or high school where teachers and pupils may just be faces in the crowd. The rest of society does not help, with its tendency to lump young people together under negative labels such as “rebels” or “troublemakers”, rather than treating them as the individuals they are.

The term “identity” is also used to refer to our perception of ourselves as consistent, both physically and psychologically, from one day to the next. We do not, of course, expect total consistency. We can be happy one day, sad the next. We can gain or lose weight, change our hair color without feeling that we have changed our identity. It is abrupt and major changes in these areas that are likely to have us feeling like a different person. Adolescence, as we shall see later in this chapter, is a time of exceptionally rapid, and major, physical change.

The ways we think of ourselves psychologically is strongly related to the way in which people react towards us. Not only do people’s reactions to an adolescent differ from their reactions to a child (“you’re a man now”), they also tend to fluctuate from moment to moment. Adolescents may be expected to take responsibility, to “act their age” but still, in many ways, be treated as children.

Adolescents are also expected to make major choices which may affect them for the rest of their lives. To leave school or stay on? To take this subject or that? To “go steady” or date lots of people? To start smoking or not? In some ways, this range of choices and opportunities is beneficial, but it can be very problematic-not because of the number of choices, but because we still expect these choices, once made, to be irrevocable. If you do not believe this, try telling your friends (or your future spouse) that you do not expect your marriage to last more than a few years. Or tell an interviewing panel that you intend to take up a quite different profession in five years’ time. Adolescents, confronted with the necessity to choose, may say “I need time to find myself” when they simply mean that they do not want to make an irrevocable choice at such an early age (or, indeed, at any age). Many of the identity problems of which adolescents complain may be created by a society which expects them to take up a role and carry it with them for the rest of their lives. Looked at in this way, we can see that identity problems are by no means confined to adolescence.

Sexual identity

An important part of our sense of identity is the awareness and acceptance of our basic biological nature as a man or a woman. Because one’s sex is a biological fact about which little can be done, sexual identity conflicts are likely to create significant problems for adolescents who experience them.

It is important to distinguish between sexual identity, in the sense of biological sex, and sex role behavior. People who complain of sexual identity problems are often confusing the two. Appropriate behavior as a man or a woman need not mean rigidly conforming to sex-role stereotypes such as that of the ambitious, self-reliant assertive but not very sensitive male and the affectionate, gentle, sensitive but not very assertive female. There is no biological reason why men and women should not be capable of both independence and a reasonable kind of assertiveness, as well as sensitivity. Indeed, the findings of recent scientific investigations suggest that young men and women who are androgynous (that is, who display both

“masculine” and “feminine” behaviors) score higher on measures of self-esteem, do better in their academic work in school and college, have better relations with the opposite sex and are more self-reliant and independent and less conforming than more purely masculine or feminine types.

Although this “mix” is probably a very desirable state of affairs, it is perhaps important, in our enthusiasm for women’s- and men’s liberation, to avoid imposing a new set of stereotypes, even some “ideal” androgynous balance, on all boys and girls, men and women. The ultimate aim of any process of socialization should be to permit each adolescent to develop his or her unique potential as an individual, consistent with the rights of others.

Growing up

Unlike younger children, whose physical growth is gradual and orderly, adolescents are likely, over a short period, to find that they feel strangers to the self with which they have been familiar since early childhood. The process of integrating these dramatic physical changes successfully into an emerging sense of a stable, self-confident personal identity may be a prolonged and difficult one. There is no doubt that it could often be made considerably easier if young people (and their parents) had a clearer idea of the true nature of the physical changes of their puberty and later adolescence.

Hormones and the biological clock

The term “puberty” derives from the Latin word pubertas, meaning “age of manhood or womanhood”. It refers to the first phase of adolescence, when sexual maturation becomes evident. The onset of puberty becomes most readily apparent with the initial appearance of public hair and, in girls, the first signs of elevation of the breasts (the “bud” stage). In fact, by this stage, the process has already been going on for some time internally, with an increase in the size of the testes in boys and of the ovaries in girls.

The intricate sequence of events producing physical growth and sexual maturation is controlled by hormones secreted by the endocrine glands. These hormones are triggered by signals originating in the hypothalamus, an important coordinating centre in the brain. This can only occur when the hypothalamus is sufficiently mature. The signal stimulating the pituitary gland, which lies immediately below the base of the brain, to release hormones which themselves have stimulating effects on other endocrine glands in the body. It is from these that more hormones finally come—they will affect physical growth and sexual development. Among them are thyroxin from the thyroid gland, cortisol from the adrenal gland, and sex hormones, including androgens (the masculine hormones) and progestins or gestagens (the female hormones). By means of a complex feedback system, these and other hormones stimulate and accelerate the many physical and physiological developments of puberty and adolescence.

The growth spurt

The term “adolescent growth spurt” refers to the accelerated rate of increase in height and weight that accompanies puberty. The age at which the growth spurt (and puberty generally) begins varies widely even among perfectly normal children. In boys, the growth spurt may begin as early as 10 ½ or as late as 16; some boys may have almost completed their physical development before it begins in others, without any implications that either one or the other is abnormal. For the average boy, however, rapid acceleration in growth begins at about 12 ½,

reaches it faster up to the age of 14 and then declines to pre-growth rates after the age of 14. The growth spurt begins on average two years earlier in girls.

Changes in height and weight are accompanied by changes in body proportions in both boys and girls. The head, hands and feet reach adult size first. In turn the arms and legs grow faster than trunk length, which is completed last.

These differences in rates of growth of different parts of the body account for the temporary feelings of awkwardness felt by some adolescents, especially those who are growing fastest. For brief periods, some young people may feel that their hands and feet are too big, or that "they are all legs". Thoughtless comments by adults will not help.

Sex differences

Sex differences in body shape are also magnified during early adolescence. Although girls have wider hips than boys even in childhood, the difference becomes pronounced at the onset of puberty. Conversely, boys develop thicker as well as larger bones, more muscle tissues and broader shoulders. Partly because of this, boys become and remain much stronger than girls as adolescence proceeds. There are, however, other reasons for the boys' relatively greater strength. Relative to their size, boys develop larger hearts and lungs, a higher systolic blood pressure, a greater capacity for carrying oxygen in the blood and a lower heart rate while resting. They are also chemically more resistant to fatigue.

Nutritional needs

Many discouraged parents, with a wary eye on the ever-rising cost of food, have the feeling that rapidly growing adolescents, particularly boys, are "eating us out of house and home". As can be seen in the accompanying table, on average boys need more calories at every age than girls. However, a very large, very active girl will obviously have greater nutritional needs than a small, inactive boy.

Recommended daily dietary allowances (calories)

	Age	Weight in pounds	Height in inches	Calories
Boys	11-14	97	63	2800
	15-18	134	69	3000
	19-22	147	69	3000
Girls	11-14	97	62	2100
	15-18	119	65	2100
	19-22	128	65	2000

Anxieties

A number of normal characteristics of sexual maturation may be a source of embarrassment or anxiety, to a male adolescent. During the process of voice change (which can be abrupt or gradual), the larynx (Adam's apple) grows larger and the vocal cords virtually double in length. As a result, the boy's voice drops about an octave in tone. It takes at least two years for the average boy to gain full control of this change, during which there may be sudden jumps from a deep bass to a high-pitched squeak.

In all adolescent boys, there are increases in the size of the areola (the area surrounding the nipple): in some, perhaps 20 to 30 per cent. There is also a distinct enlargement of the breasts themselves about midway through adolescence, which usually appears in about a year. This enlargement may cause some boys anxiety about their masculinity, and it is a good idea to reassure them that this is normal and will pass. They are not going to turn into girls. Likewise, the pre-pubescent boy may show a tendency to rounded hips, which may reinforce the anxiety, but in all normal circumstances, this too disappears after the onset of the growth spurt. Like boys, adolescent girls frequently harbor a number of anxieties about their bodies during this period of rapid physical change. They may worry, but usually less these days than formerly, whether their breasts will be "too big" or "too small". Breast size, in fact, has nothing to do with capacity for either breast-feeding or sexual arousal.

A few girls who are worried about aspects of their maturation may develop a reactive sexuality, as, indeed, may boys. They may pursue sexual experience, not so much for its own sake, but to reassure themselves about sexual normality. Adolescent girls may also be concerned about such things as the size of their hips, and many may be anxious about the physical, psychological and social aspects of menstruation. Accurate and freely given information about normal development and its many possible variations can help to dispel and unnecessary distress

Menstruation	Menstrual problems
<p>Nowadays, more and more girls seem to accept the onset of menstruation calmly. Some look forward to it. But many other girls look on this normal-and inevitable-development negatively as "something women just have to put up with". One common reason for these negative attitudes is how other women present this experience. If a girl's parents and friends act as though she requires sympathy for her "plight", the first herself is likely to react in a similar fashion.</p> <p>Also, if she resents growing up, or if she has been unable to establish a satisfactory feminine identification, the adolescent girl may be disturbed by the unmistakable signs of approaching woman-hood. A wise and understanding approach by parents, who</p>	<p>Negative reactions to menstruation may also stem from physical discomfort during the early years of puberty. A number of girls experience headaches, backache, cramps, abdominal pain and feelings of fullness. In many cases these disturbances disappear or lessen in time. The female hormone estrogen and progesterone play their part in the menstrual cycle. They have also been implicated in menstrual pain and in the physical and psychological changes labeled "premenstrual tension" (PMT). Different theories of the causes of menstrual problems have their own, often fierce support. The difficulty is that no one theory seems to apply to all cases.</p>

show pride in their daughter's maturity, may help to alleviate these problems.

Early and Late Maturers

In general, early or late maturing appears to have a greater effect on boys than on girls. Adults and other adolescents tend to think of the 14 or 15-years-old boys who looks 17 or 18 as older than he actually is and therefore to expect more mature behavior from him. Because there is less of a physical discrepancy between an early-maturing boy and most girls of this age (because of the earlier growth spurt in girls), he may become involved sooner, and with more self-confidence, in boy-girl relationships. He may also have an advantage in athletics and in other activities. So although an early-maturing boy may feel different from his peers, he is not likely to feel insecure about the difference.

By contrast, a late-maturing boy is more likely to be treated "as a child", which may infuriate him, even while he continues to behave maturely. He will probably have a harder time achieving recognition in athletic and other physical activities as well as in his relations with girls.

Parents, teachers and others to minimize the anxiety and other negative psychological effects of late maturing can do much. They can make a conscious effort to avoid the trap of treating the later maturer as younger than he is. They can help him to realize that his slower maturation is perfectly normal—that he will indeed "grow-up" and be just as physically and sexually masculine as his peers.

Among girls, the effects of early and later maturing are generally fewer and more variable. Although early-maturing girls tend to be somewhat more relaxed, more self-confident and secure, the differences are not large. Why the differences should be greater among boys is something of a mystery. One reason, however, may be that our society's expectations for adolescent boys are less ambiguous than for girls, but whether they are greater is open to dispute.

Erection, ejaculation and nocturnal emission	Anxieties
A boy's capacity for erection of the penis and for pleasurable genital stimulation is present from infancy, but only with the onset of puberty and the associated increases in testosterone (male hormone) levels do sexual urges become strong and insistent. Erections become far more frequent and are likely to be aroused by a wide variety of stimuli, some of which are patently sexual but others much less obviously so. Boys may be proud of their capacity for erection as symbol of emerging virility, but its uncontrollability can be a source of social and even moral anxiety.	The "wet dream" experience common to almost all males may produce anxieties in adolescent boys, to the point where they may be afraid to sleep or to sleep in strange beds or even their own if they think their parents disapprove of sexuality. Nocturnal emission occurs more frequently among youths without other sexual outlets, such as masturbation, petting to orgasm or intercourse and may or may not be accompanied by overtly erotic dreams.

The adolescent boy's first ejaculation is likely to happen within a year of the onset of the growth spurt and may happen as a result of masturbation or during sleep (the so-called "wet dream") or of spontaneous waking orgasm. A boy who has previously masturbated, with accompanying pleasant sensations but without ejaculation, may indeed be taken by surprise by his initial ejaculation of seminal fluid and wonder whether it is harmful

Being different

As adolescents stop being dependent mainly on the family and more on the peer group as a major source of security and social status, they need to conform to peer group standards more, not only in social behavior, but in appearance and physical skills. If they deviate from the idealized peer group norms in body build, facial features, physical abilities-even, at times, in such seemingly irrelevant matters as whether one's hair is straight or curly-this may be a source of great distress to adolescents.

Many adolescents, however, find themselves faced with very real problems about their appearance. At a time when it seems vitally important to them that they look their best, their lives are made unhappy or miserable by acne. While it is nice to think that it is what you are and not what you look like which is important, there is quite overwhelming evidence that physical appearance plays a crucial role in the judgments which we make about each other. The problem of acne therefore deserves to be taken as seriously by adults as by adolescents themselves. In fact, even severe acne can be significantly controlled or abolished by specialist medical treatment

Sexual behaviour

In early adolescence, at least, the problem of sex is likely to be greater for boys than for girls. For reasons that we do not entirely understand-although physiological (including hormonal) and psychological factors are probably both involved-boys seem more conscious of specifically sexual impulses than girls and find them harder to deny. Sexual drive among girls is likely to be more diffuse and ambiguous. Many younger adolescent girls may choose to deny their sexual impulses for a time.

However, boys and girls also have much in common in their concerns about sexuality. Both want to feel liked, loved and wanted, and not just be treated as sex objects. They want to know about practical matters such as masturbation, sexual intercourse, conception, pregnancy and birth control. They also want to know how to fit sex into their overall values and how to have mutually rewarding, constructive relations with others, both of the same and the opposite sex. On these matters, most young people receive little help from the inconsistent, conflict-ridden and sometimes hypocritical world in which they live.

Sex education

A good many adults in western society remain adamantly opposed to adequate sex education. Some parents believe that sex education, even at high-school level, is dangerously premature for “impressionable” adolescents and likely to lead them into promiscuity. Others maintain that information about sex should be taught only by parents in the privacy of their homes. Still others have apparently reached the conclusion that today’s adolescents have nothing left to learn about sex—certainly nothing their parents could teach them. None of these views will stand up to scrutiny.

In the light of current statistics on premarital intercourse and pregnancy, it is difficult to see how sex education for adolescents could be in any way “premature”. Whether or not parents should be educating their young about sex, the fact is that the great majority are still not doing so. When adolescents in a recent national survey in the United States were asked whether their parents talked “pretty freely” about sex, over 70 per cent reported that they did not. When asked specifically if their parents had ever discussed such topics as masturbation, contraceptive methods or venereal disease, two-thirds or more said they had not.

The notion that adolescents have nothing left to learn about sex is equally shaky. Myths about sex are widespread. More than a quarter of adolescent’s aged 16 and over expressed the belief that “if a girl doesn’t want to get pregnant she won’t have a baby, even if she fails to use any contraceptive measure”. Nevertheless, only about a third of high schools in the United States provide comprehensive sex education.

Adolescent and masturbation

Although there has been a marked liberalization of views in recent years among professionals, parents and young people themselves, masturbation is still a source of concern for a significant number of adolescents. And there are still doctors who assert that masturbation among children and adolescents is likely to make it difficult for them to transfer to heterosexual intercourse.

What are the facts? Obviously, early predictions that masturbation would severely impair physical and psychological health are wrong. Furthermore, in the absence of previously acquired guilt and anxiety, masturbation may be enjoyable and reduce tension. There is no indication that it increases the difficulty of later adjustment to heterosexual relations—indeed, available evidence suggests the opposite.

In the case of women who have difficulty in achieving orgasm, sex therapists have found that practice in masturbation can often be of help in learning sexual arousal during sex with a partner.

It is sometimes argued that masturbation, though not physically harmful, may lead to a preoccupation with sex. It seems more reasonable to suppose that such preoccupation is likely to result from continuing, anxiety—ridden efforts to avoid masturbation. Nevertheless, in some instances, it may reflect some adolescent problems. Young people who use masturbation not just as a sexual outlet when “real” sex is unavailable, but as a substitute for other activities in which they feel inadequate, have a problem—not masturbation, although its availability may delay seeking a solution to the real social problem.

Changing values and sexual behavior

One of the more prominent aspects of the youth culture of the 1960s and clearly one of the more enduring – was the development of a new sexual morality. This brought a greater openness and honesty about sex, and an increasing tendency to see decisions about individual sexual behavior as a purely private concern of the person or people involved. This trend appears to reflect in part a growing disenchantment with established social institutions, together with a shift in values among many young people in the direction of self-discovery and self-expression. In a recent study, most adolescents in the sample agreed that “it’s right that people should make their own moral code”, but only a minority (a quarter of 16 to 20-year-olds) agreed that “so far as sex is concerned, I wouldn’t do anything that society would disapprove of”.

The growing emphasis on openness and honesty is not evidence of an increased preoccupation with sex, as many parents and other adults seem to think. Indeed, it may well be that today’s average adolescent, accepting sex as a natural part of life, is less preoccupied with sex than his or her counterparts in earlier generations, with their atmosphere of secrecy, guilt and suppression.

How are these changing attitudes about sex among adolescents reflected in their behavior? Although almost all adolescent boys already engaged in masturbation before the so-called “youth revolutions” of the 1960s (and indeed did so as far back as human records go), there is some evidence that masturbation among boys is currently beginning at younger ages than in the past, and is accompanied by less guilt and anxiety than previously. Among girls, recent data indicate that there has been a significant increase in the incidence (or, at least, the reported incidence) of masturbation at all ages between 12 and 20. However, girls generally appear to engage in masturbation—or admit to it—only about half as often as boys. Interestingly, it occurs three times as frequently among those with experience of sexual intercourse or petting to orgasm as among the sexually inexperienced.

Petting appears to have increased somewhat in the past few decades and to occur earlier. The major change, however, has been in the frequency of petting leading to erotic arousal or orgasm and, certainly, frankness about this activity.

These manifestations of sexuality are something most societies and parents have become used to dealing with. Currently, however, the greatest amount of concern from parents and society is focused on the dramatic increase in actual sexual intercourse among young people.

This trend has been found in the United States and other Western countries, although there are clear national differences in the total incidence of premarital intercourse. For both males and females, England, West Germany and the Scandinavian countries (in that order) show a higher incidence than the United States and Canada, while some other countries, such as Ireland, show a lower incidence.

However, there are wide individual differences within each country, with the lowest incidence generally occurring amongst adolescents who are younger, female, highly religious and politically conservative. More adolescent virgins than non-virgins have “a lot of respect” for their parents’ ideas and opinions, feel close to and liked by their parents, believe that their parents understand what they want out of life and find it relatively easy to communicate with them. By contrast, nearly three times as many non-virgins as virgins agree that “I’ve pretty much given up on ever being able to get along with my parents”. Compared with the parents of non-virgins, the parents of virgins are more likely to have discussed topics such as masturbation, birth control and venereal disease with their children.

These findings are echoed in an investigation of American high-school youth, where another important finding was that the degree of influence the mother had was related to the amount of maternal affection she exhibited.

Effects of the “new morality”

In today's more open social climate, many experienced adolescents seem able to handle sexual involvement without undue stress. Four out of five non-virgins in the United States report getting “a lot of satisfaction” out of their sex lives.

However, significant minorities report feelings of guilt, find themselves exploited or rejected, or discover belatedly that they cannot cope emotionally with full sexual relationship. Especially after their first experience of sexual intercourse, girls are far more likely than boys to experience negative feelings: whereas boys are most likely to report being excited, happy and satisfied, girls often report being guilty, afraid, worried or embarrassed after their initiation. As one 16-years-old girl expressed it, “I felt really guilty. I wondered if my mother really knew. I came in after it had happened, I felt I had guilt written all over my face.”

On the other hand, another 16-year-old girl who had been going with her boyfriend for several years had a very different experience: “What were my feelings...They were warm feelings, physically close feelings...The only thing I could think of is the wanting each other, a sharing each other. I still feel that way.” There are obvious dangers in the assumption that sexual involvement is OK “as long as you're in love”. Encouraged by such a philosophy among peers, a girl or boy may become more emotionally and physically involved than he or she can handle. An adolescent may also think that his or her attitudes are more “liberal” than they really are, and involvement may lead to unanticipated feelings of guilt, anxiety or depression.

Adolescents, like adults, may become involved in sexual relations for a variety of reasons which have little to do with liking the other person or seeking sexual satisfaction. Often, it may be to gain peer approval, to escape from or to rebel against parents, to gain affection denied by parents or others or as a “cry for help”

PREGNANCY / CONTRACEPTION

Family planning workers often adopt the simplistic view that the answer to unwanted pregnancy is to make effective birth control devices freely available. Nobel as these sentiments may be, the fact is that less than a third of unmarried girls having intercourse have used the contraceptive pill to prevent pregnancy, and a disturbingly high percentage-between 55 and 75per cent-have used no contraceptive device whatsoever, at least in their first experience. Only a minority consistently uses such a device thereafter. Even among those in steady relationships, only two-thirds reported always using contraceptive devices.

This widespread failure to take contraceptive precautions, together with the continuing increase in premarital intercourse among adolescents, has resulted in more than a million 15 to 19-year-old girls in the United States alone (10 per cent of this entire age group) becoming pregnant each year; two-thirds of these pregnancies happen outside marriage. In addition, annually some 30,000 girls under the age of 15 become pregnant.

The consequences of this “epidemic” of adolescent pregnancies are serious indeed. More than a quarter are terminated by induced abortion; 10 per cent result in marital births that were conceived premaritally; over one-fifth result in out-of-wedlock births. Fourteen per cent miscarry.

In recent surveys, the main reasons given for using contraceptives were that the teenagers thought (usually mistakenly) that they could not get pregnant because of the time of the month, age, or frequency of intercourse, or that contraceptives were not available when they needed them. Planned Parenthood in America noted that “the first set of reasons could be remedied by better education, the second with more adequate service program”. Yet, only one in three high schools currently teach about birth control methods, despite the fact that 8 out of 10 American adults old enough to have adolescent children favor such teaching.

However, we must be careful about assuming that more education and widely available contraception are the whole answer. It is easy to lose sight of the fact that, compared with 10 or 20 years ago, the availability and acceptability of contraception has increased dramatically. Those who wish to see more education about birth control certainly have a point: ignorance about the mechanisms of conception is widespread among adolescents (and some adults).

What these changes do not deal with are the complex psychological factors which underline the decision to have sex and to use or not use contraception. The immediate consequence of sexual activity are (usually) pleasurable. The negative consequences (pregnancy, venereal disease) are significantly delayed. Likewise, the immediate consequences of using effective contraceptive may be negative (medical examination, unwanted side-effects, mess, interference with spontaneity), while the positive consequences (avoiding pregnancy) are delayed.

Psychologists have long been aware of the importance of immediate consequences in controlling behavior. The use of contraception requires the setting aside of these immediate consequences and engaging in long-term planning and foresight. Specifically, it requires the conscious acknowledgement that sexual activity will take place and must be prepared for. A girl may know all there is to know mechanically about birth control, but if the reaction of her family, friends and teachers to planned sexual activity is somewhat negative (and in spite of the sexual revolution this is often the case, particularly for girls), then we should not be surprised if she “chooses” to be erratic in her use of a contraceptive or in her expectation that one will be used by her partner.

It seems likely that premarital intercourse will continue to become accepted practice, and steady relationships will still be viewed as the most frequent and the most socially approved pattern among sexually experienced adolescents. What we must hope is that those who do enter sexual relationships can be helped to become sufficiently mature, informed, responsible, sure of their own value systems and sufficiently concerned about the welfare of others, for the inevitable casualties of sexual activity to be reduced to a minimum which, of course, depends on the attitudes of adults towards the adolescent.

Homosexual behaviour

Many adolescents worry at one time or another that they may be homosexual. But at least half of all boys and one third of girls have engaged in some form of sex-play with other members of the same sex during pre-adolescence. Most of these young people go on to lead heterosexual lives.

Kinsey found that most adults are more or less exclusively heterosexual. A small minority are exclusively homosexual. But a quarter of adults fall in between these two groups. They may be mainly heterosexual, but with some homosexual involvement or the reverse. The most important factor in predicting whether an adolescent will become primarily or exclusively homosexual in orientation is not whether the young person is capable of arousal with members of the same sex, but whether he or she is incapable, for whatever reason or reasons, of attraction to the opposite sex.

In some instance, disturbed parent-child relations seem to play a part. Homosexuality seems to occur more frequently among boys with overly intrusive dominating mothers and detached or rejecting fathers.

Among girls, a number of factors may contribute to a homosexual orientation: a sexual education that encourages girls to view men as dangerous, threatening or dirty or, conversely, as weak and inadequate, or in the situation in which the father, while outwardly puritanical, is subtly seductive, encouraging a too-close relationship with himself, but discouraging relationship with boys who are the girl's own age

Narcotics and alcohol

Although there may be significant differences between generations in their patterns of drug use (and drug abuse), the broader society of which adolescents are a part has been developing into a “drug culture” for many years. For example, one-quarter to one-third of all prescriptions currently being written in the United States are for pep or diet pills (amphetamines) or tranquillizers. Between 1964 and 1977, prescriptions for Valium and Librium, the two most widely used tranquillizers, increased from 40 to 73 million a year in the United States alone.

Television and radio bombard viewers with insistent messages that relief for almost anything-anxiety, depression, restlessness-is “just a swallow away”. Adolescents who have adopted this view of how life is to be coped with may only be reflecting societal and parental models.

Research has shown that young people whose parents make significant use of such drugs as alcohol, tranquillizers, tobacco, sedatives and amphetamines are more likely than other adolescents to use marijuana, alcohol and other drugs themselves.

It is also true that while too many adolescents are becoming serious, high-risk drug users, the majority are not. Despite dire predictions in the late 1960s about the imminence of an “epidemic” of adolescent drug use, nothing of the kind has materialized.

Nevertheless, there is no room for complacency. Although it is accurate, for example, to state that “only” 3-5 per cent of junior and high-school students in the United States have ever tried heroin, this still adds up to over a million young people. In addition, use of traditional (i.e., adult) drugs, particularly alcohol, has increased in recent years.

Alcohol

A common refrain among many parents of adolescents today is: “I’m becoming concerned about his drinking, but at least it’s better than drugs.” In fact, alcohol is just as much a psychoactive drug as, say, marijuana and its dangers have been far more clearly established.

Furthermore, the use of alcohol is more common among users of marijuana and other drugs-especially tobacco-than among non-users.

Most adolescents have tried alcoholic drinks at some time, although the frequency of use varies with age, sex, religion, social class, place of residence and country of origin. In non-Muslim countries alcohol is the most frequently used of all psychoactive drugs, including marijuana. It is estimated that in the United States between 71 and 92 per cent of adolescents have tried alcohol by the end of the teenage years. One phenomenon of the 1970s has been the equalization of the rate of alcohol use amongst teenage boys and girls: both groups show an increase over the last 20 years or so, with the rate for girls increasing much faster than that for boys. It should be noted, however, that most adolescents who have engaged in drinking are temperate in their use of alcohol and are likely to remain so.

Nevertheless, if one uses getting high or drunk once a week or more as a criterion of problem drinking, about 5 per cent of United States teenagers at high school are already problem drinkers. And these figures only include students still at school. Surveys of college students find a much higher figure, at least among males.

Marijuana

Among adolescents who have experimented with one or other illicit drugs, marijuana users account for by far the greatest percentage. In the United States currently more than half of all young people have at least experimented with marijuana. But it is only among chronic heavy users (as is the case with alcohol) that there are fairly consistent indications of real psychological and social disturbance. However, as heavy, chronic marijuana use is typically associated with multiple use of drugs, a direct cause-effect relationship between heavy use and emotional disturbance is difficult to establish.

Furthermore, studies of multiple drug users suggest that their use is a result of psychological or social disturbance, rather than its cause. Obviously, once such drug use has begun, a vicious circle may be initiated, with mutual reinforcement of both disturbance and drug need.

Why do adolescents take drugs?

One reason why adolescents may try a drug is simply because it is there. Unlike the average young person of 50 years ago, whose opportunities for drug use were limited in most countries to alcohol and tobacco (and even alcohol was then much less freely available), today's adolescents face a cornucopia of drugs from which to choose, both those sold in pharmacies and those available only on the street. Adolescents are characteristically curious about their expanding world and far more inclined than most adults to take risks. This is probably partly to prove their boldness, their sense of adventure, and partly because they do not believe, at least initially, that anything disastrous can happen to them.

Young people may also try drugs because of a need to be accepted by a group of peers who are already involved with drugs. In recent research, it has been found that one of the best predictors of whether an adolescent will become involved with a drug is the use of that drug by friends, especially best friends. Adolescents themselves acknowledge the importance of peer group influences.

Parental influence

For the child of democratic, loving parents who allow their children gradually increasing, age-appropriate opportunities to “test their wings”, the risk of serious drug involvement is generally lower than that for children whose parents have not been loving and who are neglectful, overly permissive or-in contrast-authoritarian and hostile. It is the authoritative parent who is most likely to use the induction techniques, described in “childhood”, that foster the kind of mature morality which to some extent immunizes the young person against the sometimes superficial rewards and punishments which may be exerted by peer groups for using or not using drugs.

Another reason for drug use, often given by the adolescents themselves, is to escape from the tension and pressure of life and from boredom. Ironically, this is also a major reason why adults resort to drugs. One of the greatest dangers of drug use by adolescents is that it can become a substitute for learning to deal with the daily problems and inevitable frustrations of living. And if this learning is never achieved, then drugs may continue to be the answer to life’s problems.

What can parents do?

Even the most enlightened, sensible parents cannot guarantee that their children will not become involved with some drug experimentation. There are, however, a number of steps that parents can take to minimize the possibility.

- Try to keep the lines of communication open with your children.
- Help your children to become more independent and to take increasing responsibility for their own actions long before the onset of adolescence.
- Remember that you are role models for your children. What you do is often more important than what you say.
- Take an interest in your children’s activities-young people need to know that their parents really care.

What if parents discover drug use?

First try to find out just how serious the matter is. The average person who has smoked a few joints or had a few drinks is not in imminent danger.

Assuming that the use of drugs is not, at least yet, out of hand, parents should attempt to discover what lies behind it: curiosity, adventure, a simple desire to share in peer group activities, or resentment against parents, fear of school failure, feelings of inadequacy, and low self-esteem, depression or acute anxiety? Parents should attempt not only to talk to their child, but to look at the young person’s life as a whole-and at themselves.

Are they part of the problem, as well as part of the solutions? If honest efforts to explore these issues fail, if it becomes obvious that the adolescent’s drug use has already become a serious problem, professional help should be sought promptly

Body problems

With the adolescent growth spurt and awareness of developing sexual maturity, a teenager's anxieties become focused on his appearance and on the functioning of his body. Rates of growth vary considerably, and at any time someone may be feeling too short or too tall, that his or her shoulders are too narrow or breasts too large. In Western society boys are typically most concerned with muscular development-while girls try to combine their more rounded, maturing shape with fashionable slimness. Fitness and athleticism may be considered desirable for both sexes. But, when it comes to weight control, excessive dieting may lead to anorexia, while overeating provides some compensation for unmet emotional or sexual needs. The main pressure is to fit in with the peer group as far as possible in appearance and style. Sadly, minor problems or differences may result in teasing and insults, which add to the burden of coming to terms with a growing body.

Problems	Problems % concern	Problems % concern
	Boys	Girls
1 Pimples, blackheads and acne	51	82
2 Uneven teeth	39	42
3 Greasy skin	27	52
4 Large or misshapen nose	10	38
5 Having to wear glasses	23	31
6 Skin blemishes, moles, birthmarks	13	30
7 Receding chin	10	13
8 Heavy eyebrows	10	11
9 Forehead too high or too low	0	13
10 Homely, unexciting appearance	0	42
11 Dry, scaly or flaky skin	0	43
12 Narrow lips	0	13
13 Freckles	0	24
14 Face pudgy or too rounded	0	21
15 Face narrow or too thin	15	0
16 Large or sticking out ears	10	0

17 Gaps between front teeth	26	0
18 Heavy growth of facial hair	13	0
19 heavy lips, lack of beard	10	0

Depression

Saying that a person is depressed tells us little. The word is used when someone is sad over a loss or disappointment, and when the mood is so low the person is almost immobile and expressing feelings of worthlessness and severe guilt.

For most adolescents, low mood is transient, a part of the emotional ups and downs that are so frequent at this time. For some, however, depression may become the dominant mood; it is at this point that professional help may be required. If ignored, such depression may become chronic or even result in suicide.

Depressed adolescents may be unwilling to talk about their feelings and they may show “depressive equivalents” such as boredom and restlessness, which may confuse anyone trying to clarify the problem. A strong dislike of being alone, or a constant search for new activities, drugs, sexual promiscuity, delinquency, risk-taking (including reckless driving) may all be indications of depression, although obviously they may be the result of other factors.

In general, adolescent depression is most likely to take one of two forms. In the first, a young person may complain of a lack of feeling and a sense of emptiness. It is not so much that these adolescents have no feelings as that they are sadly unable to deal with or express those they have.

A second type of depression is usually more difficult to resolve. It has its basis in long-standing, repeated experiences of defeat or failure. A large number of adolescent suicidal attempts are not in fact the result of a momentary impulse but of a long series of unsuccessful attempts to find alternative solutions to problems. The last straw is often the loss of a desired relationship, whether with a parent, friend or loved one.

Clues to suicidal risk

- A persistently depressed or despairing mood.
- Eating and sleeping disturbances.
- Declining school performance.
- Gradual social withdrawal.
- Breakdown in communication with parents or other important people in the young person's life.
- A history of previous suicide attempts or involvement in accidents.
- Seemingly reckless, self-destructive and uncharacteristic behaviour, such as drug or alcohol use, or reckless driving.

- Statements such as “I wish I were dead” or “What is there to live for?”
- Enquirer about the lethal properties of drugs, poisons, or weapons.
- Unusually stressful events in a young person’s life such as school failure, break-up of a love affair, or loss of a loved one.

Eating problems

Early adolescence is a period of rapid physical and physiological change, and it is not surprising that after the onset of puberty many adolescents go through a brief period of weight fluctuations.

Our society, in contrast with some others, places a great emphasis on being slim. Many adolescents, particularly those with a naturally large body structure, may eat less than good health requires in an effort to look like some currently admired model of attractiveness such as a film or television star. The result, though hardly desirable, gives no real cause for parental anxiety.

Some adolescents, mostly girls, undereat for so long that they become severely malnourished and their very survival may be threatened. The label given to this behavior is anorexia nervosa. A girl often begins with what appears a sensible diet to get rid of a few extra pounds, but once she reaches an ideal weight or even slightly less, she does not stop dieting. She is fearful that anything she eats will result in an unsightly weight gain.

While this kind of behavior is still relatively rare, it is becoming more common. Parents are often surprised by it, because their child has always seemed so “normal”—in fact, almost too good: quiet, obedient, always dependable, eager to please. Most have been good students.

When one looks closely, however, the picture is not so bright. Although they may not be able to articulate it, many of these girls feel they have been exploited and prevented from leading their own lives, and that they have not been able to form a strong identity of their own. They may have struggled to be “perfect” in the eyes of (often demanding) others. Perhaps in reaction they are likely to display a strong desire to be in control of every aspect of life, including their own bodies. Indeed, they may discover with pleasure that their weight is one area where they are now in control, however tenuously.

Studies of parents of these girls show that the parents had frequently exerted such firm control and regulation during childhood that the girl herself had had great problems in establishing independence, psychologically and physically. These parents are also likely to have encouraged their children to become perfectionists and overachievers.

Because of the physical effects of prolonged undernourishment, carefully planned hospital treatment may first be necessary. But if long-term progress is to be made, psychological intervention, not only with the adolescent but also with the parents, is essential.

On the other hand, some adolescents may eat too much. Most obese adolescents become so through overeating. A few owe their large size to genetic or constitutional factors, and others may develop a physical predisposition to overweight as a result of overfeeding by parents early in life. Infants are born with a certain number of fat cells, and overfeeding during

infancy can result in a permanent increase in the number and size of these cells, making normal weight difficult to achieve.

The psychological reasons for overeating to obesity are many and varied—feelings of emptiness or loneliness, anxiety about being taken care of, feelings of inadequacy. Overweight may be seen as a way of avoiding social or sexual relationships, or even of just getting out of physical exertion. In our weight-conscious society, obesity can be as good as a chastity belt. Obese adolescents—and adults—often seem bad at labeling their bodily feelings, including hunger. The average adolescent will eat when hungry and avoid eating when full, as will the slim adult. This is not typically true of the obese, who tend to eat if food is present or in response to cues other than hunger.

Helping an adolescent lose weight needs parental support and understanding as well as sensible diet. It will not do to nag and deride. Where significant psychological problems seem to play a part in obesity—for example, anxiety over social relationship—an attempt must be made, if necessary with professional help, to clarify this and deal with it as with weight.

Delinquency

More than 2000 years ago, an Egyptian priest carved on a stone, “Our earth is degenerate. Children no longer obey their parents.” Delinquency is no new problem. Today it includes not only the more serious offences such as burglary, assault and robbery, but also minor offences such as truancy, running away, sexual activity or “being beyond parental control”, which would not constitute criminal offences if committed by an adult.

Nevertheless, current rates of delinquency are cause for serious concern in many Western countries, particularly the sharp rise in the rate of serious offences and for delinquency among girls.

Delinquency is both a psychological and social problem. The incidence is higher in socially disorganized, economically deprived areas such as the urban ghettos of large cities, although this does not mean that all young people raised in these areas are delinquents, or that children raised in affluent backgrounds are not.

What distinguishes the delinquent? Research studies indicate that delinquents tend to be more angry and defiant, suspicious of authority, resentful, impulsive and lacking in self-control. They also appear to have lower self-esteem and more feelings of personal inadequacy and emotional and social rejection.

Although influences such as peer-group pressure and a generally adverse social environment obviously play a part in delinquency, the role of parents appears to be crucial.

Fathers of delinquents are likely to be rated by independent observers as cruel, neglecting and inclined to ridicule their children (sons in particular). Mothers of delinquents are more likely to be rated as careless or inadequate in child supervision, and as hostile and indifferent rather than loving and responsive.

What can parents do? In the first place, keep the problem in perspective. Delinquent behavior should never be ignored but many people who become involved in minor delinquent acts go on to become perfectly responsible adults. Sneaking into a movie without paying,

“borrowing” a peer’s property, playing truant from school, even minor shoplifting are not crimes comparable with mugging and burglary.

Serious and honest discussions between parent and child, conducted in a calm but realistic atmosphere, can often be helpful, especially if the basic relationship between them is one of mutual trust, warmth and respect. When such communication is impossible or when it appears that emotional disturbance is playing a part in delinquent behavior, professional help should be sought. As we have seen, parents who encourage the development of independence and self-reliance are less likely to have a delinquent son or daughter.

Health problems

Adolescence is a time of great physical and psychological changes. The majority of health problems are due to the activity of sex hormones, e.g., acne and menorrhagia. Other problems are related to diet-many cases of anemia are attributable simply to bad eating habits. Anxiety about their developing bodies may lead adolescents to seek reassurance that they are not suffering from serious illnesses. But generally this is a time of high energy and relatively few diseases are characteristic of this stage.

PROBLEM	SYMPTOMS	TREATMENT
Anorexia nervosa	Obsessive dieting in girls extreme thinness, cessation of periods low resistance to infection.	There may be reluctance to admit a problem but advice is needed. A period in hospital may be advised when food intake can be monitored.
Bulimia nervosa	Binge eating followed by self-induced bouts of heavy vomiting	These problems are usually part of problems within family relationships and may be difficult to treat in isolation.
Menstrual problems Pre-menstrual tension	Period pain, swelling of body due to fluid retention, painful breasts, backache, depression and irritability.	Consult a doctor. Hormone preparations, such as progesterone, are sometimes effective. A diuretic relieves fluid retention.
Menorrhagia (heavy periods)	Heavy bleeding during periods often accompanied by pain; blood loss can cause anaemia.	Heavy periods may cease later when the menstrual cycle settles into a regular pattern. Bleeding

		between periods should be reported to a doctor. Hormone treatment may be effective.
Dysmenorrhea (painful periods)	Severe period pain and cramps, nausea, dizziness.	Self-help remedies include relaxation and physical exercise. Aspirin temporarily helps the pain. Seek medical advice for drugs to control pains and cramps.
Migraine	Headaches lasting up to several hours, nausea, dizziness, sensitivity to light.	The cause of migraine has not been identified. Some sufferers get relief from anti-histamine drugs; diet may be a factor, seek medical advice.
Allergies	Sneezing, skin rashes, difficulty with breathing.	For severe allergies an allergy test is necessary to identify the cause, when suitable treatment can be prescribed.
Acne	Regular crops of surface pimples, some abscessing to affect deeper layers of skin and cause scarring.	Many proprietary brands of acne creams and gels are available. If the infection is deeply seated it may respond to antibiotics given under medical supervision. For most people acne disappears at the end of adolescence when glandular activity settles.
Sexually transmitted Diseases(STDs) Gonorrhoea	In males, yellow discharge from the penis and pain when urinating. In women,	Self help is not effective for STDs. Abstain from sex and seek immediate

	unusual vaginal discharge.	treatment. Since many people show no symptoms, it is important to consult a doctor if there is fear of infection.
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(D)YOUNG ADULTHOOD

Marriage

The vast majority of adults marry, at least once. They also tend to contract their first marriages during the early part of young adulthood. The rising divorce rate has led some observers to conclude that marriage is becoming an outmoded institution, but this view is not supported by the data. If anything, a slightly higher proportion of the population now marries than 50 years ago; in addition, a substantial number of the divorced and widowed (especially divorced men) remarry, showing that, at least as far as marriage is concerned, once bitten is not twice shy.

What is changing is the form of relationships into which people enter before marriage. (It is interesting to note the extent to which the phrase “trial marriage” has virtually disappeared from the language, thus elevating living together to the status of a separate relationship in its own right). More people are also marrying more often, sometimes in the process creating families so complicated that even their members have difficulty in describing the relationship within them. We have noted that a major preoccupation of early adulthood is the search for a “mate”; the figures for the number of marriages which take place would seem to indicate that most people are, at least initially, successful in their search.

Why him, why her?

Forming a partnership involves three processes. The first is the initial attraction between the pair, the second the decision to take the relationship beyond the first meeting or two, and the third the decision to marry or live together for an indefinite period.

What determines whether people will find each other attractive? Social psychologists have identified two extremely powerful factors, which are, in order, physical appearance and similarity of attitudes. The ideas that we are attracted to people by their personalities, or that opposite attract, have found very little support. People are generally reluctant to admit that they are attracted to people because they look good, perhaps because this seems such a superficial and unfair way to judge others. It is also possible that we are unaware of the powerful effect of physical attractiveness and rationalize our liking for others in terms of their personalities. However, there is now overwhelming evidence that people's appearance is one of the prime determinants of whether we find them attractive (in the psychological sense)-not only that, but physically attractive adults (and children) are judged, *a priori*, to have more attractive personalities, even if the judgements are made from photographs.

In one large-scale experiment, Elaine Walster and her colleagues invited students at the University of Minnesota to fill in questionnaires describing their background, attitudes, interests and so on. They were told that the answers would be fed into a computer which would match them with a partner of the opposite sex, to whom they would be introduced at a “computer dance”. The students were, in fact, matched randomly. As they entered the dance,

they gave their names and were rated by two observers for physical attractiveness. A few weeks later, the students were contacted again and asked how much they liked their dance partners, whether they wanted to see them again and whether the relationship had actually continued. It was found that the most powerful factor in determining whether partners liked each other and whether they continued to see each other was physical attractiveness.

The second important determinant of attraction is attitude similarity. Presumably this is partly because we find it reinforcing to have our view of the world validated. Not all attitudes are equally important, of course. It is those dealing with social, moral and political issues which seem to influence people most.

When relationships go wrong

We have seen that satisfaction in relationships is associated with maintenance of a balanced exchange of rewards. There are two main ways in which this exchange can go wrong and result in unhappiness. Firstly, couples may reward each other much less than they did in the past-the wife may complain that her husband does not try to please her any more, the husband that his wife is “letting herself go”. Signs of appreciation and affection may become much rarer than they were during courtship. In these cases, couples are likely to describe their dissatisfaction as boredom, or being in a rut with the relationship.

The second way in which this exchange can go wrong is when the exchange of rewards becomes unbalanced-one partner continuing to reward at a high rate while the other partner reduces his or her rate of reward. When this happens; the “over-benefited” partner, who is getting more than he or she is giving, or whose partner is more desirable, is likely to report feeling guilt or shame, or being insecure or fearful of losing the partner. The “deprived” partner, on the other hand, who is giving more than he or she is getting, will probably described the distress felt in terms of anger, or resentment, stemming from feelings of not getting fair rewards from the relationship.

The importance of good communication

Marital therapists (and divorce lawyers) have long realized that dissatisfied couples do not communicate with each other very effectively. At extremes of dissatisfaction, communication is used to score points or exchange insults rather than to gather information and to exchange views.

The importance of communication is highlighted when we consider that inequity may result from, or be maintained by, poor communication. A women, for example, may not tell her husband how she likes to be stimulated sexually, either because of shyness or the mistaken belief that he should somehow “know”. A husband may not tell his wife that he preferred her when she was slimmer. Couples in an imbalanced relationship will almost certainly try to restore equity through verbal communication. Constructive and positive attempts would include the women asking her husband to touch her in certain ways and rewarding him (by her response) when he does. The husband might tell his wife how attractive she was slim, try to find out why she is no longer controlling her weight and ask if there is anything he can do to help. Unconstructive and negative attempts would include the women complaining that she is not interested in sex or “punishing” her husband when he does not stimulate her in the way she wants. The husband might tell his wife how ugly she looks, shout at her if she overeats and often remark on the attractiveness of other, slimmer, women.

Does dissatisfaction equal breakdown?

We noted that people take the decision to marry when they feel that the rewards from marriage will outweigh those from remaining single. It follows that couples may tolerate an extremely high level of dissatisfaction in their relationship as long as they do not feel that any better alternative exists. Indeed, some couples may marry only because the alternatives are so bleak-loneliness, remaining with disliked parents, even social rejection. Until relatively recently, our society operated on the assumption, “it is better to marry than to do almost anything else.”

Alternatively, some couples may break up when dissatisfaction is relatively low, but when an extremely attractive alternative presents itself to one of the partners. In this case, the deserted partner is likely to use phrases such as “I don’t understand why she left me” or “she always seemed quite happy”.

Is marital break-up inevitable?

In order for there to be no divorce (apart, of course, from legally banning it), individuals would have to remain perfectly matched throughout their married lives. This would mean that neither of them changed at all, or that each change in one was matched by an equivalent change in the other. Secondly, the married stated would have to remain the most attractive option throughout the lives of both partners. Some couples manage to achieve this state of affairs, though often more through luck than judgement.

There is a great deal we could do to try and ensure that fewer marriages end in divorce. We could try to make sure that young people know something of the reality of marriage, so that their choice of it as an alternative is based less on fantasy and more on reality. It is ironic that in order to reduce the number of marriages breaking down we must reinforce the idea that marriage is, by no means, the perfect institution we first thought. Not only that, but actively discouraging people from marrying when young may also prevent disaster-as we age we are less likely to change, although it becomes more difficult to adapt to a new partner. We could encourage young people to experiment with alternative styles of living so that the choice of marriage as an option is an informed one. Last, but not least, we could take marriage off its pedestal and regard it as only one of a number of rewarding ways of living. Even if all this was achieved, however, it is difficult to see how a certain rate of marital breakdown could be avoided. People are constantly growing, changing and meeting new experiences. We regard this as desirable, but it must inevitably affect the ways in which people relate to each other

Sexual reactions & problems

Before the pioneering work of American sexologists William Masters and Virginina Johnson in the 1960s, our information on the sexual responses of men and women was very limited indeed. Men, of course, knew that when they were sexually aroused they experienced an erection and, eventually, ejaculation. What happened to women was anybody’s guess. In Victorian times and later, it was suggested that women did not experience sexual arousal or, if they should be so remiss, it certainly could not be compared to that of men. Freud, on the other hand, recognized the existence of female sexual response but, again speaking from a platform of ignorance, made his now famous statements about vaginal and clitoral orgasms.

Masters’ and Johnson’s important contribution was not only to chart the course of sexual response in men and women, but to show that this course was virtually the same regardless of

the type of stimulation being responded to. Over almost a decade, they studied 10,000 orgasms experienced by almost 700 volunteers of both sexes, aged 18-89, who were not having any sexual problems.

The way in which the response cycle is divided up is somewhat arbitrary, and different researchers have divided it in slightly different ways. Ultimately, the best systems will probably be that which is most useful in helping us understand sexual problems. The point to note, however, is that people who have no sexual problems experience roughly the same cycle on each occasion, but that there will be wide variations, both within and between individuals, in the duration and intensity of each part of that cycle. A large number of people, particularly men, are unaware of this and think that there is something wrong with them if their response is not the same each time. This misconception partly arises from the still prevalent belief that sexual behaviour and sexual arousal are instinctive. The capacity to experience sexual arousal and to respond sexually to others is certainly inborn, but the responses and behaviour of individuals are profoundly influenced by their learning experiences-a phenomenon well established in both human and non-human animals.

The male response cycle

Erection phase. Within a short time of receiving sexual stimulation, men respond with a swelling and stiffening of the penis, caused by congestion of its spongy tissue, which in turn results from blood flowing in one direction into the sexual organs. Early in the response cycle, the erection may be quite easily lost if there are extraneous distractions; this is less likely to happen later in the cycle. During this phase, the skin round the scrotal sac thickens and the testicles gradually rise within it, so that this area becomes "tighter". Later, a clear fluid may flow from the penis. This can serve a lubricating function, but it may also contain a considerable number of sperm cells. More general changes in this phase include raising of the heart rate and blood pressure, skin flushes and increased muscle tension. **Ejaculation phase.** Ejaculation is preceded by a heightening of all the responses of the erection phase. This second phase has two parts. In the first, the prostate gland, seminal vesicles, vas deferens and testes undergo contractions which result in semen being deposited at the entrance to the urethra. In this stage, the man will feel that ejaculation is inevitable, as indeed it is. In the second part of the phase, semen is expelled from the urethra by a series of contractions involving the urethra and the muscles at the base of the penis. Afterwards, a man is physically incapable of attaining another erection or of ejaculating for variable periods of time which, because they are so variable, cannot be specified. **Resolution phase.** As its name implies, it is during this phase that things "resolve" or return to normal. Like the previous phase, it has two parts. Men usually lose a good deal of their erection within a short time of ejaculation, but this will vary depending on how long the erection had been maintained before ejaculation occurred. In the next half-hour or so (again there are variations) the remainder of the erection will subside and the scrotal sac regain its usual slackness. The general bodily changes which accompany sexual arousal and which reach a peak at ejaculation will also return to normal.

The female response cycle

Lubrication phase. Like men, women respond to sexual stimulation with congestion of the sex organs. Lubrication of the vagina quickly follows, and the inner two-thirds of the vagina lengthen and expand. The increased blood flow to the vulva causes a colour change in the labia minora, which become bright red, or a deeper red if the woman has had children. The clitoris does not become engorged until late in this phase, and just prior to orgasm it retracts under the clitoral hood. The woman also undergoes general physiological changes in muscle

tension, heart rate and blood pressure. Some women develop what Masters and Johnson called a “sex flush”—a rash which starts in the chest area and spreads to other parts of body. **Orgasm phase.** The physiological mechanism which triggers orgasm in women is still unknown. The orgasm is made up of a series of rhythmic contractions which involve the womb, the pelvic muscles and the vaginal entrance. For most women, orgasms are triggered by clitoral stimulation; even if they are not, they still involve identical changes in the clitoris. Thus, while an orgasm may result from different kinds of stimulation, there are not two “kinds” of orgasm.

Unlike men, women do not have a refractory period when they are incapable of being aroused. Women are capable of having several orgasms in succession if they continue to receive stimulation.

Resolution phase. Within a few seconds of orgasm, the clitoris returns to its usual position, and the labia minora resume the normal colour. Other changes occur over a longer period—about 15 minutes. The vagina contracts to its usual size, and the womb, which has risen in the pelvis, returns to its usual position. The general bodily changes also decline slowly.

For both men and women, this response cycle remains essentially the same from puberty to old age. What does change with age is the intensity and duration of each phase.

Sexual problems

Before we consider those problems which are commonly reported by men and women, some general points need to be made. Firstly, we have to be very careful about labelling someone as having a sexual problem. Humans are immensely varied in their sexual behaviour—sexologists are only beginning to realize just how varied. This is a particularly important point because self-proclaimed experts, whether professional, religious or publishers of pornography, are much given to making pronouncements about sexual behaviour which may bear no relationship to reality. This would matter less if people freely discussed their sex lives, because they would soon discover the truth.

Secondly, the new insights we have gained from research, may help us understand why men and women tend to report their problems in different ways. Men usually use mechanical term, while women tend to talk in terms of not becoming aroused.

Thirdly, researchers are gathering an increasing amount of information about the neurological pathways involved in sexual responses, and this may have implications for our understanding of sexual dysfunction. Touch, for example, can evoke the mechanical aspects of arousal independently of the brain. The erection centre is in the lowest portion of the spinal cord. A man who has an injury which has separated this part of the cord from the brain can still have an erection if the genital area is stroked.

It also seems that the physiological processes of initial arousal and vasocongestion and the process of orgasm are controlled by different parts of the nervous system. Thus, full arousal can occur without orgasm, and orgasm without vasocongestion—it is quite possible for a man to ejaculate while his penis is flaccid. This distinction between arousal and ejaculation is important, because it used to be assumed, at least in the case of women, that a lack of orgasm meant lack of arousal. It seems to be very difficult for writers on the subject to assume an equivalent lack of interest in men. Even if they cannot have an erection, ejaculation or both,

they are still assumed to be interested! This, of course, reflects the prevailing beliefs about patterns of sexual response which were discussed earlier.

Men's sexual problems

Erectile dysfunction. This term has now replaced the earlier, more derogatory label "impotence". Every man experiences difficulty in getting or maintaining an erection at some time in his sexual career. It is only if this happens over a long period of time or in a variety of situations that it is likely to be reported as a problem.

The men who would be included under this heading are a very heterogeneous group, which means that the label itself conveys very little information about the person. The group will include men who have never had an erection at all (extremely rare), men who have erections only, say, on waking or during masturbation but have never had intercourse with a partner, men who have had intercourse in the past but now cannot, men who can have intercourse with some partners but not others, even though they are attracted to them, men who get an erection and then lose it if they try to have intercourse, men who lose their erections during intercourse and men who have erections of varying quality.

Premature ejaculation. Initially, Masters and Johnson defined this problem in terms of the man's inability to satisfy his partner on at least 50 per cent of their sexual encounters. Obviously, this definition cannot be used, as it assumes an unvarying response not only from all women but from each women on every occasion. Definitions based on time between the start of intercourse and ejaculation are equally problematic, as (fortunately) there are no rules about how long intercourse should last. It is better, in describing this problem, to concentrate on the man's feeling that he cannot control his ejaculatory processes even when he tries to do so. Again, most men will experience this problem at some time, and with new partners it is almost common place. It is only when control is not established over a reasonable period with the same partner that a problem could be said to exist. Premature ejaculation is almost never a problem during masturbation.

Retarded ejaculation. When Masters and Johnson carried out their initial research into sexual problems, they encountered only 17 men (or 3.8 per cent of their sample) with this problem. These men were unable to ejaculate during intercourse even though they were fully aroused, or they were able to ejaculate, but only after a much longer period of time than they and most people would judge to be reasonable.

Many men experience retarded ejaculation when they are tired or have had sex a short time before. For some men who experience this problem regularly, it may still be limited to certain partners or certain situations, but even if it is more general, the man will still usually ejaculate during masturbation or have nocturnal emissions.

There is some evidence that Masters' and Johnson's figures may have underestimated the scope of this problem. Out of 486 men who reported sexual problems at one clinic, 72 (15 per cent) said that they had never ejaculated during either masturbation or intercourse. The figure for men who experience this problem to a lesser degree is probably much higher.

Women's sexual problems

Disorders of arousal. We have seen that women are often unaware of (or fail to report) that they are sexually aroused. If a woman complains of this as a general problem, it is therefore

important to find out whether she is actually experiencing physiological arousal (vascongestion and lubrication) and is mislabelling it, or if she is not experiencing many physiological changes at all. Strictly speaking, we can only speak of a problem of arousal if the physiological changes that go with it are absent.

As in the male equivalent of erectile dysfunction, this group is very heterogeneous a woman may be unaroused only with one particular partner or with a number of men (or women). She may be unresponsive to a wide variety of erotic stimuli or become very aroused during masturbation, but not with partners.

Vaginismus. This can be seen as a problem of arousal and more besides. We have seen that the usual female response to sexual stimulation is a lengthening and widening of the upper part of the vagina. Some women, however, respond to attempts at intercourse with a massive tightening of the muscle walls of the lower third of the vagina, so that penetration is impossible. It is usual to find that these women respond in a similar way to medical attempts at internal examinations (general anaesthetics are sometimes resorted to if the examination is essential) and that they have never used tampons during their periods. The label “married virgins” is often applied to these women. Some never seek help and their marriages remain unconsummated or break up; some seek help because they very much want to have children.

Orgasmic dysfunction. Most women who do not become aroused with sexual stimulation also fail to experience orgasm. A large number of women, however, do initially become aroused, but do not have orgasms. Again, this problem may be a global one, with the woman never having experienced orgasm even during masturbation-if she has ever masturbated; it may, however, be confined to particular partners, or to partners in general, or occur only in specific situations-as, for example, when there is a possibility of lovemaking being interrupted by the children. A women also may experience orgasms in response to manual or oral stimulation, but not during intercourse (the reverse is unusual).

Both men and women sometimes report that intercourse is painful. For women, it is important to rule out vaginismus, as many women will, not unnaturally, report this problem as “intercourse being painful”. Painful intercourse, however, may itself cause vaginismus. It is important for both men and women to define not only the type of pain experienced-sharp, throbbing, aching and so on-but also its location (groin, testicles, penile head, vaginal entrance, deep in the vagina) and its timing (when intercourse is attempted, during intercourse, when thrusting and so on)

PREGNANCY

Social attitudes towards women and motherhood are confused, to say the least. A woman is bombarded by contrary advice and opinion from every side. The influence of psychiatrists such as John Bowlby and Rence Spitz has emphasized the vital and irreplaceable role of the mother in the first months and years of a baby’s life. Some sections of the women’s movement, however, appear to be saying that motherhood is a denigration and denial of human potential. They may state that “women are denied personhood. However, such statements are not meant to denigrate motherhood as such, but are made in reaction to widely held assumptions about the mother’s role.

The signs of pregnancy

The first sign of pregnancy is nearly always the “missed period”. Pregnancy, however, is only one of a number of possible causes of amenorrhea, so that, in a woman who has irregular menstrual periods, this is not a very reliable early sign.

Breast tissue is very sensitive to hormonal changes and many healthy women experience a feeling of fullness and even some tenderness in their breasts just before menstruation. These changes are related to the female sex hormones, oestrogen and progesterone. In early pregnancy, the high levels of these hormones may be a cause of breast tenderness. At the same time there is an increase in blood supply to the breasts, development of the milk ducts and enlargement of breast tissue. The nipples become larger and the circular patch around them, the areola, darkens and may swell slightly.

So-called “morning sickness” is another common early sign of pregnancy, but it certainly does not occur only in the morning. The cause of the nausea, which is usually mild, is unknown, but it may be related to the large increase in circulation sex hormones that occurs early in pregnancy. There may also be psychological elements involved and these will be discussed in more detail later.

The pregnant women may find that in the early weeks she urinates more frequently than usual. The kidneys work overtime early in pregnancy, probably again as a result of the increase in sex hormones, so that the bladder fills more quickly than usual.

The later stages

Pregnancy becomes obvious as the foetus and the uterus grow in size. At about 20 weeks of pregnancy, the top of the uterus has reached the level of the mother's navel. This is regarded as roughly the mid-point of pregnancy, until 20 weeks, the top of the uterus rises the breadth of two fingers above the front of the pelvic bone every two weeks of pregnancy, having appeared above this bone at about 10 weeks.

After 20 weeks, the top of the uterus rises the breadth of two fingers every four weeks until it has reached the front centre of the ribcage at 36 weeks. Towards the end of pregnancy, the foetal head is pressed downwards and engages in the birth canal entrance of the pelvis. This means that the top of the uterus is lowered and at 40 weeks (term) it will be where it was at about 30-32 weeks.

Around the 18th to 20th week in first pregnancies and the 16th to 18th week in later pregnancies, the first foetal movements may be felt. They are initially very slight and feel like a tremor. The movements become much stronger as pregnancy proceeds. The developing foetal limbs push against the uterine wall and can be seen and felt through the abdominal wall.

Activity in the womb

Foetuses have quiet periods (perhaps actual sleep periods) and these vary in length and degree of activity. These phases are often not synchronized with maternal rest or sleep periods and this, while normal, can be disturbing to the mother. The pregnant women can become anxious when the foetus is quiet for a day or more after being notably active. However, this prolonged rest is quite common and does not signify that anything is amiss unless it lasts longer than a couple of days, in which case medical advice should be sought.

Obstetricians listen to the foetal heart sounds, their rate and regularity, for many reasons. These sounds not only confirm that the foetus is living, but are also a good monitor of its health, especially as labour nears. Foetal sounds can usually be heard from the 12 th week, and are almost always detectable after the 16 th week.

Antenatal care

A pregnant woman may be looked after by her family doctor, who knows the background and her medical history. In Britain and the rest of Europe, the mother-to-be may also be attended by a midwife, with whom she builds a continuous relationship up to, during and immediately after the birth.

On the other hand, it may be more desirable to attend a regular antenatal clinic (which has all the expertise, tests and so on) for regular examinations. Here the “doctor” may, in fact, be a team.

It is vital that a pregnant woman has regular medical examinations. If trouble is spotted early, there is more chance of its being dealt with successfully.

The best time to start antenatal care is when the second missed menstrual period would have happened. At the first visit, a medical history will be taken, and a complete examination will determine the woman’s present state of health. Important base-lines will be determined, including body weight, abdominal size, blood pressure and breast size. At subsequent visits, the physician will see if things are progressing normally and whether changes from these baselines are acceptable. Ideally, visits should be every four weeks up to 28 weeks of pregnancy, then every two weeks until 36 weeks and, finally, weekly.

Exercise in pregnancy

The uterus is a muscular thick-walled container that gets bigger and bigger in pregnancy. It is supported within the abdominal cavity by two strong ligaments on either side-like guy ropes. The mother’s abdominal wall, which is quite, thick, regardless of the amount of fat present, covers the abdominal cavity.

The uterus contains the amniotic fluid or “waters” within two tough membranes or “envelopes”. Inside this fluid compartment the foetus floats, grows and develops. In this way, protection is provided. A pregnant woman’s fall need not mean damage to the foetus. On the other hand, it would not do to imagine that the foetus is immune from all damage.

When labour comes, it is ideal for the woman to be in good physical shape. During the pregnancy, she should continue to practise her usual exercise as far as she can without strain. There is no need for the busy housewife, who may not usually exercise or play a sport, suddenly to go overboard and start. But if swimming is usual and enjoyed-continue swimming; similarly, gardening, walking. There is no need to avoid travel during pregnancy, although some airlines may need a certificate of “good” health for a woman who is more than 30 weeks pregnant.

The diet itself

The pregnant woman must see that she eats sufficient nutrients and provides sufficient energy for the growth of her foetus and for her own needs. Clichés such as “eating for two” do not apply. A normal, healthy pregnant woman does not have to bother with a special diet. In

general, provided it is within a usual and normal range, the diet has very little influences on the pregnancy or birth or on the size or survival of the newborn baby.

However, pregnant women may need an extra protein component and iron-containing foods in the diet. In some countries, health services provide mineral and vitamin pills, as precautionary supplements but this is by no means standard practice.

Day-to-day hygiene and care

Without spending extravagant sums on special maternity clothes, it is possible for a pregnant woman to dress well and feel attractive. But comfort is important: constricting clothes below the waist are to be avoided, as they restrict the blood flow and may cause varicose veins. The breasts are enlarging and need adequate support.

The antenatal team should advise on daily breast care. The nipples need to be gently drawn out and stroked for a short time daily. After about 30 weeks, the pregnant woman needs to be shown how to press the body of each breast towards the nipple. This is called ‘expression’ and can help the milk to flow when it first comes in.

Long, soothing, warm baths are perfectly safe, and so is ordinary swimming. During the last four weeks, however, in rare cases, the doctor may advise a woman to take showers and not lie in water that could enter the genital tract.

If the natural drinking water is low in fluoride, a doctor is likely to prescribe a daily fluoride tablet to help the baby’s teeth develop strongly and so prevent decay in late foetal life and early infancy.

There is no reason why a pregnant woman should not have any necessary immunizations or boosters during early pregnancy-except where the inoculation is with a live virus, as in smallpox or German measles (rubella) inoculations. In these cases the virus from the inoculation can reach the foetus and could cause malformation. Rubella is especially dangerous. Careful discussion with the doctor is therefore always necessary.

Sex in pregnancy

With few exceptions, there is no reason why a couple who want to make love during pregnancy should not do so. It is true that lovemaking can cause contractions in the womb. These may be temporary exaggeration of the regular small contractions that the womb undergoes throughout life, or they may be caused by the hormones contained in semen. In any case, they are insignificant compared with the contractions of labour. Only where there is already a high risk of miscarriage should a woman abstain from intercourse or from orgasm. It is sometimes said that lovemaking when birth is very near can bring on labour, but at least one study has found no evidence of this.

However, many women simply do not want to make love during pregnancy. Although it is not common for interest in sex to be lost as soon as pregnancy begins, it does happen. There is wide variation in the amount of interest pregnant women feel in sex (as there is in non-pregnant women) and in how it changes during the course of pregnancy.

Some women, perhaps a quarter, feel an increased interest in sex which lasts until the seventh month. About a quarter feel less interest from the beginning, rising to three-quarters in the ninth month. Overall, however, there is a steady reduction in sex interest and activity

throughout pregnancy. Masters and Johnson found a greater decrease in sex interest in women expecting their first child than in women who were already mothers; others have not found any difference. The change appears to be in the basic sex drive rather than in any physical problems over intercourse

ACTUAL DELIVERY

The problem of pain

There is an unspoken rule among women that one does not tell first-timer what to expect so as not to terrify her in advance. On the other hand there is an opposite feeling that it is not fair to let a woman arrive at her first delivery in complete ignorance. The result, as one woman put it, is “you try to let them know without actually telling them”. Medical staff may collude in this and some standard hospital and antenatal classes gloss over the subject. They do not ignore it, but they may deal with the question of pain by talking of technological prevention by gas or an injection. At the same time, old-fashioned nurses talk about the “pains”, enquiring in labour, “How often are the pains coming?”

The result is a confused state of half-knowledge. Many women who arrive in labour without the benefit of good childbirth classes are utterly unprepared for what happens to them.

Does childbirth have to be painful? In order to answer this question, we must first ask a more fundamental and perhaps more surprising question: is childbirth painful at all? Many women in the West would say, “Of course; it is the most intense pain known to humanity: you men can know nothing like it.” But the British pioneer doctor Grantly Dick Read was alerted to the possibility of painless childbirth when he encountered a woman in labour in London who reported no pain at all.

After the birth

As many as four-fifths of mothers experience a brief period of tearfulness at some time during the first few days after birth. Sometimes the mood creeps on slowly; more often, however, the onset is sudden and many women are unprepared for it when it happens. A woman may be astonished to find herself bursting into tears without any apparent provocation at the moment when she “should” be happy, such as when her husband arrives for a visit. Then, after perhaps as little time as an hour, the mood is gone.

A much smaller proportion of new mothers find themselves with a depression that may last a few weeks or months or, occasionally even longer.

In the first few days after giving birth, some women find themselves confused and disoriented, feeling not quite sure where or who they are, or what age. Except in a very tiny number of cases, these feelings pass after two or three weeks at the most, leaving only the depression

Keeping healthy

Young adulthood is a time when increasing responsibilities in the home and at work may mean less leisure time for sports and other active pursuits. At the same time, changes in lifestyle (involving catering for children, for example, or more entertaining at home, or business lunches) may bring alterations in diets that are not altogether healthy. Obesity and a

general lack of fitness are dangers. They can be guarded against by keeping a sensible (not fanatical) watch on your weight (cutting down on calorie intake if necessary) and making sure that you take some form of regular exercise. This latter need may be answered by a simple, regular exercise routine done at home, everyday or even 20 minutes twice a week.

(E)MIDDLE AGE

Until recently there was yawning gap in the human lifespan that was largely ignored by social and behavioral scientists. Freud's message (only slightly exaggerated) was that once the Oedipal period ended at the age of seven or eight, the individual's problems, conflicts and adaptability were more or less set for the duration of life. However, one consistent research finding which is emerging (which tends to disprove Freud) is that people do change in the later phases of life and that, in nearly all the important spheres of living, change for the better is almost as frequent as change for the worse.

These findings have led to a heightened sense of the flexibility and growth potential of the middle-aged. They have also raised questions about some of our earlier assumptions, such as the continuing influence on the capacity for change, in later life, of various kinds of deprivations in infancy and early childhood. For example, how long can you go on blaming early circumstances, and those who peopled them, for your current problem? If middle age can now confidently be viewed as growth-oriented, then some adult changes may altogether offset the negative consequences of early life events.

However, the process is by no means automatic. Studies exploring the effects of early life experience on adaptation in middle and later life will help us to understand the circumstances under which unfortunate early experience may be kept where they belong-firmly in the past. The negative emotions, which accompanied them, may not be forgotten-rather, they become accepted and integrated parts of oneself

The Effects of Ageing

Those women who experienced ageing symptoms such as deteriorating eyesight or hearing, or a reduced energy level, tended also to report less emotional closeness with their children. Ageing symptoms were also associated with stress in the marital relationship, and with a desire on the mother's part to be much younger. It is impossible here to tease out cause and effect, but it is certainly possible that a poor relationship with her husband and children, for whatever reasons, might affect a woman's perception of the physical changes of middle age.

We cannot be sure that these findings would be replicated in a few years' time with a new sample of middle-aged women. Not-yet-middle-aged mothers are having smaller families, successful careers and, probably, do not see their families as their only source of fulfillment, which will affect their relationship with their children. It may be that signs of ageing do not appear until later in life.

A mild-life crisis?

The idea of mid-life as inevitably crisis-ridden is very speculative. It is possible that preconceptions about what should happen at middle age have somewhat biased researchers' interpretation of the material they have gathered from their subjects. It is also worth noting that these subjects have usually been well-educated and probably more given to introspection.

So while some people may experience middle age as a sort of watershed, we should be very wary about generalizing from them to everyone in middle age.

Viewing ourselves

An alternative view of the adult years is that crises, rather than being an inherent part of them, are manifestations of asynchrony in the timing of life events. Thus, to become a widower at 30 or a mother at 50 may be stressful because cultural expectations of appropriate timing have been violated. It has been shown that many middle-aged women “feel” a different age to their chronological age-sometimes there is a considerable gap-and that their perceived age bears a strong relationship to their evaluation of their social and work roles, as well as to physiological changes.

However, our chronological age is a powerful determinant of society’s response to us, and one of the fascinating questions about middle age is the extent to which any personal re-evaluation is a product of this obsession with age, rather than an integral part of growing older. In the following sections, we will be describing the experiences in middle age of people in industrialized societies, which have a strong tradition of age-grading. Because most of the results have been gathered recently, subjects also share roughly similar historical backgrounds. We can only speculate on how their experiences might differ from people in another place or at another time.

Stress

What is stress? This question can be approached from two directions. We can think in terms of events, such as loss of a job, which are assumed to be stressful. Or we can look at the individual’s response to certain situations and define stress in terms of particular response patterns, regardless of the events preceding them.

The problem with the first approach is that people vary enormously as to the kinds of events and circumstances which they consider stressful: few of us could contemplate, say, a severe earthquake with equanimity. But in the grey areas of everyday life, it is very difficult to make prescriptive judgements about what constitutes a stressful event.

On the other hand, if we look at response patterns, we face the problem of deciding what kind of response to consider and in what system-physiological, cognitive (mental) or behavioural? Unfortunately, in any given situation, responses across these three systems do not always agree with each other. If we concentrate on one rather than another, we might get a very misleading impression of how the individual as a whole is responding. If, however, we decide that certain response patterns are manifestations of stress, do we assume that those who do not show these responses are not stressed?

Hypertension

It is normal (at least in Western nations) for blood pressure to rise with age, just as it is normal for it to vary at different times and in response to stress. However, if your blood pressure is consistently above a certain level, you can be said to suffer from high blood pressure (or hypertension).

Hypertension is a peculiarly Western problem. About 8 per cent of the population aged between 40 and 49 are affected, and that figure increases in older age groups. These high

figures may be at least partly the result of some feature of Western dietary habits (such as an excess of salt or refined foods), or of an inherited tendency; but some experts suggest that stress is an important factor. Weight has an effect, with those who are overweight significantly more susceptible, and efforts should be made to reduce it.

Strokes and heart failure can be caused by hypertension. Other cardiovascular accidents, kidney damage and haemorrhage into the retina of the eye are also possible results if high blood pressure is not reduced in good stead in the face of future stresses. However, not everyone develops these skills. For some, this may be because they have experienced so little stress they have never had the chance to learn them. Others, however, seem to give up even in the face of mild stress. We will return to this point later, but we can see that by middle age many people may be experiencing chronic stress and that individual differences in coping skills will be very marked. Middle age is also a time when stresses in the form of uncontrollable losses-of health, of partners (by death), of jobs (by retirement), of looks, of social roles (such as motherhood) begin to accumulate.

Menopause

The menopause, strictly speaking means “cessation of the menses”. For the majority of women, this occurs between the ages of 45 and 50, but the average age is rising. The more general term “climacterium” refers to change in the ovaries and the various physiological and hormonal changes associated with the menopause-these happen over a period of time beginning perhaps as long as 10 years before and perhaps continuing for 10 years after the menopause itself. For some women, but by no means all, this process is accompanied by a variety of more or less distressing physical symptoms such as hot flushes and vaginal dryness. Various muscle and bone changes can also be detected, and the risk of coronary heart disease gradually increases

Preparing for Old Age

Health

The best preparation for health in the later years is simply to keep active physically, mentally and socially. It is wise to have a regular check-up at your doctor's and to seek his or her advice about your general health.

Exercise is probably the most valuable way of keeping yourself fit and of guarding against later problems. A word of warning, though. If you are not used to very much physical activity, begin slowly. If you have difficulties consult your doctor at once.

Exercise does not have to entail following a rigid plan of strenuous push-ups and kneebends. But if you do favour this type of exercise, there is plenty of information available in books and libraries. Or you can attend fitness, dance or yoga classes.

There are many other methods of exercise: walking is both easy and enjoyable, and many people in retirement get a dog to ensure that they walk regularly. Cycling, swimming and golf are good exercise, as are most sports.

The beneficial effects of exercise will be increased by learning to relax and avoid stress, by careful attention to diet and by reducing alcohol and tobacco consumption (better still, stop

smoking altogether). A regular, healthy pattern of eating can combat many diseases of middle age

Preparing for Retirement

The practical problem of retirement often centres for most people on a reduction in income. People prepare for this eventuality in a number of ways. Some organize their savings so that their income is reduced as little as possible. Others try to arrange things so that their outgoings will be reduced after retirement. They do this by, for example, moving to a more economical house, or by purchasing or upgrading major items such as car or washing machine. These solutions will not suit everyone, but it is as well to recognize that the problem exists.

How will you fill your time? We can see retirement as a kind of socially sanctioned unemployment. Those who coped best with unemployment (or who even saw it as a positive experience) were, as we saw, those who were able to fill their time with other activities. In thinking about this problem, those approaching retirement should be careful to avoid two common errors. One is to underestimate the actual amount of time to be filled. Overtime and travelling time, which once ate into their days, must also be taken into account.

Retirement is a time when favorite activities can be extended, or it may be an opportunity to take up a sport, skill or occupation outside previous experience. How leisure time is to be spent should be given the same careful consideration as other aspects of retirement-how fit are you, what can you afford to spend on hobbies, do you prefer solitary activities or being involved with friends and new acquaintances? Isolation can be a problem of ageing, so it is as well to join an evening class, social or sports club that draws you into a group. To set unrealistic goals for retirement is to invite disappointment, but this is not to say ambition is out of place. Many people assume that they have an aptitude for a particular skill, when in reality they have only lacked the time and energy to acquire the aptitude. A retired person can take time to learn and enjoy new pursuits and to a large extent is relieved of the competitive atmosphere that caused a strict division between success and failure in earlier life

Middle Age Myths

“For the last 20 years I have known what happiness means. I have the good fortune to be married to a wonderful wife. I wish I could write more about this, but it involves love, and perfect love is the most beautiful of all frustrations because it is more than one can express”- Charlie Chaplin talking about his wife Oona O’Neill whom he married in 1943. He was then 54 and she was 20. They had eight children.

“Aging is natural and the changes in us are natural. My wrinkles and my arthritis are a part of my testimony of change”-Margaret Kuhn, who at 64 (in 1970) founded the Gray Panthers, an organization of older people dedicated to fighting the ageing process.

“There is beauty in sincere and honest aging. I guess people who concentrated on themselves are most afraid of age. If they would think of the purpose of our being here, they wouldn’t stop to worry if their teeth were crumpling or if a bit of gray appeared in their hair...To be helpful to others makes the world so much brighter, keeps one youthful and active...There is simply no time to worry about growing old. It’s such a wasted effort to try to turn back the clock when there’s so much to be done”-Helen Hayes, American actress, when aged 60.

“Some people tend to resign-to retire or to withdraw too early. Others may not recognize the necessity of switching their function to one that is less active and more advisory. I don’t believe in retiring from life. Retirement from business is an artificial, technical thing, simply from a certain responsibility to a certain group. It’s true that some older people become too inflexible, too habituated to certain ruts and reactions they can’t get out of. But then there are some people of 40 to whom this also happens and some of whom it does not happen even at 80”-Karl Menninger, founder of the Menninger Clinic and Foundation in Texas for the treatment of mental illness, at the age of 77. And consider the following people:

- Charles De Gaulle was 68 when he was returned to power in 1958
- Gandhi was 60 when he led the 200-mile march of non-violent disobedience against the salt tax in 1930
- Sonia Delaunay was 65 when her painting first began to be exhibited internationally
- The Irish poet W.B. Yeats produced some of his best work after the age of 60
- Helen Bradley, illustrator, began to paint when over 60 to show her grandchildren her own childhood.

Misconceptions of middle age

1. After 65 everyone goes steadily downhill. There is no truth in this at all: in fact, some people’s health improves after retirement. Many of the problems connected with this period are due to illness, not ageing.
2. People should retire because their capabilities decline. The age for retirement is an outdated convention. The many artists, musicians, writers and politicians active over this age prove the point.
3. Middle age is a time for settling down. On the contrary, many people make fresh starts in their lives at this time

Middle Age Health Problems

One of the major hazards of middle age is coronary artery disease. Several contributory factors have now been isolated, and ways suggested of maintaining health through prevention rather than cure. It is important to note “early warning signs”, both mental and physical, that indicate that all is not well-for example, chest pains, headaches, persistent diarrhoea, indigestion and palpitations; inability to relax, remember or concentrate, or habitual over-reacting.

PROBLEM	SYMPTOMS	TREATMENT
Angina pectoris	The arteries harden with age and become clogged up so that blood circulation is impaired. Can result in stroke or heart attack.	For prevention: diet carefully to avoid cholesterol. Treatment: diet, as above.
Bronchitis	Can cause permanent lung damage.	For prevention: lose weight; stop smoking; have an influenza injection each autumn.

		Treatment: antibiotic drugs; “postural drainage”; change sleeping posture.
Coronary thrombosis (myocardial infarction)	A coronary artery becomes blocked by a blood clot (thrombus) and the heart muscle is deprived of its blood supply. Symptoms: chest pain radiating out towards the left shoulder and sometimes down the left arm.	For prevention: lose weight; stop smoking; decrease anxiety and tension. Treatment: complete rest until circulation is restored; the heart muscle has to be re-educated back to full activity. Gradual exercise.
Diabetes	The pancreas secretes insufficient insulin to control the blood sugar. Sufferer feels extremely unwell (weight loss, fainting, excessive thirst, low energy) until the disease is diagnosed and treated.	Cannot be cured but is controlled by doses (in tablet form or, more often, by injection) of insulin.
Duodenal ulcers	Sufferers complain of “chronic indigestion”.	For prevention: balanced diet, reduction of stress. Treatment: diet; sometimes an operation is necessary.
High blood pressure (hypertension)	Known as the “silent killer” because it is rarely accompanied by any symptoms. It is estimated that one in every five people is hypertensive and one-third of those are not aware of it. Can lead to strokes, kidney failure, heart disease and a hemorrhage into the retina.	For prevention: reduce stress; lose weight; have regular checks on blood pressure. Treatment: may need hospital observation; drugs can reduce blood pressure and reduce strain on the heart and arteries.
Strokes	A blood vessel in the brain gives way suddenly thereby allowing blood to leak out into the brain tissue or it becomes blocked by a clot of blood so that part of the brain is deprived of essential blood supplies. A small clot can cause temporary interference with speech; a large clot can cause unconsciousness or even death.	For prevention: lose weight; take proper exercise. Treatment: physiotherapy “re-education” of affected muscles.

(F) OLD AGE

Old Age Is Not An Illness

We often associate being old with being ill. There is undoubtedly more physical impairment and illness among 80-year-olds than among men and women half a century younger. It is easy but not accurate to conclude that old age itself is a kind of generalized illness. Let us see why this conclusion is off the mark and whether there is an alternative view.

Results of an official national survey in the United States actually show a decreased incidence of certain illnesses among adults' aged 45 and over. Asthma, hay fever and peptic ulcers, for example, are conditions that afflict young and old equally, while older people are strikingly less vulnerable than the young and middle-aged to a variety of disease caused by certain infections or parasites.

Loss in various capacities may begin fairly early in adult life and without being caused by disease. Fitness and agility are good examples of abilities which have far more to do with life styles than with actual chronological age.

What then are the effects of old age on its own, apart from physical illness and the effects of an unhealthy life style? Is there a biological process that could be known as normal ageing, a process partly hidden by additional deficits brought on by disease, accidents and unhealthy life habits? This is the view of many gerontologists. It is difficult to put to the test, especially with humans. It is very important that we do test it, however, because those who care for or live with the elderly (and the elderly themselves) usually have a set of more or less explicit beliefs about the standards of health or cognitive functioning we would expect to find in the elderly. Thus, many physical states and "mental" behaviours, which are changeable or preventable, may be put down to ageing. As we shall see later when talking about dementia, the danger in having such an easily available label with which to 'explain' an old person's state is that it distracts attention from social, psychological or other physical variables which are actually responsible.

Healthy old age

There have been some carefully designed studies that help to establish the distinction between being old and being ill. Psychologist James Birren recruited a group of elderly men who were free from illness, as determined by both clinical and laboratory examinations. These men willingly cooperated in extensive studies of their physical, psychological and social functioning. Although all the men (average age 71) were in good health, the researchers were still able to distinguish between the healthiest and the less healthy.

The very healthy old men functioned as well in various physical tests as did a comparable group of healthy young men. Altogether, the old men showed less impairment when compared with healthy young men than would ordinarily have been expected. There were no differences between old and young in blood levels of white blood cells, hemoglobin, the basic level of blood sugar and serum cholesterol, or in the type of electrical brain function. The very healthy old men were similar to the young men in blood pressure, in the utilization of oxygen and the flow of blood in brain tissue.

There are, however, a few clear-cut differences between even the healthiest old men and the young men. For example, electroencephalographic reading indicate that the brain waves of older men are slower. However, the apparent reduction in the tempo of brain waves is not a sign of disease, nor is it obviously associated with observable changes in thought or behaviour.

When the researchers look at the complete set of findings, they are impressed by the negative effect on an older person of even a small "touch" of disease. An older man who would be considered quite healthy by ordinary standards would show a loss in measures of brain functioning with even a small degree of arteriosclerosis. It was observed that decreased oxygen

consumption and blood flow in the brain are not signs of ageing as such, but result from a specific disease.

In everyday life, however, all too often old is ill. Apart from the fact that certain chronic conditions are more common in late life, there is the additional consideration that many older people suffer from several physical problems at the same time. Multiple illness can greatly complicate both diagnosis and treatment. Also, the over-readiness to take old for ill sometimes prevents the elderly themselves as well as their families and doctors from making efforts to restore health. Studies of this kind emphasize the importance of prevention and early treatment of disease in the elderly

Changes in Old Age

There are many changes – both physical and mental – associated with old age. While some of these are undoubtedly a normal and natural part of ageing, others are less inevitable.

- Eyes-look dimmer and mucus tends to collect in the corners.
- Hair-on the head becomes grey or white and thinner. In women more hair grows on the upper lip and chin, while men's facial hair grows less thickly.
- Teeth-become yellow and may be lost.
- Skin-becomes more wrinkled and rougher, and sags, with the dark circles and bags under the eyes becoming more prominent. Bluish red patches may appear on the ankles and lower legs.
- Muscles-become flabby around the chin, abdomen and upper arms.
- Limbs and joints-may become stiff, and movements awkward.
- Body fat-accumulates around the stomach and hips.
- Posture-the spine contracts slightly, leading to a loss in height, and the shoulders tend to become more rounded.

Other common changes in appearance

- The nails on hands and feet may become thicker and more brittle.
- The feet can become larger (as a result of sagging muscles) and blemishes may appear.
- The nose may become less fleshy and appear to lengthen.
- Moles, warts and dark spots may appear on the skin.
- The shape of the mouth may change (as a result of the loss of teeth).
- The veins can become more prominent on the legs (especially around the ankles) and on the backs of the hands.
- In a woman, the breasts may become flabby and sag.

Changes in sensory functioning

- Vision-the eyes adapt less quickly to changes in lighting, the field of vision shrinks, sports may appear before the eyes and basic visual sharpness declines.
- Hearing-sensitivity diminishes, especially at the higher frequencies.
- Appetite-the taste buds in the tongue and inner surface of the cheeks function less efficiently, as do the sensory cells in the nose, so that the sensual appeal of food

decreases, often contributing to a loss of appetite. (Increased hair in the nostrils can also contribute to a diminished sense of smell.)

- Touch-drier and rougher skin makes the sense of touch less acute.
- Sensitivity to pain-declines.

Mental changes in old age

- Reasoning-old people seem to “think more slowly”. This may be because their daily lives give them less “practice” in speedy problem-solving, rather than because of an organic decline in mental powers.
- Learning-old people are expected to find learning more difficult. This may to a significant extent be because of deficient hearing, vision, and so on, and lack of confidence and motivation.
- Creativity-old people are generally seen as past their creative peak, but this may be culturally determined (that is different, expectations might produce a different pattern).
- Memory-old people tend to remember very recent and remote events better than those in between. Physiological changes may partly explain this, as may lack of attentiveness or motivation.
- Mental rigidity-old people often seem to have very set ideas. This can be related to the apparent decline in learning ability and creative powers (it may be partly culturally determined).

Keeping fit

The benefits of keeping fit are both physical and mental. For an elderly person fitness means maintaining mobility, greater resistance to disease and a better standard of general health. It also increases mental alertness and the ability to cope with stress or emotional problems. Because older people expect to become less active or more vulnerable to illness, many signs that only mean lack of fitness are put down to age and are not countered by positive action. But old age is not a disease, nor should illness and immobility be accepted as a necessary state.

Several basic points should be remembered in keeping fit. First and foremost, forget your age and don't let it become an excuse to retire from life. Watch your weight and keep up a diet that includes proteins, vitamins and carbohydrates for energy. Get some exercise every day and resist the temptation to take long naps in the daytime. Cut out or cut down on alcohol and cigarettes. Keep busy with a job, hobbies or chores at home. Visit a doctor if any health problem arises that signals a definite or sudden change.

Exercising keeps joints and muscles working smoothly and improves the functioning of the heart and circulatory system. Exercising the spine is important, to avoid backache or a stooping posture. When you start a sport or exercise routine, take it slowly and work into it naturally. Have a medical check-up before you start and follow a doctor's advice if you are disabled or have been ill.

Highly competitive sports and team games are stressful; choose an activity where you can set your own pace and enjoy its physical demands. Swimming uses most of the body muscles, tennis can be paced to the abilities of the players. Walking jogging and cycling are good for keeping fit. Yoga and dancing classes offer exercise and pleasant social contact. If you prefer to be on your own there are many books that show routines to do at home.

There is no need to be over-ambitious—even a small amount of regular exercise is beneficial. Start walking short distances instead of using car or bus; take stairs instead of lifts

Physical Hazards of Old Age

Chronic ailments. In old age people are susceptible to illness causing accompanying disability—rheumatism and arthritis, impaired sight and hearing are relatively common, as are disease of the heart and circulatory system.

Malnutrition. Some old people feel they cannot afford to eat properly and a greater number lose appetite through illness, anxiety or depression. Poor diet undermines health, lowering resistance to disease. In addition, chronic digestive disorders may reduce the value of food intake. Decaying teeth or ill-fitting dentures interfere with chewing, often causing the person to prefer low protein foods because they are easy to swallow.

Loss of fitness. Some muscles and joints are more used than others through life and those that have been neglected stiffen or weaken with age. Most people expect to slow down and fail to realize the importance of continuing to exercise and keep fit.

Accidents. All the above factors put old people at greater risk of accidents, such as falls and collisions. The damage from fall may aggravate other health problems.

Sexual deprivation. There is evidence that a happy sexual relationship helps prolong life

Health problems of old age

Old age is not synonymous with poor health; in fact, older people are less vulnerable to certain diseases. The universal process of ageing leads to reduced abilities at all stages of life. However, certain conditions are more common in later life and an injury considered minor in a younger person could prove serious. The most common problem is degeneration of the heart and arteries. For more information about this and other diseases, see “Health problems in middle age”

PROBLEM	SYMPTOMS	TREATMENT
General Nutrition	Bad eating habits can cause problems later in life. An inadequate diet leaves the elderly person more vulnerable to a variety of diseases. A few old people suffer from malnutrition because of deficiencies in their diet, often due less to economic factors than to psychological ones (e.g. loss of appetite due to anxiety and depression).	Emphasis should be placed on green vegetables, milk, eggs, meat and whole wheat bread. Fried food is best avoided and rich highly spiced food is not easy to digest. Salt intake are more easily digested than cold.

Sleep	Research suggests that we sleep less as we grow older and that sleep is less deep. Many people half-sleep during the day to compensate for a disturbed night.	
Accidents	Older people are more accident-prone. Men are more likely to be involved in a motor accident, either as driver or pedestrian. Women are more prone to falls. Poor eyesight, reeducation in leg-lift when walking, and temporary dizziness are the usual causes.	
Hypothermia	It usually means that the body temperature has dropped to below 95F. It may be caused by a disease which causes a failure of the body's temperature regulating system or by environmental/economic factors which lead to cold living conditions.	Relatively little is known about the numbers of old people who die from this condition. The environmental/economic factors should be improved.
Osteo-arthritis	Affected joints are painful and sometimes deformed but there is no inflammation. It usually affects the knee, hip and spine. The elderly are particularly vulnerable to all forms of arthritis.	Pain relief through analgesics; the strain is reduced by losing weight; exercises improve joint mobility and strengthen muscles. In some cases joints may be replaced by surgery.
Rheumatoid arthritis	Joints become swollen, stiff and painful, with limited movement, and are eventually destroyed. Occasionally fever and weight loss.	Physiotherapy and exercise are recommended to prevent joints from becoming deformed, with painkillers or anti-inflammatory drugs.

Pneumonia	Inflammation of the lung. Old people often suffer from hypostatic pneumonia due to staying in one position for long periods of time.	Can be eased by drugs and rest, but often occurs at the same time as other chronic illnesses.
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DEATH

The need to be open

There are many factors that make it difficult to achieve what we shall call (for want of a better term) an “appropriate” death in old age.

Health care of the aged has become a major budget item in many countries. There is reluctance to spend any more than is “necessary”, and the definition of “necessary” is seldom in the hands of the elderly themselves. Any new program of improve care for terminally ill elderly people that threatens to cost more is likely to run into determined opposition.

Many of us (including health care providers) assume that we know what old people and dying people want. This assumption is often a projection of our own thoughts and feelings upon the other person. “When I get to that age, I’ll be ready to die,” a young person may think. This assumption may also be constructed out of bits and pieces of observation. “I don’t want to go on like this,” may be interpreted as a desire for death, when the person is actually lamenting the poor quality of his or her current existence. “I won’t be around long,” may be interpreted as a plea for attention or a “morbid preoccupation”, when it is a simple acknowledgement and notification. Whatever the source of our assumption, it provides an excuse to avoid close contact with terminally ill old people.

Ignoring the signs

“He doesn’t known” and “It’s better that way” are both assumptions that interfere with the achievement of an “appropriate death.” The first is based on the premise that the old man is too confused or senile to be aware of his situation. Yet research has shown that awareness of impending death is common, even if it is expressed in ways that escape our notice. Communication between a dying person and others is subject to extraordinary omissions and distortions. Even direct statements may be “not heard” or “forgotten” or reinterpreted by the listener.

The idea that a dying old person should be “protected” from knowledge of his or her condition often serves to protect others from the uncomfortable prospect of a conversation about dying and death. Since many terminally ill people know or suspect the truth, this evasion does not accomplish a protective function. Instead it leads to increased isolation and gives dying people the feeling that it is best to keep their knowledge and suspicions to themselves. An opportunity to discuss the situation, clear up misunderstanding and express preferences is lost.

Making our wishes known

Our deaths, as well as our lives, affect other people. An “appropriate death for a person may depend upon the actions of other people, and the nature of the death may influence their lives for a long time to come.

It is not unusual, for example, for one close family member to believe that life-sustaining efforts should be restricted at a certain point, while another person believes that everything possible should be done to keep the person alive. Both may believe they are advocating precisely the kind of action the dying person himself or herself would prefer, when the old person’s wishes are not consulted or not taken seriously. The likelihood of the dying person achieving an “appropriate” death is greater when there has been a pattern of continued, open communication among patient, family and professional care-givers.

General theories, no matter how firmly based, cannot take the place of direct contact with particular people. We put the books away when we approach this unique person whose life is drawing to an end. Guidelines drawn from clinical experience and research are only useful if they supplement the good sense and emotional honesty that a helping person can bring to the situation.

Signs in advance

Mental changes in old people are sometimes the first signs of terminal decline. Awareness of this can help us provide more appropriate care for individuals and encourage sensitivity to their needs and wishes.

Two people of the same age may function at the same intellectual level. Six months later, one shows a decline, while the other holds steady. Research shows that the person whose mental functioning has declined is more likely to die soon.

A quality of agitation may appear in speech and manner. Behaviour may be inappropriate to the situation. Mental contact with the environment may become disarranged. Premonitions of death are often expressed indirectly.

Professionals as well as lay people have made the mistake of regarding those who show this kind of behavior as senile. Terminally ill old people have been misdiagnosed as mentally ill and shunted away into closed custodial wards, where they have spent their final days without sensitive medical or nursing care and away from the people and places who have been part of their lives. They are left alone with their sense of disintegration. We respond only to the changes in thought and behavior, using perhaps the good old stand-bys: “senile”, “confused”, “stubborn” and so forth, missing the opportunity to comfort and to be a part of the most intimate human experiences.

Some chronically ill old people show a dramatic improvement in mental functioning shortly before death. A person who has seemed confused and out of contact for a long time suddenly becomes lucid and in control of his or her life shortly before death.

The tendency for mental functioning to decline does not mean that dying old people are without thought and feeling. Research with geriatrics indicates that most people retain a significant degree of mental functioning, or continue to be alert until the very end of life, unless put under heavy sedation.

What does a dying person need?

Each person has his or her own specific personal resources and needs. We do not relate to an abstract “old” or “dying” person, but to a very special individual who deserves consideration on his or her own unique terms. As death approaches, the person may be flooded with feelings and experiences from the past. Some memories can be painful. The person may recall how somebody else died many years ago and hope that some of those conditions do not exist for him or her. There may be memories of disagreements, rivalries, petty misdeeds and good deeds left undone. Helping the person to share some of these concerns can provide useful release. Such people may need the chance to explain why they did or did not do something. There may be a request for forgiveness—or perhaps a family secret that must now be passed on to somebody else. Even if we know a person fairly well, we may not recognize what situation from the past is troubling him or her most at a certain time.

Leaving their lives in proper order

Dying people may have simple requests to make which allow them to feel that they can leave their lives in proper order. Sometimes this involves messages and the distribution of small items to certain people. Sometimes it involves certain aspects of the funeral arrangements. Dying people may be concerned about the welfare, of the survivors: “Look in every once in a while on my brother, he’s so absentminded”; “Your mother’s never learned much about handling money; would you give her some help with the bank and the insurances?” Most messages and requests are either practical or sentimental. Dying people do not ask to be made young or immortal. They simply want to round off their lives.

People are sometimes afraid to enter into conversations with the terminally ill, especially if the topics of dying, death and funerals come up. Part of this hesitation is based on the concern that such talk will only depress or frighten the dying person. Yet often it is our own apprehension or difficulty in facing death and acknowledging the plight of the dying person that interferes with communication.

People’s functioning during terminal illness depends on who they have been throughout their life, the type of conditions afflicting them, the treatment being received, the special characteristics of their present environment and many other factors. We can relate better to terminally ill old people if we do not load ourselves with expectations and assumptions, but approach them as the individuals they are

CHAPTER 3:

POPULATION MEDICINE

Introduction to Population Medicine

Knowledge about human health and disease is sum of the contributions of a large number of disciplines, classified as (a) basic sciences (b) clinical sciences, and (c) population medicine. The basic sciences (e.g., biochemistry, physiology, microbiology) are primarily sited in laboratories; clinical activities are carried out in hospitals, and population medicine in the community. Tuberculosis provides a good illustration of the three different approaches to the same disease. The basic sciences are concerned with tubercle bacilli; the clinical sciences with the treatment of tuberculosis in the individual, and population medicine with prevention and control of tuberculosis in the community. All these approaches are highly interrelated.

In different settings, population medicine is referred to as hygiene, public health, preventive medicine, social medicine or community medicine. All these share common ground in their concern for promotion of health and prevention of disease. Each has originated at a different time, and each has introduced a new direction or emphasis. So there should be little expectation that definitions can be other than arbitrary and imprecise. It has been truly said that every definition is dangerous

Hygiene

The word “hygiene” is derived from **Hygieia**, the goddess of health in Greek mythology. She is represented as a beautiful woman holding in her hand a bowl from which a serpent is drinking. In Greek mythology, the serpent testifies the art of healing which symbol is retained even today. Hygiene is defined as “the science of health and embraces all factors which contribute to healthful living.”

Public Health

The term “public health” came into general use around 1840. It arose from the need to protect “the public” from the spread of communicable diseases. Later, it appeared in 1848 in the name of a law, the Public Health Act in England to crystallize the efforts organized by society to protect, promote, and restore the people’s health.

In 1920, C.E.A. Winslow, a former professor of public health at Yale University, gave the oft-quoted definition of public health. The WHO Expert Committee on Public Health Administration, adapting Winslow’s earlier definition, has defined it as:

“The science and art of preventing disease, prolonging life, and promoting health and efficiency through organized community efforts for the sanitation of the environment, the control of communicable infections, the education of the individual in personal hygiene, the organization of medical and nursing services for early diagnosis and preventive treatment of disease, and the development of social machinery to ensure for every individual a standard of living adequate for the maintenance of health, so organizing these benefits as to enable every citizen to realize his birthright of health and longevity”.

Whereas in developing countries such as India, public health has not made much headway in terms of sanitary reforms and control of communicable diseases, it has made tremendous strides in the industrialized western countries resulting in longer expectation of life and significant decline in death rates. As a result of improvement in public health during the past 50 or 60 years, public health in the developed countries has moved from sanitation and control of communicable diseases (which have been largely controlled) to preventive, therapeutic and rehabilitative aspects of chronic diseases and behavioral disorders.

A EURO symposium in 1966 suggested that the definition of public health should be expanded to include the organization of medical care services. This was endorsed by another Expert Committee of WHO in 1973. Thus modern public health also includes organization of medical care, as a means of protecting and improving the health of people. Since the organization of public health tends to be determined by cultural, political and administrative patterns of the countries, there is a wide mosaic of organizational arrangements.

Public health, in its present form, is a combination of scientific disciplines (e.g., epidemiology, biostatistics, laboratory sciences, social sciences, demography) and skills and strategies (e.g., epidemiological investigations, planning and management, interventions, surveillance, evaluation) that are directed to the maintenance and improvement of the health of the people.

With the adoption of the goal of “Health for All”, a new public health is now evident worldwide, which may be defined as:

“The organized application of local, state, national and international resources to achieve “Health for All”, i.e., attainment by all people of the world by the year 2000 of a level of health that will permit them to lead a socially and economically productive life.”

Although the term “public health” has lost its original meaning, the term is still widely used. Terms like preventive medicine, social medicine and community medicine are used as synonyms for public health. Public health is not only a discipline but has become a “social institution” created and maintained by society to do something about the death rate and sanitary conditions and many other matters relating to life and death. In this sense public health is both a body of knowledge and also a means to apply that knowledge

Preventive Medicine

Preventive medicine developed as a branch of medicine distinct from public health, based on etiology. It is, by definition, applied to “healthy” people. It scored several successes in the prevention of communicable diseases based on immunization, so much so, in its early years, preventive medicine was equated with the control of infectious diseases.

As concepts of the etiology of disease changed through time, so too have the techniques and activities of preventive medicine. Preventive medicine is no longer concerned, as it used to be, with immunization, important though it may be. The concept of preventive medicine has broadened to include health promotion, treatment, and prevention of disability as well as specific protection. Preventive medicine has thus come to include both specific medical measures (e.g., immunization), as well as general health promotional measures (e.g., health education). Within this change in the definition and scope of preventive medicine, it has become clear that promoting health and preventing illness involve responsibilities and decisions at many levels – individual, public and private; and that these efforts are applied to

whole populations or to segments. In this, preventive medicine has become akin to public health.

Preventive medicine has become a growing point in medicine. It has branched into newer areas such as screening for disease, population control, environmental control, genetic counseling and prevention of chronic disease. Community prevention and primordial prevention are relatively new concepts which are being applied in the community control of coronary heart disease, hypertension and cancer with palpable success. The emergence of preventive pediatrics, preventive geriatrics and preventive cardiology are relatively new dimensions of prevention.

Since preventive medicine has increasingly tended to be applied to the organized health activities of the community, the term “preventive medicine” is regarded as synonymous with public health.

Association with the concept of public health, prevention medicine has been defined as meaning “not only the organized activities of the community to prevent occurrence as well as progression of disease and disability, mental and physical, but also the timely application of all means to promote the health of individuals, and of the community as a whole, including prophylaxis, health education and similar work done by a good doctor in looking after individuals and families”. In this the goals of preventive medicine and public health have become identical, i.e., Health for All. In line with this extension of the scope of preventive medicine, it is now customary to speak of primary, secondary and tertiary levels of prevention. The cornerstone of preventive medicine is, however, “primary prevention”

Community Health

The term “community health” has replaced in some countries, the terms public health, preventive medicine and social medicine. A EURO symposium in 1966 defined community health as including “all the personal health and environmental services in any human community, irrespective of whether such services were public or private ones”. In some instances, community health is used as a synonym for “environmental health”. It is also used to refer to “community health care”. Therefore, WHO Expert Committee in 1973 observed that without further qualification, the term “community health” is ambiguous, and suggested caution in the use of the term

Social Medicine

Jules Guerin, a French physician in 1848, first introduced the term “social medicine”. In 1911, the concept of social medicine was revived by Alfred Grotjahn of Berlin who stressed the importance of social factors as determinants of health and disease. These ideas of social medicine spread throughout Europe and England after the First World War.

By derivation, social medicine is “the study of man as a social being in his total environment”. It is concerned with all the factors affecting the distribution of health and ill health in population, including the use of health services. Social medicine is not a new branch of medicine, but rather an extension of the public health idea reflecting the strong relationship between medicine and social sciences.

Professor Crew of Edinburgh defined social medicine as follows: “Social medicine stands upon two pillars, medicine and sociology. Social medicine, by derivation is concerned with

the health of groups of individuals and individuals within these groups with a view to create, promote, preserve, and maintain optimum health. The laboratory to practice social medicine is the whole community; the tools for diagnosing community ills are epidemiology and biostatistics; and social therapy does not consist in administration of drugs but social and political action for the betterment of conditions of life of man. Social medicine is one more link in the chain of social organizations of a civilized community.” Terms such as social anatomy, social physiology, social pathology and social therapy came into vogue to describe the various aspects of social medicine.

Although the term “social medicine” was introduced more than 135 years ago, the characteristics aspect was its repeated advent and disappearance. It never came to be generally accepted. There was no unanimity in its objectives or subject matter. This is reflected in more than 50 definitions given to social medicine.

Social medicine had achieved academic respectability in England when John Ryle was appointed as professor of social medicine at Oxford, and Crew at Edinburgh. The post-war period (1945-1967) saw considerable expansion of social medicine as an academic discipline.

With the development of epidemiology as a new discipline and a practical tool in the planning, provision and evaluation of health services, interest in social medicine began to wane. In 1968, the Report of the Royal Commission on Medical Education (Todd Report) for the first time referred to “community medicine” instead of social medicine, and defined it in terms which embraced social medicine, but went beyond it, by giving greater emphasis to the organizational and administrative aspects than had academic social medicine in the past. This gave a blow to the further development of social medicine which had tended in many countries to be displaced by the newer term “community medicine”

Community Medicine

The term “community medicine” is a new term. It is the successor of what has been previously known as public health, preventive medicine, social medicine and community health. Since community medicine is a recent introduction, it has borrowed heavily from the concepts, approaches and methods of public health, preventive medicine and social medicine.

The history of community medicine in England is interesting. It was instituted by Ordinance and by Act of Parliament. The Todd Commission (1968) forcibly recommended that every medical school in England should have a department of community medicine. The Royal College of Physicians of Edinburgh and London and the Royal College of Physicians and Surgeons of Glasgow established the Faculty of community medicine, which came into being in March 1972 as the central body with a responsibility of setting standards and overseeing the quality of postgraduate education and training in the field. On the night of Sunday 31 March 1974, the traditional medical officer of health passed into the pages of the history book. And on the following morning there arose out of the ashes like the phoenix, the “community physician”.

The term community medicine means different things in different countries. For example, in most European countries various aspects of community medicine are taught at medical universities, though under different names, such as general practice, family medicine, community medicine or social medicine. Even in the same country and region, the variation in the amount and range of teaching remains remarkable. These variations are reflected in the definitions quoted below.

- The field concerned with the study of health and disease in the population of a defined community or group. Its goal is to identify the health problems and needs of defined populations (community diagnosis) and to plan, implement and evaluate the extent to which health measures effectively meet these needs.
- The practice of medicine concerned with groups or populations rather than with individual patients. This includes the elements listed in definition (a), together with the organization and provision of health care at a community or group level.
- The term is also used to describe the practice of medicine in the community, e.g., by a family physician. Some writers equate the terms “family medicine” and “community medicine”; others confine its use to public health practice.
- Community oriented primary health care is an integration of community medicine with the primary health care of individuals. In this form of practice, the community practitioner or community health team has responsibility for health care at a community or at an individual level.

It will be seen that a common thread runs through all the above definitions. Diagnosis of the state of health of a community is an important foundation of community medicine. As used in the present context, community medicine is a practice which focuses on the health needs of the community as a whole. The combination of community medicine with “primary health care” extends the functioning of both elements to a health care system which aims to change the state of health of the community by intervention both at the individual are in no way different from those of modern public health and social medicine, viz. epidemiology, biostatistics, social sciences and organization of health care which includes planning implementation and evaluation

CHAPTER 4:

CORPORATE HEALTH CARE

Introduction to Corporate Health care

Health is not merely the absence of disease it is a state of physical, mental, social & spiritual well being. Corporate health care is the translation of these objectives in to the organisation, whereby all the employees can achieve a state of optimal well being and good health. The opposite of health is illness and several corporate organisations have created methods to manage illness. Some organisations have their own dispensaries, clinics and even hospitals. Others organisation register them selves with various medical specialists and medical installations, where their employees are referred to when sick, and yet other organisation simply take out health insurance cover and each employee and family, which allows the employee to use the facilities of various hospitals when sick.

Corporate Health Care as in now evolving is not simply a means of disease management rather it is a state of wellness management, by means of preventive and promotive health care.

To explain this concept, we present three perspectives. Firstly, the TISCO awakening, a report on the introduction, and management of wellness systems into India's largest private Corporation. Beyond Tata Steel there are several other private and public corporations that have initiated their own wellness systems. The second presentation is a compilation of health and wellness statistics, by the Lifestyle Department of Apollo Hospitals, based on their findings while conducting health check ups of various corporate all over India. This may be considered the Corporate Health profile of India. In the third presentation, we record and highlight the wellness activities of various corporate organisations in the USA. This is not to say that Corporate Health Care and wellness is confined to the USA alone. There are similar and better programs conducted in Singapore and other parts of the world. Taken together, these three perspectives, introduce us to Corporate Health Care

(A) EXECUTIVE HEALTH THE TISCO AWAKENING

Medical investigation into the causes of death of individuals, in the present century is revealing new trends. In earlier centuries, death was largely caused by disease of poverty and infection. Malnutrition, cholera, plague and so on accounted for most death. With the advent of industry, commerce, and medicines – these diseases are now more or less wiped out or exist in small microscopic pockets. The great scourges of the present century are the diseases of plenty and prosperity – these account for 80% of this century's death.

The main culprits are, Heart attack 60% and Cancer related deaths – 20% (sickness, accident and deaths from natural and unnatural causes together account for the balance 20%).

The diseases of plenty and prosperity or the modern diseases of mankind are all self-inflicted and caused by a sedentary lifestyle, of which, obesity, overeating, lack of activity and exercise, automated vehicles, stress and mental tension, alcohol, smoking, medication etc. are all a way of life.

With this background, the Executive Health Department, the Tata Main Hospital, Jamshedpur and the Tata Management Centre, created in 1991 a PATH CLAPSCAN; (Positive and Total Health Computerized Lifestyle Assessment and Prescription Scan) to evaluate nutrition, activity, body condition, stress levels, dependency situation (alcohol, smoking, medication), cardiac, cancer, AIDS risk, etc. of individuals and to print out advice on how to improve. Every year executives who are required to undergo the medical check up also undergo PATH CLAPSCAN.

Tata Steels Executive Health Status as compiled by the CLAPSCAN for the 3 year period, 1991-93: –

		1991	1992	1993
I.	Physically Unfit	69.41	52.48	51.10
II.	Overweight	78.25	48.76	51.84
III.	Highly Stressed	48.33	38.51	30.15
IV.	Smokers	18.77	22.98	19.49
V.	Alcoholic	2.31	4.66	4.41
VI.	Cardiac Risk	31.36	45.65	43.38

The Findings were at best frightening and an analysis of the year 1993 revealed,

1. Physical Unfitness: 51.10% of the Senior Officers were physically incompetent. Their body functional capacity was less than 60% – in later years they could become victims of arthritis, spondiolysis, back ailments, joint & muscle weakness, etc. This group had elevated heart rates of above 80-bpm and lung retention capacity of less than 60 seconds. Their body fat ratio was above 25% and they were unable to do the minimum fitness tests such as toe touching, etc.

Comparative studies done in the USA indicated Executive Fitness levels for similar test at 40% unfit as compared to TISCO 51.10% unfit.

2. Overweight: 51.84% of the officers were found to be overweight (Height – weight standards were taken from the book-Fitness a way of life – an accepted reference book for India Standards). Obesity is a state where a person is more than 10kgs beyond the accepted range for his height – and the consequences of obesity are, high blood pressure, diabetes, hyperlipidaemia, elevated cholesterol, personality disorders, joint problems, etc. Interestingly – in 1991 – the TISCO obesity figure averaged at 78.25% while the world standard then stood at 59%. Obesity in TATA STEEL dropped 26.41% over the last two years as a result of recent lifestyle management and weight management classes.

3. High stress: Even while the stress levels in 1993 stood at 30.15% – a drop of 18.18% from a figure of 48.33% in 1991, the figures do not give the whole picture. Stress is a state of psychological and physiological alarm. This is caused by various incidents and situations –

and when the stress accumulates, the body breaks down – resulting in psychosomatic disorders ranging from headaches, irritability and insomnia – to strokes. From HBP and diabetes to heart attacks; from indigestion and flatulence to ulcers; the range also includes backaches, impotence and frigidity.

To assess the true stress of a person, stress in various areas was identified. The position in TISCO was as follows,

		1991	1992	1993
I.	Cumulative Stress	48.33	38.51	30.15
II.	Psychosomatic Stress	84.83	81.68	82.72
III.	Stress at Work	2.00	3.42	9.56
IV.	Personality Stress	50.64	41.93	34.93
V.	Stressful Routine	31.88	25.16	16.18

a. Cumulative (High) Stress: Is a state where the individual is stressed in more than one area. It would mean that there is stress at work, a stressful routine, an aggressively competitive personality and psychosomatic stress symptoms. This high stress, when out of control causes heart attacks, strokes, suicide, alcoholism, drug dependency, etc.

b. Psychosomatic Stress: This group comprises individuals who due to mental pressure as a result of stress – suffer physiological symptoms. These symptoms as enumerated in the CLAPSCAN include headaches, irritability forgetfulness, insomnia, HBP, diabetes, high cholesterol, breathing difficulties, digestive ailments, back problems, muscular pains, skin ailments, alcoholism, smoking and drug dependency, etc.

c. Work Stress: Factors that account for work stress in the CLAPSCAN include, poor working conditions (such as heat, dust, etc.), long and irregular working hours, work overload, underutilization, lack of recognition, lack of support, neglect of home, role stagnation, lack of promotional avenue, etc.

d. Personality Stress: In stress there are basically two types of personalities. One is a stressful, ambitious, competitive, aggressive, impatient, workaholic, time pressured personality, known as the cardiac type A personality. He is the dynamic result oriented executive whose last port of call is the heart attack. The other is the type B personality who is comparatively less stressed since he is more realistic in his ambitions, is a delegator, is accommodating, is self competitive, relaxed, patient and philosophical. Incidentally, most chief executives are B type personalities – usually because the more aggressive front running type A Personality is struck down by a heart attack in mid race for the top post.

e. Stressful Routine: Is a situation where the individual works late hours, sleeps less than 8 hours, does little or no exercise, does not take vacations, etc. In other words, a person who is afraid to relax and let go.

Due to TATA STEEL's stress management classes the overall high stress levels dropped 18.18% (from 43.33% to 30.15%). The world executive figure of stress is 55% as indicated by Human Kinetics, USA , and Dr. Sam Batlivala in his book (stress, friend or foe?) has put the India Executives stress figure at 50%.

4 & 5. Smoking and Alcoholism: TATA STEEL's figure of 19.49% compares with the smoking executive of USA at 19% – and the Tisco's Executive who tip the bottle a little too much in the evening, stand at 4.51% as opposed to his American counterpart at 9%. Smoking causes cancer – the second biggest killer in the World today and any person who smokes daily is at risk of the deadly lung cancer from which even today only 30% survive. Cancer is a highly fickle ailment and sometimes rejects the compulsive chain smoker of 30 years – for a comparatively lighter one cigarette a day smoker of 10 years.

Alcoholism in CLAPSCAN is defined as a person who drinks every day and consumes more than 2 (60 ml) large pegs at any sitting.

6. Cardiac risk: 43.38% of the executives were high cardiac risk – and this is perhaps the most frightening statistic. It means simply that, 43.38% of the executive cadre were at high multiple cardiac risk and could drop dead at their desks – or simply never turn up again for work. And – as any Tisco executive will confirm – this has happened to several colleagues.

There are two categories of cardiac risk. Secondary and Primary. Secondary risk factors cover those factors that contribute to cardiac ailments – but have not already physically affected the cardiovascular system of heart blood vessels and lungs. These factors cover those who smoke, lack exercise activity, are overweight or highly stressed. However, the 43.38% referred to above are those executives who are primary risk – or high risk. That is those whose cardiac systems are already affected by blood pressure, diabetes high cholesterol, or cardiac ailments.

In 1991, the high cardiac risk category stood at 31.38% – and this figure had risen 14.29% to 45.65% in 1992. Fortunately with the commencement of cardiac care classes for the high risk category, the figure in 1993 dropped by 2.27% to 43.38%. A study conducted in Tenneco , USA indicates a cardiac risk level of 48% while Batlivala puts the National Executive level at a mere 24%.

So with statistics like those – what does Tata Steel or any corporation do? The Tata Steel Executive Health package comes in three phases.

Phase-I: Annual medical checkup and PATHSCAN health checks with counseling and individual lifestyle prescriptions given to each executive as mentioned already.

Phase-II: Year round follow up Health Management classes. The PATH CLAPSCAN categories all the executive into categories as follows:

a. Cardiac Care Program: In this group are those executives who have high blood pressure, diabetes, high cholesterol, who have already had a heart attack – or who have a genetic cardiac profile. This group is the high risk group and comprised 43.38% of the executive work force as on 1993. They are invited with their spouses for 3-day residential live in

programs where specialists and cardiologist explain to them such concepts as cardiac risk factors, how to avoid a heart attack, first aid and emergency steps during an attack, cardiac care diet, healthy heart exercises, yoga, meditation, stress reduction, etc.

b. Lifestyle Management Program: In this group are located those executives who are not at any immediate risk-but who have been found to be simply, overweight, unfit, highly stressed, and who smoke or are alcoholic, but who do not have any other cardiac risk factor, 56.62% of the executives come into this category. They too are invited in groups of 15 couples – for 3 day live in program covering such subjects as; nutrition and weight management, fitness program (including yogasanas, walking, calisthenics, home exercise, and office exercise program), meditation, etc. In short the program teaches a healthy lifestyle. Amazingly, almost 100% of executives are covered by this program and there are very few if any executives who do not require health correction.

c. Executive Wellbeing: This third category covers the younger officers and spouses who for whatever reasons have not had a medical check-up. This is 2-day non-residential program covering such topics as fitness and age related tests, diet for efficiency, personal fitness programs (aerobics, weight training etc.), managing stress, quit smoking, alcohol, drugs, etc. and also human sexuality.

Phase-III: Comprises low cost or high cost facilities for promoting health. Low cost facilities include office exercise and meditation programs, weight loss clubs etc. High cost facilities include the building of Gyms, Spas, stadiums, etc.

As on date, several aspects of Phase-III have already been implemented. 7 day health care programs in Naturopathy and Drugless therapy have been introduced for workers and supervisors at the local Tisco sponsored Nature Care Centre. Fitness classes are held daily (morning and evening), for officers and spouses in the JRD Sports Complex and at Tata Football Academy , in aerobics, yoga, weight training etc. Meditation sessions, both active and passive, are held every day, the weight loss club for overweight executives and spouses is already functioning

The Tisco experiment is on the right track.

The decision to implement Executive Corporate Health Schemes such as the PATH CLAPSCAN and health classes is not merely a welfare decision – it has a sound basis in profitability.

Improved Health leads to lower absenteeism due to sickness, which leads to reduced medicare and medical hospital costs. It also leads to higher output per shift than with ailing counterpart. The Japanese and Americans put a figure of 1% of turnover as profitability on Corporate Health.

With Tata Steel turnover of over Rs. 3000 crores per annum in 1993, the returns from Corporate Health could be pegged at Rs. 30 crores – as against an investment of less than Rs. 5 lakh for health measures introduced so far. However, increased investment will only lead to greater productivity.

Corporate & Executive Health in Tata Steel is managed by the Executive Health Department which functions out of the Tata Main Hospital. Year on year it conducts three activities. First

the Medical & Health Check up. This is followed up by Health Workshops, & finally, there are year round, Age related Sports & Physical Fitness Activities.

Mentioned below is the 1994 Executive Health profile.

1. Poor Physical Fitness – 47.65%

- 52.80% of Executives do not exercise at all
- 47.65% have failed their age related fitness tests.

The trend towards improvement in physical fitness continues. with increasing awareness of the benefits of exercise on health. In '93, 51% of execs were unfit as opposed to 47% in '94. However, there still exists ample scope for improvement.

2. Obesity – 51.18%

- 46.41% of Execs. Have excess body fat (more than 25% fat)
- 31. 86% of Execs. Are in addition, overweight
- 24.78% of Execs. Have stomachs larger than their chest.

Here too there is continuing improvement, but here also exists ample scope for improvement.

3. Stress – 35.00% (Multidimensional)

- 37.35% have Type A Personality Stress
- 48.38% have work overload
- 36.58% have insufficient family time
- 82.65% have psychosomatic ailments (Headaches, etc.)

We seem to be on an upward trend in stress with the cumulative stress levels up by approximately 5% over the last year. Overall stress at work in 1994 was 12.58% as opposed to 9.56% in 1993, an increase of 3%. Also personality stress has risen to 37.35% in 1994 as opposed to 34.93%. Certainly these figures read with the 48.38% overload, factor, account for the overall increase. What are the reasons for this increase in stress? A quick survey of reasons from Tisco executives, gives the following explanations. Market competitiveness; Tisco now has to work harder to sell its products. Steel is no more a sellers market. Management attitude; no more is the Tisco Executives job guaranteed, several executives have lost their job for lack of performance and a fear psychosis has set in. These factors amongst others requires the Executive today to be aggressive, result oriented and workaholic, as compared to more laid back as in the previous years.

4. Cancer risk – 47.06%

- 3.82% drink alcohol excessively
- 23.24% smoke

- 11.50% eat paan, etc
- 15.93% have a genetic profile

The cancer risk scan was introduced in PATH CLAPSCAN for the first time in Jan. 1994 and the risk figure of 47.06% with an increasing tendency in smoking has resulted in a new health program; Dependency Management, in which executives are equipped with the latest techniques on how to Quit alcohol, smoking and paan.

5. Cardiac risk – 53.53% (High Cardiac risk)

- 62.94% have secondary risk (Unfit, Stress, Obesity)
- 22.16% have High Blood pressure
- 14.45% have Diabetes
- 9.73% have Hyper Lipids
- 25.07% have a Genetic Profile

The sharp increase of almost 10% over the 1993 figure is certainly cause for alarm. With fitness and obesity improving – the reason for increased Hypertension, diabetes and cardiac risk certainly seems to point at the increased levels of stress and smoking in the organisation.

6. Hospitalization & Medication

- 7.08% Executive were hospitalized (avg. 7 days).
- 22.71% Executives are on daily medication.

7. Cost of Poor Employee Health (at Standard Formulas)

- With an annual turnover of Rs 3800 Crores, 1% loss of Productivity of Hospitalized persons =Rs. 3.80 crores.
- Annual Cost of Medicines of employees Rs. 3.60 crores.
- Annual Medical Budget (maintenance of hospitals, salaries of doctors), etc. Rs. 25.00 crores

(B) CORPORATE HEALTH AND WELLNESS IN INDIA

The wellness of corporate employees is relevant to a corporate's bottom line in two ways. Firstly, one way or another most corporates pay for the medical expenditure of their employees. Secondly, it is universally acknowledged that a healthy employee is capable of higher productivity as opposed to his sick colleague (i.e. less absenteeism, higher production per shift etc.). However since several aspects of corporate wellness comprise financial intangibles; productivity, absenteeism etc as opposed to other aspects that can be accounted for hospitalization & medication costs, experts peg improved employee wellness at affecting the bottom line by 1% of turnover. The impact of Corporate Health Care therefore is in reducing Medicare costs & improving productivity & profits.

Annually, the Apollo Group of Hospitals located at Delhi , Chennai, Mumbai, Hyderabad , etc., conducts the medical check ups of several thousand Executives from all the leading national & international corporations in the country. What follows is the status of Corporate Health in India for the period 98-99,covering the lives of over 15,000 Employees from multiple Corporate Organisations.

Cardiac Risk

High Cardiac risk – 56.05 %

High Blood Pressure – 25.30 %

Diabetes – 15.50 %

High Cholesterol – 38.23 %

Existing Heart problem – 6.19 %

The biggest killer worldwide especially amongst Executives accounting for over 60% Medicare costs & deaths is the heart attack. A research study published in June'98 indicated that not only were Asian Indians more prone to heart attack & coronary diseases than the rest of the world; but that the prevalence of heart attack in Indians started at age 40 years & less, as compared to 50 years & more in the western world. According to statistics available from Apollo's Computerized Health Scan (PATH CLAPSCAN). 6.19% of executives had survived a heart attack in the year under review. Since approximately 50% individuals survive a heart attack, we can generally surmise that the actual incidence of heart attack amongst Executives India was in the region of 12.38%.

Risk of heart attack can comfortably be divided into two categories. Primary Cardiac risk (i.e. High Risk) comprises those individuals who in addition to other cardiac risk factors, also have either High Blood Pressure, Diabetes, High Blood Cholesterol, or abnormal ECG's. The existence of any of these factors puts the individual at high risk for a cardiac ailment. Our research statistics indicates that as against the International Cardiac risk status of 48.00%, the Indian Executives' High Cardiac risk status was 56.05%, with 25.30% having high blood pressure, 15.50% having diabetes, 38.23% having elevated blood cholesterol and 4.79% having an abnormal ECG's or positive TMT, with several having more than one of these ailments. Other factors that predispose an individual to heart attacks, high blood pressures, diabetes, high blood cholesterol, etc. are; a sedentary life; obesity; high levels of stress; & smoking. Beyond the 56.05% high risk category indicated earlier, an additional 36% executives come into this category.

Sedentary Life

Overweight – 70.98 %

Physically Unfit – 48.46 %

Executives perks include, the latest cars, 5 star hotel stay etc. These symbols of success come with a great cost to personal health. 70.98% of Executives were found to be overweight. (In one organisation 96.00% executives were overweight) 56.13% Executives had stomachs that were larger than their chests. 35.28% Executives ate out at 5 star facilities more than twice a week. 55.52% subsisted on a high fat diet, of butter, eggs, cheese etc. 48.15% ended each

meal with savory desserts of cake, ice cream or a helping of mithai, 36.90% snacked between meals with highly salted wafers & nuts. With such high calorie intake, one would imagine that Executives would be full of energy & activity; however the facts speak differently. 48.46% of executives were found to be in hopelessly poor physical fitness condition. 58.65% were unable to touch their toes, 50.52% were unable to do a single push up or sit up & 43.85% had never exercised since their childhood. So what does this sedentary life predispose the Executives to? Heart attacks, High Blood pressures, Diabetes, High Cholesterol, arthritis, spondylosis, backaches, digestive disorders, ulcers, sexual incompetence, insomnia etc, to name just a few ailments. And this predisposition it seems is reality, with over 30.31% Executives taking daily medication to overcome these ailments, when a simple remedy of eating less & being more physically active would rid them of all these ailments. Incidentally world wide it is now acknowledged that the simple most health beneficial habit, to guarantee good health is daily exercise.

Stress

Stress Ailments – 83.71 %

Headaches – 30.07 %

Asthma etc – 11.48 %

Ulcers etc – 40.05 %

Backaches – 37.47 %

Allergies – 32.02 %

Insomnia – 15.02 %

Multi Stress – 32.76 %

Personality Stress – 57.52 %

No discussion on Executive Health can take place without the mention of Stress. Stress in this context simply means mental pressure; i.e. the pressures involved in doing a job. Once the job is successfully accomplished one can relax and celebrate.

However in order to accomplish the task several problems have to be overcome, this causes tension & stress, resulting in physiologic, neurological and endocrine responses in the body. If the stress continues for a period of time, or if this happens too often these body changes become permanent, resulting in various psychosomatic ailments. (Psycho meaning mind, soma-meaning body; i.e. mind affecting body). Our study revealed that 83.71% of executive's suffered from psychosomatic stress ailments. (In one large organisation; the psychosomatic stress factor was 93.26%) Taken on a national level we find that besides High Blood Pressure, Diabetes, Cholesterol and abnormal ECG other Stress ailments suffered include;

30.07% executives suffered frequent headaches

11.48% suffered respiratory ailments including asthma

40.05% had digestive problems including ulcers

37.47% suffered from arthritis, backache & other joint problems

32.02% suffered from various allergies & skin problems

15.02% were unable to sleep well & suffered from insomnia

So where is all this stress coming from? Surprisingly it is not from the corporate organisation. In spite of all the problem that exist in Indian Industry only 3.40% Executives looked upon their jobs as stressful. (This, in spite of the fact that an earlier study done in 1996 indicated that 32.69% executives felt restricted by lack of promotional avenues, 44.10% felt that they were not adequately rewarded, 45.26% felt frequently overloaded, 71.18 felt that there was no clarity regarding their role & responsibilities). The stress was certainly not coming from their homes, less than 1.62% had home problems. The stress was neither coming from financial problems or legal problems, less than 1% complained of these stresses. 8.84% did complain about their daily routines; too little time at home, too much time spent on commuting, too little time for leisure & relaxation. However the major stressor it turns out is personality. 57.52% of Executives have a Type A stress prone personality. With some organizations reporting a 76.97 Type A personality profile. This personality type comprises individuals who are time pressured, impatient, feel compelled to win & are by nature critical & condescending etc. This type A Executives also referred to as a Cardiac prone personality, is then the major cause of Stress in Indian Industry.

Cancer Risk

High Cancer Risk – 30.31 %

Industrial – 11.02 %

Smoking – 14.09 %

Alcohol – 5.72 %

Paan – 6.47 %

If Cardiac ailment & stroke are the leading killers, then certainly Cancer with a 20% mortality rate worldwide is the 2nd biggest killer. The Heart attack is a modern age disease, first manifesting itself in an epidemic form only in the 1940s – 50s, while cancer is an ancient disease having existed for centuries. Still, in spite of hundreds of years of research into the cure for cancer, the cure rate for cancer still stands at not more than 50% overall. And since cancer is a disease of aged & retired persons, & with longevity now reaching above 75 years in the western world, the incidence of cancer is increasing. Most of us blame industry & environment for causing cancer. However in a recent study from the American Cancer Institute it was reported that less than 4.00% cancers were caused by Industrial units, & less than 2.00% cancers were caused by environment pollution. The major causes of cancer worldwide were Smoking 60%, High fat diet 30% & Alcohol 3.00%. (In India dietary cancers are less, however paan & paan products, account for 13.00% cancers). So what is the Corporate employees risk of cancer. According to the PATH CLAPSCAN study in 98-99, 30.31% of Executives stood the risk of getting cancer in later years. (remember it takes 20 years for cancer to gestate). Of this 11.02% from exposure to Industrial chemicals, fumes & radiation; 14.69% due to chronic smoking (1 packet and more for last 10 years); 5.72 due to alcohol, (2 pegs & more daily for the last 10 years) and 6.47% due to paan & paan products.

However cancer can more correctly be rated as a poor man's disease – & in a study done with PATH CLAPSCAN in 1995, it was found that amongst workers in one of India 's largest industrial organisations; 42.50% workers were at risk due to paan, 14.58% due to smoking & 5.44% due to alcohol

Conclusion

Cardiac Risk – 56.05%

Cancer Risk – 30.31%

Overweight – 70.98%

Physically Unfit – 48.46%

Psychosomatic Stress – 83.71%

Daily Medication – 30.31%

The facts speak for themselves. With 56.05 % Executives at risk for Heart attack; 70.98% Executives overweight; 48.46% physically unfit for their age group; 83.71% Executives suffering from psychosomatic stress ailments, 30.31% at risk for cancer & 30.31% also on daily medication; the status of Health of our Executives is at best dismal. What should we do? For the executive the solutions are quite straight forward (easy to say, but hard to do – so to speak.) Eat less, Exercise more, cut the booze, quit smoking & relax. Everything Grandma advised years ago. For industry to keep their Executives healthy (thereby reducing Medicare costs & improving productivity & profits) the solutions are a little more complex. Step one, would be to ensure that all Executives (why not all employees) undergo an annual medical & health check up. This check up must include Lifestyle risk evaluation for Cardiac, Cancer, and Stress etc. Step two, could be to conduct Health Management programs, or make available information on how to remain healthy ;(what to eat, how to exercise, stress management methods, quit smoking systems etc). Step three, could be to make available health enhancing facilities to employee (may be start a walkers club, or do 5 minutes exercises at the start of the working day; perhaps end the shift with 5 minutes meditation etc.). The result, rather than the bottom line being minus 1% of turnover, due to ill health; it could be plus 1%, and add to that, Goodbye heart attacks, Goodbye cancer, Goodbye stress

(C) BEST PRACTICES —COMPANY SPONSORED WELLNESS PROGRAM IN THE U.S.A

1)New Mexico Company's Wellness Program Results in Lower Insurance Claims for Participants

The mission of the wellness program at Sandia National Laboratories (SNL), Albuquerque , N.M. , is helping people to be healthy. While it is accomplishing this goal, Salud! To Your Health is saving SNL money in the form of lower insurance claims.

An assessment in 1991 showed that the 1,000 employees who were the wellness program's original participants in 1986 filed fewer health insurance claims each year and, when they did file, the claims were an average of \$400 less per year than the company's other employees.

The program began in 1986 while SNL was under the outside management of AT&T. It was modeled after AT&T's Total Life Concept Program.

Before the program was established a committee was formed to look at the company's insurance claims and increasing costs of healthcare. The committee found that the lifestyle of the employees were directly related to the health risk factors they exhibited. It surveyed employees and found that 93 percent wanted a wellness program.

The program began by focusing on the core risk factors identified by the American Heart Association because these were consistent with the risk factors of the employees identified by the committee.

A random sample of 1,500 of SNL's 8,000 employees were invited to participate in the program at its inception. Of this number, 1,000 actually participated. These employees took part in a health risk assessment (HRA) and an orientation to the program. Based on the result of their HRAs, employees were advised as to which of the nine lifestyle classes to take. Classes included: back care, blood pressure, cancer control, cholesterol reduction, fitness and exercise, interpersonal communication, stress management, weight control and smoking cessation.

After employees completed their first year in the program they were no longer required to take any lifestyle classes but were encouraged to continue the fitness and exercise portion of the program. All participants, past and present, are contacted through a quarterly newsletter, e-mail, information on the company's internal web site and SNL's new paper.

During each invitation period approximately 1,000 people registered and after five years Salud! To Your Health went to open enrollment.

The program started small because of budget constraints, said Singer, the Corporate Wellness Manager.

An evaluation in 1991 showed that the program was fulfilling its goal. A cholesterol screening of 175 of the original participants showed their pre-participation cholesterol levels to be an average of 265. Twelve weeks into the program their levels fell to 239. One year after these employees completed the program their cholesterol levels averaged 243.

Now, more than 10 years after its inception, the program emphasizes fitness, health education, nutrition, cholesterol education, smoking and stress. It offers a number of activities including:

Nutrition, fitness, stress assessments and individual counseling;

Bi-monthly newsletters of all participants;

Preventative finger-stick cholesterol screenings;

Monthly health observances, guest speakers and special events (e.g., nutrition month);

Organizational stress assessments and programs to intact workgroups;

Salud Premier Program for Sandia retirees which includes HRAs and seminars on physical activity, aging and self-care; and Educational seminars and lifestyle programs in weight management, cholesterol reduction, smoking cessation and self-care.

Most of these activities take place in on-site classrooms. Aerobic classes are offered after work in SNL's cafeteria and the company has a track for walking and jogging.

Evaluation

According to Singer, the program has an evaluation for every interaction with employees.

She uses a variety of customer satisfaction surveys as well as surveys when lifestyle classes are completed and one-on-one assessments. In 1993 SNL used the Johnson and Johnson's Quality Audit.

Singer also does follow-up with employees who have stopped participating in the program's activities. For example, she will contact former participants in the aerobic classes to find out why the person stopped participating and, if it is because of dissatisfaction with the class, how it can be improved.

The Greatest Strength

The program's ability to continuously change as the environment and the needs of SNL's employees change is its greatest strength, Singer said. It has adapted to changes in staff, budget, and corporate culture while maintaining quality and its reputation with SNL's employees, she noted.

New Programs

The new programs at SNL speak to the wellness program's ability to change and evaluate the needs of its participants. Singer is now concentrating on meeting the needs of employees who want to participate but feel pressured by time constraints. She and her staff are taking the programs to the employees. They work with department heads to find out what the employees in each department want and what will benefit them the most and then they bring programs to the sites of the various departments.

For example, the departments that are involved in heavy labor may have programs about back care brought to the location of their job site.

Recently stress had been identified as a company-wide problem. Singer has been working with entire workgroups in different departments to help them identify their strengths and weakness as well as they need as a group to help reduce stress

2) Wellness Programs entice employees to stay with the Company

A commitment to its corporate mission statement was the driving force behind the establishment of the wellness program of Parke-Davis Pharmaceutical Research Company, or, Mich., a program that is so successful among employees that two have refused other job offers Ann Arbor because the other companies did not offer wellness programs.

Begun in 1984 as a benefit to the company's colleagues, the Life Wise program seeks to fulfill the mandate in the company's mission statement: "To advance the health and well-being of colleagues and their families."

Because the company is a medical industry of sorts, the management thinks it is important that employees take care of their own health, said Sheila Calhoun, director of Life Wise.

After an initial HRA conducted by the University of Michigan and a consideration of these results, the human resource department of Parke-Davis designed the program based on these results as well as national observances of various fitness themes. Life Wise began with fitness classes after hours in the cafeteria and lunchtime seminars.

The program has grown to encompass a fitness center – established in 1991, a one-kilometer fitness trail, and activities including a medical and fitness evaluation prior to membership, a smoke-free environment, two wellness libraries, over 15 recreational programs, free annual cholesterol and glucose screenings, mammograms, free HRAs every four years, a stress management program and a healthy menu.

The wellness program got its own staff in 1991, which added professionalism to the program, said Calhoun.

The Greatest Strength

According to Calhoun, the greatest strength of Life Wise is the fact that it has management support. The management subsidizes Life Wise because it feels the program is good for employees. There are vice presidents who belong to the fitness center who are there exercising with the rest of the colleagues, said Calhoun.

The company funds most programs. If there is a fee, an attendance incentive is often offered. Membership to the fitness center costs \$14 a month, payroll deducted.

Promotion is Key

"You have to promote, promote, promote," said Calhoun about outreach to colleagues.

She does just that. Life Wise has its own newsletter, which is distributed every other month, and the program receives mention in the company's newsletter, which is published twice a month. Each month, Calhoun distributes fliers containing information about upcoming wellness program activities to each department.

There are wellness program bulletin boards located throughout the company that advertise upcoming events and an electronic message board in the cafeteria for the same purpose. Once a month in the cafeteria, a table is set up with brochures about Life Wise.

Information about Life Wise and a tour of the fitness center are even included in a new employee's orientation.

Eventually Calhoun hopes to have a web site for Life Wise with links that would enable the user to register for different parts of the program.

A Personal Touch

Calhoun adds a personal touch to Life Wise in the follow-up she does with participants who have fallen away from the program. Every so often the staff of the fitness center will generate a list of those colleagues who have not used the fitness center in a specific amount of time, e.g., three months. Calhoun will send personal letters to these employees saying that Life Wise misses them and will offer incentives for them to come back. For example, Calhoun may waive the re-initiation fee to entice a colleague to return to the fitness center.

Calhoun also follows-up with personal phone calls and by simply “chatting” with colleagues as she encounters them during the workday.

A similar personal touch is employed in monitoring whether the program is meeting the needs of employees. She seeks feedback after all seminars offered through Life Wise. There are suggestion boxes in place throughout the company. The human resource department asks for comments about Life Wise during an exit interview when a colleague is leaving the company.

Word of mouth is another way to monitor the success of the program, said Calhoun

3) Management Support, program recognition keys to success; incentive help too

Recognition and management support are two of the most important ways to have your wellness program succeed, said hte director of a wellness program at a South Carolina school district.

The schools where there is a participation rate exceeding 70 percent have principals who are active in and supportive of the program, said Ginny Stevenson, director of the Mariner Project Staff Wellness and Incentive program in the Berkeley Country (South Carolina) School District .

Program recognition comes through notices about the program in the school district newspaper and local newspapers. Stevenson also communicates with participants through on-site wellness representatives and monthly programs.

In 1994, the Berkeley Country school district was awarded a grant from the U.S. Department of Education Found for Innovation and Reform in Schools. The wellness program is a piece of the large program funded by the grant. Stevenson coordinates the Mariner Project at seven schools in the Goose Creek area of South Carolina .

Calendar of Events

The Mariner Project operates on a yearlong thematic calendar, with each month bearing a different focus and activities to go along with that theme.

For example, September was stress management month. Stevenson brought stress management seminars to her schools, had the teachers make stress tamers out of balloons and rich and conducted meetings at which she instructed everyone to get up and dance the Macarena.

“Wellness begins with stress management,” said Stevenson.

October and November were drug-free month and smoking cessation month, respectively.

In December, Stevenson cut and handed out 5,500 red ribbons for MADD (Mothers Against Drunk Driving) as one way to observe alcohol awareness month.

In January, health fairs and health screenings were held at two of the schools and a walking program was begun. The school that has the greatest participation in the program will have a massage therapist come on-site to offer massages to the staff.

A third school had a health fair / screening on-site in February to celebrate the theme of heart health. The school that creates the best heart health initiative as a part of this program will win a cardiology machine or a cross-country ski machine for its on-site exercise room or \$150 toward its nutrition program, one of the programs scheduled for March – nutrition month.

During March, the teachers were flooded with information on nutrition, said Stevenson. She organized after-school tasting sessions for them to sample healthy alternative to common after – school snacks.

April brought discussions about children: their roles in community service, child abuse, parenting and healthy relationships. May focused on physical activity and June, July and August on summer safety.

The Incentive Program

Stevenson created an incentive-based program to be a component of the Mariner Project. She gave the staff a packet including over 300 different activities. Participants earn points – “Mariner Bucks” – for each activity completed. Activities include: reading the packet, vowing never to diet again, programming the blinking VCR, using low-fat milk for one week, drinking fruit juice instead of soda for one week, and taking a CPR course, to name a few.

“I tried to reward not only physical activities but other activities as well,” she said.

There had to be a broad range of activities because of the wide age range – 24 to 60 – of the staff, Stevenson said.

“Mariner Bucks” can be redeemed for prizes ranging from socks to T-shirts to videos about back care.

Incentives aren’t the main reason teachers participate, said Stevenson, but they help.

Problems in the Beginning

One problem Stevenson and the Mariner Project encountered in the beginning was with teachers who already had their own exercise / health programs at private gyms. They didn’t know how they would fit into the program. Stevenson decided that these individuals should be able to use their personal programs to fulfill the requirements in Stevenson’s packet.

“Why not reward [them] for something they already do?” she said.

A self-paced, self-motivated health awareness program, The Mariner Project reflects in the staffs’ relationships with the school, in their own homes and with their students, said Stevenson.

"It has far-reaching effects," she said

4) On – Site Rehab Program proves to be boon for fitness center, Company benefits too

Half of the employees rehabilitated through the in-house rehabilitation center at Merck Pharmaceutical Company's West point, Pa., site go on to become members of the company's fitness center, according to one of its injury prevention specialists.

And the benefits for the fitness center don't end there, Susan Crawford of Medifit Corporate Services said at the New Jersey State Association for Worksite Health Promotion conference recently.

According to Crawford, there are many benefits for a company's fitness center from a Medifit on-site rehabilitation program. The program has three phases, the third of which is a free, three-month membership to the fitness center. This generates new memberships and provides an avenue to Merck's high-risk population, which might otherwise sidestep the advertising tactics of the fitness center.

The fitness center also receives free marketing from the rehabilitation program and, because of the program, the amount of time a fitness center staff person must spend with the new member is reduced because he or she is already familiar with the center and its facilities.

Overall Benefits

An on-site rehabilitation program has positive effects for the entire company, said Crawford.

The program has reduced worker's compensation costs at Merck and eliminated the time needed off from work to travel between the worksite and the rehabilitation facility, thus decreasing the amount of time and money wasted by employee absences, while simultaneously increasing worker productivity.

Rehab sessions were turning into half-day absences, Crawford explained.

Merck also found that outside clinics were keeping patients too long, she added.

An on-site physical therapist can consider the individual's work environment and his or her individual work demands in creating the rehabilitation plan. This way the therapist can provide quantifiable measures of a patient's progress more easily. The therapist also can act as a player on the return-to-work team, said Crawford.

Other benefits for a company form an on-site rehabilitation program include:

- Immediate care for the patient;
- Convenience;
- Flexible scheduling in case of a job-related time conflict;
- Identification of high-risk jobs so that employees in those positions can be properly trained; and

- The patient maintains a psychological connection to the worksite, even if he or she is just going there a couple times a week for rehabilitation services. The on-site program “keeps the worker’s head at the worksite,” said Crawford.

The program

The Medifit Program is a three-phase program made up of: physical therapy, pain assessment, mobility assessment and patient strengthening; re-injury prevention and education, with a concentration on improving physical tolerance for work activities and a worksite assessment to see how it may contribute to re-injury; and an independent program created around the free three-month membership to the fitness center, during which the patient is mainstreamed with other employee members and encouraged and assisted by the fitness center staff.

Outcomes measures include; the amount of time the patient is involved with the program and the length of time he or she is away from work; the length of treatment sessions; the employee’s return-to-work status – whether he or she will return full time or part time; the number of injuries per department; the number of injuries per specific anatomical regions; and the number of new fitness center members after the program’s conclusion

5) WOW! Metropolitan’s Wellness Program Modernized, Expanded

Metropolitan Life Insurance Company is building on the success of its health promotion programs with a modernized, expanded initiative that company officials hope will spark further healthy behaviors.

Begun as the Center for Health Help in 1979, the company’s wellness program quickly became a successful model for health promotion programs conducted by Metropolitan for other companies. The program now consists of the Center for Healthy Living and a full-service, corporate fitness center, and is run under the auspices of corporate wellness and fitness services, according to Jane Lehrman, coordinator of the Center for Healthy Living.

The Center for Health Help basically focused on the company’s New York office, recalled Dr. James Corry, director of corporate wellness and fitness services. The program was modernized entirely and taken nationally, Corry said.

While the previous fitness program was more recreational, with low participation, Metropolitan now has an organized fitness program based on cardiovascular risk-reduction, with an extensive series of classes, such as aerobics, being offered from 7 a.m. to 7 p.m.

The center, which is located in the home office in New York , is responsible for developing health education campaigns, which Lehrman describes as “in-depth programs, not a scatter-gum approach.” Topics are selected for “quarterly campaigns,” and seminars and events relevant to that topic are dealt wit in-depth for several months, according to Lehrman.

Offering In-depth Approach

“By the time we finish three months of the program on women’s health issues, people will have an in-depth understanding [of that subject],” she explained, noting a total of 10 campaigns have been developed.

“It allowed us to offer a very coherent message to people,” added Corry.

"Rather than a potpourri of seminars, we would offer, for example, eight or 10 on heart health."

This setup is hoped to provide a better understanding of the subjects, and, thus, a better chance of having that understanding reflected in healthy lifestyles. "we're interested in behavioral changes," said Corry.

Metropolitan surveyed employees when trying to develop the curriculum for the quarterly campaigns. A similar survey was done of physicians, nurses and supervisors across the country. Since these responses formed the basis of the 10 campaigns, Corry said they are "pretty confident" that the campaigns reflect the needs of their employee population.

These programs in turn are used as a model for the company's Working on Wellness (WOW) program nationwide, which is now in 90 of the larger Metropolitan offices. Regional and telephone training for WOW is provided to each coordinator, according to Lehrman.

"These are people we've trained in how to arrange health education programs, access experts in their community, [and so on]," said Corry. "We supply them with fact sheets and materials that pertain to those campaigns."

Each of the WOW sites is provided with a wellness budget, so coordinators have money to spend on things like incentives or guest speakers for wellness topics, he added. The company has a "help line" to the central office, and keeps in touch with each coordinator. In addition, a newsletter keeps coordinators abreast of news from other sites. And, the smaller offices that are not part of WOW also receive special mailings on specific subject areas.

The efforts appear to be paying off.

"The numbers are way, way up. There's a much, much higher level of participation in the home office," Corry said.

In fact, the demand for the fitness center at the home office has become so great, that some employees are on a waiting list to join as members, he said. Membership is required for participation not only because of the heightened demand, but, more importantly, to permit the company to screen people entering the program, said Corry. These screening are used to determine whether there are any conditions that may mitigate a person's participation in strenuous activity, he said, explaining. "It's a safer way to do it."

A number of other Metropolitan offices also are putting in fitness centers, said Corry, including the company's Bridgewater, Rensselaer and Albany , N.Y. , offices.

Program WOWs Employees

Overall, Metropolitan has had a "pretty good response" from employees to its programs, Corry said. They are using such methods as advertising on the company's e-mail system, television monitors in the lobby and company fliers. In addition, employees were introduced to the wellness program a few years ago with the gift of a book, written by two physicians, or prevention and wellness, noted Lehrman, adding, "The company's made a major, major commitment to wellness."

Metropolitan also has an incentive program entitled "Passport to Wellness." The more activities and seminars employees attend, the more wellness-related prizes they are eligible to

win. This program has been run “to great success,” said Corry. “We really do see people staying with the seminars and learning, and changing their behavior.”

The program also is tied into the company’s benefits package, explained Corry, so that employees have been able to earn wellness credits to offset medical benefits expenses. For example, employees who finish the sports challenge sponsored by the President’s Council on Physical Fitness and Sports earn \$25 in wellness credits, and, if another family member completes the challenge, the employee can earn an additional \$25 in wellness credits.

Employee also earned \$25 in wellness credits a few years ago, by returning a questionnaire concerning employees’ health behaviors, entitled the Wellness Behavior Inventory. In addition to the wellness credits, respondents received a report about their wellness behaviors, Corry said. Some 38,000 employees responded to this questionnaire, he noted, which provided the company with good baseline data and insight into the health needs of the employee population. Metropolitan plans to conduct this survey, to get updated data, as well as determine whether any positive behavioral changes have taken place, he said.

Corry said he is confident the survey will reveal at least some positive effects, since company officials already have noticed such changes. The company’s exercise data also reveals some concrete evidence of lifestyle changes, since employees are offered a six-month fitness assessment, in addition to the fitness membership screening. People also are reporting improvements themselves, Corry said.

He related an anecdote from the company’s Orange , Calif. , site, where the program officer challenged employees to meet him at 7:30 a.m. for daily walks. A few hundred people answered the challenge, and would go on these walks before work for months. That company official reported tremendous changes, Corry said – morale significantly improved, people were happier to be at work, and the absenteeism rate was positively affected.

In addition to the anecdotal information, Metropolitan is hoping to do a more formalized assessment by looking at claims data, Corry said

6) Heart Association gets employees pumped up about healthier living

The American Heart Association (AHA) was “heart at work” revising its health promotion program, in response to the increasing interest in such programs throughout the corporate world.

Heart At Work, which was introduced in 1985, is designed to help employers motivate employees to learn how to prevent the development of heart and blood vessel diseases, which are reported to be the No. 1 cause of death in the United States.

The Heart At Work program emphasizes employees’ need to take charge of their own health. It has a three-pronged approach – awareness, education and lifestyle change, explained Margaret Hawkins, AHA corporate relations.

The program consists of resource materials with step-by-step guidelines for implementation, said Hawkins, and is then implemented by the company’s worksite coordinate, who is supported by the heart association. In addition to providing employees with such things as smoking-cessation kits, videos and literature on a number of health-related topics, the

program includes on-site blood pressure and cholesterol screenings. Other activities include guest speakers, exercise classes, nutrition consultations and employee wellness newsletters.

It is available for single or multiple sites.

In the past, resource materials consisted of different modules on nutrition, cholesterol, blood pressure, exercise, smoking and signs of heart attack and stroke. In the last couple of years, the heart association extended the product line and new materials were introduced, according to Hawkins. The “whole menu of kits” will make it very easy for worksite coordinates to implement the program in their companies, she added.

Although the modified program will continue to focus on the previously mentioned five areas, AHA has expanded the program to include stress management programs, said Hawkins. Now, seven kits are currently available:

- Living the Active Life, which focuses on fitting moderate physical activity into employees' lives'
- Is Your Number Up?, which encourages employees to know their blood pressure and how to control it;
- Let's Clear the Air, which aims to help employees and their families enjoy a smoke-free life;
- Sound Bytes, which promote healthier eating habits that help to reduce the risk of heart disease.
- Check to Detect, which provides a simple-to-use tool to help employees assess their risk of heart attack;
- Clues, Cues & What To Do's, which identifies employees at risk and teaches them about the warning signs of heart attack and stroke; and
- Common Sense About Feeling Tense, which helps employees learn how to better manage stress at work and at home.

Heart At Work can be implemented locally or nationally. If it's a national company, the national center will work with the company headquarters to implement the program at all of company's worksites, and will develop a network through local affiliates for each of those worksites.

Why is this program important?

“Heart disease is still the nation’s No.1 killer. Doing health promotion through the worksite can reach a large proportion of adults,” Hawkins explained, noting, “Over 51 percent of factors influencing premature death are lifestyle-related. These are things that can be modified and impacted through health promotion.”

“Most Americans spend the majority of their time in the workplace,” added Dr. Dennis Richling, medical director, Union Pacific Railroad, and AHA national program committee member. “Incorporating health education as a priority in a company’s business plan, we

believe, can significantly reduce the incidence of cardiovascular diseases through modification of lifestyle behaviors.”

Things like lunchtime seminars, payroll stuffers and posters can get the message out to a large number of adults, Hawkins said.

“If people are able to modify their risks, then their utilization of the healthcare system is going to be reduced. If their utilization is reduced, then it’s going to make an impact [on healthcare costs],” she added.

There is a growing body of research that indicates that healthy, physically fit employees are more productive and spend more time on the job and less time out sick. In today’s business climate, this can add up to a positive impact on a company’s bottom line,” agreed Dr. Edward S. Cooper, AHA president and professor of medicine at the University of Pennsylvania .

“The American Heart Association made a commitment to promote worksite wellness...years ago,” added Richling. “We believed then, as we do now, in the effectiveness of ‘prevention through education.’ It’s in the best interest of the employer and the employee to motivate behavior changes that promote healthier lifestyles.”

Companies such as Dean Foods, a Fortune 500 company headquartered in Franklin Park, III, have seen the difference the wellness program can make.

“Employees have visibly increased their knowledge and awareness of nutrition and lifestyle issues since the implementation of the Heart At Work program,” said Laurie Walsh, human resources coordinator at Dean Foods. “They watch what they eat and encourage each other to exercise and quit smoking. There’s real commitment by our employees and management to this program. We’ve seen a difference here. Together, our Heart At Work coordinators at each site and their local AHA supporter, continue to take great strides toward our goal of better overall employee health and lower medical costs.”

“I believe the promotion of health at the worksite will pay off for companies.” Richling said. “I think companies will see positive results in the areas of reduced healthcare costs, reduced employee absenteeism, increased productivity and a higher morale among employees as a result of implementing programs such as Heart At Work. The future looks healthier for working Americans and we couldn’t be happier about it.”

The Heart at Work program now is used in more than 11,00 facilities, reaching some 6 million employees nationwide. AHA and Club Corporation of America (CCA) entered a partnership in early 1993, whereby CCA’s 200 athletic clubs nationwide may offer Heart At Work materials and activities to members of its Heart Healthy program, and the Heart At Work companies can offer employees special membership package with a variety of services, including stress management, health risk appraisals and weight loss programs available through CCA clubs in their area

8) Haggar’s Comprehensive Wellness Initiatives are a hit

After almost eight years, Haggar Apparel Company’s comprehensive wellness efforts are meeting a variety of employee issues, and resulting in cost savings exceeding the half-million dollar mark in one program alone.

The wellness program at the 67-year-old, Texas-based company began in 1988. The company has between 4,500 and 5,000 employees, who are referred to as “associates.” Approximately 90 percent are female, and 80 percent to 85 percent are Hispanic, half of whom are Spanish-speaking only, according to Anne Hunt, who served as health and wellness coordinator.

One of the first elements of the company’s wellness program implemented was its prenatal program, which started in 1988. After looking at the company’s top 50 health claims, officials continued to see such things as low birth weight babies and complicated pregnancies. They found that most doctors required a significant co payment up front, so the woman wouldn’t return until it was time to deliver. Immediately after discovering this trend, Haggar changed its policy to cover prenatal care at 100 percent, including such expenses as doctor’s visits during the prenatal period, prenatal vitamins and delivery fees, Hunt said. Tracking and follow-up is done by the utilization company, and the program consists of such elements as health risk assessments, a “pregnancy” packet with information, calendars and a book, follow-up with a physician and follow-up with the patient.

“We wanted to educate them more during that time, so they would be more aware [of what can contribute to problems],” Hunt explained. “They now have more educated questions they can ask their doctors.”

Associates also have the opportunity – and are highly encouraged – to attend prenatal classes that are offered on a quarterly basis at each of the plants. Haggar uses the March of Dimes’ “Babies & You” program for its curriculum. An associate can receive her choice of an infant car seat or a booster seat for attending five classes any time during her pregnancy. For attending six classes during their first trimester, associate and spouses are eligible to receive an infant-to-toddler car seat. Participation has fluctuated, but rose significantly in 1993; in 1991, roughly 36 percent of all pregnant associates participated in the program, and in 1992, 22.3 percent participated. In 1993, however, 72 percent of all pregnant associates participated, Hunt said.

Associates also can call Dallas Medical Resource’s “Health Information Line,” a toll-free number that provides current information about more than 800 healthcare topics. Each topic has a code number that can be dialed to hear a tape-recorded message. In addition, access to a nurse is available from 7 a.m. to 7 p.m. Central Standard Time. This service is free, Hunt said.

Haggar’s wellness program is completely voluntary. Since its inception, there have been blood pressure machines, Schwinn Airdyne Cycles and weight scales at all nine company locations. The cycles were installed because associates had been saying that they didn’t have time to exercise.

“We set them up so they’re very accessible during work hours – at break, lunch, after work,” Hunt said.

In 1993, the company installed Health Bulletin Boards in each of the plants. Information is changed monthly, and is in English and Spanish.

The wellness program also does such screens as blood analysis (since 1988), cancer and health risk assessments (added in 1993). The blood tests are done yearly at each facility, with the costs shared by Haggar and the associate, Hunt said, and include Chemistry 23, complete blood count, HIV, thyroid profile and serum antigens. Testing is totally voluntary and

confidential, Hunt stressed. Associates receive a comprehensive report that they can take to their physicians, and the lab follows up to see if they are going.

"Most of our associates really appreciate this service," Hunt said.

Associates who participate in the blood analysis also can complete a health risk assessment, which blends clinical test-assessment results with lifestyle and demographic data, and outlines steps for reducing the individual's particular health risks.

Cancer screening, which is done at the corporate office, consists of a mobile unit on location. Screening is done for oral, breast, abdomen, skin, lymph node, thyroid, hernia, rectal, prostate, testicle, Pap smear and PSA. Of 24 associates who participated in the cancer screening one year, seven had abnormal findings and needed to go to a doctor, Hunt said.

All associates, spouses and children also are invited to an annual health fair, she said. The fairs involve local participating hospitals displaying their services; physicians and nurses who are present to answer health and medical questions; school immunizations available for children; and additional booths which include such organizations as Consumer Credit Counseling Service, Planned Parenthood, American Diabetes Association, KIDS Safety Program Jazercise, Woman's Battered Shelter, Drug & Alcohol Abuse Center and more.

"It's intended to make associates aware of resources and programs located in their own community," said Hunt. "It's good time to show partnership between hospitals and the employer."

Perhaps the most comprehensive program, she said, is the incentive wellness program. In 1993, participants earned points for certain wellness-related items, such as buckling their seat belts, having a fire extinguisher in their home, or attending seminars. After accumulating points for a month, score cards were turned in, and at the end of the year, points accumulated were used to purchase a choice of one out of 15 different gifts. Approximately 2 percent of the company participated.

This program was initiated to make people aware of what affects a person's health; "the problem was, it took too much time," Hunt said.

Haggar then opted to go with quick, 60-day promotions. "It's easy for everybody," Hunt said. Each quarterly promotion focuses on three healthy activities – drinking water, eating fruits and / or vegetables, and physical activity. The quantities and days needed to qualify increases throughout the four promotions. Participants receive a small scorecard the size of a dollar bill, and mark off the days they did an activity. After the first quarter's promotion, the company recorded a 13 percent participation. The company cost for the gift was just \$2.50 per participant.

"I don't think that it's the gift; I think it's the challenge," said Hunt.

After each subsequent quarter, associates also are eligible to receive a bonus gift, providing they have participated in the previous promotions.

"We wanted people to be consistent and actually change their behavior," Hunt explained.

For example, during the first promotion, employees who drank five 8-oz. Glasses of water at least 20 days, ate three fruits and / or vegetables at least 20 days and did at least 20 minutes of

aerobic exercise once a week were given a Haggar visor and sports bottle. During the next quarterly promotion, participants received a T-shirt as a gift, and Haggar hand weights as the bonus gift.

In 1994, Haggar added a weight control support group – H.U.G.S. (Healthy Uplifting Group Support) – to its wellness offerings. Each location establishes and runs its own group, which must consist of at least five members. Groups are given information on habit assessment, nutrition, fitness, self-esteem and more. Weight was identified as one of the problems that needed to be addressed at the Haggar plant. With the support group, the focus was not just on the weight, but on the reasons people are overweight – so, it's looked at individually. The focus is to make sure they continue.

The company also has expanded its monthly seminars. Previously, the seminars included such subjects as nutrition, diabetes, selecting a family doctor, the importance of screening and early detection, self-esteem and motivation, cooking and preparing healthier food.

The company has not calculated a per-employee cost for the wellness program; however, it has noticed changes at least in its pregnancy-related healthcare costs, Hunt said. Between 1988 and 1991, the costs were steadily increasing with pregnancy-related claims, but costs then dropped \$542,000. Hunt said she had approximately \$80,000 per year to spend on the company's wellness programs; in 1993, the program came in 40 percent under budget.

"Most of my programs are very low costs," she explained.

The company plans to track health outcomes, Hunt said

9) Auto Company takes steps to lead employees to healthier lifestyles

General Motors launched a wellness program aimed at helping current and retired employees and their families lead healthier lifestyles "one step at a time."

Called Life Steps, the program was announced to prospective participants through a newsletters sent to their homes. The program was developed by GM and the International Union, UAW, in conjunction with consultants. It is sponsored jointly by GM and unions with GM members, and is available to all 1.6 million GM United States hourly and salaried enrollees in GM healthcare plans.

The name for the program was selected because it is believed that individuals' health can best be enhanced through a series of learning and action steps on their part, complemented with sound mechanical advice. The motto of the program is "Building a Health Life One Step at a Time."

Within a few weeks of mailing the first newsletters, enrollees were sent an orientation kit containing a health risk appraisal questionnaire, details about a toll-free information service and a healthcare information book.

Through health information and support services, "Life Steps will provide individuals with tools to become more knowledgeable about the decisions that affect their health," explained Richard Shoemaker, UAW vice president and director of the Union's General Motors Department, and Gerald A. Knechtel, vice president of personnel for GM's North American Operations.

However, neither the program nor the information it provides is intended to replace appropriate medical care and consultation with a person's private physician, they added.

The confidential health risk questionnaire, which will assess an individual's health practices and how they influence his or her level of wellness, is being evaluated by the University of Michigan Fitness Research Center. Those taking part in the appraisal will be sent a confidential, personalized report and offered specific suggestions to improve their health.

Another component of the program – "Personal Health Advisor" – is a 25-hours, seven-days-a-week, health information service operated by Access Health. The service gives enrollees telephone access to specially trained registered nurses, as well as use of an audiotape library. It's designed to help enrollees becomes more knowledgeable about healthcare matter's to work more effectively with their physicians.

The other part of the orientation kit is a healthcare information book called "Take Care of Yourself," by Dr. James Fries and Dr. Donald Vickery. The book aims to help enrollees improve their health, sharpen knowledge on their health concerns, communicate more effectively with their physicians and better cope with chronic diseases.

In addition to the nationwide program, wellness pilots will be started in two communities with concentrations of GM employees and retirees – Anderson , Ind. , and Flint , Mich.

Enrollees in those communities, in addition to receiving the orientation kit, will be eligible to take part in several additional program features, including: on-site health screenings, health fairs, wellness classes, voluntary lifestyle management for weight control and cholesterol reduction, and medical follow-up by a primary care physician for enrollees with high risk in some health areas.

Results of the nationwide and pilot activities will be reviewed by the University of Michigan Fitness Research Center to determine the effectiveness of the program and possible future directions, program spokesmen said

10) How one company mixed" All the Right Ingredients" for a successful Disease Management Program

A combination of careful analysis, employee support and physician support helped contribute to a pilot disease management program that is paying off for Sara Lee Corporation.

To achieve this success, the corporation crafted a model for disease management consisting of four basic "ingredients," or programs, Diana L. Murray, senior manager of group insurance plans for Sara Lee Corporation, said.

In addition to the disease management programs themselves, Murray's model includes the following elements,

- **Sara Lee Benefit Programs** – programs that actually support its goals. "It's essential that our focus starts with the corporation and filters downward," she said.
- **Employee / Worksite Support** – "It's all very well and good for me, on the 44 th floor in Chicago to come up with a program... The employees have to not only buy into it, they have to do it," explained Murray .

- **Medical Community Support** – You have to get the feedback of the members of the medical community; “they can be instrumental,” she added.

Sara Lee’s pilot effort focused on the corporate headquarters for the personal products division, which is located in Winston-Salem, N.C., and has 2,000 employees on-site. There were several reasons the corporation selected the Winston-Salem site for the ulcer management program, Murray said:

- **The number of employees** – “Many of our locations are much, much smaller,” she said, noting that most of the corporation’s plants have between 300 and 400 employees.
- **Sara Lee Corporation’s PP** – one the, corporation has developed and contracted with 400 doctors in the area.
- **Network Pharmacies** – available through the carve-out program. The corporation’s vendor, Diversified Pharmaceutical services, worked with Sara Lee Corporation on the program, Murray noted.
- **Management / Employee Support** – Sara Lee’s Personal Products division is very supportive of its employees, and very supportive of wellness programs, said Murray, who explained, “I would not have taken this program to an area that I thought would be hostile – at least not as a test site.”

One of the first things the corporation did in developing the disease management program was select the disease state on which to focus. Sara Lee Corporation did a prescription analysis – not only of what kinds of medications the employees were getting, but also whether they were complying (utilization review). And, it included a physician protocol side, Murray said.

After analyzing the data, Sara Lee discovered that ulcer medication was the No. 1 drug class in the Winston-Salem facility, comprising 14 percent of prescription costs for that site. Moreover, \$2 million was spent on that particular drug class, at that particular site, Murray said.

Now that it had identified one problem area, Sara Lee Corporation needed to set the scope of the ulcer management program, said Murray . It was trying to create a model, not cure or solve the ulcer problem, so the corporation looked at ulcer prevention. It also planned to focus on patient support and compliance, clinical intervention and appropriate drug therapy.

The next step was to define the program, focusing in part of employee’s awareness “Rx for Better Health.”

“We spent a great deal of time at the worksite talking about employee awareness,” Murray said, noting such other awareness-raising methods as newsletters and a hotline.

The company also wanted a proactive PPO MD educational interaction, and was somewhat shocked by the response of the physicians to this request.

“The doctors thought it was wonderful...Not one responded negatively and said, ‘get out of my business,’ ” Murray recalled.

Not only were the physicians appreciative and supportive of the idea, she continued, but they also indicated that they'd be willing to work on other disease state issues.

"The key was we used clinical people to talk to them," said Murray .

The company also wanted to create a pharmacy-patient link, and, as with the physician response, it found that pharmacy was more than willing to provide information to the patients.

Sara Lee Corporation is seeing the impact of the ulcer management program not only in medical costs, but in customer satisfaction as well.

"Customer satisfaction is primary to us. If was very important that our employees saw this as positive," said Murray .

Because of this belief, Sara Lee focused on employee relations, employer-medical community relations, and community public relations. It also was important that the community saw Sara Lee as a very caring company, Murray added, explaining that the program resulted in "some nice PR" for the employer.

Sara Lee estimates the potential medical / prescription savings from the ulcer management program to be \$50 per prescription, and \$150 per patient, she said

11) Demanding Responsibility has cut costs, changed behaviours for one Utah company

A Utah meat-packing plant has found its answer to skyrocketing healthcare costs; through a controversial wellness program that some may contend takes a heavy – handed approach to encouraging healthy behaviors in employees and their dependents.

E.A. Miller Inc.'s wellness initiatives focus on demanding accountability of the people covered under its health plan, and in some cases, denying coverage to those who don't act responsibly, according to Eric Falk, director of human resources for the company.

What it comes down to, essentially, is whether health insurance is a right, or a privilege, Falk said at an industry conference.

"There are no absolute guarantees in this life, so why should we insist that healthcare be any different?" he asked.

This approach has enabled E.A. Miller to lower healthcare costs over a recent three-year period, without slashing benefits, by telling employees they are responsible for their own actions, Falk continued.

"Long-term cost control without accountability is impossible," he asserted.

In the late 1980s, with health costs rising as much as 25 percent in one year, the company was ripe for some type of cost-containment initiative. Wellness programs were a logical addition to the mix for several reasons. As many as one-third of the workers have literacy problems, regardless of race or ethnicity, and many don't have an understanding of proper preventive health techniques, said Falk.

Tackling Prenatal Care

In addition, in reviewing its healthcare costs, E.A. Miller discovered that the three single largest claims in one year were a result of low-weight births.

The company now uses the March of Dimes' Healthy Babies program, and, since designing a prenatal program, it has seen dramatic results, Falk said. In more than four years, with more than 300 births, none of participants had low birth-weight babies, he said.

The program has been so effective, in part, because of attendance, said Falk. All mothers-to-be see a physician in their first trimester, and attend a prenatal seminar in which the father and mother participate. Free dinner and babysitting are provided to allow expectant parents to attend.

This prenatal program is mandatory, Falk noted. If employees don't attend, their health insurance won't cover the costs associated with the birth and delivery, or the baby's care in the hospital.

"I don't think we're imposing an undue hardship on anyone," said Falk.

"Employee education is a wonderful tool; however, you can't educate people if they're not there when the information is given out," he added. "Why settle for less, when it may be well within your ability [to get higher attendance]?"

The Carrot or the Stick?

Falk is a strong advocate of the effectiveness of disincentives over incentives in program planning.

As an example, the company has encouraged immunizations through the health department and reimburses a portion of the cost; however, the results are not nearly as good with this type of incentive program, he said.

"When it comes to choosing between the carrot and the stick...I strongly believe the stick wins," said Falk.

"Responsibility is demonstrated only when employees are required to act responsibly," he said.

The company has adopted a similar stance with the auto accident coverage and smoking portions of its wellness program. Individuals involved in a motor vehicle accident who were not wearing their seatbelt, or who were under the influence of drugs or alcohol, do not have coverage of any medical costs incurred in that accident. The same is true if the individual was in a motorcycle accident and wasn't wearing a helmet.

"The employee and the employer must accept responsibility for their actions," said Falk, explaining that employers must stick with what they said they were going to do.

In terms of smoking, E.A. Miller has had a smoke-free packing plant for the last five years, which Falk said was the "toughest think we tried to do." There is no tobacco use-period. After several years of having a smoke-free plant, the company decided to expand its program to include employee contributions toward healthcare premiums, doubling the monthly premium

for anyone who uses tobacco or has a family member who uses tobacco. To get the low premium, employees must sign a statement that they and their dependents are non-smokers; if they're dishonest, they could lose their medical benefits, Falk said.

Employees' behavior has changed as a result of the programs, and E.A. Miller has benefited from reduced healthcare costs. Significantly, in 1994, less than \$10,000 was denied for people who didn't follow the program's guidelines, so the cuts aren't a result of paying less in claims, Falk noted.

Spreading the Word

"We spend a great deal of time educating employees on these topics," he said.

The employee newsletter, "The Cattle Cutter," always includes an article on healthcare, including what employees can do to cut costs. The newsletters are mailed to the employees' homes – "if not, a lot just end up in the parking lot," said Falk.

The company also produced a pamphlet containing things for employees to remember, such as wearing seatbelts and attending prenatal classes, and, team meetings are held.

"By taking these steps, you're going to counter the universal excuse, "I didn't know that; nobody told me that," Falk explained. "It doesn't mean you're not going to hear it, but it's no longer a viable excuse."

E.A. Miller's approach has generated controversy in several corners, including concerns about wellness programs being mandatory at all, as well as criticism about the possibility of these policies discriminating against certain employees. Falk said he counters those concerns in several ways; first every E.A. Miller employee is held to some accountability for his or her actions, and second, the company checks with an attorney before implementing anything controversial.

The wellness program continues to pose challenges for the company, in part because of the nature of its work force. The turnover in the meatpacking plant is very high – in fact, 200 percent is not unusual, said Falk.

"When we have 120 percent [turnover]...we feel we've taken great strides," he said. "That makes it very difficult. Each time you're dealing with a new group, so it's a constant educational process

12) Incentive – Based Wellness Program generates savings for large employer with multiple sites

An integrated health management system that focused on gain sharing incentives helped one large, multi-site employer cut healthcare costs dramatically while improving its employees' healthy lifestyle behaviors.

The program – dubbed Health Works – was designed and implemented by Indianapolis-based Summex Corporation for PSI Energy, a public utility in that state, after the utility had experienced several years of double-digit growth in its healthcare costs.

In just one year, the program saved some \$1.5 million off PSI Energy's annual healthcare costs; average claim costs for participants were \$519 per person lower than projections, while non-participants' claims averaged more than \$260 per person higher than expected.

In fact, program participants' healthcare costs are lower and more stable year-to-year than either the non-participants in the company or the average for the utility industry, according to Summex's data. The company expects this trend to continue.

Plus, as a result of the program, PSI Energy saw its healthcare cost growth rates positively impacted, according to information presented by Larry Chapman, Summex's chairman of the board and president of Corporate Health Designs in Seattle, and Nancy Lee, also of Summex, who is the on-site program manager. Although the healthcare rates had grown each year from 1991 through 1993 – in one case by as much as 14 percent – they declined almost 2 percent in 1994, when Health Works was implemented.

But the impact hasn't only been felt in the area of health costs. When comparing the wellness scores from spring to fall of Health Works' first year, positive improvements were seen in a variety of areas, including safety awareness, seat belt usage, cancer risk, coronary risk, happiness, sleep, alcohol use, sick days and stress Chapman and Lee said.

More specifically, PSI Energy employees lost a cumulative 3,984 pounds; flexibility increased 15.5 percent; measures of aerobic fitness and flexibility were significantly improved; and average body fat decreased by 8.6 percent, they noted. In addition, participants' glucose level significantly decreased.

The Health Works program began with essentially six goals in mind, according to Chapman and Lee,

- Stabilize healthcare cost increases to less than 10 percent per year;
- Enhance employees' physical and emotional ability to work;
- Improve employee morale;
- Create standards and innovative programs in employee health management; and
- Evaluate the effectiveness of an integrated health management system.

Prior to implementing the program, extensive organizational diagnostics were done with surveys to managers and employees, said Chapman. A health-cost audit also was conducted, looking at such areas as sick-leave patterns and diagnoses of medical claims.

As initially designed, Health Works focused on gain sharing – the company shared with employees half of the amount saved between the company's projected healthcare spending and actual expenses. The actual amount each employee would receive depended on his or her success in keeping claims costs down and improving healthy behaviors.

A wellness account was created for each individual, Chapman explained. It had a mandatory side, which was based on healthcare premiums. For each dollar spent on healthcare premiums, the employee received a point; for each claim dollar used by that employee, a point was deducted from the account. At the end of the year, each point was converted to cash. There also was a voluntary side, Chapman noted, which involved meeting other health-

related criteria (for blood pressure, cholesterol levels and seat belt usage, for example); points could be earned for each positive behavior employees achieved.

The company then rolled out the program with mandatory meetings with employees and supervisors. During the meetings, representatives discussed what Summex's findings were in its initial assessments, as well as the specifics of the program. Employees also were given a medical self-care text, Chapman said.

High-risk interventions were made (after wellness assessments) for such conditions as cardiovascular health, cancer and stroke.

A fitness center at the corporate headquarter was available for use, as were centers at some of the company's more than 70 sites. Another part of the intervention involved workshops on such issues as medical self-care, weight management, low-back pain and injury prevention, nutrition and smoking cessation.

"These were developed across the organization in different sites," Chapman said.

A monthly newsletter also was circulated.

"The incentive program was communicated routinely," added Chapman.

The company also used as "employee health network," composed of approximately 140 people from all sites who acted as liaisons, and short-term incentives were focused around such activities as "fun runs" at individual sites, he said.

Some activities were on employee time, such as the exercise-type programs, while others, like the medical self-care and mandatory meetings, were held on company time – "piggybacked" onto safety meetings and other such employee meetings, said Chapman.

Traditionally, companies have said to employees, "we'll put it on work time, because we want you to come," Chapman said. But fewer and fewer employers have that luxury now, he added.

Approximately 91 percent of all employees attended the Health Works orientations, with 97 percent learning new skills to help change their health-affecting behavior, according to Chapman and Lee. In addition, 61 per cent of all managers attended the Managing for Health and Productivity Seminars. And, more than one-quarter of all employees (76 per cent) said they thought Health Works was "good" or "excellent," they said.

Chapman credited the mandatory rollout and the incentive program with sparking individuals' high level of participation in the program.

There was a lot of consideration and effort to broaden the program past just the corporate headquarters, Chapman continued. The company is composed of distribution and production people, service offices, technical support – a lot of different kinds of people, with different needs, he noted.

To incorporate the different needs at the multiple sites, the Health Work program was designed to be 70 percent core program and 30 percent local initiative, explained Chapman.

In its second year, the company decided to shift its focus more toward wellness attributes, rather than claims.

"It's still working off a gain sharing formula – whatever we don't spend or use, you get half," Chapman added. "It's a performance-based model."

The new focus is on the areas of smoking cessation, exercise, cholesterol, blood pressure, consumerism / self-care, education / prevention criteria and self-directed change materials, he said.

Incentives consider incremental effects. For example, if someone has between five and eight out of 10 wellness attributes, he or she receives a \$50 gift certificate; with eight or more, there is a \$300 cash bonus.

Chapman said incentives play an important role in today's wellness initiatives, as the traditional program design is no longer meeting people's needs.

"You see it most dramatically in more mature programs – a significant drop-off in participation. The only way to get them back in is to put in strong incentives," he said

13) Communication Contributed to One Wellness Program's Success

In 1986, Hoechst Marion Roussel Inc. began its Health Promotion program by offering aerobic classes. Ten years later, it has developed into a program that boasts a 94 percent annual participation rate among its associates, in at least one program sponsored health conscious activity.

Communication

Hoechst Marion Roussel's ability to get information to its associates may have contributed to the success of the program. One way the company gets word out is through the Health Link Committee. The committee is made up of people from different departments who disseminate the information about the program in their departments.

A second way is through F2 monitors. These television-like screens in the cafeteria and throughout the building are used to advertise upcoming activities in the company, including Health Promotion events.

Health Promotion sends bimonthly newsletters to all associates, and a second newsletter – Fitness Spectrum – to members of the fitness center. It also has displays in the cafeteria.

Positive Effects

This attention to communication has enabled Health Promotion to have an impact on the Hoechst Marion Roussel community in positive ways, including:

- One-quarter of all associates are members of the fitness center and, of this number, 48 percent use the center at least once a month.
- Sixty-seven percent of associates participate in two or more Health Promotion activities a year.

- In 1995, 50 percent participated in a blood pressure screening and, of that number, 10 percent were borderline hypertensive.
- That same year, 10 percent participated in a skin cancer screening.

The program has grown in content as well as participation. Health Promotion now offers a half-mile outdoor walking trial; an annual health fair; quarterly incentive programs for all associates and biannual programs for fitness center members; health screenings including skin cancer, cholesterol, blood pressure and mammograms; a resource committee; an active associate wellness committee; an annual golf outing; bimonthly lunch and learns; and safety meeting presentations. In 1995, the fitness center was relocated to an on-site facility.

Health Promotion decided which programs to offer after a needs assessment determined the health risks that were most prevalent among the associates, said Joan Lipinski, director of the program.

According to Lipinski, the associates were skeptical in the beginning. She said that they probably wondered, "What are these people trying to force on us now?". The program has helped to boost employee morale, said Lipinski. In the past few years there have been a number of buyouts and people have been moved to different locations.

"It's been pretty stressful and the program helps keep stress down," she said.

The company is beginning to learn how to quantify the program in terms of money to see if there have been any savings since its inception, Lipinski said.

Lipinski has heard overwhelmingly positive feedback from the associates. She said that the members of the fitness center are like a family. They are positive about the center and feel good about the things management is trying to do, said Lipinski.

Fitness center membership is paid for through a \$5 monthly fee, subtracted from the individual's paycheck. Most of Health Promotion's exercise and awareness programs are free. Hoechst Marion Roussel subsidizes screenings and multi – session programs 40 percent to 75 percent

14) Assessment and Communication Generate 100 percent Participation for College's Wellness Program

Established in 1991, the Pure Energy Wellness Program at Chattanooga State Technical Community College started with the addition of a step aerobics class at the on-site fitness center.

"I guessed a little in the beginning," said Tom Crum, the wellness director at the college.

Since then, Pure Energy has grown into an award-winning program that boasts a 100 percent participation rate among administrators, in at least some aspect of the program, with 93 percent of administrators encouraging their employees to participate.

How does the college garner such a high rate of participation? Assessing the employees seems to be one reason for their success.

"We did just about every assessment you could do in terms of health promotion programs to determine what to do [with Pure Energy]," said Crum.

These evaluations include health risk assessments, lifestyle assessment questionnaires and the Health Intervention and Evaluation Strategy Framework assessment.

A health audit, issued in 1993 evaluated not only the health habits of employees, but also their job satisfaction, how they perceived the corporate culture at Chattanooga State , who they felt was supportive – in the workplace – of a lifestyle change, how they viewed the institution as an employer and how employees felt they were treated by their supervisors.

Crum has also used resources from the Association for Worksite Health Promotion and the Wellness Councils of America (WELCOA).

The Seven Dimensions of Wellness

Crum also looked at the college's course catalog to see what programs already existed at the institution. From this review, he established the seven dimensions of wellness – physical, social, spiritual, emotional, intellectual, occupational and environmental.

"We try to emphasize a healthy, balanced lifestyle," he said. "It's what makes our approach unique."

Based on these seven facets, Crum has devised a number of varied programs for the approximately 400 full-time employees at the college.

In 1992, the program offered CPR classes, cholesterol screenings, a weight management program, intramurals for students and staff, day-long canoe outings, SCUBA lessons and the first of what has become an annual international bike tour. It then added a smoking cessation program, a cholesterol seminar, a healthy eating seminar, a back seminar and a stress seminar.

There was even a presentation from a man who had hiked the entire Appalachian Trail , he said. While none of the college's employees will probably ever do this, they each absorbed different things from his talk, said Crum.

The program encourages the participants to do fund raising for local organizations through bike rides or walks, said Crum.

Currently, Pure Energy also includes: the Sneak into Summer exercise campaign, hiking, backpacking, a walking class that was begun at the request of employees and a video highlighting the activities in the wellness program.

Communication

Communication through Pure Energy's monthly newsletter is another important aspect of the program.

Launched in 1992, the newsletter is considered one of the most valuable aspects of the program, according to Crum.

"I get comments about it each month from employees," he said.

The newsletter contains varied material, from articles on money management, medical self-care, time management, stress management and healthy eating to stories about employees who have made positive lifestyle changes as well as cartoons and healthy recipes.

The annual spring health fair, the largest event on campus, according to Crum, is another form of outreach employed by the program organized by the wellness committee, which Crum calls the greatest strength of the program, it attracts about 1500 people.

Recently, the wellness program became a part of the human resources department.

"This will position us to solidify our efforts to date," said Crum "[and allow' for more significant changes."

The work of the Pure Energy Wellness Program has been recognized by two national health organizations. It received WELCOA's bronze, silver and gold awards in 1993, 1994 and 1995, respectively. In 1994, the program won an award from the Association for Worksite Health Promotion: Business and Industry.

Most programs offered under Pure Energy, except wellness-related adventure weekends and European bike tours, are free to employees or available through tuition reimbursement

CHAPTER 5:

OCCUPATIONAL HEALTH

Introduction to Occupational Health

Occupational health is essentially preventive medicine. The Joint ILO/WHO Committee on Occupational Health, in the course of its first session, held in 1950, gave the following definition: "Occupational health should aim at the promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations". This includes the following; the prevention among workers of departures from health caused by their working conditions; the protection of workers in their employment from risks resulting from factors adverse to health; the placing and maintenance of the worker in an occupational environment adapted to his physiological and psychological equipment and. To summarize the adaptation of work to man and of each man to his job.

Preventive medicine and occupational health have the same aim – 'the prevention of disease and maintenance of the highest degree of physical, mental and social well-being' of workers in all occupations; the levels of application of preventive measures are the same-health promotion, specific protection, early diagnosis and treatment, disability limitation and rehabilitation; the tools are the same-epidemiological approach, statistics, health screening, health education etc. Occupational health, therefore, is the application of preventive medicine in all places of employment.

In the past, it was customary to think of occupational health entirely in relation of factories and mines; hence the terms "industrial hygiene" or "industrial health" were in vogue. Modern concepts of occupational health now embrace all types of employment including mercantile and commercial enterprises, service trades, forestry and agriculture and includes the subjects of industrial hygiene, industrial diseases, industrial accidents, toxicology in relation to industrial hazards, industrial rehabilitation and occupational psychology. Occupational health in agriculture and ergonomics (human engineering) are relatively new concepts.

Ergonomics is now a well recognized discipline and constitutes an integral part of any advanced occupational health service. The term "ergonomics" is derived from the Greek 'ergon', meaning work and 'nomos', meaning law. It simply means: "fitting the job to the worker". Training in ergonomics involves designing of machines, tools, equipment and manufacturing processes, layout of the places of work, methods of work and environment in order to achieve greater efficiency of both man and machine. The object of ergonomics is "to achieve the best mutual adjustment of man and his work, for the improvement of human efficiency and well-being". The application of ergonomics has made a significant contribution to reducing industrial accidents and to the overall health and efficiency of the workers.

Industrial workers constitute only a segment of the general population, and the factors that influence the health of the population also apply equally to industrial workers, i.e., housing, water, sewage and waste disposal, nutrition, and education. In addition to these factors, the health of the industrial workers, in a large measure, will also be influenced by conditions prevailing in their work place. One of the declared aims of occupational health is to provide a

safe ‘occupational environment’ in order to safeguard the health of the workers and to step up industrial production

Occupational Environment

By “occupational environment” is meant the sum of external conditions and influence which prevail at the place of work and which have a bearing on the health of the working population. The industrial worker today is placed in a highly complicated environment, which is getting more complicated as man is becoming more ingenious. Basically, there are three types of interaction in a working environment:

- Man and, Physical, Chemical and Biological agents
- Man and Machine
- Man and Man

I. Man and Physical, Chemical and Biological agents
Physical agents: The physical factors in the working environment, which may be adverse to health, are heat, cold, humidity, air movement, heat radiation, light, noise, vibrations and ionizing radiation. The factors act in different ways on the health and efficiency of the workers, singly or in different combinations. The amount of working and breathing space, toilet, washing and bathing facilities are also importance factors in an occupational environment.

Chemical agents: These comprise a large number of chemicals, toxic dusts and gases, that are potential hazards to the health of the workers. Some chemical agents cause disabling respiratory illnesses, some cause injury to skin and some may have a deleterious effect on the blood and other organs of the body.

Biological agents: The workers may be exposed to viral, Rickettsial, bacterial and parasitic agents which may result from close contact with animal or their products, contaminated water, soil or food.

II. Man and machine

An industry or factory implies the use of machines driven by power with emphasis on mass production. The unguarded machines, protruding and moving parts, poor installation of the plant, lack of safety measures are the causes of accidents which is a major problem in industries. Working for long hours in un-physiological postures is the cause of fatigue, backache, diseases of joints and muscles and impairment of the worker’s health and efficiency.

III. Man and Man

There are numerous psychosocial factors, which operate at the place of work. These are the human relationship amongst workers themselves on the one hand, and those in authority over them on the other. Examples of psychosocial factors include the type and rhythm of work, work stability, service condition, job satisfaction, leadership style, security, workers participation, communication, system of payment, welfare conditions, degree of responsibility, trade union activities, incentives and a host of similar other factors, all entering the field of human relationships. In modern occupational health, the emphasis is upon the

people, the conditions in which they live and work, their hopes and fears and their attitudes towards their job, their fellow – workers and employers.

The occupational environment of the worker cannot be considered apart from his domestic environment. Both are complementary to each other. The worker takes his worries home, and bring to his work, disturbances which arise in his domestic environment. Stress at work may disturb his sleep, just as stress at home may affect his work. Severe prolonged stress, no matter where it has been aroused, may produce serious physical or mental symptoms that do not allow man to work efficiently. According to ecological approach, occupational health represents a dynamic equilibrium or adjustment between the industrial worker and his occupational environment

Occupational Hazards

An industrial worker may be exposed to five types of hazards, depending upon his occupation:

- Physical hazards
- Chemical hazards
- Biological hazards
- Mechanical hazards
- Psychosocial hazards

I. Physical Hazards
Heat and Cold: The common physical hazard in most industries is heat. The direct effects of heat exposure are burns, heat exhaustion, heat stroke and heat cramps; the indirect effects are decreased efficiency, increased fatigue and enhanced accident rates. Many industries have local “hot spots” – ovens and furnaces, which radiate heat. Radiant heat is the main problem in foundry, glass and steel industries, while heat stagnation is the principal problem in jute and cotton textile industry. High temperatures are also found in mines for instance in the Kolar Gold mines of Mysore which is the second deepest mine of the world (11,000 feet), temperatures as high as 150 deg. F are recorded. Physical work under such conditions is very stressful and impairs the health and efficiency of the workers. For gainful work involving sustained and repeated effort, a reasonable temperature must be maintained in each workroom. The Indian Factories Act has not laid down any specific temperature standard. However, the work of Rao (1952, 1953) and Mookerjee et al. (1953) indicate that a corrected effective temperature of 69 to 80 deg. F is the comfort zone in this country and temperature above 80 deg. F cause discomfort. Important hazards associated with cold work are chilblains, erythro cyanosis, immersion foot, and frostbite as a result of cutaneous vasoconstriction. General hypothermia is not unusual.

Light: The workers may be exposed to the risk of poor illumination or excessive brightness. The acute effects of poor illumination are eyestrain, headache, eye pain, lacrimation, congestion around the cornea and eye fatigue. The chronic effects on health include “miner’s nystagmus”. Exposure to excessive brightness or “glare” is associated with discomfort, and annoyance and visual fatigue. Intense direct glare may also result in blurring of vision and lead to accidents. There should be sufficient and suitable lighting, natural or artificial, wherever persons are working.

Noise: Noise is a health hazard in many industries. The effects of noise are of two types: (i) Auditory effects which consist of temporary or permanent hearing loss (ii) Non-auditory effects which consist of nervousness, fatigue, interference with communication by speech, decreased efficiency and annoyance. The degree of injury from exposure to noise depends upon a number of factors such as intensity and frequency range, duration of exposure and individual susceptibility.

Vibration: Vibration, especially in the frequency range 10 to 500 Hz, may be encountered in work with pneumatic tools such as drills and hammers. Vibration usually affects the hands and arms. After some months or years of exposure, the fine blood vessels of the fingers may become may also produce injuries of the joints, of the hands, elbows and shoulders.

Ultraviolet Radiation: Occupational exposure to ultraviolet radiation occurs mainly in arc welding. Such radiation mainly affects the eyes, causing intense conjunctivitis and keratitis (welder's flash). Symptoms are redness of the eyes and pain, these usually disappear in a few days with no permanent effect on the vision or on the deeper structures of the eye.

Ionizing Radiation: Ionizing radiations are finding increasing application in medicine and industry, e.g., x-rays and radioactive isotopes. Important radioisotopes are cobalt 60 and phosphorus 32. Certain tissues such as bone marrow are more sensitive than others and from a genetic standpoint, there are special hazards when the gonads are exposed. The radiation hazards comprise genetic changes, malformation, cancer, leukemia, depilation, ulceration, sterility and in extreme cases death. The International Commission of Radiological Protection has set the maximum permissible level of occupational exposure at 5 REM per year to the whole body.

II. Chemical Hazards

There is hardly any industry, which does not make use of chemicals. The chemical hazards are on the increase with the introduction of newer and complex chemical. Chemical agents act in three ways: local action, inhalation and ingestion. The ill effects produced depend upon the duration of exposure, the quantum of exposure and individual susceptibility.

Local Action: Some chemicals cause dermatitis, eczema, ulcers and even cancer by primary irritant action; some cause dermatitis by an allergic action. Some chemicals, particularly the aromatic nitro and amino compounds such as TNT and aniline are absorbed through the skin and cause systemic effects. Occupational dermatitis is a big problem in industry. Rao and Banerji (1952) were the first to draw attention in India to the prevalence of occupational dermatitis due to machine oil, rubber, x-rays, caustic alkalis and lime.

Inhalation:

Dusts: Dusts are finely divided solid particles with size ranging from 0.1 to 150 microns. They are released into the atmosphere during crushing, grinding, abrading, loading and unloading operations. Dusts are produced in a number of industries mines, foundry, quarry, pottery, textile, wood or stone working industries. Dust particles larger than 10 microns settle down from the air rapidly, while the smaller ones remain suspended indefinitely. Particles smaller than 5 microns are directly inhaled into the lungs and are retained there. This fraction of the dust is called "respirable dust", and is mainly responsible for pneumoconiosis. Dusts have been classified into inorganic and organic dusts; soluble and insoluble dusts. The inorganic dusts are silica, mica, coal, asbestos dust, etc; the organic dusts are cotton, jute and

the like. The soluble dusts dissolve slowly, enter the systemic circulation and are eventually eliminated by body metabolism. The insoluble dusts remain, more or less, permanently in the lungs. They are mainly the cause of pneumoconiosis. The most common dust diseases in the country are silicosis and anthracosis.

Gases: Exposure to gases is a common hazard in industries. Gases are sometimes classified as simple gases (e.g., oxygen, hydrogen), asphyxiating gases anesthetic gases (e.g., chloroform, ether, trichlorethylene). Carbon monoxide hazard is frequently reported in coal-gas manufacturing plants and steel industry.

Metals and their compounds: A large number of metals, and their compounds are used throughout industry. The chief mode of entry of some of them is by inhalation as dust or fumes. The industrial physician should be aware of the toxic effects of lead, antimony, arsenic, beryllium, cadmium, cobalt, manganese, mercury, phosphorus, chromium, zinc and others. The ill effects depend upon the duration of exposure and the dose or concentration of exposure. Unlike the pneumoconiosis, most chemical intoxications respond favorably to cessation, exposure and medical treatment.

Ingestion: Occupational diseases may also result from ingestion of chemical substance such as lead, mercury, arsenic, zinc, chromium, cadmium, phosphorus etc. Usually these substances are swallowed in minute amounts through contaminated hands, food or cigarettes. Much of the ingested material is excreted through faeces and only a small proportion may reach the general blood circulation.

III. Biological hazards Workers may be exposed to infective and parasitic agents at the place of work. The occupational diseases in this category are Brucellosis, Leptospirosis, Anthrax, Hydatidosis, psittacosis, tetanus, encephalitis, fungal infections, schistosomiasis and a host of others. Persons working among animal products (e.g., hair, wool, hides) and agricultural workers are specially exposed to biological hazards.

Mechanical hazards

The mechanical hazards in industry center round machinery, protruding and moving parts and the like. About 10 per cent of accidents are said to be due to mechanical causes.

Psychosocial hazards

The psychosocial hazards arise from the workers' failure to adapt to an alien psychosocial environment. Frustration, lack of job satisfaction, insecurity, poor human relationships, emotional tension are some of the psychosocial factors which may undermine both physical and mental health of the workers. The capacity to adapt to different working environments is influenced by many factors such as education, cultural background, family life, social habits, and what the workers expects from employment.

The health effects can be classified in two main categories: (a) Psychological and behavioral changes: including hostility, aggressiveness, anxiety, depression, tardiness, alcoholism, drug abuse, sickness absenteeism; (b) Psychosomatic ill health: including fatigue, headache; pain in the shoulders, neck and back; propensity to peptic ulcer, hypertension, heart disease and rapid ageing.

Reports from various parts of the world indicate that physical factors (heat, noise, poor lighting) also play a major role in adding to or precipitating mental disorders among workers. The increasing stress on automation, electronic operations and nuclear energy may introduce newer psychosocial health problems in industry. Psychosocial hazards are therefore assuming more important than physical or chemical hazards.

Occupational Cancer

Occupational cancer is a serious problem in Industry. The sites of the body most commonly affected are skin, lungs, bladder, and blood-forming organs.

1. Skin cancer. **Percival Pott was first to draw attention to cancer of scrotum in chimney sweeps in 1775.** It was subsequently found that cancer of the scrotum and of the skin in other parts of the body was caused by coal tar, x-rays, certain oils and dyes. Statistics now show that nearly 75 per cent of occupational cancers are skin cancer. Skin cancers are an occupational hazard among gas workers, coke oven workers, tar distillers, oil refiners, dye-stuff makers, road makers and in industries associated with the use of mineral oil, pitch, tar and related compounds.

2. Lung cancer. Lung cancer is a hazard in gas industry, asbestos industry, nickel and chromium work, arsenic roasting plants and in the mining of radioactive substances (e.g., uranium). Nickel, chromates, asbestos, coal tar (presumably 3.4 benxypyrene), radioactive substances and cigarette smoking are proved carcinogens for the lung. Arsenic, beryllium and isopropyl oil are suspected carcinogens. More than nine-tenths of lung cancer is attributed to tobacco smoking, air pollution and occupational exposure.

3. Cancer bladder. Cancer bladder was first noted in man in aniline industry in 1895. In more recent years, it was noted in the rubber industry. It is now known that cancer bladder is caused by aromatic amines, which are metabolized in the body and excreted in the urine. The industries associated with cancer bladder are the dyestuffs and dyeing industry, rubber, gas and the electric cable industries. The following have been mentioned as possible bladder carcinogens: Betanaphthylamines, Benzedrine, paraamino-diphenyl, auramine and magenta.

4. Leukemia. Exposure to benzol, roentgen rays and radioactive substances give rise to leukemia. Benzol is a dangerous chemical and is used as a solvent in many industries. Leukemia may appear long after exposure has cased.

The characteristics of occupational cancer are: (1) they appear after prolonged exposure, (2) the period between exposure and development of the disease may be as long as 10 to 25 years, (3) the disease may develop even after the cessation of exposure, (4) the average age incidence is earlier than that for cancer in general, (5) the localization of the tumors is remarkably constant in any one occupation. Personal hygiene is very important in the prevention of occupational cancer.

Control of industrial cancer

The control measures comprise the following: (1) Elimination or control of industrial carcinogens. Technical measures like exclusion of the carcinogen from the industry, well-designed building or machinery, closed system of production, etc., (2) Medical examinations, (3) Inspection of factors, (4) Notification (5) Licensing of establishments, (6) Personal hygiene measures, (7) Education of workers and management, and (8) Research

Health Problems due to Industrialisation

Industrialization implies the transformation of a peasant society into a community dependent upon the industries. It involves individual and collective technical skills for the manufacture of particular goods through highly specialized processes. There is division of work under the same roof with emphasis on mass production and community profit. In short industrialization means a social and economic revolution in the culture of a nation. Any such revolution is bound to carry with it some associated hazards.

The community health problems arising out of industrialization may be enumerated as follows.

1. Environmental sanitation problems

Housing: A rise in the number of slums and unsanitary dwellings is one of the chief problems in all industrial areas due to migration of people from the country-side for employment. The effect of substandard housing on the health of the population is discussed elsewhere in detail.

Water pollution: Water pollution is one of the tragic aftermaths of rapid industrialization due to discharge of industrial wastes without treatment, into water courses. Industrial wastes may contain acids, alkalis, oils and other organic and inorganic chemicals, some of which may be toxic; synthetic detergents and radioactive substances. It requires legal, administrative and technical measures to deal with the situation. Pollution control measures should be instituted in the planning stage itself in the process of industrialization.

Air pollution: This is an important problem in industrial areas, which may have an adverse effect on the health of the population. Air pollution is due to the discharge of toxic fumes, gases, smoke and dusts into the atmosphere. It requires proper town planning and zoning to eliminate these hazards.

Sewage disposal: There is bound to be pressure on the existing sanitation services if proper planning is not undertaken before locating industries. Lack of facilities for the disposal of sewage leads to pollution of water supply, contamination of soil with parasites and their ova.

2. Communicable Disease. The main problems in industrial areas are tuberculosis, venereal diseases, and food and water borne infections. These are in addition to the specific diseases associated with specific industries. Industrial areas without proper sewage disposal have become hotbeds for filariasis owing to the breeding of the mosquito vectors in contaminated water.

3. Food Sanitation. The standards of food sanitation are bound to be lowered due to industrialization, if proper precautions are not taken. Food-borne infections such as typhoid fever and viral hepatitis are all too common in India.

4. Mental Health. Mental health problems are due to altered living conditions. People are removed from the warmth of village community life and are transplanted in an alien environment, which calls for certain adjustments. Failure of adjustment leads to mental illness, psychoneurosis, behavior disorders, delinquency etc.

5. Accidents. Accidents are a public health problem in industrial areas due to congestion, vehicular traffic and the increased tempo of life. These accidents are in addition to those that occur in the factors.

6. Social Problems. Alcoholism, drug addiction, gambling, prostitution, increased divorce, breaking up of home, juvenile delinquency, higher incidence of crime are some of the social problems due to industrialization.

7. Morbidity and Mortality. Vital statistical rates indicate that industrial areas are characterized by incidence of chronic bronchitis. Cancer of the Lungs is also higher in industrialized areas than in rural areas. The crude death rate and infant mortality rate tend to be high in industrial areas

Measures for Health Protection of Workers

The aim of occupational health is “the promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations”. The measures for the general health protection of workers was the subject of discussion by an ILO/WHO Committee on Occupational Health in 1953. The Committee recommended the following.

1. Nutrition. In many developing countries, malnutrition is an important factor contributing to poor health among workers and low work output. Malnutrition may also affect the metabolism of toxic agents and also the tolerance mechanisms. Under the Indian Factories Act, it is obligatory on the part of the industrial establishments to provide a canteen when the number of employees exceeds 250. The aim is to provide balanced diets or snacks at reasonable cost under sanitary control. It is important to combine this action with the education of the workers on the value of a balanced diet. If the worker carries his own lunch to work, provision should be made for a safe and uncontaminated place to store the food before it is eaten to avoid spoilage or contamination. Likewise, some place separate from the workroom should be provided so that the meal may be eaten in sanitary surroundings.

2. Communicable disease control. The industry provides an excellent opportunity for early diagnosis, treatment, prevention and rehabilitation. It is a general objective everywhere, to detect cases of communicable disease and to render them non-infectious to others by treatment or removal from the working environment, or both. The communicable diseases of special importance in India are tuberculosis, typhoid fever, viral hepatitis, amoebiasis, intestinal parasites, malaria and venereal diseases. There should be an adequate immunization program against preventable communicable diseases. Anthrax, undulant fever, and Q fever are examples of communicable diseases, which may be of in the handling of working materials and substances.

3. Environmental sanitation. Within the industrial establishment, the following need attention for the prevention of the spread of communicable diseases by water, food or other means:

Water supply: A sufficient supply of wholesome drinking water is one of the basic requirements in all-industrial establishments. The common glass tumbler for drinking water should be abandoned as it spreads infection. Installation of drinking water fountains, at convenient points should be encouraged.

Food: If food is sold, its sanitary preparation, storage and handling are essential. Education of food handlers and other measures may be necessary to prevent outbreaks of gastro-intestinal disease.

Toilets: There should be sufficient number of latrines and urinals of the sanitary type, separate for males and females, conveniently situated. It is recommended that there should be at least one sanitary convenience for every 25 employees (males and females separate) for the first 100 employees, and thereafter one for every, 50. Garbage and waste disposal should be such as to avoid the breeding of flies and vermin.

General plant cleanliness: The walls, ceilings and passages should be painted with water washable paint and repainted at least once in 3 years and washed at least once in every 6 months. The dust, which settles down on the floor and machinery, should be promptly removed by vacuum cleaners or by wetting agents before it is redistributed into the atmosphere by the vibration of the machinery or buildings. A high standard of general cleanliness is one of the fundamentals of accident prevention. It also contributes to the efficiency and high morale of the workers.

Sufficient space: Sufficient floor space and cubic space are essential to prevent not only respiratory infections but also to ensure a comfortable working environment. The recommended standard is a minimum of 500 Cu. ft. of space for every worker; space more than 14 feet above the floor level is not to be taken into consideration.

Lighting: The results of poor industrial illumination are workers' eye fatigue, increased accidents, decreased production and more rejections of finished products. Furthermore, defective illumination over a long period of time may result in permanent impairment of vision. There should be sufficient and suitable lighting, natural or artificial or both, in every part of a factory where workers are working or passing through. The standards of illumination for different kinds of work have been set out – precision work for a high degree of accuracy may require 50-75 foot candles; where people work regularly, 6 to 12 foot candles may be sufficient. Illumination in corridors and passage should be at least 0.5 feet candles.

Ventilation temperature: Poor ventilation not only increases the chances of infection from person to person, but also affects the mental and physical efficiency of the workers. Proper ventilation is also needed for the control of noxious vapors, fumes and dusts and prevention of fatigue and industrial accidents. Effective and suitable provision should be made in every factor for securing in and maintaining in every work room adequate ventilation by the circulation of fresh air; and such a temperature as will secure to workers therein reasonable conditions of comfort and prevent injury to health.

Protection against hazards: There should be adequate environmental controls designed to protect the workers against exposure to dusts, fumes and other toxic hazards.

Housing: There is usually an acute shortage of housing in industrial areas. Most workers come from rural areas. The housing of workers near a plant must be correlated to essential community amenities and to social and sanitary facilities. Town planning and zoning are highly desirable.

4. Mental health. The objective of an occupational health service is not only to keep the workers physically healthy, but also mentally and psychologically stable. Industrial workers are susceptible to the effects of love, recognition, rejection, job satisfaction, rewards and

discipline. The master-servant era is now disappearing from industry. The workers, individually and collectively, like to be recognized, like to have a measure of control over their own affairs, like to have the opportunity to develop skills appropriate to their individual capacity.

The goals of mental health in industry are: (1) to promote the health and happiness of the workers, (2) to detect signs of emotional stress and strain and to secure relief of stress and strain where possible. (3) The treatment of employees suffering from mental illness, and (4) the rehabilitation of those who become ill.

5. Measure for women and children Women workers require special protection because (1) the developing embryo may be more susceptible to noxious agents than the exposed mother (e.g., in the case of methyl mercury poisoning), (2) females may be less suited for some work tasks than man; pregnancy may decrease the capacity to cope with many work factors. (3) Women tend to feed themselves less substantially than men and also restrict their nourishment in difficult economic circumstances, (4) the infant mortality is higher amongst children of women employed in industrial work.

The following types of protection are available for women workers in India: (1) Expectant mothers are given maternity leave for 12 weeks, of which 6 weeks precede the expected date of confinement; during this period they are allowed ‘maternity benefit’, which is a cash payment, under the Employees State Insurance Act, 1948, (2) provision of free antenatal, natal and postnatal services, (3) The Factories Act (section 66) prohibits night work between 7 PM and 6 AM. Section 34 prohibits carrying of excessive weights beyond a certain schedule which has been laid down. (4) The Indian Mines Act (1923) prohibits work underground. (5) The Factories Act, 1976 provides for crèches in factories where more than 30 women workers are employed, and also prohibits the employment of women and children in certain dangerous occupations. Regarding protection of children, the Constitution of India declared: “No child below the age of fourteen shall be employed to work in any factory or mine or engaged in any other hazardous employment”.

6. Health education Health education is a basic health need. It is an important health promotional measure. Health education in the industrial setting should be envisaged at all levels – the management, the supervisory staff, the worker, the trade union leaders and the community. The content varies from matters of personal hygiene and protection to participation of the workers in the planning and operation of the total health service program in industry.

7. Family planning Family planning is now recognized a decisive factor for the quality of life, and this applies to industrial workers also. The workers must adopt the small family norm

Occupational Disease

Occupational diseases and other work-related ill health The effect that occupation may have on a worker’s health is dependent on the exposure (expressed quantitatively) to relevant agents, and on host factors. Taking a history is often very important in identifying relevant exposures and linking them to ill health. The concept of “cumulative exposure” i.e. a quantitative measure of the intensity of exposure and the duration of exposure is important, since generally it is the main determinant of risk. Health may be harmed by occupational exposures in many different ways, and practically any organ system can be affected.

Some examples follow – starting with the lungs and skin, the organs of first contact for most chemical occupational exposures: –

1. Skin

- Eczema/ dermatitis – This can be irritant e.g. caused by detergents, or allergic e.g. as caused by certain rubber chemicals.
- Cancer – From skin exposure to pitch/tar, or to excessive sunlight

2. Lungs

- Asthma – causes of asthma may include flour, or other agents in bakeries, or di-isocyanates in twin-pack spray painting.
- Silicosis – caused due to inhalation of dust containing free silica or silicon dioxide (SiO_2).
- Byssinosis – due to inhalation of cotton fiber dust.
- Bagassosis – farmer's lung from sugarcane dust containing Thermophilic Actinomycete.
- Pneumoconiosis – dust is the main factor implicated.
- Asbestosis – from asbestos dust inhalation.
- Farmers Lung – due to the inhalation of moldy hay or grain dust.

3. Musculoskeletal

- Tenosynovitis and similar conditions.

4. Nervous

- Back pain – from manual handling.
- Peripheral neuropathy – caused by lead or n-hexane.
- Nerve deafness – induced by noise.
- Mental ill-health – caused by stress, or by chemical exposures such as mercury.

5. Blood and Marrow

- Anemia – caused by lead, which may impair the synthesis of normal hemoglobin.
- Aplastic Anemia – may be caused by high exposures to benzene.
- Leukemia – caused by benzene.

6. Genitourinary and Endocrine

- Kidney damage – caused by some solvent exposures, or by cadmium.

- Bladder cancer – caused by beta naphthylamine, or compounds of similar structure (generally aromatic amines, with an aromatic group in the ‘para’ position to the amine).
- Infertility – caused by some chemical exposures e.g. male infertility caused by DBCP (dibromochloropropane).

A range of other chemicals have also been implicated in the potential for endocrine disruption and/or effects on reproduction such as phthalates, glycol ethers, and organophosphates

7. Liver

- Hepatitis – toxic from some chemicals or viral e.g. in health care workers Cancer e.g. Vinyl chloride monomer causing angiosarcoma

Prevention of Occupational Diseases

The various measures for the prevention of occupational diseases may be grouped under three heads: medical engineering and statutory or legislative.

MEDICAL MEASURES

1. Pre-placement Examination

Pre-placement examination is the foundation of an efficient occupational health service. It is done at the time of employment and includes the worker's medical, family, occupational and social history; a thorough physical examination and a battery of biological and radiological examinations, e.g., chest x-ray, electro-cardiogram, vision testing, urine and blood examination, special tests for endemic diseases. A fresh recruit may either be totally rejected or given a job suited to his physical and mental abilities. The purpose of pre-placement examination is to place the right man in the right job, so that the worker can perform his duties efficiently without detriment to his health. This is ergonomics. The following is a list of some occupations in which it is risky to employ men suffering from certain diseases.

Hazard	Undesirable conditions
Lead	Anemia, hypertension, nephritis, peptic ulcer.
Dyes	Asthma; skin, bladder and kidney diseases; Precancerous Lesions.
Solvents	Liver and kidney disease, dermatitis, alcoholism.
Silica	Healed or active tuberculosis of lungs, chronic Lung Disease.
Radium and X-rays	Signs of ill-health, especially any blood disease

Pre placement examination will also serve as a useful benchmark for future comparison. It may be mentioned that in most countries, many workers start employment without the benefit of a pre-employment medical examination. This is particularly true of workers in small-scale

industries and mines and those engaged in construction and agricultural work in the developing countries.

2. Periodical Examination

Many diseases of occupational origin require months or even years for their development. Their slow development, very often, leads to their non-recognition in the early stages and this is harmful to the workers. This is the reason why a periodical medical check-up of workers is very necessary when they handle toxic or poisonous substances.

The frequency and content of periodical medical examinations will depend upon the type of occupational exposure. Ordinarily workers are examined once a year. But in certain occupational exposures (e.g., lead, toxic dyes, radium) monthly examinations are indicated. Sometimes, even daily examinations may be needed such as when irritant chemicals like dichromates are handled. The periodical examinations may be supplemented, where necessary by biological workers returning from medical leave, to assess the nature and degree to any disability and to assess suitability or otherwise of returning to the same job.

3. Medical and health care services

The medical care of occupational diseases is a basic function of an occupational health service. In India, the Employees State Insurance Scheme provides medical care not only for the worker but also his family. Within the factory, first aid services should be made available. Properly applied first aid can reduce suffering and disability and hasten recovery. Immunization is another accepted function of an occupational health services.

4. Notification

National Laws and Regulations (Factories Act, 1976; Mines Act, 1952; Dock Laborers Act, 1948: etc.) require the notification of cases and suspected cases of occupational disease. In the Factories Act, a list of 22 diseases is included while in the Mines Act 3 diseases and in the Dock Regulations 8 diseases are listed. These diseases are recognized internationally for the purpose of workmen's compensation. The main purpose of notification in industry is to initiate measures for prevention and protection and ensuring their effective application; and to investigate the working conditions and other circumstances, which have caused or suspected to have caused occupational diseases.

5. Supervision of working environment

Periodic inspection of working environment provides information of primary importance in the prevention of occupational disabilities. The physician should pay frequent visits to the factory in order to acquaint himself with the various aspects of the working environment such as temperature, lighting, ventilation, humidity, noise, cubic space, air pollution and sanitation which have an important bearing on the health and welfare of the workers. He should be acquainted with the raw material, processes and products manufactured. He should also study the various aspects of occupational physiology such as occurrence of fatigue, night-work, shift-work, weight carried by the workers and render advice to the factory management on all matters connected with the health and welfare of the workers. For studies of this kind the physician should enlist the cooperation of safety engineers, industrial hygienists and psychologists.

6. Maintenance and analysis of records

Proper records are essential for the planning, development and efficient operation of an occupational health service. The worker's health record and occupational disability record must be maintained. Their compilation and review should enable the service to watch over the health of the workers, to assess the hazards inherent in certain types of work and to devise or improve preventive measures.

7. Health education and counseling

Ideally, health education should start before the worker enters the factory. All the risks involved in the industry in which he is employed and the measures to be taken for personal protection should be explained to him. The correct use of protective devices like masks and gloves should also be explained. Simple rules of hygiene – hand washing, paring the nails, bodily cleanliness and cleanliness of clothes, should be impressed upon him. He should be frequently reminded about the dangers in industry through the media of health education such as charts, posters and handbills. The purpose of health education is to assist the worker in his process of adjustment to the working, home and community environment.

ENGINEERING MEASURES

1. Design of building

Measures for the prevention of occupational diseases should commence in the blueprint stage. The type of floor, walls, height, ceiling, roof, doors and windows, cubic space are all matters which should receive attention in the original plan of the building which is put up by the industrial architect. Once the building is constructed, it would be difficult to introduce alterations without much trouble and expense.

2. Good housekeeping

Good housekeeping is a term often applied to industry and means much the same as when used domestically. It covers general cleanliness, ventilation, lighting, washing, food arrangements and general maintenance. Good housekeeping is a fundamental requirement for the control or elimination of occupational hazards. Ceilings, and passages should be white-washed at least once a year. The dust, which settles down on the floor, ledges, beams, machinery and other stationery objects, should be promptly removed by vacuum cleaners or by wetting agents. Masks, gloves, aprons and other protective equipment should be kept clean and in a state of good repair. To prevent accidents, the right thing should be in the right place. Not only the inside, but also the outside of the plant should also be kept clean and tidy.

3. General ventilation

There should be good general ventilation in factories. It has been recommended that in every room of a factory, ventilation opening shall be provided in the proportion of 5 sq. Feet for each worker employed in such room, and the openings shall be such as to admit of a continued supply of fresh air. In rooms where dust is generated there should be an efficient exhaust ventilation system. Good general ventilation decreases the air-borne hazards to the workers, especially hazards from dusts and gases. The Indian Factories Act has prescribed a minimum of 500 c. Ft. of air space for each worker.

4. Mechanization

The plant should be mechanized to the fullest possible extent to reduce the hazard of contact with harmful substances. Dermatitis can be prevented if mechanical devices replace hand mixing. Acids can be conveyed from one place to another through pipes. There may be other similar situations where mechanization can be substituted to hand-operation.

5. Substitution

By substitution is meant the replacement of a harmful material by a harmless one or one of lesser toxicity. A classical example is the substitution of white phosphorus by phosphorus sesquisulphide in the match industry, which resulted in the elimination of necrosis of jaw (Phossy jaw). Zinc or iron paints can be used in place of harmful lead paints; silver salts can be used in place of mercury salts; acetone can be used in place of benzene. But substitution is not always possible in industry. Where possible, it should be used to the fullest possible extent.

6. Dusts

Dusts can be controlled at the point of origin by water sprays, e.g., wet drilling of rock. Inclusion of a little moisture in the materials will make the processes of grinding, sieving and mixing comparatively dust-free. In the lead industry, the Bombay Factory Rules 1950 enjoin that the floor and workbenches be kept wet when the work is progressing. Wet methods should be tried to combat dust before more elaborate and expensive methods are adopted.

7. Enclosure

Enclosing the harmful materials and processes will prevent the escape of dust and fumes into the factory atmosphere. For example, grinding machinery can be completely enclosed. Such enclosed units are generally combined with exhaust ventilation.

8. Isolation

Sometimes it may be necessary to isolate the offensive process in a separate building so that workers not directly connected with the operation are not exposed to the hazard. Isolation may not be only in space, but also in the fourth dimension of time. Certain operations can be done at night in the absence of the usual staff.

9. Local exhaust ventilation

By providing local exhaust ventilation dusts, fumes and other injurious substances can be trapped and extracted "at source" before they escape into the factory atmosphere. The heart of the local exhaust ventilation is the hood which is placed as near as possible to the point of origin of the dust or fume or other impurity. Dusts, gasses and fumes are drawn into the hood by suction and are conveyed through ducts into collecting units. In this way, the breathing zone of workers may be kept free of dangerous dust and poisonous fumes.

10. Protective devices

Respirators and gas masks are among the oldest devices used to protect workers against air-borne contaminants and they are still used for that purpose. There are two classes of respirators: (i) those, which remove contaminants from, air, (ii) those to which fresh air is

supplied. The workers should know what kinds to use, and when and how to use. Respiratory devices should not be used as substitute for other control methods. The other protective devices comprise earplugs, earmuffs, helmets, safety shoes, aprons, gloves, gumboots, barrier creams, screens and goggles. The workers should be instructed in the correct use of protective devices.

11. Environmental monitoring

An important aspect of occupational health program is environmental monitoring. It is concerned with periodical environmental surveys, especially sampling the factory atmosphere to determine whether the dusts and gases escaping into the atmosphere are within the limits of permissible concentration. The use of "permissible limits" has played an important part in reducing occupational exposure to toxic substances. Thermal environment, ventilation, lighting would also have to be monitored. Such monitoring should be done by joint collaboration of doctors and engineers.

12. Statistical monitoring

Statistical monitoring comprises the review at regular intervals of collected data on the health and environmental exposure of occupational groups. The main objective of these reviews is to evaluate the adequacy of preventive measures and occupational health criteria, including permissible exposure levels.

13. Research

Research in occupational health affords fertile ground for study, which can provide a better understanding of the industrial health problems. There are two kinds of research – pure research and research for the improvement of, or in connection with a manufactured product. Both are important. Study of the permissible limits of exposure to dusts and toxic fumes, occupational cancer, accident prevention, industrial fatigue and vocational psychology are some aspects of research in occupational health

CHAPTER 6:

FIRST AID & GENERAL PRINCIPLES OF SAFETY

Introduction to First Aid General Principles of Safety

First aid is the initial care of the injured or the sick. After studying this chapter you should

- Know what a First Aider must be able to do
- Know the principles of management of an emergency situation.

Learn these words before studying this chapter:

Airway	The passage by which air enters and leaves the lungs
Cardio-pulmonary resuscitation (CPR):	
Cardio	Relating to the heart
Pulmonary	Relating to the lungs
Resuscitation	Reviving one who is dying
Casualty	A victim of an accident or sudden illness
Expired air resuscitation (EAR)	Breathing for the casualty who cannot breathe for him/her self
Nausea	A feeling of sickness
Pallor	Paleness of skin.

First aid begins immediately the First Aider arrives at the scene of an accident or emergency, and continues until medical aid arrives or the casualty recovers. Medical aid is treatment by a doctor, registered nurse or ambulance officer. The First Aider should be prepared to remain and assist if needed.

First aid can:

- Preserve life
- Protect the unconscious
- Prevent injury or illness from becoming worse

- Promote recovery

Principles of Management of an Emergency Situation

General first aid procedure

When the First Aider arrives at the scene of an accident or emergency, the following procedure is carried out in a logical and ordered sequence. Firstly, check whether there is danger to yourself, the casualty or any bystanders. Only proceed if it is safe to do so.

Prevention

Perhaps the most important principles underlying the whole field of medicine, which include first aid, is that of prevention. It is also probably the most neglected.

Principles of prevention

The aims of first aid can be stated as the principles of prevention. They still follow that logical sequence of incident and casualty management. They are:

- Prevent the incident occurring
- Prevent complications arising from the in-accident
- Prevent the casualty dying
- Prevent the casualty's condition becoming worse
- Prevent delay in the recovery of the casualty
- Prevent your intervention being harmful

Prevent the incident occurring. Most accidents are preventable! As a First Aider, you should know the safety rules for the home, for work, for recreation and on the roads. Prevent complications arising from the incident (dangers) e.g. wearing seat belts, or the second accident occurs, you must be able to,

- Assess and control the situation
- Protect yourself, the casualty and others from danger by removing the cause or by removing the casualty from the source of danger. Make use of bystanders to warn others.
- Assess the casualty
- Is the casualty unconscious? (Response)
 - a) Airway (A)
 - b) Breathing (B)
 - c) Circulation (C)

- d) Pulse
 - e) Bleeding
 - f) Shock
- Decide on the management needed
 - Start to manage the situation and the life-threatening problems according to priorities decided on as a result of assessment.

After controlling the life-threatening problems:

- Obtain a detailed history of the incident
- Conduct a detailed assessment of the casualty
- Manage other problems and anticipate complications
 - i. Immobilize any fractures
 - ii. Cover any wounds

Prevent delay in recovery of the casualty, e.g. reassurance, blankets

- Arrange for further care of the casualty.

Prevent your intervention being harmful

- Always show a caring attitude towards your casualty
- Learn and accept your limitations
- Maintain and improve your level of skills and knowledge – first aid skills need regular practice and updating.

The principles of assessment

The principles involved in the detailed assessment of the casualty are not described.

History: The history of the incident is the account of the accident or the illness obtained from the casualty and from any witnesses, and by observing the scene of the incident.

Symptoms: The symptoms are the sensations the casualty describes, for example pain, nausea, headache.

Signs: Signs are the evidence of injury or illness detected by the First Aider, for example tenderness, deformity, and pallor.

Initial assessment of the casualty: The most important single observation you need to make is whether the casualty is conscious or unconscious. A casualty is conscious if he responds to

the spoken words and obeys a shouted command. Ask the casualty his name and give him a simple command:

‘Can you hear me?’

‘Open your eyes’

‘What is your name?’

If he does not respond, gently shake him by grasping the shoulders.

If the casualty is unconscious, then:

- Check the Airway and clear it if blocked
- Check the casualty’s Breathing and breathe for him if respiration is absent
- Also, check the casualty’s Circulation by feeling the neck for the carotid pulse. If the carotid pulse is absent, try to restore circulation, using cardiopulmonary resuscitation (CPR). These techniques are described. ‘The ABC of resuscitation’.
- Check for and control serious external bleeding.

Detailed assessment: Having controlled the life-threatening problems, then makes a detailed assessment of the casualty.

You need to obtain a history of the incident and note the symptoms and signs presented by the casualty.

Treat the casualty gently, confidently and efficiently, thereby easing discomfort and anxiety and reassuring the casualty. Special patience and skill are needed when assessing casualties with handicaps such as deafness, blindness or mental retardation. The casualty’s privacy should always be maintained and clothing should only be removed when it is necessary to expose an injury for assessment and treatment.

Obtaining a detailed history: If an accident, ask the casualty or witnesses for a description. Then determine:

- The casualty’s name, age and sex
- What the casualty was doing at the time of the incident or when the problem started
- The symptoms the casualty complains of
- The location of the problem, to identify the body system involved
- The duration of the problem
- Whether there were any contributing factors, such as a dizzy spell before a fall
- Whether there are factors that ease the problem or make it worse, such as posture or medication

- The casualty's past medical history in cases where the problem appears to be medical rather than the result of an accident.

Past medical history: You are only concerned with details of the casualty's past medical history that are relevant to the current problem.

The casualty may not be able to give this information but it can be sought from the family, from documents carried by the casualty or from a medical warning bracelet or pendant.

Try to determine whether the casualty:

- Has had a similar episode previously
- Is presently under treatment for:
 - a) diabetes
 - b) high blood pressure
 - c) any other medical condition
- Has a close relative who suffers a similar condition
- Attends a doctor or local hospital for regular treatment
- Takes any medications
- Has any known allergies

Examination of the casualty: Once the initial assessment has been made, you should undertake an orderly examination of the casualty, noting any tenderness, swelling, wounds or deformity while examining each area in the following order:

- Head
- Chest (including shoulders)
- Abdomen (including hip bone)
- Upper limbs
- Lower limbs
- Back, except in potential spinal injuries in the conscious casualty.

Use all of your senses to obtain signs for assessment – look, listen, feel, smell.

Making a detailed examination: When making a detailed examination of the casualty, you will need to observe and assess the features discussed below.

Breathing: Normal breathing is quiet, easy and regular. The normal breathing rate at rest is:

- In adults, 16 to 18 per minute, but this increases considerably with exercise
- In children, 20 to 36 per minute
- In infants, 30 to 50 per minute

Check to see if breathing is:

- Labored – this may be due to a blocked airway or asthma
- Noisy – this may be due to head injuries
- Irregular, weak and gasping – this indicates that breathing is failing
- Shallow – this may result from chest injuries.

Pulse: The pulse is the pressure rise felt over the arteries, as a result of each heartbeat. The pulse rate is the rate of the heartbeat. The normal pulse is regular and strong and the usual rate at rest is:

- In adults, 60 to 80 per minute
- In children, up to 100 per minute
- In infants, up to 140 per minute

But, the rate in healthy humans can vary considerably. Athletes have much slower pulses, sometimes as low as 40 per minute. The rate can also be much faster during exercise and excitement, sometimes as high as 180 per minute.

In illness and after injury the pulse can change considerably. Check whether pulse is:

- Weak and rapid – this may indicate bleeding, shock
- Bounding and slow – this may indicate brain injury
- Irregular – this may indicate heat conditions.

Check the pulse early in the assessment and continue to monitor and record it. The pulse is usually checked at the neck, where it is called the carotid pulse or at the wrist, where it is called the radial pulse.

- Lay your hand, palm downwards, across the front of the neck
- Draw your outstretched fingers backwards across either side of the neck until the tips of your fingers rest in groove behind the Adam's apple and in front of the strap muscle of the neck
- Gently roll your fingers until you can feel the maximum beat
- Your thumb must not press on the other side of the neck while feeling for the pulse.

To take the radial pulse:

- Place at least two fingers along the inner border of the bone on the thumb side of the wrist (the radius) about 1 centimeter in from the thumb side of the lower end of the forearm
- Gently roll the artery under your fingers until you can feel maximum beat
- In severely injured or ill casualties the radial pulse may be difficult or impossible to feel.

Skin: Normal, ‘white’ Caucasian skin is pink, warm and dry but can become red and moist in a hot environment and after exercise. Pigmented skin undergoes the same changes, but these may be more difficult to see. The changes may be more obvious inside the mouth. Changes of the circulation may reduce the flow to the skin. Consequently, the blanching of the skin with pressure may take longer to disappear.

Check whether the skin is:

- Cold and dry – these signs may indicate cold exposure
- Blue – this may be due to lack of oxygen
- Hot and moist – these signs may indicate fever
- Hot and dry – heart stroke.

Note: Blueness of the skin or mucous membranes indicates lack of oxygen.

To assess, inspect an area at body temperature, such as the tongue or the inside of the lips. Lips and finger nail beds will look blue when the environmental temperature is low or if the casualty is lacking oxygen (asphyxia).

Note: Some fluorescent lights and mercury vapor lamps will make a casualty look blue.

Eyes: Normally the eyes move together and the pupils are equal in size. Check whether:

- The casualty can see
- The eyes move
- The pupils are large or small
- The pupils are equal in size and regular in shape
- There is an injury

Deformity: Deformity is caused by damage to soft tissue and / or bones

- Compare with the opposite side, check and determine the cause.

Loss of function of a limb: Loss of function of a limb may be caused by:

- A stroke

- Spinal injury
- Damage to a nerve
- A limb fracture
- Pain such as that caused by a fracture.

Ask the conscious casualty the followings:

- ‘Can you feel your toes and fingers?’
- ‘Can you move your toes and finger?’
- ‘Do you have any pain in the neck or back?’

If the casualty is lying on the side, feel along the whole length of the spine for possible deformity, but do not move a conscious casualty suspected of having a spinal injury.

Wounds, marks, bruising and swelling: All wounds, marks and bruising must be assessed for size, shape, depth and amount of bleeding. Most swelling in soft tissue is due to bleeding into tissue spaces. This should be managed promptly with R.I.C.E. (see below)

At all times maintain verbal contact with the conscious casualty so that you can quickly recognize any change in the conscious state.

Remember the quality of immediate care is determined by:

- Accurate observation together with:
- The history and physical examination
- Immediate treatment of life-threatening conditions

Management of the casualty: You must now decide on the management needed. After assessing the casualty, any bleeding must be controlled and the casualty reassured. All fractures must be immobilized and large wounds dressed before the casualty is moved. Handle the casualty gently and avoid unnecessary movement. Then treat other injuries, if time permits, before medical aid arrives. Further care of the casualty should be arranged, if necessary, and you should be prepared to help if needed.

Seeking medical aid: Immediately it is decided that medical aid is needed, then:

- Send for medical aid, but do not leave the casualty
- State the exact place, with directions how to get there
- State the time of the incident
- State number of casualties, with some indication of their seriousness
- Ask the likely time of arrival of aid.

Message should be brief; you must confirm that they are understood.

Make use of bystanders to:

- Telephone for ambulance / police
- Assist in management of the casualty
- Make a written note of your observations and the time you made them.

You may need to initiate transfer of the casualty to shelter, home or medical aid. Skill in the use of simple technique of transport should be practiced. To prevent the casualty's condition from becoming worse, careful selection and use of the correct method of transport is necessary.

The basic principles of first aid must be continued during transport. These are as follows:

- The airways is clear at all time
- Bleeding is controlled
- The casualty is safety maintained in the correct position
- The casualty is safety secured to the stretcher, where one is used
- Regular checks of the casualty's condition are made
- Supporting bandages and dressings remain effectively applied but do not restrict circulation
- The method of transport is as safe and comfortable as the casualty's condition permits
- The casualty is not left alone.

Remember your responsibility ceases when medical aid arrives, but you should wait in case it is necessary to give further care or information.

Emergency rescue

Emergency rescue is a procedure for moving a casualty from a dangerous location to a place of safety. Rescue of the casualty should be left to trained personnel if they are available, but you may have to move the casualty yourself in an emergency. Examples of such emergencies are:

- Traffic accidents or where there is:
- Danger of fire or explosion
- Danger of suffocation due to toxic gases or smoke

- Risk of drowning
- Exposure to cold or intense heat
- Possibility of injury from collapsing walls
- Possible electrical danger

Warning: Take care not to become a casualty yourself.

Principles of management of injuries (R.I.C.E): The following are notes on some of the principles of management of injuries using rest and ice (R.I.C.E) or heat and exercise.

Rest: Rest tends to reduce the flow of blood to a part. Resting the whole casualty allows the blood pressure and pulse rate to drop, and this also reduces the flow of blood around the body. This helps to reduce bleeding.

Ice: Ice or other forms of cold, causes the small blood vessels in the skin and other tissues to constrict. This reduces the blood flow through those tissues. If a blow has damaged some of the blood vessels, blood escapes into the tissues. This is a bruise (contusion). Cold helps to reduce this bleeding, and the narrowed blood vessels will block with blood and clot more quickly. This in turn means that less blood accumulates in the tissues, there is less fluid swelling, less pain, and recovery will be quicker.

Ice should never be put directly on the skin. A good method of application is to put ice into a plastic bag with a little cold water, seal the bag tightly, and wrap it in a damp towel. The whole cold pack can then be applied to the injured area. It should not be left on for longer than 20 minutes at a time. It may be reapplied again after a further 20 minutes, '20 minutes on, 20 minutes off' for 4 hours, and thereafter every 4 hours.

Do not use anything that is very cold, such as from a deep-freeze. It may be cold enough to freeze the tissues, which would be harmful.

Commercially available cold packs can be used, but ice is cheaper, usually available and just as good.

Compression: Compression helps to narrow bleeding vessels and reduce swelling. It can be used as an addition to cold, or as an alternating form of management. Compression bandages should extend well beyond the injured area. Good elastic bandages are best. Old crepe bandages that have lost their stretch will not help very much.

Compression also helps to stop the spread of some injected poisons, such as snake venom. This also works by squeezing the small vessels of the limb so that they close sufficiently to delay the circulation, and hence stop the poison from reaching the rest of the body.

Elevation: Raising part of the body also helps to reduce the blood pressure and flow of blood in that part. It is difficult for a casualty to hold a limb elevated for long, as he will tire quickly. The casualty needs assistance. Such as bandaging, a sling, or to be flat with the limb raised and supported.

All four methods of management above are used to reduce bleeding from a wound (internal or external). They may be of use for as long as 48 hours after an injury. After that time, damaged

blood vessels will be blocked, and active bleeding stopped. From then on, it is useful to encourage the circulation in order to remove the fluid and remaining escaped blood from the tissues.

Heat: Heat causes blood vessels to dilate (widen) thus increasing the blood flow to the part. This is good management but only 48 hours or more after an injury. Before that time the use of heat might increase bleeding. Any form of heat can be used, and special apparatus is not needed. The heat should be gentle. (Inflicting a burn is bad management!) Domestic electric radiators, a hot-water bag, or simply hot bathing can be used, so long as they are used carefully.

Exercise : Exercise is used in the rehabilitation, or recovery, after injury. While not first aid, it is an important part of the later management of sports injuries. It is important that a competent trainer, sports medicine specialist, etc. should supervise exercise after injuries because there is a real risk of re-injury. A program of regular graduated exercise is needed

CHAPTER: 7

ENVIRONMENT & HEALTH

Environmental Pollution & Disease

The four major elements, vis-à-vis land, air, plants and animals constitute what is known as environment. Environment is also divided into (i) Physical comprising of land, water and air, (ii) Biological or Organic represented by plants and animals (iii) Social comprising of interactions between human beings. While the physical environment is essential for existence of life in various forms. The biological environment provides the required food so very essential for the sustenance of man on Earth. Micro organisms in the environment breakdown organic waste matter in to simple salts and thereby help in recycling them. In fact man cannot survive with out plant and animal life.

Pollution is defined as “ introduction into a natural resource like soil, water or air of substances of such character and in such quantity, that its natural quality is so altered as to impair its usefulness and render it offensive to the sense of sight taste or smell”. It may be harmful to health. Thus, environmental pollution has a direct bearing on the lives of plants and animals, including human beings. The following major forms of pollution will be discussed here,

- Water pollution.
- Air pollution.
- Soil pollution.
- Noise pollution.
- Radioactive Substance Pollution

WATER POLLUTION

Water quality is closely linked to water use and to the state of economic development. In industrialized countries, bacterial contamination of surface water caused serious health problems in major cities throughout the mid 1800's. By the turn of the century, cities in Europe and North America began building sewer networks to route domestic wastes downstream of water intakes. Development of these sewage networks and waste treatment facilities in urban areas has expanded tremendously in the past two decades. However, the rapid growth of the urban population (especially in Latin America and Asia) has outpaced the ability of governments to expand sewage and water infrastructure. While waterborne diseases have been eliminated in the developed world, outbreaks of cholera and other similar diseases still occur with alarming frequency in the developing countries. Since World War II and the birth of the “chemical age”, water quality has been heavily impacted worldwide by industrial and agricultural chemicals. Eutrophication of surface waters from human and agricultural wastes and nitrification of groundwater from agricultural practices has greatly affected large parts of the world.

Acidification of surface waters by air pollution is a recent phenomenon and threatens aquatic life in many area of the world. In developed countries, these general types of pollution have occurred sequentially with the result that most developed countries have successfully dealt with major surface water pollution. In contrast, however, newly industrialized countries such as China , India , Thailand , Brazil , and Mexico are now facing all these issues simultaneously. Water can also be an important source of chemical hazards. It can leach lead from pipes especially if the water is soft. There is good epidemiological evidence that this can have a relatively small but measurable harmful effect especially on neurological function even at levels hitherto considered “acceptable”. Other adverse effects can arise from chemicals added to the water.

Water Pollution comprises contamination of streams, lakes, underground water, bays, or oceans by substances harmful to living things. Water is necessary to life on earth. All organisms contain it; some live in it; some drink it. Plants and animals require water that is moderately pure, and they cannot survive if their water is loaded with toxic chemicals or harmful microorganisms. If severe, water pollution can kill large numbers of fish, birds, and other animals, in some cases killing all members of a species in an affected area. Pollution makes streams, lakes, and coastal waters unpleasant to look at, to smell, and to swim in. Fish and shellfish harvested from polluted waters may be unsafe to eat. People who ingest polluted water can become ill, and, with prolonged exposure, may develop cancers or bear children with birth defects.

River Pollution in developing countries brings hazardous impact in its continual stream to the estuary if not immediately cleaned

MAJOR TYPES OF POLLUTANTS

The major water pollutants are chemical, biological, or physical materials that degrade water quality. Pollutants can be classed into eight categories, each of which presents its own set of hazards.

A. Petroleum Products

Oil and chemicals derived from oil are used for fuel, lubrication, plastics manufacturing, and many other purposes. These petroleum products get into water mainly by means of accidental spills from ships, tanker trucks, pipelines, and leaky underground storage tanks. Many petroleum products are poisonous if ingested by animals, and spilled oil damages the feathers of birds or the fur of animals, often causing death. In addition, spilled oil may be contaminated with other harmful substances, such as polychlorinated biphenyls (PCBs).

B. Pesticides and Herbicides

Chemicals used to kill unwanted animals and plants, for instance on farms or in suburban yards, may be collected by rainwater runoff and carried into streams, especially if these substances are applied too lavishly. Some of these chemicals are biodegradable and quickly decay into harmless or less harmful forms, while others are nonbiodegradable and remain dangerous for a long time.

When animals consume plants that have been treated with certain nonbiodegradable chemicals, such as chlordane and dichlorodiphenyltrichloroethane (DDT), these chemicals are absorbed into the tissues or organs of the animals. When other animals feed on these

contaminated animals, the chemicals are passed up the food chain. With each step up the food chain, the concentration of the pollutant increases. In one study, DDT levels in ospreys (a family of fish-eating birds) were found to be 10 to 50 times higher than in the fish that they ate, 600 times the level in the plankton that the fish ate, and 10 million times higher than in the water. Animals at the top of food chains may, as a result of these chemical concentrations, suffer cancers, reproductive problems, and death.

Many drinking water supplies are contaminated with pesticides from widespread agricultural use. Even in the USA more than 14 million Americans drink water contaminated with pesticides, and the Environmental Protection Agency (EPA) estimates that 10 percent of wells contain pesticides. Nitrates, a pollutant often derived from fertilizer runoff, can cause methemoglobinemia in infants, a potentially lethal form of anemia that is also called blue baby syndrome.

C. Heavy Metals

Heavy metals, such as copper, lead, mercury, and selenium, get into water from many sources, including industries, automobile exhaust, mines, and even natural soil. Like pesticides, heavy metals become more concentrated. When they reach high levels in the body, heavy metals can be immediately poisonous, or can result in long-term health problems similar to those caused by pesticides and herbicides. For example, crops can absorb cadmium in fertilizer derived from sewage sludge. If humans eat these crops, the metal can cause diarrhea and, over time, liver and kidney damage. Lead can get into water from lead pipes and solder in older water systems; children exposed to lead in water can suffer mental retardation.

D. Hazardous Wastes

Hazardous wastes are chemical wastes that are either toxic (poisonous), reactive (capable of producing explosive or toxic gases), corrosive (capable of corroding steel), or ignitable (flammable). If improperly treated or stored, hazardous wastes can pollute water supplies. In 1969 the Cuyahoga River in Cleveland, Ohio, was so polluted with hazardous wastes that it caught fire and burned. PCBs, a class of chemicals once widely used in electrical equipment such as transformers, can get into the environment through oil spills and can reach toxic levels.

E. Excess Organic Matter

Fertilizers and other nutrients used to promote plant growth on farms and in gardens may find their way into water. At first, these nutrients encourage the growth of plants and algae in water. However, when the plant matter and algae die and settle underwater, microorganisms decompose them. In the process of decomposition, these microorganisms consume oxygen that is dissolved in the water. Oxygen levels in the water may drop to such dangerously low levels that oxygen-dependent animals in the water, such as fish, die. This process of depleting oxygen to deadly levels is called eutrophication.

F. Sediment

Sediment, soil particles carried to a streambed, lake, or ocean, can also be a pollutant if it is present in large enough amounts. Soil erosion produced by the removal of soil-trapping trees near waterways, or carried by rainwater and floodwater from croplands, strip mines, and

roads, can damage a stream or lake by introducing too much nutrient matter. This leads to eutrophication.

G. Infectious Organisms

A 1994 study by the Centers for Disease Control and Prevention (CDC) estimated that about 900,000 people get sick annually in the United States alone because of organisms in their drinking water, and around 900 people die. Many disease-causing organisms that are present in small numbers in most natural waters are considered pollutants when found in drinking water. Such parasites as Giardia lamblia and Cryptosporidium parvum occasionally turn up in urban water supplies. These parasites can cause illness, especially in people who are very old or very young, and in people who are already suffering from other diseases. In 1993 an outbreak of Cryptosporidium in the water supply of Milwaukee, Wisconsin, sickened more than 400,000 people and killed more than 100.

H. Thermal Pollution

Water is often drawn from rivers, lakes, or the ocean for use as a coolant in factories and power plants. The water is usually returned to the source warmer than when it was taken. Even small temperature changes in a body of water can drive away the fish and other species that were originally present, and attract other species in place of them. Thermal pollution can accelerate biological processes in plants and animals or deplete oxygen levels in water. The result may be fish and other wildlife deaths near the discharge source. Thermal pollution can also be caused by the removal of trees and vegetation that shade and cool streams

SOURCES OF WATER POLLUTANTS

There are many causes for water pollution but two general categories exist, **direct, Indirect** and **Contaminant** sources.

Direct sources include effluent outfalls from factories, refineries, waste treatment plants etc. that emit fluids of varying quality directly into urban water supplies. In the United States and other countries, these practices are regulated, although this doesn't mean that pollutants can't be found in these waters.

Indirect sources include contaminants that enter the water supply from soils/groundwater systems and from the atmosphere via rainwater. Soils and groundwater contain the residue of human agricultural practices (fertilizers, pesticides, etc.) and improperly disposed of industrial wastes. Atmospheric contaminants are also derived from human practices (such as gaseous emissions from automobiles, factories and even bakeries).

Contaminants can be broadly classified into organic, inorganic, radioactive and acid/base. Examples from each class and their potential sources are too numerous to discuss here.

Water pollutants result from many human activities. Pollutants from industrial sources may pour out from the outfall pipes of factories or may leak from pipelines and underground storage tanks. Polluted water may flow from mines where the water has leached through mineral-rich rocks or has been contaminated by the chemicals used in processing the ores. Cities and other residential communities contribute mostly sewage, with traces of household chemicals mixed in. Sometimes industries discharge pollutants into city sewers, increasing the variety of pollutants in municipal areas. Pollutants from such agricultural sources as

farms, pastures, feedlots, and ranches contribute animal wastes, agricultural chemicals, and sediment from erosion.

The oceans, vast as they are, are not invulnerable to pollution. Pollutants reach the sea from adjacent shorelines, from ships, and from offshore oil platforms. Sewage and food waste discarded from ships on the open sea do little harm, but plastics thrown overboard can kill birds or marine animals by entangling them, choking them, or blocking their digestive tracts if swallowed.

Oil spills often occur through accidents, such as the wrecks of the tanker Amoco Cadiz off the French coast in 1978 and the Exxon Valdez in Alaska in 1992. Routine and deliberate discharges, when tanks are flushed out with seawater, also add a lot of oil to the oceans. Offshore oil platforms also produce spills: The second largest oil spill on record was in the Gulf of Mexico in 1979 when the Ixtoc 1 well spilled 530 million liters (140 million gallons). The largest oil spill ever was the result of an act of war. During the Gulf War of 1991, Iraqi forces destroyed eight tankers and onshore terminals in Kuwait , releasing a record 910 million liters (240 million gallons). An oil spill has its worst effects when the oil slick encounters a shoreline. Oil in coastal waters kills tidepool life and harms birds and marine mammals by causing feathers and fur to lose their natural waterproof quality, which causes the animals to drown or die of cold. Additionally, these animals can become sick or poisoned when they swallow the oil while preening (grooming their feathers or fur).

Water pollution can also be caused by other types of pollution. For example, sulfur dioxide from a power plant's chimney begins as air pollution. The polluted air mixes with atmospheric moisture to produce airborne sulfuric acid, which falls to the earth as acid rain. In turn, the acid rain can be carried into a stream or lake, becoming a form of water pollution that can harm or even eliminate wildlife. Similarly, the garbage in a landfill can create water pollution if rainwater percolating through the garbage absorbs toxins before it sinks into the soil and contaminates the underlying groundwater (water that is naturally stored underground in beds of gravel and sand, called aquifers).

Pollution may reach natural waters at spots we can easily identify, known as point sources, such as waste pipes or mine shafts. Nonpoint sources are more difficult to recognize. Pollutants from these sources may appear a little at a time from large areas, carried along by rainfall or snowmelt. For instance, the small oil leaks from automobiles that produce discolored spots on the asphalt of parking lots become nonpoint sources of water pollution when rain carries the oil into local waters.

Toxic waste is the most harmful form of pollution to marine creatures and humans alike. Once a form of toxic waste affects an organism, it (the toxic waste) can be quickly passed along the food chain and might eventually end up as seafood, causing various problems. Toxic wastes arrive from the leakage of landfills, dumps, mines and farms. Sewage and industrial wastes introduce chemical pollutants such as PCB, DDT, and Sevin. Farm chemicals (insecticides and herbicides) along with heavy metals (e.g., mercury and zinc) can have a disastrous affect on marine life and humans alike.

Radioactive wastes, reactor leaks, natural radioactivity, and radioactive particles, which originate from the Atmospheric Testing Program from explosions of nuclear weapons, are dispersed in water all over the world. The effect of these radioactive particles is currently being researched. All of these factors allow seafood to have a chance of being hazardous to human health. For example, if a fish is contaminated with the metal Mercury (by either eating

it or consuming a creature who had), birth defects and nervous system damage in humans may result. Also, Dioxin causes genetic and chromosomal mutations in marine life and is suspected of causing cancer in humans.

Medical wastes, such as stale blood vials, hypodermic needles, and urine samples that have been found in ocean around the U.S. are being researched to determine if swimmers have a chance of contracting Hepatitis or Aid's from such wastes. Other wastes have been known to cause viral and bacterial diseases such as cholera, typhoid, dysentery, and diarrhea.

The lawful ocean dumping of various pollutants was once common practice, but is now regulated. However, the wastes that were dumped into the ocean in the early 1900's remain there still. Human wastes, ground-up garbage, water from bathing, and plastics all contribute to ocean dumping.

Examples of trash found in the ocean are: syringes, laboratory rats, human stomach lining, Navy decontamination kits, test tubes with various substances (with radioactive markings), tampon applicators, and a wallet-sized photo of a dead communist dictator.

One of the main causes of trash finding its way to the ocean is the fact that some sewage pipes share their space with storm water drains. Rainfall (at least 1/4 of an inch) causes the sewage pipes to flood and the sewage wastes (basically anything you flush down your toilet), mingles with the storm water drain, which flows unhindered to a water source.

Balloons have been known to find their way into animals such as sperm whales, blocking their digestive tracts; causing the animals to die. Plastic six-pack rings choke various animals and other waste is mistaken by animals for food. Basically any unnatural trash can be harmful to ocean life.

Marine Pollution

For close to thirty years, most academics studying the phenomena of marine pollution have adhered to a definition developed by a UN body, the Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP), who define it as the...

“Introduction of man, directly or indirectly, of substances or energy into the marine environment (including estuaries) resulting in such deleterious effects as harm to living resources, hazard to human health, hindrance to marine activities including fishing, impairment of quality for use of sea-water, and reduction of amenities.”

The definition has two important qualities. First, it is action oriented. Marine pollution is conceptualized as a human activity, thereby omitting all natural activities that could potentially have damaging effects on the ocean eco-system. So, for example, earth quakes or volcanic eruptions that emanate from the ocean floor and subsequently damage or change already existing ocean eco-systems would not be considered pollution.

Second, the definition is amenable to measurement. Marine pollution is harmful, and its danger can be identified in a variety of ways. For example, it is easy to see the deleterious effects that oil spills have on the sea birds and mammals that happen to run into them. Scientists likewise can readily identify various toxic substances found in the marine environment, measure their quantities, and provide estimates of their potential danger for the health of both marine life and humans

Effects of Water Pollution

The effects of water pollution are varied. They include poisonous drinking water, poisonous food animals (due to these organisms having bioaccumulated toxins from the environment over their life spans), unbalanced river and lake ecosystems that can no longer support full biological diversity, deforestation from acid rain, and many other effects. These effects are, of course, specific to the various contaminants.

Comprising over 70% of the Earth's surface, water is undoubtedly the most precious natural resource that exists on our planet. Without the seemingly invaluable compound comprised of hydrogen and oxygen, life on Earth would be non-existent: it is essential for everything on our planet to grow and prosper. Although we as humans recognize this fact, we disregard it by polluting our rivers, lakes, and oceans. Subsequently, we are slowly but surely harming our planet to the point where organisms are dying at a very alarming rate. In addition to innocent organisms dying off, our drinking water has become greatly affected, as is our ability to use water for recreational purposes. In order to combat water pollution, we must understand the problems and become part of the solution

Global Water Pollution

Estimates suggest that nearly 1.5 billion people lack safe drinking water and that at least 5 million deaths per year can be attributed to waterborne diseases. With over 70 percent of the planet covered by oceans, people have long acted as if these very bodies of water could serve as a limitless dumping ground for wastes. Raw sewage, garbage, and oil spills have begun to overwhelm the diluting capabilities of the oceans, and most coastal waters are now polluted. Beaches around the world are closed regularly, often because of high amounts of bacteria from sewage disposal, and marine wildlife is beginning to suffer.

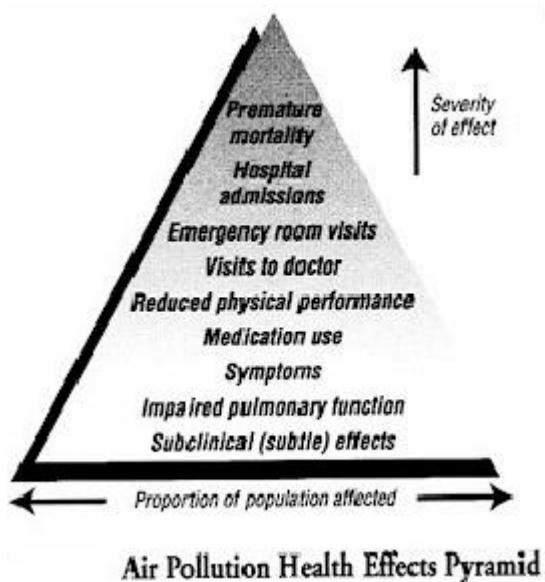
Perhaps the biggest reason for developing a worldwide effort to monitor and restrict global pollution is the fact that most forms of pollution do not respect national boundaries. The first major international conference on environmental issues was held in Stockholm , Sweden , in 1972 and was sponsored by the United Nations (UN). This meeting, at which the United States took a leading role, was controversial because many developing countries were fearful that a focus on environmental protection was a means for the developed world to keep the undeveloped world in an economically subservient position. The most important outcome of the conference was the creation of the United Nations Environmental Program (UNEP).

UNEP was designed to be “the environmental conscience of the United Nations,” and, in an attempt to allay fears of the developing world, it became the first UN agency to be headquartered in a developing country, with offices in Nairobi , Kenya . In addition to attempting to achieve scientific consensus about major environmental issues, a major focus for UNEP has been the study of ways to encourage sustainable development increasing standards of living without destroying the environment. At the time of UNEP’s creation in 1972, only 11 countries had environmental agencies. Ten years later that number had grown to 106, of which 70 were in developing countries.

B) AIR POLLUTION

Air, Water and food are the three essential life supports. Man may survive for days without water and food but without air he can only survive a few minutes. Smoke, ash, sulphur

dioxide and other products have long since been recognized as a costly nuisance, however air pollution is not only a source of discomfort but can also cause serious health problems.



Air Pollution visible over the skyline of the city

Air poisoning can occur due to inhalation of certain gasses and aerosols. The six most common air pollutants are,

1. Carbon monoxide

Carbon monoxide, or CO, is a colorless, odorless gas that is formed when carbon in fuel is not burned completely. It is a component of motor vehicle exhaust, which contributes about 56 percent of all CO emissions nationwide. Other non-road engines and vehicles (such as construction equipment and boats) contribute about 22 percent of all CO emissions nationwide. Higher levels of CO generally occur in areas with heavy traffic congestion. In cities, 85 to 95 percent of all CO emissions may come from motor vehicle exhaust. Other sources of CO emissions include industrial processes (such as metals processing and chemical manufacturing), residential wood burning, and natural sources such as forest fires. Woodstoves, gas stoves, cigarette smoke, and unvented gas and kerosene space heaters are sources of CO indoors. The highest levels of CO in the outside air typically occur during the colder months of the year when inversion conditions are more frequent. The air pollution becomes trapped near the ground beneath a layer of warm air.

2. Nitrogen dioxide

Nitrogen oxides, or NOx, is the generic term for a group of highly reactive gases, all of which contain nitrogen and oxygen in varying amounts. Many of the nitrogen oxides are colorless and odorless. However, one common pollutant, nitrogen dioxide (NO₂) along with particles in the air can often be seen as a reddish-brown layer over many urban areas.

Nitrogen oxides form when fuel is burned at high temperatures, as in a combustion process. The primary sources of NOx are motor vehicles, electric utilities, and other industrial, commercial, and residential sources that burn fuels.

3. Sulphur dioxide

Sulfur dioxide, or SO₂, belongs to the family of sulfur oxide gases (SOx). These gases dissolve easily in water. Sulfur is prevalent in all raw materials, including crude oil, coal, and ore that contains common metals like aluminum, copper, zinc, lead, and iron. SOx gases are formed when fuel containing sulfur, such as coal and oil, is burned, and when gasoline is extracted from oil, or metals are extracted from ore. SO₂ dissolves in water vapor to form acid, and interacts with other gases and particles in the air to form sulfates and other products that can be harmful to people and their environment.

Over 65% of SO₂ released to the air, or more than 13 million tons per year, comes from electric utilities, especially those that burn coal. Other sources of SO₂ are industrial facilities that derive their products from raw materials like metallic ore, coal, and crude oil, or that burn coal or oil to produce process heat. Examples are petroleum refineries, cement manufacturing, and metal processing facilities. Also, locomotives, large ships, and some nonroad diesel equipment currently burn high sulfur fuel and release SO₂ emissions to the air in large quantities.

4. Lead

Lead is a metal found naturally in the environment as well as in manufactured products. The major sources of lead emissions have historically been motor vehicles (such as cars and trucks) and industrial sources. Due to the phase out of leaded gasoline, metals processing is the major source of lead emissions to the air today. The highest levels of lead in air are

generally found near lead smelters. Other stationary sources are waste incinerators, utilities, and lead-acid battery manufacturers.

5. Ozone

Ozone (O_3) is an odorless, colorless gas composed of three oxygen atoms. It is not usually emitted directly into the air, but at ground level is created by a chemical reaction between oxides of nitrogen (NO_x) and volatile organic compounds (VOC) in the presence of heat and sunlight. Ozone has the same chemical structure whether it occurs miles above the earth or at ground level and can be “good” or “bad,” depending on its location in the atmosphere. “Good” ozone occurs naturally in the stratosphere approximately 10 to 30 miles above the earth’s surface and forms a layer that protects life on earth from the sun’s harmful rays. In the earth’s lower atmosphere, ground-level ozone is considered “bad”.

6. Particulate matter

Particulate matter, or PM, is the term for particles found in the air, including dust, dirt, soot, smoke, and liquid droplets. Particles can be suspended in the air for long periods of time. Some particles are large or dark enough to be seen as soot or smoke. Others are so small that individually they can only be detected with an electron microscope.

Some particles are directly emitted into the air. They come from a variety of sources such as cars, trucks, buses, factories, construction sites, tilled fields, unpaved roads, stone crushing, and burning of wood.

Other particles may be formed in the air from the chemical change of gases. They are indirectly formed when gases from burning fuels react with sunlight and water vapor. These can result from fuel combustion in motor vehicles, at power plants, and in other industrial processes.

Particulate matter air pollution refers to microscopic airborne particles that can travel into your lungs and cause a variety of respiratory problems. These particulates are 10 microns or less in size (about half the width of a human hair) and are found both outdoors and in homes and work places. They are referred to as “PM10” (Particulate Matter 10 microns or less in diameter). Even smaller particles — less than 2.5 microns in diameter —, which can penetrate even more deeply into the lungs, are called “PM2.5”.

Any form of combustion will create small particulates, although the most harmful particulates are generated by combustion of organic materials. Tobacco is one obvious source of small particulates, and the harmful effects of tobacco smoke are well known. As a result, many municipalities have enacted local by-laws to restrict tobacco smoking in public places.

However, there are other sources of combustion, which can cause large quantities of small particulate to be released into the air. Wood smoke is a major offender in many communities, whether it comes from a beehive burner, slash burning after land clearing or logging, the burning of agricultural stubble, or a fireplace or woodstove. Diesel-burning vehicles such as buses and trucks are another major source of this pollution. Building incinerators and furnaces can also contribute to airborne particulate levels.

From a public health perspective, air-borne small particulate from combustion is now considered to be the single greatest air pollution problem in British Columbia.

Scientific research has shown that increased levels of this small particulate are responsible for a marked increase in Emergency Room visits, hospitalizations, and days lost from school and work.

This type of air pollution has been closely linked to aggravation of existing heart and lung conditions and even increased death rates. Children and senior citizens are most vulnerable a recent study estimated that small particle pollution is responsible for many thousands of premature deaths annually in the United States. Studies of small particulate air pollution also indicate a significant increase in the population death rate in areas suffering prolonged exposure to this type of pollution.

Scientists also have found that some of these air pollutants are responsible for the following phenomena:

- Acid Rain
- Ozone Depletion

Acid Rain

Acid rain is a serious environmental problem that affects large parts of the US and Canada.

“Acid rain” is a broad term used to describe several ways that acids fall out of the atmosphere. A more precise term is acid deposition, which has two parts: wet and dry.

Wet deposition refers to acidic rain, fog, and snow. As this acidic water flows over and through the ground, it affects a variety of plants and animals. The strength of the effects depend on many factors, including how acidic the water is, the chemistry and buffering capacity of the soils involved, and the types of fish, trees, and other living things that rely on the water.

Dry deposition refers to acidic gases and particles. About half of the acidity in the atmosphere falls back to earth through dry deposition. The wind blows these acidic particles and gases onto buildings, cars, homes, and trees. Dry deposited gases and particles can also be washed from trees and other surfaces by rainstorms. When that happens, the runoff water adds those acids to the acid rain, making the combination more acidic than the falling rain alone.

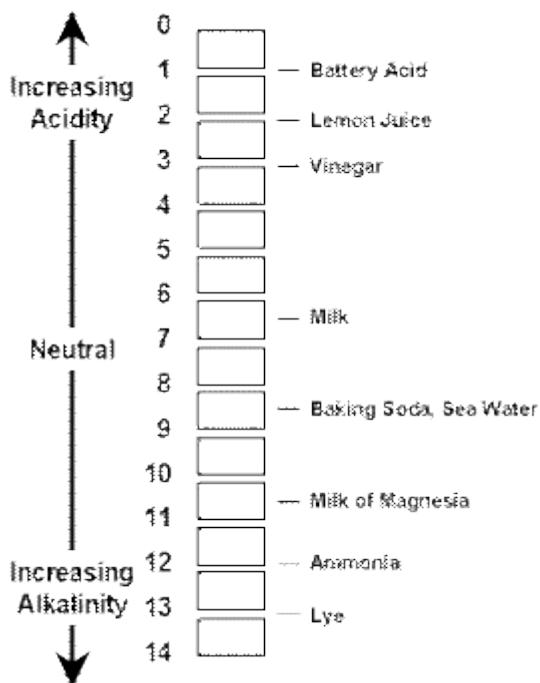
Prevailing winds blow the compounds that cause both wet and dry acid deposition across state and national borders, and sometimes over hundreds of miles.

Scientists discovered, and have confirmed, that sulfur dioxide (SO_2) and nitrogen oxides (NO_x) are the primary causes of acid rain. In the US, About 2/3 of all SO_2 and 1/4 of all NO_x comes from electric power generation that relies on burning fossil fuels like coal.

Acid rain occurs when these gases react in the atmosphere with water, oxygen, and other chemicals to form various acidic compounds. Sunlight increases the rate of most of these reactions. The result is a mild solution of sulfuric acid and nitric acid.

Acid rain is measured using a scale called “pH.” The lower a substance’s pH, the more acidic it is. See the pH page for more information.

Pure water has a pH of 7.0. Normal rain is slightly acidic because carbon dioxide dissolves into it, so it has a pH of about 5.5. As of the year 2000, the most acidic rain falling in the US has a pH of about 4.3.

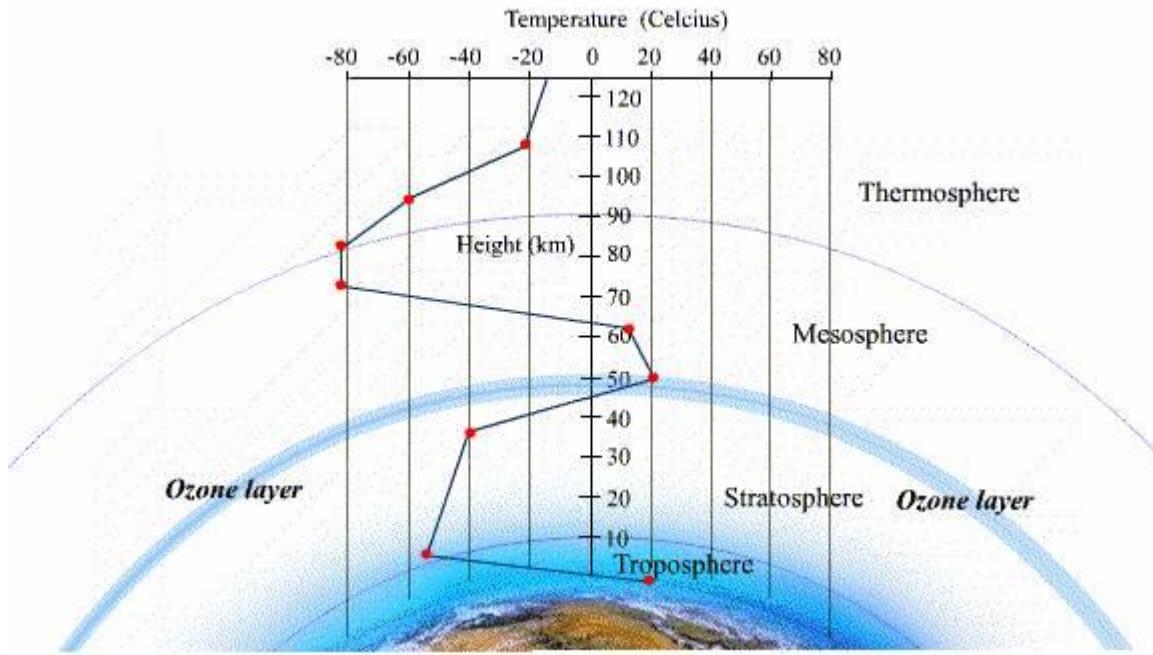


Ozone Depletion

The ozone layer is thinning out because of the air pollutants that we are releasing.

A layer of ozone gas (O_3) surrounds the Earth about 40km above the ground. This ozone absorbs harmful UV radiation from the Sun, preventing it from reaching the ground. Since 1976, there has been an alarming decrease in the amount of ozone in the upper layer of the atmosphere (stratosphere) over the South Pole. It is caused by chlorofluorocarbons (CFC).

CFC's – are a class of volatile organic compounds that have been used as refrigerants, aerosol propellants, foam blowing agents, and as solvents in the electronic industry. They are chemically very unreactive, and hence safe to work with. In fact, they are so inert that the natural reagents that remove most atmospheric pollutants do not react with them, so after many years they drift up to the stratosphere where short-wave UV light dissociates them. CFC's were invented in 1928, but only came into large-scale production after ~1950. Since that year, the total amount of chlorine in the stratosphere has increased by a factor of 4.



The thinning of the ozone layer results in an increased exposure to UV rays from the Sun. In humans, this can cause diseases like skin cancer and cataract and may also result in a reduced resistance to diseases. Humans are also indirectly affected. Too much UV rays will damage plant tissues and destroy crops, thus reducing food production. Also, planktons – basic source of food for marine life – would be killed, and this will affect the entire ecosystem. Strong UV rays have also been known for deforming fish larva. In the end, all these would result in catastrophic damage to the world's ecological balance.

C) LAND POLLUTION

Soil gets polluted from both the domestic and industrial wastes as specified in the case of water pollution. The most important pollutants of soil in India are, human excreta, by way of passing stool in open fields and all along the railway tracks through the open toilets of the Indian Railways. Pesticides and Chemical fertilizers used indiscriminately and widely for agriculture and other purposes.

Apart from causing most illness due to infection of the digestive system, the pesticides, chemical fertilizers etc. enter the human food chain and accumulate in human tissues in high concentration, e.g. DDT in fat and milk.

Every single day, tons and tons of domestic waste ranging from fish bones to huge pieces of rubbish such as unused refrigerator waste. If all these wastes are not disposed of properly, the damage they can do to the environment and humankind can be extremely devastating. While waste collected from homes, offices and industries may be recycled or burnt in incinerators, a large amount of rubbish is neither burnt nor recycled but is left in certain areas marked by the government as dumping grounds. With the rising standards of living, we throw away more things and there is an increase in the quantity of solid waste. This has given rise to problems, as new dumping grounds have to be found.

Besides domestic waste, pesticides and herbicides used by farmers to increase crop yields also pollute the land when they are washed into the soil. Industrial activities also contribute to land pollution. For example, in open cast mining, enormous holes are dug in the ground and these form dangerously deep mining pools. Heaps of mining waste is left behind and these waste often contain many poisonous substances that will contaminate the soil.

Unhealthy dumping groundsThe sources and methods of Soil Pollution

Sources	Methods
Agriculture	<ul style="list-style-type: none"> • Accumulation of animal manures • Excessive input of chemical fertilizers • Illicit dumping of tainted crops on land
Mining and Quarrying	<ul style="list-style-type: none"> • Using of explosives to blow up mines • Using of machineries which emits toxic byproducts and leaks to the ground
Sewage sludge	<ul style="list-style-type: none"> • Improper sanitation system causes sludge to leak at surrounding soil
Dredged spoils	<ul style="list-style-type: none"> • Improper method of dredging at fertile land causes soil infertility, leaving the soil more prone to external pollution
Household	<ul style="list-style-type: none"> • Improper waste disposal system causes waste accumulation • Improper sanitation system
Demolition and construction	<ul style="list-style-type: none"> • Non biodegradable rubbles or debris which are not cleared settled in the soil undergo chemical reactions and increase soil toxicity
Industrial	<ul style="list-style-type: none"> • Poisonous/toxic emissions of gases which are not filtered or neutralized

Statistically, it has been shown that pollution causes

- Loss of 6 million hectares of land per year
- Loss of 24 billion tons of topsoil per year
- Loss of minimum 15 million acres prime agricultural land to overuse and mismanagement
- Desertification of land results in the loss of 16 million per square miles of world's land surface

The causes for such devastation are generally due to two forms of malpractices

1. Unhealthy soil management methods

- Improper tillage of soil in which excessive tillage result in the deterioration of soil structure
- Non-maintenance of a proper supply of organic matter in the soil from the imbalance composition of the reserves of organic matter especially nitrogen, phosphorus and sulfur unplenished supply after cultivation of vegetation, leaving the soil prone to soil infertility, unable to stabilize the soil physicality which ultimately led to desertification
- Irregular maintenance of a proper nutrient supply of trace elements gives rise to the use of excessive synthetic fertilizers, which are non biodegradable and accumulate in the soil system which eventually destroys useful organisms such as bacteria, fungi and other organisms
- Improper maintenance of the correct soil acidity which ultimately disrupts the adaptation of various crops and native vegetation of different soils as the solubility of minerals present will be affected. In a more acidic soil, minerals tend to be more soluble and washed away during rainfall while alkaline soil, minerals are more insoluble which form complex minerals unable to be absorbed into the flora system physiological usage. .

2. Improper irrigation practices

- Poorly drained soil result in salt deposits leading to high soil salinity that inhibit plant growth and may lead to crop failure
- Un irrigated land giving rise to stagnation of agriculture waste products which accumulates and increases land toxicity and also decreasing irregular irrigation leads to decreasing moisturization of land for soil medium and replenishments of solvents for minerals

D) NOISE POLLUTION

The acoustic world around us continuously stimulates the auditory system. The brain selects relevant signals from the acoustic input, but the ear and the lower auditory system are continuously receiving stimulation. This is a normal process and does not necessarily imply disturbing and harmful effects. The auditory nerve provides activating impulses to the brain,

which enable us to regulate our vigilance and wakefulness necessary for optimum performance.

Problems associated with noise-induced hearing loss go back to the Middle Ages. The workers in certain professions such as blacksmithing, mining, and church bell ringing were known to become deaf after years of work. However, with industrial development, the number of workers exposed to excessive noise increased significantly as has the number of people exposed to other sources of noise such as transportation noise and loud music.

In industrialized societies of today, the risk of occupational noise-induced hearing loss mostly is being met by efficient technical and other countermeasures. The occupational health authorities are now much more observant of the problem than before. In developing countries, the risk for much increased rates of occupationally acquired hearing loss have to be met by strong preventive measures in engineering and medicine.

Sound is produced by any vibrating body and is transmitted in air only as a longitudinal wave motion. It is, therefore, a form of mechanical energy and is typically measured in energy-related units. For listeners sound is defined as acoustic energy in the frequency range from 20,000 Hz to below 20 Hz that is typical of the human auditory system. The sound output of a source constitutes its power and the intensity of sound at a point in space is defined by the rate of energy flow per unit area. Intensity is proportional to the mean square of the sound pressure and, as the range of this variable is so wide, it is usual to express its value on a logarithmic scale, in decibels (dB). Sound pressure has the unit Pascal (Pa), while sound pressure level has the unit dB. The effects of noise depend strongly upon frequency of sound-pressure oscillation.

Noise pollution can be defined as unwanted or offensive sounds that unreasonably intrude into our daily activities. It has many sources, most of which are associated with urban development: road, air and rail transport; industrial noise; neighborhood and recreational noise. A number of factors contribute to problems of high noise levels, including: increasing population, particularly where it leads to increasing urbanization and urban consolidation; activities associated with urban living generally lead to increased noise levels, increasing volumes of road, rail and air traffic.

The common sources of noise are,

- Machinery Noise, Noise from Industrial Plants
- Transportation Noise
- Road traffic
- Rail traffic
- Air traffic
- Sonic booms
- Construction Noise, Public Works Noise and Military Noise
- Building Services Noise

- Domestic Noise
- Noise from Leisure Activities

A report on the social costs of land transport showed the following effects of noise pollution,

- Productivity losses due to poor concentration,
- Communication difficulties or fatigue due to insufficient rest
- Health care costs to rectify loss of sleep,
- Hearing problems or stress
- Lowered property values
- Loss of psychological well being.

The WHO suggests that noise can affect human health and well-being in a number of ways, including annoyance reaction, sleep disturbance, interference with communication, performance effects, effects on social behavior and hearing loss. Noise can cause annoyance and frustration as a result of interference, interruption and distraction. Activity disturbance is regarded as an important indicator of the community impact of noise.

A Survey done in Australia has revealed two major disturbances related to noise, namely, listening activities and sleep: 41% of respondents reported experiencing disturbance to listening activities and 42% to sleep.

Research into the effects of noise on human health indicates a variety of health effects. People experiencing high noise levels (especially around airports or along road/rail corridors) differ from those with less noise exposure in terms of: increased number of headaches, greater susceptibility to minor accidents, increased reliance on sedatives and sleeping pills, increased mental hospital admission rates. Exposure to noise is also associated with a range of possible physical effects including: colds, changes in blood pressure, other cardiovascular changes, increased general medical practice attendance, problems with the digestive system and general fatigue. There is fairly consistent evidence that prolonged exposure to noise levels at or above 80 dB (A) can cause deafness. The amount of deafness depends upon the degree of exposure

Radioactive Waste

The radioactive waste products from the nuclear industry must be isolated from contact with people for very long time periods. The bulk of the radioactivity is contained in the spent fuel, which is quite small in volume and therefore easily handled with great care. This "high level waste" will be converted to a rock-like form and emplaced in the natural habitat of rocks, deep underground. The average lifetime of a rock in that environment is one billion years. If the waste behaves like other rock, it is easily shown that the waste generated by one nuclear power plant will eventually, over millions of years (if there is no cure found for cancer), cause one death from 50 years of operation. By comparison, the wastes from coal burning plants that end up in the ground will eventually cause several thousand deaths from generating the same amount of electricity.

The 40's was the era where the first nuclear bomb is being developed, and that's why it's called the nuclear era. However, nuclear energy has already researched back since 1900. Nuclear era reached its greatest peak in the world war, by showing its massive ability of destroying things. Nuclear energy is a form of energy that's released by the splitting of atoms. Since scientists have found a way to make use of the energy, it has also been used to generate electricity. Nuclear energy has been recognized as a clean energy because it doesn't release pollutants such as CO₂ to the atmosphere after its reaction that could damage our environment. It's also known that nuclear energy has reduced the amount of greenhouse gas emission, reducing emissions of CO₂ for about 500 million metric tons of carbon.

Despite the advantage of nuclear as a clean energy, the big concern is the waste resulted from nuclear reaction, which is a form of pollution, called radioactivity. Radioactivity is a form of radiation (a form of energy that travels through space). Some elements in this world are naturally radioactive while some others are made to be. Radioactivity is emitted when a radioactive element become unstable and begin to decay in the attempt to regain their molecular stability. When an element decays, it emits energy and small particles. If it's still radioactive, it will repeat the process, until it finally regains its molecular stability and stop decaying. The time that it takes for half way of decaying process is called half-life, and this differs for each radioactive element. It possibly takes up to 4.5 billion years (Uranium 238) and as short as 8 days (Iodine 131). This process constantly remains, not considering external factors such as pressure or temperature. This process is expressed in units called Becquerels. One Becquerel is equal to one disintegration of nuclei per second.

There are commonly three types of radiation, namely:

- **Alpha** particles can be blocked by a piece of paper and human skin.
- **Beta** particles can penetrate through skin, while can be blocked by some pieces of glass and metal.
- **Gamma** rays can penetrate easily to human skin and damage cells on its way through, reaching far, and can only be blocked by a very thick, strong, massive piece of concrete

Sources and methods of Radioactive Pollution

Major sources	Methods of pollution
Nuclear power plants	<ul style="list-style-type: none"> • The waste resulted, in form of radioactivity, brings hazard when unsafely maintained • Nuclear power plant accidents, if radioactive core is exposed and meltdown is occurring and releasing high amount of radioactivity, will endanger the life and surrounding environment.
Nuclear weapon	<ul style="list-style-type: none"> • Nuclear weapon tests that are conducted

	<ul style="list-style-type: none">above ground or under waterNuclear bombing such as what have happened in Hiroshima and Nagasaki will create a vast and thorough devastation in a short time.
Transportation	<ul style="list-style-type: none">Transportation of nuclear wastes from one place to another, by any forms of transportation (air, land, water, sea) will possibly bring serious hazards to the environment if they are not maintained carefully and/or facing accidents.
Disposal of nuclear waste	<ul style="list-style-type: none">The decaying process of radioactive wastes takes a very long time in progress. Some radioactive substances have a half-life of more than 10,000 years, which means they are dangerous in that great amount of time. A half-life is the 'period of time required for the disintegration of half of the atoms in a sample of a radioactive substance' (Britannica). There are common ways to dispose nuclear waste (nuclear wastes are resulted from many kinds of use, for example medical use, mining, etc.): burying under ground very deeply and burying under the sea, and even an idea that to send them to outer space. However, they are still dangerous and expensive. Science is still on its way finding a better way to solve this problem.
Uranium mining	<ul style="list-style-type: none">Uranium, substance that is used in nuclear power plants, is harvested from uranium mining. Uranium mining results in radioactive waste that pollutes the surrounding environment.

CHAPTER: 8

ALTERNATIVE MEDICINE THERAPIES

Introduction.

According to the WHO, in the USA 158 million of the Adult population use alternate & complimentary medical therapies. 78% of the Canadian population has used complimentary therapies. In Africa 80% of the population uses traditional medicine for primary health care. Traditional medicines are also widely used in India, especially in its villages where 80% of its people live. Many of these traditional Medical Systems date back thousands of years & have survived because they are both effective & safe.

Some better known Alternative & Complimentary Therapies include, Ayurveda, Accupuncture, Homeopathy, Naturopathy, Yogatherapy, Nutrition Therapy, Psychotherapy & also Physical therapy. Each of these systems have stood the test of time & have existed successfully for thousands of years. We mention briefly the guiding principles of some of these therapies here.

AYURVEDA

Ayurveda is the ancient Indian medical science, the origin of which can be traced back to the Vedas, the ancient books of knowledge and science.

Ayurveda is a holistic healing science with comprises of two words. *Ayu* and *Veda*. *Ayu* means life and *Veda* means knowledge or science. So the literal meaning of the word Ayurveda is the science of life. Ayurveda is a science dealing not only with treatment of disease but is a complete way of life.

Ayurveda is not an ordinary medical science, dealing only with disease and treatments. It is more than that. It describes about the advantageous life style. A life style, if followed that will be advantageous for the individual as well as for the society. It advises the activities and the life style, which do not disturb the natural balance of the body and the society. So, as a result there is happiness and peace at the individual level and the level of the society. Similarly Ayurveda also explains about the life style, which is disadvantageous for the individual and the society. This includes all those activities, which create an imbalance like not speaking the truth, indulging in violence, having envy, ego, and greed and not respecting the elders. Also there is a very good description about what is happy life and how one can achieve this.

According to Ayurveda, life is a combination of mind, body, senses and soul. All these four have to be present together in a person. In the absence of anyone of them, the life will not exist appropriately.

Ayurveda is not only limited to body or physical symptoms but also gives a comprehensive knowledge about spiritual and mental aspects of health. According to the above definition, a person is said to be healthy, when all three *doshas* are balanced, all the seven *dhatus* (body tissues) are in a balanced state, all the thirteen types of fires or *agnis* are working in a balanced form, all the excretory functions are perfect and balanced. Not only that, all the

senses are working properly, the mind and the soul are happy. Health according to Ayurveda is not merely getting rid of the physical symptoms of the disease, but the person has to have a happy mind and soul too.

There are two basic aims of Ayurveda.

- To maintain the health of healthy people.
- To cure the diseases of the sick people

The first part describes about various diets, like styles and remedies, by following which, a healthy person can maintain his health and can increase his life span. This part of Ayurveda is also known as hygiene. The second part describes about various diseases, their diagnosis and treatments etc. This part has a relation with the first, in a way because most diseases according to Ayurveda are caused due to not following the instructions given in the first part. The maintenance of health is possible by maintaining the equilibrium of the *doshas*, which is maintained by following proper diet, life style, regulated sleep etc.

Ayurveda is an eternal as well as universal science. According to the Ayurvedic texts the knowledge of Ayurveda was well practiced in the higher planets before it descended to the earth. According to Vedas there are a lot of other planets on which exist even higher forms of life.

Tridosha is a term used for three types of bodily humors. Tri means three and the literal meaning of the word *dosha* is fault. They are called *dosha* or faults because the imbalance of these three causes faults or diseases in the body. As long as there is equilibrium of these three *doshas* or *tridosha* the body remains healthy. They are spread all over the body. The three *doshas* are named as *vata*, *pitta* and *kapha*. *Vata* can be compared to air, *pitta* to fire and *kapha* to water. As the world is maintained by air, sun and moon, the body is maintained by the *tridosha* in a similar way.

There are 80 types of diseases, which are caused due to aggravation of *vata* in the body. Diseases like arthritis, constipation, insomnia, numbness, anxiety, depression, paralysis etc. are caused due to aggravation of *vata*.

There are 20 types of diseases caused by aggravation of *kapha*. Diseases like nausea, anorexia, weak digestion, drowsiness, excessive sleep, lassitude, cough, congestion in the chest, difficult breathing and obesity are caused by aggravation of *kapha*.

This psychophysical nature of the individual is known as *prakrit* or constitution. Though each one of us has all the three *doshas*, the proportion varies. The constitution of the individual is decided by the predominant *dosha*.

Depending upon the predominance of *dosha* there are seven types of Ayurvedic constitution.

- *Vata*
- *Pitta*
- *Kapha*
- *Vata-pitta*

- *Vata-kapha*
- *Pitta-kapha*
- *Vata-pitta-kapha.*- This is the best type of constitution but is very rare.

For instance, a person with *pitta* (fire) type constitution will most likely smoke too many cigarettes, take too much tea, coffee or alcohol and eat foods like tomatoes, spinach, chilies, etc., which are hot. As all these increase *pitta* in the body they will cause an imbalance of *doshas* in the body and the person is likely to suffer from urinary tract infections, fevers, skin diseases or liver disorders.

A *vata* type person is more likely to have *vata* type diseases like arthritis, constipation, insomnia, anxiety, dry skin, paralysis, migraine, palpitation, weak memory etc. The knowledge of constitution helps in the treatment of diseases too. So an Ayurveda physician always checks for the constitution of the patient before prescribing medicine. In this way he can avoid many side effects while treating the patient

A *kapha* type person is usually sedentary, overeats sweets & rich foods,& is overweight. This personality suffers from asthma, allergies, depression, diabetes, HBP,& CHD. *Kapha* can be balanced by eating a moderate diet, doing daily exercise, & having sufficient sleep.

ACUPUNCTURE

Acupuncture is a therapy based on the principle that there is a connection between the organs of the body and the body surface. When an organ is diseased, the sufferer sometimes feels a tender spot on or beneath the skin. Acupuncture specialist hold that these tender spots disappear when the organ is healed, no matter how the organ is treated, (i.e. either by allopathic medicine or any other means) acupuncture itself involves the healing of organs by stimulation of these sore acupuncture points. Acupuncture is an ancient Chinese art dating back to 3000 BC.

Acupuncture literally means of puncture, (“acu”, means needle, “puncture” means puncture). Even while acupuncture has spread throughout the world, it is most widely practised in China. In most Chinese hospitals and medical universities, modern medicine and Chinese medicine (i.e. Acupuncture) function side by side. The Chinese describe 1000 acupuncture points and categorize them into twelve main groups.

All the points belonging to one group are joined by an imaginary line called a meridian and the twelve meridian control, various organs including the genitals, liver, gall bladder, lung, spleen, small intestine, bladder, large intestine, stomach, heart, kidney, etc. In addition to these twelve meridians, there are two more one for the front of the body and one for the back. Stimulation along the meridians benefits not only the organs associated, but also the surrounding areas and tissues. Modern research is shedding new light on how acupuncture might work, but there seem to be no definite answers however US researchers claim that the brain releases natural healing endorphins in response to acupuncture.

Usually acupuncture points are stimulated with a needle, however in shiatsu the stimulation is done with the fingertips. Acupuncture needles are usually made of stainless steel and once the relevant point is located, the needle or needles are inserted and left in position for a few seconds. Some specialists vibrate, or heat the needle for enhanced effect. Some patients feel

relief immediately whereas others feel benefit after a few days, some need four or five treatments.

Acupuncture is painless and the needles are lightly inserted; there is no benefit in a deep insertion at all. Usually treatment is carried out once or twice a week. Acupuncture is credited with an 80% cure rate. Acupuncture is useful in the treatment of headache, menstrual problem, digestive ailments, rheumatic conditions, etc, but is best utilized for pain relief and China, acupuncture is used frequently in place of general anesthesia for various surgical operations. Acupuncture is well accepted in China and Japan, with over 500,000 doctors practising acupuncture, in the US, Europe, and even India, its practice is less popular

AROMATHERAPY

Most of us are aware that plants contain chemical substance of various kinds that can be extracted and used in the benefit of mankind specifically, aromatherapy uses the essence from plants rather than the plant themselves. These aromatic oils are extracted from the root of a plant as in colomus, or the flower as in Lavender, the leaves as in rosemary and bark as in sandalwood and in modern days these aromatic oils are widely used in toiletries of pharmaceuticals. Sandalwood used for cosmetics and clove oil and eucalyptus in medicines are good examples. The ancient Egyptian's probably did the most of aromatherapy thousands of years ago, and when the pharos tombs were opened recently, pots of frankincense and myrrh. Were found as proof of usage.

The Greeks and Romans too used aromatherapy widely and in more recent times Frenchman Battenforse proved that Lavender oil healed burn wounds and M. Boddestart reported its excellent results when dealing with skin cancers and gangerine. The father of modern aromatherapy however is Dr. Valnet, a Frenchman who used aromatherapy widely for wounded soldiers during the IIInd world war in 1945.

The aromatic essence extracted from plants are complex natural oils that can be taken orally inhaled through the nostrils or massaged through the skin, and have been found to reduce blood pressure, improve circulation, relax the patient, and even improve healing.

More specifically the various aromatic products including camphor, Lavender, sandlwood, pepper, Cardamom, jasmine, jumper, rose, orange blossom, eucalyptus, Lemon, pepper mint, sage, thyme, frankincense, myrrh, clove chamomile, have been successfully used in acne, asthma, Bronchitis, Burns, acidity, constipation, cough and cold, depression, Eczema, fever, headache, ulcers, vomiting, senusitis, sore throat, toothache etc. this natural therapy has been found to work time and again and with no side effects, in the limited ailments mentioned

BIOCHEMIC

Biochemistry is that branch of science which treats the composition of living substance and the process of its formation. However common usage describes Biochemistry as the treatment of disease by Biochemic salts that as a result of their deficiency cause the disease.

An analysis of the body shows it to contain organic and inorganic matter. The organic matter comprises Protein, Carbohydrate and fats from Nutrition. The inorganic matter comprises water and minerals. These minerals are commonly called cell salts and include, lime, izon, potash, soda, magnesium and silica.

Health is a state of the body when all the various tissues of the body are in a normal condition due to the tissues having the requisite amount of cell salts. Disease is an altered state of the tissue produced by some deficiency. A cure compared in restoring the normal cell growth by furnishing a minimal dose of the deficient inorganic salt. The treatment of disease by supplying the needed tissue salt is called Biochemic treatment.

Biochemic remedies are prepared in the form of powders and tablets. The usual dose for adults is 5 celloids (5 grains) and half of that for children – given 2/3 times a day, morning, noon and night.

Biochemistry is a method of treatment discovered by Dr. Shussler in 1873, in which supplying to the body its deficient cell salts restores the body's health. Dr Shussler identified 12 biochemical salts which were tissue builders and the body's vitality and health was dependent upon the distribution of these salts in the cells.

These 12 biochemical salts known, as tissue salts are not drugs and have no side effects. They are prepared homeopathically such that they are easily assimilated and immediately spell health and vitality by restoring the body's balance.

The 12 inorganic salts used in Biochemics are: –

- **Cal Phose** – useful in malnutrition, growth, recuperation after illness and for healthy bones and teeth.
- **Far Phose** – useful in anemia, bleeding piles, menstruation, hemorrhage.
- **Kali Phose** – useful in nervous disorders, insomnia, fatigue, depression, headache.
- **Natrum Phose** – useful in hyper-acidity, vomiting, bile, indigestion.
- **Mag Phos** – useful in cramps, muscle, pain, colic.
- **Kali Mur** – useful in dysentery, indigestion, pneumonia, diphtheria etc.
- **Nat Mur** – good for headache, toothache, Leucorrhoea etc.
- **Nat Sulph** – useful in gastric, biliousness, liver disease etc.
- **Kali Sulph** – Good for skin ailments and inflammations.
- **Cal Fluorica** – useful in piles, tumors and gumboils etc.
- **Cal Sulph** – useful in different suppurations.
- **Silica** – good for healthy hair, and all ailments attendant with pus formations.

The advancement of mankind, man tends to suffer from complex ailments and a combination of diseases in order to cover the complexity of ailments a set of biochemical combinations have been established for usage.

Biochemic salts are used in the USA, UK, and in Asia (particularly in India) and are supplied alongside Homeopathy remedies. People who take Biochemics (and there are million of

them) claim considerable results and practising Homeopaths recommend its usage as a practical self help and first aid kit. In the ailments that are treatable by these inorganic salts

HOMEOPATHY

Homeopathy is a system of medical practise that treats a disease by the admistration of minutes doses of a remedy.

The word ‘homeopathy’ is derived from two Greek words, Homoios meanings similar and pathos meanings suffering. Homeopathy simply means treating disease with remedies, described with remedies, prescribed in minutes doses, which are capable of producing symptoms similar to the disease when taken by healthy people. It is based on the homeopathy principle “Similia Siilibus Curantur” which means “Likes Are Cured By Likes” The early Indians recognized this principle and stated that poison is the medicine for poision (Vishasya Vishamevam Anushadam) , but it was Dr. Samuel Hahnemann, who through his studies and experiment on the various medicines is the medicine available in nature, practically proved the law.

Dr. Samuel Christian Fredricke Hahnemann, a German Physician (1755 – 1843) is the founder of homeopathy. He discovered the principle that whatever a substances, it could also cure those symptoms.

In India, The Homeopathy Central council Act has recognized Homeopathy as one of the National Systems of Medicine, 1973. Homeopathy came to India as early as 1810 when a French traveller Dr. Honigberger who learnt Homeopathy from Dr. Samuel Hahnemann visited India. In 1839 Dr. John Martin Honigberger was called to treat Maharaja Ranji Singh, the ruler of Punjab for paralysis of vocal cords. The Maharaja was relieved of his complaints and in return Dr. Honiberg received valuable rewards and made officer in charge of a hospital. Dr. Honiberg later on went to Calcutta and started practise there. This royal patronage helped the system to have its roots in India. A large number of missionaries practised Homeopathy extensively and spread this system mostly in Bengal and Southern parts of India.

Law of Similars

It is also called the Law of Cure and is the guide to prescribe in curable as well as incurable cases. Homeopathy is based on the principle of “Similia Siilibus Curantur” Law of similars, which means – Let like be treated by likes. It signifies a system of treated which the prescription is based on the similarity of symptoms of the patient, to those of a drug as obtained during proving of the drug on healthy human beings.

Law of Minimum

The minimum dose should be given to stimulate the human organism and to produce perceptible change. The dose varies in each patient. The similar remedy selected is prescribed in a minimum dose, so that when administered there are no toxic effects on the body. It just acts as a triggering and catalytic agent to stimulate and strengthen the existing defense mechanism of the body.

Concept of Disease

Homeopathy regards man as a whole and treats a man in disease, not the disease in man. This is a key point and unique to homeopathy. It may sound strange but homeopathy does not treat disease per se. The concept of disease in homeopathy is that ‘Disease’ is a total affection of mind and body, the disturbance at the inner level is the cause of illness. A homeopathy therefore does not limit his treatment to painful joints, inflamed bronchi or malignant growth. Rather, he treats all aspects mental, emotional and physical of the patient.

Scope of Homeopathy

Homeopathy is ideal for infants and children. Most of the pediatric ailments like Cold, Cough, Fever, Vomiting, Diarrhea, Dysentery, Colic, Tonsillitis, Asthma, Measles, Chickenpox, Mumps, Dentition problem, etc., could be very effectively and quickly treated with homeopathy.

Viral infections such as common cold, influenza, measles, Chickenpox, mumps, viral hepatitis (jaundice), viral meningitis etc. are very well treated with Homeopathy.

Homeopathy offers very effective treatment in all allergic disease such as in various skin disease like Urticaria Eczema, Contact Dermatitis and also Asthmatic Bronchitis.

Homeopathy gives good results in the treatment of emotional disturbance such as excessive anxiety, irritability, insecurity, obsessive traits, undue jealousy, suspicion (paranoid) fears, depression, neurosis etc. Homeopathy is gaining popularity and also becoming a part of medical establishments, as an alternative holistic approach to health. With a track record proven over 200 years, Homeopathy is a natural medicine that is safe, non addictive; it is relatively inexpensive and treats the person as a whole.

Homeopathy is a highly scientific, logical. Safe, quick and an extremely effective method of healing. It offers permanent cure for most of the ailments.

CHIROPRACTIC AND OSTEOPATHY

Both these therapies manipulate the spine and other joints in order to maintain and restore good health. The word Chiropractic comes from the Greek words “Cheris” meaning hands and “praktitios” meaning done by. Chiropractic therefore means that which is done by the hand. The word Osteopathy is also derived from Greek, “Osteo” meaning bone and “pathos” meaning disease. Chiropractic originated in ancient Egypt; however ancient Hindus and Chinese also used similar manipulative techniques. Osteopathy had its origins in ancient Greek and Rome, where great emphasis was laid on the use of exercise manipulation to maintain a healthy body.

Today’s understanding of chiropractic is based on the work of a Canadian, Dr. Daniel Palmer who became the first president of the Chiropractic Association of USA. Today there are more than 30,000 Chiropractors in the US and Canada alone, where Chiropractic is recognized under state Law. Most practitioners undergo 4 year full time training and this discipline is most popular in Germany, but also recognized in much of Europe and Australia also. Chiropractic is a skill in which the joints of the body, especially the spine are manipulated by hand to rebalance the body’s function. Chiropractic works from the basic principle that modern life with its mental stresses, physical laziness, and postural imbalance produces abnormal stresses

on the joints and that by manipulation of the joints and correction of posture the correction of the joints will lead to balance and consequently good health. Usually a chiropractor examines the patient and pays special attention to this.

Spinal X ray. The objectives are:

- To correct distortion in posture.
- To restore functions of the joints and spine
- To remove irritation on the spinal nerves.

Chiropractic is especially good for back pain, slipped disc, neck pain, headaches, joint pains, arthritis spondioliosis as confirmed by its millions of users.

Dr. Andrew Still conceived osteopathy in the USA in 1870. Still was an Engineer and a Doctor and perceived the human body as a machine. His theory was that a lot of ailments can be explained as a physical malfunction of the body's various moving parts. Osteopathy is based on a scientific study of the human body, and comprises seven year course of study of ten found to be more tedious than a medical program. It is a recognized profession in the USA, where there are over 7,000 practising Osteopath. Osteopath believe that man's erect posture is the root of all medical problems, resulting in back pain and sciatica, they also confer that with the upright posture and downward pressure on the abdomen; piles, hernias and constipation results. An Osteopathic session starts with a consultation, medical history, laboratory tests and an X ray. The examination includes detection of changes in the bones, joints and muscles using the hands. The treatment comprises mainly manipulations of the affected parts so as to relieve the problem. Modern Osteopaths believe in a holistic approach, and also address emotional, dietary, postural and environmental issues as part of treatment, and not merely treating the spine and joints. The Backache is one of the major medical problems of modern man, and current medical science has not paid enough attention to this problem. Osteopathic achieve much better results with the back, neck and joints, and an Osteopath can succeed in minutes, where conventional medicine will take minutes also as a consequence of the intricate bone, nerve, spinal connections, Osteopathic achieve great success in correlated areas including migraine, asthma, bronchitis etc

HERBOLOGY

Herbology is the ancient system of using plants to prevent disease and cure ailments. There are more than 350,000 varieties of plants known to man and over 10,000 of these have known medicinal value. The practices of using plants for medicine dates before the existence of mankind, animals are known to eat various plants when sick. (anyone who has a dog or cat as a pet will see this happen frequently). Archeologists have discovered that all ancient civilizations, Egyptian, Chinese, Indian and Greek, all kept records of medicinal and herbal plants in day to day use and one third of modern medicinal drugs are derived directly from plant sources.

In fact the modern pharmacy industry has all but replaced Herbal medicines. There seems to be no academic programme in Herbology except in the surrounding local environment and not by distant factors. Meaning that one does not have to go to the Amazon forest, or to the Himalayas to find exotic cures, Local diseases will be cured by local products and plants. Beyond the Herb, all Herbologists dispose Lifestyle change in diet, activity, sleep and so on

as an essential part of the treatment. Herbal medicine is receiving great support from the cosmetic industry and Herbal shampoos and such like are now available worldwide. The world health organisation has also started projects in all countries to encourage the growth of this discipline to combat rising medical costs and abuse.

Britain and the British Herbal Medicine association scientific committee has recently published its new pharmacopia, under the authorship of several qualified botanists, which is being used worldwide as a reference source for Herbal cures.

Taken from this publication the association of plants with ailments includes. Mistletoe for blood pressure; onions and potatoes for burns, cinnamons and ginger for colds; prunes for constipation, black berry for diarrhea cardamom and turmeric for flatulence, lavender for headaches, tea for rheumatism, arnica for strains and bruises, clove for toothaches, peppermint for vomiting, and asthma etc. traditional Herbologists as still exist in Africa and other rural communities worldwide believe that remedies for most cures are available in the areas in and around a village or locality itself, since ailments are caused locally

NATUROPATHY

Naturopathy is a system of medicine, which prevents and treats a disease by using natural therapies, which increase the inherent healing capacity of the body, for the restoration of the homeostatic equilibrium and reversal of disease.

Naturopathy medicine integrates alternative medical practise, with modern scientific diagnostic methods. Naturopathic physician are trained in conventional medical disciplines as well as in alternative approaches. They integrate this knowledge according to principles that recognize the body's inherent ability to heal itself. It emphasises the importance of prevention and the therapeutic use of nutrition to promote health and fight disease.

Naturopathy is essentially a treatment process in which the natural remedies assist the patient to regain health by stimulating the body's healing forces. Naturopathy is not just a temporary treatment but also a healthy way of life. It is a way of helping people to increase their sense of harmony and well nature can lead to health. Our bodies, movements and thoughts must be harmonious with nature to have true health. Man being the product of nature is governed by nature. Man's life, health and existence is influenced and affected by nature.

Naturopathy does not reject the great discoveries of modern medicine. Naturopathy physician do not underrate the value of surgery in serious cases. They however suggest that if naturopathic treatment were stated earlier, far fewer cases would need surgery. Naturopaths do not reject other systems of medicine; they refer the patients to other doctors, when necessary.

History of Naturopathy

Since ancient times Natural therapies are being used for the treatment of disease. The healing value of water, herbs and exercises are known from a long time. Egyptians used massage, Greeks used exercise and the Romans used various kinds of baths for maintenance of health.

Naturopathy grew out of the alternative healing methods of the 18th and 19th centuries. Its philosophical roots are originated from the Hippocratic School of medicine. Hippocrates (450

BC) is considered the earliest naturopathic physician. Hippocrates knew the value of natural therapies. He uses to treat diseases with air, water, diet, fasting, herbs, massage and exercises. His basic tenet Vis Medicatrix Naturae (only nature heals) is the motto of Naturopathy.

Modern Naturopathy had its origin in Germany Vincent Prissnitz (1799 – 1851), from a small village named Grafenburg, in the Silesian Mountains, treated people with water, exercise, fresh air and wholesome natural foods. His method of healing attracted not only thousands of patients, but also many doctors, who realised the limitations of medicine alone. They became students of Pressnitz and developed and improved some therapeutics of naturopathic medicine.

Today Naturopathy has been highly developed in many countries and it is accepted as a safe and effective form of medical treatment. In 1983 the World Health Organization (WHO) recommended the integration of naturopathic medicine into Govt has recognised Naturopathy by The Indian Medicine Central Council Act. Naturopathy Doctors are fully qualified through conventional 5 1/2 years full time naturopathic medical training and are licensed by the Board of Indian Medicine, Government of India, to practise naturopathy

Therapeutics of Naturopathy

More than any other single method of treatment, Naturopathy is a multi disciplinary approach to illness and health. It comprises of several systems of Natural Therapies. It aims not only to treat disease, but also to promote health and to educate people towards improving their lifestyle in order to prevent illness.

The earliest Naturopathy used herbs, foods, water, fasting, exercise and massage. In addition to these therapies modern Naturopathy make practical use of the latest biochemical research involving nutrition, herbs and other natural treatments. Naturopaths employ natural treatments such as Detoxification; Clinical Nutrition; Physical therapies like physiotherapy, chromotherapy, hydrotherapy; Herbal medicine; Yoga therapy; and Psychological medicine; in their practice.

Naturopathic therapies can be employed to complement the treatment used by other systems of medicine. This helps the patients to receive the best overall treatment most appropriate to his or her specific medical condition.

PART – 2

Disease Management

Introduction to Disease Management

In the earlier part of the book, on Health Management, we provided an introduction to a range of traditional & alternative medical disciplines. Some of these therapies were born thousands of years ago. The latest & most up to date medical system is Allopathy It came into existence a little over a hundred years ago, & is currently in use globally. In this part of the book, we talk about the Management of Disease from this Allopathic perspective

The concept of **Disease Management**, as an integrated subject, covering both Communicable & Non Communicable Diseases is a relatively new one. The aim is to outline the risk factors for both types of diseases in a manner such that, they may be used to prevent disease and promote health. It is for this reason that the subject has been created for the Preventive and Promotive Health Care student.

The current trend in developed countries is the shift of the disease base from Communicable to Non Communicable. Even though countries like India have been part of the trend in the development of Non Communicable Diseases especially in Urban area, there is no evidence of a shift, rather, an addition to the already existing Communicable diseases has taken place.

In various chapters of this book, the medications normally prescribed against the various diseases, are mentioned. This is done with the objective of providing information to the student. It is not to be treated as a medical prescription in itself.

Prof. Adrian Kennedy Ph.D.

Dr. Arpan R. David MBBS, MDHM

CHAPTER 9:

CONCEPTS OF DISEASES

HISTORICAL PERSPECTIVE

Disease is as old as mankind itself. During prehistoric times of early man all diseases & afflictions were attributed to supernatural causes of God or Demon & the remedy as a consequence came from the priest or witch doctor. Early recorded medical practise are traced back to the Chinese from the period 2700 BC, the Egyptians dynasty, 2000 BC & Indian Medicine, dating back to 1000 BC.

In modern China the ancient practise of acupuncture has been integrated into modern Chinese Medicine. Similarly the Egyptian dynasty was adept in the use of drugs, herbs, which continues today, & the Indian Ayurvedic system has contributed Yoga & meditation practises to the modern world. It was Greeks however from 500 BC and Romans from 200 AD and the Europeans from 1600 AD to whom the credit for starting modern medicine is frequently given.

The Greeks contributed Hygeia and Panacea. Hygeia that is, Hygiene & preventive medicine and Panacea or cure, ie curative medicine, and the father of modern medicine is frequently referred to as Hippocrates 400 BC. The Romans succeeded the Greeks and added anatomy and surgery to medicine. The period 500 – 1500 AD or the middle ages is a dark period in medical history (i.e. after the fall of the Roman empire and before the rise of the European empire) This period was plagued with poor sanitation and resulted in infectious diseases like Plague, Leprosy etc. This gave rise to a resurgence of sanitation and public health and from the 16th century onwards modern medicine began to make itself felt.

CONCEPTS OF DISEASE

There have been many attempts to define disease. Webster defines disease as “a condition in which the body’s health is impaired, a departure from a state of health, an alteration of the human body, interrupting the performance of vital functions”. The Oxford English Dictionary defines disease as “a condition of the body or some part or organ of the body in which its functions are disrupted or deranged”. From an ecological point of view, disease is defined as maladjustment of the human organism to the environment”. From a sociological point of view, disease is considered a social phenomenon, occurring in all societies and defined in terms of the particular cultural forces prevalent in the society that cause disease. The simplest definition is, of course, that disease is just the opposite of health – i.e., any deviation from normal functioning or state of complete physical or mental well-being – since health and disease are mutually exclusive. All these definitions are considered inadequate because they do not give a criterion by which to decide when a disease state begins, nor do they lend themselves to measurement of disease.

The WHO has defined health but not disease. This is because disease has many shades ranging from in apparent cases to severe manifest illness. Some diseases commence acutely e.g., food poisoning, and some insidiously e.g., mental illness, rheumatoid arthritis. In some diseases, a “carrier” state occurs in which the individual remains outwardly healthy, but is able to infect others e.g., typhoid fever. In some cases, the same disease may be caused by more than one organism e.g., diarrhea. Some diseases have a short course, and some a

prolonged course. It is easy to determine illness when the signs and symptoms are manifest, but in many diseases the borderline between normal and abnormal is indistinct as in the case of diabetes, hypertension and mental illness. Finally the end-point or final outcome of disease is variable, recovery, disability or death of the host.

Distinction is also made between the words disease, illness and sickness, which are not wholly synonymous. The term “disease” literally means “without ease” uneasiness – disease, the opposite of ease – when something is wrong with bodily function. “Illness” refers not only to the presence of a specific disease, but also to the individual’s perceptions and behaviour in response to the disease, as well as the impact of that disease on the psychosocial environment. “Sickness” refers to a state of social dysfunction. Susser has suggested the following usage:

Disease is a physiological/psychological dysfunction;

Illness is a subjective state of the person who feels aware of not being well;

Sickness is a state of social dysfunction, i.e., a role that the individual assumes when ill “sickness role”.

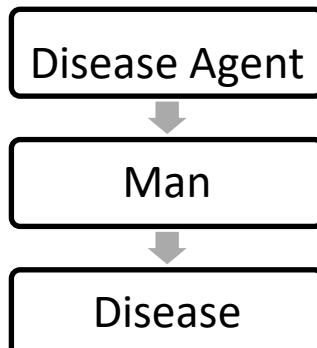
The clinician sees people who are ill rather than the diseases which he must diagnose and treat. However, it is possible to be victim of disease without feeling ill, and to be ill without signs of physical impairment. In short, an adequate definition of disease is yet to be found – a definition that is satisfactory or acceptable to the epidemiologist, clinician, sociologist and the statistician.

CONCEPT OF CAUSATION

Up to the time of Louis Pasteur 1895 AD, various concepts of disease causation were in vogue, e.g., the supernatural theory of disease, the theory of humors, the concept of contagion, miasmatic theory of disease, the theory of spontaneous generation, etc. Discoveries in microbiology marked a turning point in our knowledge of etiological concepts.

Germ theory of disease

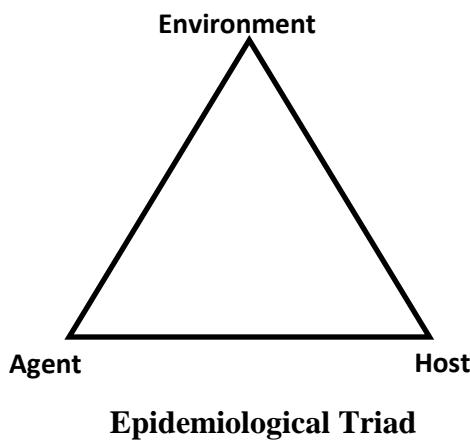
Mention has already been made about the germ theory of disease. This concept gained momentum during the 19th and the early part of 20th century. The emphasis has shifted from empirical causes (e.g., bad air) to microbes as the sole cause of disease. The concept of cause embodied in the germ theory of disease is generally referred to as a one-to-one relationship between causal agent and disease. The disease model accordingly is:



The germ theory of disease, though it was a revolutionary concept, led many epidemiologists to take one-sided view of disease causation. That is, they could not think beyond the germ theory of disease. It is now recognized that a disease is rarely caused by a single agent alone, but rather depends upon a number of factors, which contribute to its occurrence. Therefore modern medicine has moved away from the strict adherence to the germ theory of disease.

Epidemiological triad

The germ theory of disease has many limitations. For example, it is well known, that not everyone exposed to tuberculosis develops tuberculosis. The same exposure, however, in an undernourished or otherwise susceptible person may result in clinical disease. Similarly, not everyone exposed to beta-hemolytic streptococci develops acute rheumatic fever. There are other factors relating to the host and environment which are equally important to determine whether or not disease will occur in the exposed host. This demanded a broader concept of disease causation that synthesized the basic factors of agent, host and environment.



The above model – agent, host and environment – has been in use for many years. It helped epidemiologists to focus on different classes of factors, especially with regard to infectious diseases.

Multifactorial causation

The concept that disease is due to multiple factors is not a new one. Pettenkofer of Munich (1819-1901) was an early proponent of this concept. But the “germ theory of disease” or “single cause idea” in the late 19th century overshadowed the multiple cause theory.

As a result of advances in public health, chemotherapy, antibiotics and vector control communicable diseases began to decline – only to be replaced by new types of diseases, the so-called “modern” diseases of civilization, e.g., lung cancer, coronary heart disease, chronic bronchitis, mental illness, etc. These diseases could not be explained on the basis of the germ theory of disease nor could they be prevented by the traditional methods of isolation, immunization or improvements in sanitation. The realization began to dawn that the “single cause idea” was an oversimplification and that there are other factors in the aetiology of diseases – social, economic, cultural, genetic and psychological which are equally important.

As already mentioned, tuberculosis is not merely due to tubercle bacilli, factors such as poverty; overcrowding and malnutrition contribute to its occurrence. The doctrine of one-to-one relationship between cause and disease has been shown to be untenable, even for microbial diseases, e.g., tuberculosis, leprosy.

It is now known that diseases such as coronary heart disease and cancer are due to multiple factors. For example, excess of fat intake, smoking, lack of physical exercise and obesity are all involved in the pathogenesis of coronary heart disease. Most of these factors are linked to lifestyle and human behaviour. Epidemiology has contributed significantly to our present day understanding of multifactorial causation of disease. Medical men are looking "beyond" the "germ theory" of disease into the total life situation of the patient and the community in search of multiple (or risk) factors of disease.

Therefore new models of disease causation have been developed (e.g., multifactorial causation, web of causation) which de-emphasize the concept of disease "agent" and stress multiplicity of interactions between host and environment. Many epidemiologists prefer to regard the agent as an integral part of the total environment. The purpose of knowing the multiple factors of disease is to quantify and arrange them in priority sequence (prioritization) for modification or amelioration to prevent or control disease. The multifactorial concept offers multiple approaches for the prevention/control of disease.

NATURAL HISTORY OF DISEASE

Disease results from a complex interaction between man, and agent (or cause of disease) and the environment. The term natural history of disease is a key concept in epidemiology. It signifies the way in which a disease evolves over time from the earliest stage of the pre-pathogenesis phase to the termination as recovery, disability or death, in the absence of treatment or prevention. Each disease has its own unique natural history, which is not necessarily the same in all individuals, so much so, any general formulation of the natural history of disease is necessarily arbitrary.

The natural history of disease is best established by cohort studies. As these studies are costly and laborious, our understanding of the natural history of disease is largely based on other epidemiological studies, such as cross-sectional and retrospective studies, undertaken in different population settings, both national and international. What the physicians sees in the hospital is just an "episode" in the natural history of disease. The epidemiological, by studying the natural history of disease in the community setting is in a unique position to fill the gaps in our knowledge about the natural history of disease.

1. Prepathogenesis phase

This refers to the period preliminary to the onset of disease in man. The disease agent has not yet entered man, but the factors, which favour its interaction with the human host, already exist in the environment. This situation is frequently referred to as "man in the midst of disease" or "man exposed to the risk of disease". Potentially we are all in the prepathogenesis phase of many diseases, both communicable and non-communicable.

The causative factors of disease may be classified as AGENT, HOST and ENVIRONMENT. These three factors are referred to as epidemiological triad. The mere presence of agent, host and favorable environmental factors in the prepathogenesis period is not sufficient to start the disease in man. What is required is an interaction of these three factors to initiate the disease

process in man. The agent, host and environment operating in combination determine not only the onset of disease which may range from a single case to epidemics but also the distribution of disease in the community.

2. Pathogenesis phase

The pathogenesis phase begins with the entry of the disease “agent” in the susceptible human host. The further events in the pathogenesis phase are clear-cut in infectious diseases, i.e., the disease agent multiples and induces tissue and physiologic changes, the disease progress through a period of incubation and later through early and late pathogenesis. The final outcome of the disease may be recovery, disability or death. The pathogenesis phase may be modified by intervention measures such as immunization and chemotherapy.

It is useful to remember at this stage that the host’s reaction to infection with a disease agent is not predictable. That is the infection may be clinical or sub-clinical; typical or atypical or the host may become a carrier with or without having developed clinical diseases as in the case of diphtheria and poliomyelitis.

In chronic diseases (e.g., coronary heart disease, hypertension, cancer), the early pathogenesis phase is less dramatic. This phase in chronic diseases is referred to as presymptomatic phase. During the presymptomatic stage, there is no manifest disease. The pathological changes are essentially below the level of the “clinical horizon”. The clinical stage begins when recognizable signs or symptoms appear. By the time signs and symptoms appear, the disease phase is already well advanced into the late pathogenesis phase. In many chronic diseases, the agent-host-environmental interactions are not yet well understood.

AGENT FACTORS

The first link in the chain of disease transmission is a disease agent. The disease “agent” is defined as a substance, living or non-living, or a force, tangible or intangible, the excessive presence or relative lack of which may initiate or perpetuate a disease process. A disease may have a single agent, a number of independent alternative agents or a complex of two or more factors whose combined presence is essential for the development of the disease.

Disease agent may be classified broadly into the following groups.

1. Biological agents

These are living agents of disease, viz, viruses, rickettsiae, fungi, bacteria, protozoa and metazoa. These agents exhibit certain “host-related” biological properties such as: (i) infectivity: this is the ability of an infectious agent to invade and multiply (produce infection) in a host; (ii) pathogenicity: this is the ability to induce clinically apparent illness, and (iii) virulence: this is defined as the proportion of clinical cases resulting in severe clinical manifestations (including sequelae). The case fatality rate is one way of measuring virulence.

2. Nutrient agents

These can be proteins, fats, carbohydrate, vitamins, minerals and water. Any excess of deficiency of the intake of nutritive elements may result in nutritional disorders. Protein energy malnutrition (PEM), anemia, goiter, obesity and vitamin deficiencies are some of the current nutritional problems in many countries.

3. Physical agents

Exposure to excessive heat, cold humidity, pressure, radiation, electricity, sound, etc may result in illness.

4. Chemical agents

(i) Endogenous: Some of the chemicals may be produced in the body as a result of derangement of function, e.g., urea (uremia), serum bilirubin (jaundice), ketones (ketosis), uric acid (gout), calcium carbonate (kidney stones), etc: (ii) Exogenous: Agents arising outside of human host, e.g., allergens, metals, fumes, dust, gases, insecticides, et. These may be acquired by inhalation, ingestion or inoculation.

5. Mechanical agents

Exposure to chronic friction and other mechanical forces may result in crushing, tearing, sprains, dislocations and even death.

6. Absence, insufficiency, excess of, a factor necessary to health

These may be (i) Chemical factors: e.g., hormones (insulin, estrogen's, enzymes (ii) Nutrient factors (iii) Lack of structure: e.g., thymus (iv) Lack of part of structure, e.g., cardiac defects (v) Chromosomal factors, e.g., mongolism, turner's syndrome, and (vi) Immunological factors, e.g., agamaglobulinaemia.

7. Social agents

It is also necessary to consider social agents of disease. These are poverty, smoking, abuse of drugs and alcohol, unhealthy lifestyle, social isolation, maternal deprivation, etc. Thus the modern concept of disease "agent" is a very broad one; it includes both living and non-living agents

HOST FACTORS (INTRINSIC)

In epidemiological terminology, the human host is referred to as "soil" and the disease agent as "seed". In some situations, host factors play a major role in determining the outcome of an individual's exposure to infection (e.g., tuberculosis).

The host factors may be classified as (i) Demographic characteristics such as age, sex, ethnicity; (ii) Biological characteristics such as genetic factors; biochemical levels of the blood (e.g., cholesterol); blood groups and enzymes; cellular constituents of the blood; immunological factors; and physiological function of different organ systems of the body (e.g., blood pressure, forced expiratory ventilation), etc. (iii) Social and economic characteristics such as socio-economic status, education, occupation, stress, marital status, housing, etc. and (iv) Lifestyle factors such as personality traits, living habits, nutrition, physical exercise, use of alcohol, drugs and smoking, behavioural patterns, etc. The association of a particular disease with a specific set of host factors frequently provides an insight into the cause of disease.

ENVIRONMENTAL FACTORS (EXTRINSIC)

The study of disease is really the study of man and his environment. Hundreds of millions of people are affected by preventable diseases originating in the environment in which they live. For human beings the environment is not limited, as it normally is for plants and animals, to a set of climatic factors. For example, for man social and economic conditions are more important than the mean annual temperature. Thus, the concept of environment is complex and all-embracing. The external or macro-environment is defined as “all that which is external to the individual human host, living and non-living, and with which he is in constant interaction”. This includes all of man’s external surroundings such as air, water, food, housing etc.

For descriptive purposes, the environment of man has been divided into three components – physical, biological and psychosocial. It should be emphasized that this separation is artificial. They are closely related to each other and with host factors.

a. Physical environment

The term “physical environment” is applied to non-living things and physical factors (e.g., air, water, soil, housing, climate, geography, heat, light, noise, debris, radiation, etc.) with which man is in constant interaction. Man’s victory over his physical environment has been responsible for most of the improvement in health during the past century. In most developing countries, defective environment (e.g., lack of sanitation) continues to be the main health problem. Man has altered practically everything in his physical environment to his advantage. In doing so, he has created for himself a host of new health problems such as air pollution, water pollution, noise pollution, urbanization, radiation hazards, etc. The increasing use of electrical and electronic devices, including the rapid growth of telecommunication system (e.g., satellite systems), radiobroadcasting, television transmitters and radar installations have increased the possibility of human exposure to electromagnetic energy.

Man is living today in a highly complicated environment, which is getting more complicated as man is becoming more ingenious. If these trends continue, it is feared that the very “quality of life” we cherish may soon be in danger.

b. Biological environment

The biological environment is the universe of living things, which surrounds man, including man himself. The living things are the viruses and other microbial agents, insects, rodents, animals and plants. These are constantly working for their survival, and in this process, some of them act as diseaseproducing agents, reservoirs of infection, intermediate hosts and vectors of disease. Between the members of the ecological system (which includes man) there is constant adjustment and readjustment. For the most part, the parties manage to effect a harmonious inter-relationship, to achieve a state of peaceful co-existence, even though this may not be always enduring. When for any reason, this harmonious relationship is disturbed, ill health results. In the area of biological environment also, preventive medicine has been highly successful in protecting the health of the individual and of the community.

c. Psychosocial environment

It is difficult to define “psychosocial environment” against the background of the highly varied social, economic and cultural contexts of different countries and their social standards

and value systems. It includes a complex of psychosocial factors, which are defined as “those factors affecting personal health, healthcare and community well-being that stem from the psychosocial makeup of individuals and the structure and functions of social groups”. They include cultural values, customs, habits, beliefs, attitudes, morals, religion, education, lifestyles, community life, and health services, social and political organization.

In addition to this broad aspect of psychosocial environment, man is in constant interaction with that part of the social environment known as “people”. He is a member of a social group, the member of a family, of a caste, of a community and of a nation. Between the individual and other members of the group, there can be harmony or disharmony, interests and points of view that are shared or that are in conflict. The behaviour of one individual can affect others more or less directly; conflict and tension between the individual and the group as a whole or between the individual and other members of the group can yield great distress. The law of the land, customs, attitudes, beliefs, traditions, all regulate the interactions among groups of individuals and families.

The impact of social environment has both positive and negative aspects on the health of individuals and communities. A favourable social environment can improve health; provide opportunities for man to achieve a sense of fulfilment, and to the quality of life. Therefore, customs and traditions favouring health must be preserved. Beneficial social behaviour should be restored where it has disappeared due to social changes.

Psychosocial factors can also affect negatively man's health and wellbeing. For example, poverty, urbanization, migration and exposure to stressful situations such as bereavement, desertion, loss of employment, birth of a handicapped child may produce feelings of anxiety, depression, anger, frustration, and so forth; and these feelings may be accompanied by physical symptoms such as headache, palpitations as sweating. But these emotional states also produce changes in the endocrine, autonomic and motor systems, which, if prolonged and in interaction with genetic and personality factors, may lead to structural changes in various bodily organs. The resulting psychosomatic disorders include conditions such as duodenal ulcer, bronchial asthma, hypertension, coronary heart disease, mental disorders and socially deviant behaviour e.g., suicide, crime, violence, drug abuse. Of primary concern is coronary heart disease, which may be related to lifestyle and psychosocial stress. In many countries, road accidents are now the principal cause of death in young people. It is related to psychosocial states such as boredom, anxiety, frustration and other preoccupations that can impair attention.

Man today is viewed as an “agent” of his own diseases; his state of health is determined more by what he does to himself than what some outside germ or infectious agent does to him. For example, the medical cause of lung cancer may be a chemical substance in cigarettes, but the psychosocial cause in behavior, that is smoking. From a psychosocial point of view, disease may be viewed as maladjustment of the human organism to the psychosocial environment resulting from misperception, misinterpretation and misbehaviour. The epidemiologists today are as much concerned with psychosocial environment as with physical or biological environment, in search for etiological causes of disease.

Because of the fact that man exists concurrently in so many environmental contexts, it has become customary to speak of man in his “total environment”. The social environment is so inextricably linked with the physical and biological environments that it is realistic and necessary to view the human environment to promote health. A stable and harmonious

equilibrium between man and his environment is needed to reduce man's vulnerability to disease and to permit him to lead a more productive and satisfying life.

RISK FACTORS

For many diseases, the disease "agent" is still unidentified, e.g. coronary heart disease, cancer, peptic ulcer, mental illness, etc. Where the disease agent is not firmly established, the etiology is generally discussed in terms of "risk factors".

The term "risk factors" is used by different authors with at least 2 meanings:

1. An attribute or exposure that is significantly associated with the development of a disease
2. A determinant that can be modified by intervention, thereby reducing the possibility of occurrence of disease or other specified outcomes

Risk factors are often suggestive, but absolute proof of cause and effect between a risk factor and disease is usually lacking. That is, the presence of a risk factor does not imply that the disease will occur, and in its absence, the disease will not occur. The important thing about risk factors is that they are observable or identifiable prior to the event they predict. It is also recognized that a combination of risk factors in the same individual may be purely additive or synergistic, or multiplicative. For example, smoking and occupational exposure like shoe, leather, rubber, dye and chemical industries were found to have an additive effect as risk factors for bladder cancer. On the other hand, smoking was found to be synergistic with other risk factors such as hypertension and high blood cholesterol. That is, the effects are more than additive.

Risk factor may be truly causative e.g., smoking for lung cancer they may be merely contributory to the undesired outcome e.g., lack of physical exercise is a risk factor for coronary heart disease, or they may be predictive only in a statistical sense e.g., illiteracy for perinatal mortality.

Some risk factors can be modified; others cannot be modified. The modifiable factors include smoking, hypertension, elevated serum cholesterol, physical activity, obesity, etc. They are amenable to intervention and are useful in the care of the individual. The unmodifiable or immutable risk factors such as age, sex, race, family history and genetic factors are not subject to change. They act more as signals in alerting health professionals and other personnel to the possible outcome.

Risk factors may characterize the individual, the family, the group, the community or the environment. For example, some of the individual risk factors include age, sex, smoking, hypertension, etc. But there are also collective community risks – for example, from the presence of malaria, from air pollution, from substandard housing, or a poor water supply or poor health care services. The degree of risk in these cases is indirectly an expression of need. Therefore it is stated that a risk factor is a proxy for need – indicating the need for promotive and preventive health services. Epidemiological methods e.g., case control and cohort studies are needed to identify risk factors and estimate the degree of risk. These studies are carried out in population groups among whom certain diseases occur much more frequently than other groups. By such comparative studies, epidemiologists have been able to identify smoking as a risk for lung cancer; high serum cholesterol and high blood pressure as risk

factors for coronary heart disease. The contribution of epidemiology in the identification of risk factors has been highly significant.

The detection of risk factors should be considered a prelude to prevention or intervention. For each risk factor ascertained, the question has to be asked whether it can be reduced in a cost-effective way and whether its reduction will prevent or delay the unwanted outcome. Since the detection procedure usually involves whole populations, it bears some similarity to presymptomatic screening for disease.

RISK GROUPS

Another approach developed and promoted by WHO is to identify precisely the “risk group” or “target groups” e.g., at-risk mothers, at risk infants, at-risk families, chronically ill, handicapped, elderly in the population by certain criteria and direct appropriate action to them first. This is known as the “risk approach”. It has been summed up as ‘something for all, but more for those in need – in proportion to the need’. In essence, the risk approach is a managerial device for increasing the efficiency of health care services within the limits of existing resources. WHO has been using the risk approach in MCH services for sometime

Prominent Risk Factors

Disease	Risk factors
Heart disease	Smoking, high blood pressure, elevated serum cholesterol, diabetes, obesity, lack of exercise, type A personality.
Cancer	Smoking, alcohol, solar radiation, ionizing radiation, work-site hazards, environmental pollution, medications, infectious agents, dietary factors.
Stroke	High blood pressure, elevated cholesterol, Smoking.
Motor vehicle accidents	Alcohol, non-use of seat belts, speed, automobile design, roadway design
Diabetes	Obesity, diet
Cirrhosis of liver	Alcohol

Guidelines for defining at-risk groups

a. Biological situation

- Age group, e.g., infants, toddlers, elderly
- Sex, e.g., females in the reproductive age period
- Physiological state, e.g., pregnancy, cholesterol level, high blood pressure
- Genetic factors, e.g. family history of genetic disorders
- Other health conditions like disease, physical functioning, unhealthy behaviour

b. Physical situation

- Rural, urban slums
- Living conditions, overcrowding
- Environment; water supply, proximity to industries

c. Socio-cultural and cultural situation

- Social class
- Ethnic and cultural group
- Family disruption, education, housing
- Customs, habits and behaviour e.g., smoking, lack of exercise, over-eating, drug addicts
- Access to health services
- Lifestyles and attitudes

Modern epidemiology is concerned with the identification of risk factors and high-risk groups in the population. Since resources are scarce, identification of those at risk is imperative. It helps to define priorities and points to those most in need of attention. The knowledge of risk factors and risk groups can be used to prevent disease in so far as we are able to remove or minimize the risk.

ICEBERG OF DISEASE

A concept closely related to the spectrum of disease is the concept of the iceberg phenomenon of disease. According to this concept, disease in a community may be compared with an iceberg. The floating tip of the iceberg represents what the physician sees in the community, i.e., clinical cases. The vast submerged portion of the iceberg represents the hidden mass of disease, i.e., latent, unapparent, presymptomatic and undiagnosed cases and carriers in the community. The “waterline” represents the demarcation between apparent and unapparent disease.

In some diseases like hypertension, diabetes, anemia, malnutrition, mental illness the unknown morbidity i.e., the submerged portion of the iceberg far exceeds the known morbidity. The hidden part of the iceberg thus constitutes an important, undiagnosed reservoir of infection or disease in the community, and its detection and control is a challenge to modern techniques in preventive medicine. One of the major deterrents in the study of chronic diseases of unknown aetiology is the absence of methods to detect the sub clinical state – the bottom of the iceberg.

DISEASE MANAGEMENT

Disease control

The term “disease control” described ongoing operations aimed at reducing

1. The incidence of disease
2. The duration of disease, and consequently the risk of transmission
3. The effects of infection, including both the physical and psychosocial complications
4. The financial burden to the community.

Control activities may focus on primary prevention or secondary prevention; most control programs combine the two. The concept of tertiary prevention is comparatively less relevant to control efforts.

In disease control, the disease “agent” is permitted to persist in the community at a level where it ceases to be a public health problem according to the tolerance of the local population. A state of equilibrium becomes established between the disease agent, host and environment components of the disease process. An excellent embodiment of this concept is malaria control, which is distinct from malaria eradication.

Disease elimination

Between control and eradication, an intermediate goal has been described, called “regional elimination”. The term “elimination” is used to describe interruption of transmission of disease, as for example, elimination of measles, polio and diphtheria from large geographic regions or areas. Regional elimination is now seen as an important precursor of eradication.

Disease eradication

Eradication literally means to “tear out by roots”. Eradication of disease implies termination of all transmission of infection by extermination of the infectious agent. As the name implies, eradication is an absolute process, and not a relative goal. It is “all or none phenomenon”. The word eradication is reserved to cessation of infection and disease from the whole world.

Today, smallpox is the only disease that has been eradicated. So far no strategy for global eradication of any other disease has been developed and none is in sight. Every disease like every human being is unique with its own epidemiological characteristics and specific strategies for control.

During recent years, three diseases have been seriously advanced as candidates for global eradication within the foreseeable future: polio, measles and dracunculosis. The feasibility of eradicating polio appears to be greater than that of other.

Experience gained from eradication programmes (e.g., malaria, yaws) has shown that once the morbidity of a disease reaches a very low level, a “residual” infection usually persists in the population leading to a state of equilibrium between the agent, host and environmental components of the disease process. In this situation, there are always hidden foci of infection,

unrecognized methods of transmission, and resistance of the vector or organism, all of which may again flare up when the agent-host-environment equilibrium is disturbed. Failure to understand this led to disappointment in the eradication programmes mounted against malaria, yaws, plague, kalaazar and yellow fever.

Monitoring and surveillance

According to standard dictionaries, the words monitoring and surveillance are almost synonymous. But in public health practice during the past 25 years they have taken on rather specific and somewhat different meanings:

1. Monitoring

Monitoring is “the performance and analysis of routine measurements aimed at detecting changes in the environment or health status of populations”. Thus we have monitoring of air pollution, water quality, growth and nutritional status, etc. It also refers to on-going measurement of performance of a health service or a health professional, or of the extent to which patients comply with or adhere to advice from health professionals.

In management, monitoring refers to “the continuous oversight of activities to ensure that they are proceeding according to plan. It keeps track of achievements, staff movements and utilization, supplies and equipment, and the money spent in relation to the resources available so that if anything goes wrong, immediate corrective measures can be taken.

2. Surveillance

Surveillance is defined in many ways. According to one interpretation, surveillance means to watch over with great attention, authority and often with suspicion. According to another, surveillance is defined as “the continuous scrutiny of the factors that determine the occurrence and distribution of disease and other conditions of ill health”. Surveillance programs can assume any character and dimension – thus we have epidemiological surveillance. Demographic surveillance, nutritional surveillance, etc.

The main objectives of surveillance are: (a) to provide information about new and changing trends in the health status of a population, e.g., morbidity, mortality, nutritional status or other indicators and environmental hazards, health practice and other factors that may affect health; (b) to provide feed-back which may be expected to modify the policy and the system itself and lead to redefinition of objectives, and (c) provide timely warning of public health disasters so that interventions can be mobilized.

According to the above definitions, monitoring becomes one specific and essential part of the broader concept embraced by surveillance. Monitoring requires careful planning and the use of standardized procedures and methods of data collection, and can then be carried out over extended periods of time by technicians and automated instrumentation. Surveillance, in contrast, requires professional analysis and sophisticated judgment of data leading to recommendations for control activities.

Sentinel surveillance

No routine notification system can identify all cases of infection or disease. A method for identifying the missing cases and thereby supplementing the notified cases is required. This is

known as “sentinel surveillance”. The sentinel data is extrapolated to the entire population to estimate the disease prevalence in the total population. The advantages of such a system are that the reporting biases are minimized, and feed-back of information to the providers is simplified.

Sentinel surveillance agencies could be interested and competent physicians or institutions in selected areas to report the cases of disease in their areas. This system would provide more valuable and detailed information than could be obtained from the traditional notification system. Finally, these sentinel sites could be developed into a notification system for providing more detailed information, which, in some settings, may be less costly than developing and maintaining an ongoing notification system.

Evaluation of control

Evaluation is the process by which results are compared with the intended objectives, or more simply the assessment of how well a program is performing. Evaluation should always be considered during the planning and implementation stages of a program or activity. Evaluation may be crucial in identifying the health benefits derived. Evaluation can be useful in identifying performance difficulties. Evaluation studies may also be carried out to generate information for other purposes, e.g., to attract attention to a problem, extension of control activities, training and patient management, etc.

CONCEPT OF PREVENTION

The goals of medicine are to promote health, to preserve health, to restore health when it is impaired, and to minimize suffering and distress. These goals are embodied in the word “prevention”. Successful prevention depends upon a knowledge of causation, dynamics of transmission, identification of risk factors and risk groups, availability of prophylactic or early detection and treatment measures, an organization for applying these measures to appropriate persons or groups, and continuous evaluation of and development of procedures applied.

It is not necessary (although desirable) to know everything about the natural history of a disease to initiate preventive measures. Often times, removal or elimination of a single known essential cause may be sufficient to prevent a disease. The objective of preventive medicine is to intercept or oppose the “cause” and thereby the disease process. This epidemiological concept permits the inclusion of treatment as one of the modes of intervention.

Levels of prevention

In modern day, the concept of prevention has become broad-based. It has become customary to define prevention in terms of four levels:

1. Primordial prevention
2. Primary prevention
3. Secondary prevention
4. Tertiary prevention

These levels of prevention are shown in relation to the natural history of disease. Authorities on preventive medicine do not agree on the precise boundaries between these levels, but that does not minimize their importance. For example, the supply of food supplements to a family could be primary prevention for some members, and secondary prevention or curative, for others. These differences of opinion are more semantic than substantive. A general discussion of these concepts is given below.

1. Primordial prevention

Primordial prevention, a new concept, is receiving special attention in the prevention of chronic diseases. This is primary prevention in its purest sense, that is, prevention of the emergence or development of risk factors in countries or population groups in which they have not yet appeared. For example, many adult health problems e.g., obesity, hypertension have their early origins in childhood, because this is the time when lifestyles are formed for example, smoking, eating patterns, physical exercise. In primordial prevention, efforts are directed towards discouraging children from adopting harmful lifestyles. The main intervention in primordial prevention is through individual and mass education.

2. Primary prevention

Primary prevention can be defined as “action taken prior to the onset of disease, which removes the possibility that a disease will ever occur”. It signifies interventions in the prepathogenesis phase of a disease or health problem e.g., low birth weight or other departure from health. Primary prevention may be accomplished by measures designed to promote general health and well being, and quality of life of people or by specific protective measures. These are discussed in detail elsewhere under “Mode of Intervention”.

Primary prevention is far more than averting the occurrence of a disease and prolonging life. It includes the concept of “positive health”, a concept that encourages achievement and maintenance of “an acceptable level of health that will enable every individual to lead a socially and economically productive life”. It concerns an individual’s attitude towards life and health and the initiative he takes about positive and responsible measures for himself, his family and his community.

The concept of primary prevention is now being applied to the prevention of chronic diseases such as coronary heart disease, hypertension and cancer based on elimination or modification of “risk factors” of disease. The WHO has recommended the following approaches for the primary prevention of chronic diseases where the risk factors are established:

a. Population (mass) strategy

b. High-risk strategy

a. Population (mass) strategy

Another preventive approach is “population strategy” which is directed at the whole population irrespective of individual risk levels. For example, studies have shown that even a small reduction in the average blood pressure or serum cholesterol of a population would produce a large reduction in the incidence of cardiovascular disease. The population approach is directed towards socio-economic, behavioral and lifestyle change.

b. High-risk strategy

The high-risk strategy aims to bring preventive care to individuals at special risk. This requires detection of individuals at high risk by the optimum use of clinical methods.

Primary prevention is a desirable goal. It is worthwhile to recall the fact that the industrialized countries succeeded in eliminating a number of communicable disease like cholera, typhoid and dysentery and controlling several others like plague, leprosy and tuberculosis, not by medical interventions but mainly by raising the standard of living primary prevention. And much of this success came even before immunization became universal routine. The application of primary prevention to the prevention of chronic disease is a recent development. To have an impact on the population, all the above three approaches primordial prevention, population strategy and high-risk strategy should be implemented, as they are usually complementary.

In summary, primary prevention is a “holistic” approach. It relies on measures designed to promote health or to protect against specific disease “agents” and hazards in the environment. It utilizes knowledge of the prepathogenesis phase of disease, embracing the agent, host and environment. The safety and low cost of primary prevention justifies its wider application. Primary prevention has become increasingly identified with “health education” and the concept of individual and community responsibility for health.

3. Secondary prevention

Secondary prevention can be defined as “action, which halts the progress of a disease at its incipient stage and prevents complications”. The specific interventions are early diagnosis e.g., screening tests, case finding programs and adequate treatment. By early diagnosis and adequate treatment, secondary prevention attempts to arrest the disease process; restore health by seeking out unrecognized disease and treating it before irreversible pathological changes have taken place; and reverse communicability of infectious diseases. It may also protect others in the community from acquiring the infection and thus provide at once secondary prevention for the infected individuals and primary prevention for their potential contacts.

Secondary prevention is largely the domain of clinical medicine. The health programs initiated by governments are usually at the level of secondary prevention. The drawback of secondary prevention is that the patient has already been subject to mental anguish, physical pain, and the community to loss of productivity. These situations are not encountered in primary prevention.

Secondary prevention is an imperfect tool in the control of transmission of disease. It is often more expensive and less effective than primary prevention. In the long run, human health, happiness and useful longevity will be achieved at far less expense with less suffering through primary prevention than through secondary prevention.

4. Tertiary prevention

When the disease process has advanced beyond its early stages, it is still possible to accomplish prevention by what might be called “tertiary prevention”. It signifies intervention in the late pathogenesis phase. Tertiary prevention can be defined as “all measure available to reduce or limit impairments and disabilities, minimize suffering caused by existing departures from good health and to promote the patient’s adjustment to irremediable conditions”.

For example, treatment, even if undertaken late in the natural history of disease may prevent sequelae and limit disability. When defect and disability are more or less stabilized, rehabilitation may play a preventable role. Modern rehabilitation includes psychosocial, vocational, and medical components based on teamwork from a variety of professions. Tertiary prevention extends the concept of prevention into fields of rehabilitation.

MODES OF INTERVENTION

“Intervention” can be defined as any attempt to intervene or interrupt the usual sequence in the development of disease in man. This may be by the provision of treatment, education, help or social support. Five modes of intervention have been described which form a continuum corresponding to the natural history of any disease. These levels are related to agent, host and environment and are shown in. They are:

1. Health promotion
2. Specific protection
3. Early diagnosis and treatment
4. Disability limitation
5. Rehabilitation

1. Health promotion

Health promotion is “the process of enabling people to increase control over, and to improve health”. It is not directed against any particular disease, but is intended to strengthen the host through a variety of approaches (interventions). The well-known interventions in this area are:

- a. Health education
- b. Environmental modifications
- c. Nutritional interventions
- d. Lifestyle and behavioural changes

a. Health education:

This is one of the most cost-effective interventions. A large number of diseases could be prevented with little or no medical intervention if people were adequately informed about them and if they were encouraged to take necessary precautions in time. Recognizing this truth, the WHO's constitution states that “the extension to all people of the benefits of medical, psychological and related knowledge is essential to the fullest attainment of health”. The targets for educational efforts may include the general public, patients, priority groups, health providers, community leaders and decision-makers.

b. Environmental modifications: A comprehensive approach to health promotion requires environmental modifications, such as provision of safe water; installation of sanitary latrines; control of insects and rodents; improvement of housing, etc. The history of medicine has

shown that many infectious diseases have been successfully controlled in western countries through environmental modifications, even prior to the development of specific vaccines or chemotherapeutic drugs. Environmental interventions are non-clinical and do not involve the physician.

c. Nutritional interventions: These comprise food distribution and nutrition improvement of vulnerable groups; child feeding programs; food fortification; nutrition education, etc.

d. Lifestyle and behavioral changes: The conventional public health measures or interventions have not been successful in making inroads into lifestyle reforms. The action of prevention in this case, is one of individual and community responsibility for health, the physician and in fact each health worker acting as an educator than a therapist. Health education is a basic element of all health activity. It is of paramount importance in changing the views, behavior and habits of people.

Since health promotion comprises a broad spectrum of activities, a well-conceived health promotion program would first attempt to identify the “target groups” or at-risk individuals in a population and then direct more appropriate message to them. Goals must be defined. Means and alternative means of accomplishing them must be explored. It involves “organizational, political, social and economic interventions designed to facilitate environmental and behavioral adaptations that will improve or protect health”.

2. Specific protection

To avoid disease altogether is the ideal, but this is possible only in a limited number of cases. The following are some of the currently available interventions aimed at specific protection: (a) immunization (b) use of specific nutrients (c) chemo prophylaxis (d) protection against occupational hazards (e) protection against accidents (f) protection from carcinogens (g) avoidance of allergens (h) the control of specific hazards in the general environment, e.g., air pollution, noise control (i) control of consumer product quality and safety of foods, drugs, cosmetics, etc.

The term “health protection” which is quite often used is not synonymous with specific protection. Health protection is defined as “The provision of conditions for normal mental and physical functioning of the human being individually and in the group. It includes the promotion of health, the prevention of sickness and curative and restorative medicine in all its aspects”. In fact, health protection is conceived as an integral part of an overall community development programme, associated with activities such as literacy campaigns, education and food production. Thus health protection covers a much wider field of health activities than specific protection.

3. Early diagnosis and treatment

A WHO Expert Committee defined early detection of health impairment as “the detection of disturbances of homoeostatic and compensatory mechanism while biochemical, morphological, and functional changes are still reversible.” Thus, in order to prevent overt disease or disablement, the criteria of diagnosis should, if possible, be based on early biochemical, morphological and functional changes that precede the occurrence of manifest signs and symptoms. This is of particular importance in chronic diseases.

Early detection and treatment are the main interventions of disease control. The earlier a disease is diagnosed and treated, the better it is from the point of view of prognosis and preventing the occurrence of further cases or any long term disability. It is like stamping out the “spark” rather than calling the fire brigade to put out the fire.

Strictly speaking, early diagnosis and treatment cannot be called prevention because the disease has already commenced in the host. However, since early diagnosis and treatment intercepts the disease process, it has been included in the scheme of prevention, in as much as the goal of prevention is “to oppose or intercept a cause to prevent or dissipate its effect.”

Early diagnosis and treatment though not as effective and economical as “primary prevention” may be critically important in reducing the high morbidity and mortality in certain diseases such as essential hypertension, cancer cervix and breast cancer. For many others such as tuberculosis, leprosy and STD’s, early diagnosis and treatment are the only effective mode of intervention.

Early effective therapy has made it possible to shorten considerably the period of communicability and reduce the mortality from acute communicable diseases.

Mass treatment: A mass treatment approach is used in the control of certain diseases, viz. yaws, pinta, bejel, trachoma and malaria. The rationale for a mass treatment programme is the existence of at least 4-5 cases of latent infection for each clinical case of active disease in the community. Patients with a latent (incubating) infection may develop disease at any time. In such cases, mass treatment is a critical factor in the interruption of disease transmission. There are many variants of mass treatment – total mass treatment, juvenile mass treatment, selective mass treatment, depending upon the nature and prevalence of disease in the community.

4. Disability limitation

When a patient reports late in the pathogenesis phase, the mode of intervention is disability limitation. The objective of this intervention is to prevent or halt the transition of the disease process from impairment of handicap.

Concept of disability

The sequences of events leading to disability and handicap have been stated as follows:



The WHO has defined these terms as follows:

(i) Impairment: “Any loss or abnormality of psychological, physiological or anatomical structure or function”, e.g., loss of foot, defective vision or mental retardation. Impairment may be visible or invisible, temporary or permanent, progressive or regressive. Further, one impairment may lead to the development of “secondary” impairments as in the case of

leprosy where damage of nerves (primary impairment) may lead to planter ulcers (secondary impairment).

(ii) Disability: Because of impairment, the affected person may be unable to carry out certain activities considered normal for his age, sex, etc. This inability to carry out certain activities is termed “disability”. A disability is an activity in the manner or within the range considered normal for a human being”.

(iii) Handicap: As a result of disability, the person experiences certain disadvantages in life and is not able to discharge the obligations required of him and play the role expected of him in society. This is termed “handicap”, and is defined as “a disadvantage for a given individual, resulting from impairment or a disability that limits or prevents the fulfilment of a role that is normal (depending on age, sex and social and cultural factors) for that individual”.

Disability Prevention

Another concept is “disability prevention”. It relates to all the levels of prevention: (a) reducing the occurrence of impairment, viz. immunization against polio (primary prevention); (b) disability limitation by appropriate treatment (secondary prevention); and (c) preventing the transition of disability into handicap (tertiary prevention).

The major causes of disabling impairments in the developing countries are communicable diseases, malnutrition, low quality of perinatal care and accidents. These are responsible for about 70 per cent of cases of disability in developing countries. Primary prevention is the most effective way of dealing with the disability problem in developing countries.

5. Rehabilitation

Rehabilitation has been defined as “the combined and coordinated use of medical, social, educational and vocational measures for training and retraining the individual to the highest possible level of functional ability. It includes all measures aimed at reducing the impact of disabling and handicapping conditions and at enabling integration has been defined as the active participation of disabled and handicapped people in the mainstream of community life.

Rehabilitation medicine has emerged in recent years as a medical specialty. It involves disciplines such as physical medicine or physiotherapy, education, social work, vocational guidance and placement services. The following areas of concern in rehabilitation have been identified:

1. Medical rehabilitation – restoration of function
2. Vocational rehabilitation – restoration of the capacity of earn a livelihood.
3. Social rehabilitation – restoration of family and social relationships
4. Psychological rehabilitation – restoration of personal dignity and confidence.

Rehabilitation is no longer looked upon as an extracurricular activity of the physician. The current view is that the responsibility of the doctor does not end when the “temperature touches normal and stitches are removed”. The patient must be restored and retrained “to live and work within the limits of his disability but to the hilt of his capacity”. As such medical rehabilitation should start very early in the process of medical treatment.

Examples of rehabilitation are: establishing schools for the blind, provision of aids for the crippled, reconstructive surgery in leprosy, muscle re-education and graded exercises in neurological disorders like polio, change of profession for a more suitable one and modification of life in general in the case of tuberculosis, cardiac patients and others. The purpose of rehabilitation is to make productive people out of non-productive people. Health for all by 2000 AD aims at providing "rehabilitation for all".

It is now recognized that rehabilitation is a difficult and demanding task that seldom gives totally satisfactory results; but needs enthusiastic cooperation from different segments of society as well as expertise, equipment and funds not readily available for this purpose even in affluent societies. It is further recognized that interventions at earlier stages are more feasible, will yield results and are less demanding of scarce resources.

CHANGING PATTERN OF DISEASE

Although diseases have not changed significantly through human history, their patterns have. It is said that every decade produces its own pattern of disease. The truth of this will be obvious when one compares the leading causes of death in the developed countries at the beginning of this century and now.

Leading Causes of Death in the United States 1900 and 1994	
Cause of death	Percentage deaths from all other causes 1900
Pneumonia and influenza	11.8
Tuberculosis	11.3
Diarrhea and enteritis	8.3
Heart disease	8.0
Cerebrovascular disease	6.2
Chronic nephritis	4.7
Accidents	4.2
Cancer	3.7
Certain diseases of infancy	3.6
Diphtheria	2.3
Percentage of Deaths from all causes 1994	
Heart disease	32.1
Cancer	23.5

Cerebrovascular disease	6.8
Accidents	3.9
Chronic obstructive pulmonary disease	4.5
Pneumonia and influenza	3.6
Diabetes	2.4
Suicide	1.4
Chronic liver diseases and cirrhosis	1.1
HIV infection	1.8
All other causes	18.9

CHAPTER: 10

SCREENING FOR DISEASES

ICEBERG PHENOMENON OF DISEASE

Epidemiologist and others who study disease find that the pattern of disease in hospitals is quite different from that in a community. That is, hospitals have a far larger proportion of disease. Diseases like diabetes and hypertension are hidden from view in the community than is evident to physicians or to the general public. The analogy of an iceberg, only the tip of which is seen, is widely used to describe disease in the community.

The concept of the “iceberg phenomenon of disease” gives a better idea of the progress of a disease from its sub clinical stages to overt or apparent disease than the familiar spectrum of disease. The submerged portion of the iceberg represents the hidden mass of disease e.g., sub clinical cases, carriers, undiagnosed cases. The floating tip represents what the physician sees in his practice. The hidden part of the iceberg thus constitutes the mass of unrecognized disease in the community, and its detection and control is a challenge to modern techniques in preventive medicine

CONCEPT OF SCREENING

The active search for disease among apparently healthy people is a fundamental aspect of prevention. This is embodied in screening, which has been defined as “the search for unrecognized disease or defect by means of rapidly applied tests, examinations or other procedures in apparently healthy individuals.”

Historically the annual health examinations were meant for the early detection of “hidden” disease. To bring such examinations within the reach of large masses of people with minimal expenditures of time and money, a number of alternative approaches have come into use. They are based primarily on conserving the physician-time for diagnosis and treatment and having technicians to administer simpler, inexpensive laboratory tests and operate other measuring devices. This is the genesis of screening programs. The original screening programs were for individual diseases such as tuberculosis, syphilis or selected groups such as antenatal mothers, school children and occupational groups. Over the years, the screening is considered a preventive care function, and some consider it a longer extension of health care.

Screening differs from periodic health examinations in the following respects,

1. Capable of wide application
2. Relatively inexpensive, and
3. Requires little physician-time. In fact the physician is not required to administer the test, but only to interpret it.

SCREENING & DIAGNOSTIC TESTS

A screening test is not intended to be a diagnostic test. It is only an initial examination. Those who are found to have positive test results are referred to a physician for further diagnostic workup and treatment. Screening and diagnostic tests may be contrasted as in.

Screening and Diagnostic Tests Contrasted

Sl. no	Screening Test	Diagnostic Test
1	Done on apparently healthy	Done on those with indications or sick
2	Applied to groups	Applied to single patients, all disease are considered.
3	Test results are arbitrary and final	Diagnosis is not final but modified in light of new evidence, diagnosis is the sum of all evidence
4	Based on one criterion or cut-off-point (e.g., diabetes)	Based on evaluation of a number of symptoms, signs and laboratory findings
5	Less accurate	More accurate
6	Less expensive	More expensive
7	Not a basis for treatment	Used as a basis for treatment
8	The initiative comes from investigator or providing care	The initiative comes from a patient with a complaint

However, the criteria in are not hard and fast. There are some tests, which are used both for screening and diagnosis, e.g., test for anemia and glucose tolerance test. Screening and diagnosis are not competing and different criteria apply to each.

a. Screening

Strictly speaking, screening is testing for infection or disease in populations or in individual who are not seeking health care; for example, serological testing for AIDS virus in blood donors, neonatal screening, premarital screening for syphilis

b. Diagnostic tests

Use of clinical and / or laboratory procedures to confirm or refute the existence of disease or true abnormality in patients with signs and symptoms presumed to be caused by the disease; for example, VDRL testing of patients with lesions suggestive of secondary syphilis; endocervical culture for N. gonorrhoea.

The distinction between screening, and diagnosis should be clear-cut. Often, however, it is blurred by the multiplicity of tests used and the haphazard nature of diagnostic decision-making. Thus the same test may be used in different contexts for both screening and diagnosis. Each step may involve multiple tests as in the case of syphilis. In evaluating a test, then, one must consider whether it is for screening or diagnosis, alone or in conjunction with other tests.

CONCEPT OF “LEAD TIME”

Shows the possible outcomes for a given disease process. There is nothing to be gained in screening for disease whose onset is quite obvious. Detection programs should be restricted to those conditions in which there is considerable time lag between disease onset and the usual time of diagnosis. In this period, there are usually a number of critical points, which determine both the severity of the disease and the success of any treatment in reversing the disease process. There is clearly little value in detecting disease in advance of the usual time of diagnosis unless such detection precedes the final critical point beyond which treatment would be unsuccessful and / or permanent damage would be done. Detection programs should therefore concentrate on those conditions where the time lag between the disease's onset and its final critical point is sufficiently long to be suitable for population screening

USES OF SCREENING

a. Case detection

This is also known as “prescriptive screening”. It is defined as the presumptive identification of unrecognized disease, which does not arise from a patient's required, e.g., neonatal screening. In other words, people are screened primarily for their own benefit. Specific diseases sought by this method have included bacteriuria in pregnancy, breast cancer, cervical cancer, deafness in children, diabetes mellitus, iron deficiency anemia, PKU, pulmonary tuberculosis, hemolytic disease of the newborn, etc. Since medical and public health personnel initiate disease detection, they are under special obligation to make sure that appropriate treatment is started early.

b. Control of disease

This is also known as “prospective screening”. People are examined for the benefit of others, e.g., screening of immigrants from infectious diseases such as tuberculosis and syphilis to protect the home population; and screening for streptococcal infection to prevent rheumatic fever. The screening program may, be leading to early diagnosis permit more effective treatment and reduce the spread of infectious disease and / or mortality from the disease.

c. Research purposes

Screening may sometimes be performed for research purposes. For example, there are many chronic diseases whose natural history is not fully known (e.g., cancer, hypertension). Screening may aid in obtaining more basic knowledge about the natural history of such disease, as for example, initial screening provides a prevalence estimate and subsequent screening, an incidence figure. Where screening is done for research purposes, the investigator should inform the study participants that no follow-up therapy will be available.

d. Educational opportunities

Apart from possible benefits to the individual and the acquisition of information of public health relevance, screening programmers (as for example, screening for diabetes) provide opportunities for creating public awareness and for educating health professionals

TYPES OF SCREENING

Three types of screening have been described:

1. Mass screening
2. High risk or selective screening
3. Multiphase screening

1. Mass Screening

Mass screening simply means the screening of a whole population or a subgroup, as for example, all adults. It is offered to all, irrespective of the particular risk individual may run of contracting the disease in question (e.g., tuberculosis).

Mass screening for disease received enthusiastic support in the past. However, when a number of mass screening procedures were subjected to critical review, there appeared to be little justification for their use in many instances. Indiscriminate mass screening, therefore, is not a useful preventive measure unless it is backed up by suitable treatment that will reduce the duration of illness or alter its final outcome.

2. High risk or selective screening

Screening will be most productive if applied selectively to high-risk groups, the groups defined on the basis of epidemiological research. For example, since cancer cervix tends to occur relatively less often in the upper social groups, screening for cancer cervix in the lower social groups could increase the yield of new cases. One population subgroup where certain disease (e.g., diabetes, hypertension, breast cancer) tend to be aggregated is the family. By screening the other members of the family (and close relatives) the physician can detect additional cases.

More recently, epidemiologists have extended the concept of screening for disease to screening for “risk factors”, as these factors apparently antedate the development of actual disease. For example elevated serum cholesterol is associated with a high risk of developing coronary heart disease. Risk factors, particularly those of a pathophysiological nature such as serum cholesterol and blood pressure are amenable to effective interventions. In this way, preventive measures can be applied before the disease occurs. Besides effectiveness, economical use of resources will also occur if the screening tests are selectively applied to individuals in high risk group.

3. Multiphase screening

It has been defined as the application of two or more screening tests in combination to a large number of people at one time than to carry out separate screening tests for single diseases.

The procedure may also include a health questionnaire, clinical examination and a range of measurements and investigations (e.g., chemical and hematological tests on blood and urine specimens, lung function assessment, audiometry and measurement of visual acuity) – all of which can be performed rapidly with the appropriate staffing organization and equipment.

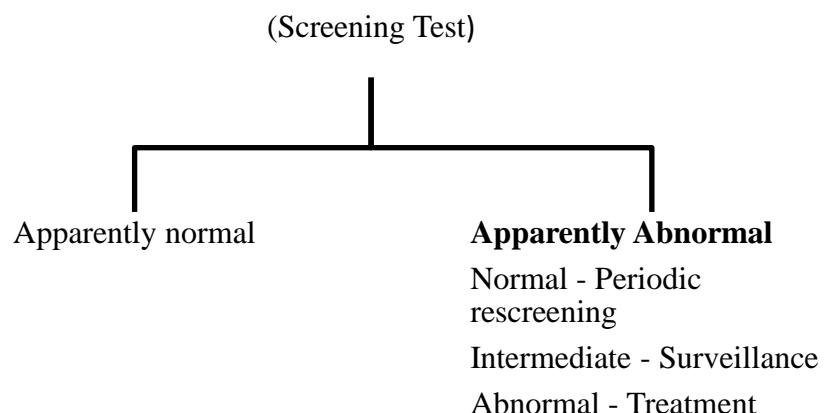
Multiphase screening has enjoyed considerable popularity until recently, when evidence from randomized controlled studies in UK and USA suggested that multiphase screening has not shown any benefit accruing to the population in terms of mortality and morbidity reduction. On the other hand, it has increased the cost of health services without any observable benefit. Furthermore, in multiphase screening, as currently practiced, most of the tests have not been validated. These observations have cast doubts on the utility of multiphase screening

AIMS & OBJECTIVES

The basic purpose of screening is to sort out from a large group of apparently healthy persons those likely to have the disease or at increased risk of the disease under study, to bring those who are “apparently abnormal” under medical supervision and treatment. Screening is carried out in the hope that earlier diagnosis and subsequent treatment favorably alters the natural history of the disease in a significant proportion of those who are identified as “positive”.

The Possible Outcomes of Screening

Apparently Healthy



CRITERIA FOR SCREENING

Before a screening program is initiated, a decision must be made whether it is worthwhile, considering ethical, scientific, and, financial justification. The criteria for screening are based on two considerations: the DISEASE to be screened, and the TEST to be applied.

Disease

The disease to be screened should fulfil the following criteria before it is considered suitable for screening:

1. The condition sought should be an important health problem (in general, prevalence should be high).
2. There should be a recognizable latent or early asymptomatic stage.
3. The natural history of the condition, including development from latent to declared disease, should be adequately understood (so that we can know at what stage the process ceases to be reversible).
4. There should be a test that can detect the disease prior to the onset of signs and symptoms.
5. Facilities should be available for confirmation of the diagnosis.
6. There is an effective treatment.
7. There should be an agreed-on policy concerning whom to treat as patients (e.g., lower ranges of blood pressure; border-line diabetes).
8. There is good evidence that early detection and treatment reduces morbidity and mortality.
9. The expected benefits (e.g., the number of lives saved) of early detection exceed the risks and cost.

When the above criteria are satisfied, then only, it would be appropriate to consider a suitable screening test.

THE SCREENING TEST

The test must satisfy the criteria of acceptability, repeatability and validity, besides others such as yield, simplicity, safety, rapidity, ease of administration and cost. Tests most likely to fulfill one condition may however, be least likely to fulfill another – for example, tests with greater accuracy may be more expensive and time consuming. The choice of the test must therefore often be based on compromise.

1. Acceptability
2. Repeatability
3. Validity (accuracy)
4. Yield

ACCEPTABILITY

Since a high rate of cooperation is necessary, it is important that the test should be acceptable to the people at whom it is aimed. In general, tests that are painful, discomforting or embarrassing (e.g., rectal or vaginal examinations) are not likely to be acceptable to the population in mass campaigns.

REPEATABILITY

An attribute of an ideal screening test or any measurement (e.g., height, weight) is its repeatability (sometimes called reliability, precision or reproducibility). That is, the test must give consistent results when repeated more than once on the same individual or material, under the same conditions. The repeatability of the test depends upon the same conditions. The repeatability of the test depends upon three major factors, namely observer variation,

biological (or subject) variation and errors relating to technical methods. For example, the measurement of blood pressure is poorly reproducible because it is subjected to all these three major factors

A. Observer variation

All observation is subjected to variation (or error). These may be of two types:

(i) Intra-observer variation:

If a single observe takes two measurements (e.g., blood pressure, chest expansion) in the same subject, at the same time and each time, he obtained a different result, this is termed as intra-observer or within-observer variation. This is variation between repeated observations by the same observe on the same subject or material at the same time. Taking the average of several replicate measurements at the same time may often minimize observer variation.

(ii) Inter-observer variation:

This is variation between different observers on the same subject or material, also known as between-observer variation. Inter-observer variation has occurred if one observer examines a blood-smear and finds malaria parasite, while a second observer examines the same slide and finds it normal.

The table below shows the results when 14,867 chest X-ray films were each read independently by the same eight radiologists.

Showing observer variation among radiologists

“Positive” No. readings	No. of films	Per cent
0/8	13,560	91,21
1/8	877	5.30
2/8	168	1.13
3/8	66	.44
4/8	42	.27
5/8	28	.19
6/8	23	.15
7/8	39	.26
8/8	64	.43

The results shown in the table are sobering and instructive. There was concurrence of all 8 readers that 91.21 per cent of the films had one or more positive readings.

Observations errors are common in the interpretation of X-rays, EG tracings, readings of blood pressure and studies of histopathological specimens. Observer errors can be minimized by (a) standardization of procedures for obtaining measurements and classification (b) intensive training of all the observers (c) making use of two or more observers for independent assessment, etc. It is probable that these errors can never be eliminated absolutely.

B. Biological (subject) variation

There is a biological variability associated with many physiological variables such as blood pressure, blood sugar, serum cholesterol, etc. The fluctuation in the variate measured in the same individual may be due to (a) Changes in the parameters observed: This is a frequent phenomenon in clinical presentation. For example, cervical smears taken from the same women may be normal one day and abnormal on another day. Myocardial infarction may occur without pain. Subject variation of blood pressure is a common phenomenon. (b) Variations in the way patients perceive their symptoms and answer: This is common subject variation. There may be errors in recollection of past events when a questionnaire is administered. When the subject is aware that he is being probed, he may not give correct replies. In short, subject variation can be a potential source of error in epidemiological studies. (c) Regression to the mean: An important example of biological variability is regression to the mean. There is a tendency for values at the extremes of a distribution, either very high or low, to regress toward the mean or average on repeat measurement. Many features of disease states vary considerably over time, for example, the pain of rheumatoid arthritis, stool frequency in ulcerative colitis, blood pressure in hypertension or the blood glucose in diabetes. This concept is particularly important to remember in evaluating the effects of a specific therapy on a variable such as the use of a specific drug to reduce blood pressure or serum cholesterol.

Whereas observer variation may be checked by repeat measurement at the same time, biological variation is tested by repeat measurements over time. This is due to the fact that measurement is done only on a tiny to sample of the normal distribution of the physiological variable

C. Errors relating to technical methods

Lastly, repeatability may be affected by variations inherent in the method, e.g., defective instruments, erroneous calibration, faulty reagents; or the test itself might be inappropriate or unreliable. Where these errors are large, repeatability will be reduced, and a single tests result may be unreliable

VALIDITY (ACCURACY)

The term validity refers to what extent the test accurately measures which it purports to measure. In other words, validity expresses the ability of a test to separate or distinguish those who have the disease from those who do not. For example, glycosuria is a useful screening test for diabetes, but a more valid or accurate test is the glucose tolerance test. Accuracy refers to the closeness with which measured values agree with “true” values

Validity has two components – sensitivity and specificity. When assessing the accuracy of a diagnostic test, one must consider both these components. Both measurements are expressed as percentages. Sensitivity and Specificity are usually determined by applying the test to one

group of persons having the disease, and to a reference group not having the disease. Sensitivity and specificity, together with “predictive accuracy” are inherent properties of a screening test

a. Sensitivity

Yerushalmy introduced the term sensitivity in the 1940s as a statistical index of diagnostic accuracy. It has been defined as the ability of a test to identify correctly all those who have the disease that is “true positive”. A 90 per cent sensitivity means that 90 per cent of the diseased people screened by the test will give a “true positive” result and the remaining 10 per cent a “false negative” result.

b. Specificity

It is defined as the ability of a test to identify correctly those who do not have the disease, that is, “true negatives”. 90 per cent specificity means that 90 per cent of the non-diseased persons will give “true negative” result, 10 per cent of non-diseased people screened by the test will be wrongly classified as “diseased “when they are not.

c. Predictive Accuracy

In addition to sensitivity and specificity, the performance of a screening test is measured by its “predictive value” which reflects the diagnostic power of the test. The predictive accuracy depends upon sensitivity, specificity and disease prevalence. The “predictive value of a positive test” indicates the probability that a patient with a positive test result has, in fact, the disease in question. The more prevalent a disease is in a given population, the more accurate will be the predictive value of a positive screening test. The predictive value of a positive result falls as disease prevalence declines.

d. False Negative and Positives

Whereas the epidemiologist thinks in terms of sensitivity and specificity, the clinician thinks in terms of false negatives and false positives.

False negatives: The term “false negatives” means that patients who actually have the disease are told that they do not have the disease. It amounts to giving them a “false reassurance”. The patient with a “false – negative” test result might ignore the development of signs and symptoms and may postpone the treatment. This could be detrimental if the disease in question is a serious one and the screening test is unlikely to be repeated within a short period of time. A screening test which is very sensitive has few “false negative”. The lower the sensitivity, the larger will be the number of false negatives.

False positives: The term “false-positive” means that patients who do not have the disease are told that they have. In this case, normal healthy people may be subjected to further diagnostic tests, at some inconvenience, discomfort, anxiety and expense – until their freedom from disease is established. A screening test with a high specificity will have few false positives. False positives not only burden the diagnostic facilities, but they also bring discredit to screening programs.

YIELD

“Yield” is the amount of previously unrecognized disease that is diagnosed as a result of the screening effort. It depends upon many factors, viz. sensitivity and specificity of the test, prevalence of the disease, and the participation of the individuals in the detection program. For example, by limiting a diabetes screening program to persons over 40 years, we can increase the yield of the screening test. High risk populations are usually selected for screening, thus increasing yield

COMBINATION OF TESTS

Two or more tests can be used in combination to enhance the specificity or sensitivity of screening. For example, syphilis screening affords an example whereby all screeners are first evaluated by an RPR test. This test has high sensitivity, yet will yield false positives. However, those entire positive to RPR are then submitted to FTA-ABS, which is a more specific test, and the resultant positives now truly have syphilis

PROBLEMS OF BORDERLINE

The question arises which of the two qualities (sensitivity or specificity) is more important in screening? No categorical answer can be given.

In screening for disease, a prior decision is made about the cut-off point, on the basis of which individuals are classified as “normal” or “diseased”. In making this decision, the following factors are taken into consideration:

1. **Disease prevalence:** When the prevalence is high in the community, the screening level is set at a lower level, which will increase sensitivity.
2. **The disease:** If the disease is very lethal (e.g., cervical cancer, breast cancer) and early detection markedly improves prognosis, a greater degree of sensitivity, even at the expense of specificity, is desired. In these cases, subsequent diagnostic work-up can be relied on to rule out the disease in the false positive. That is, a proportion of false-positives are tolerable but not false-negatives. On the other hand, in a prevalent disease like diabetes for which treatment does not markedly alter outcome, specificity must be high and early cases may be missed, but overburdened with diagnostic demands on the positives, both true and false. That is, high specificity is necessary when false-positive errors must be avoided. A useful index in making this decision is the predictive value of positive results that are true positives; it is a function of the sensitivity and specificity as well as the frequency of the disease.

There are various other points, which must also be taken into account in screening. First, people who participate in the screening program may not be those who have most to gain from it, as for example, those at greatest risk of cancer of the cervix uteri are least likely to attend for cervical cytology. Therefore screening must be applied selectively to those people most likely to benefit. Selection might be based on a person’s age, sex, medical history, occupation, family history or other factors. Secondly, tests with greater accuracy may be more expensive and time-consuming, and the choice of the test therefore often be based on compromise. Thirdly, screening should not be developed in isolation; it should be integrated into the existing health services. Lastly, the risks as well as the expected benefits must be

explained to the people to be screened. These risks include any possible complications of the examination procedures and the possibility of false-positive and false-negative test results.

Regardless of the approach taken to screening tests, regular patient follow-up visits are important (not to leave the patients high and dry) if effective health and medical care are to result from the effort.

Many screening tests were introduced in the past without subjecting them to rigid scrutiny. They were introduced because it was thought a good idea to detect and treat cases before they should reach an advanced stage. The modern view is that new screening programs should be introduced only after proper evaluation.

TRIALS

Randomized controlled trials

Ideally evaluation should be done by a randomized controlled trial in which one group (randomly selected) receives the screening test, and a control group, which receives no such test. Ideally RCT should be performed in the setting where the screening program will be implemented, and should employ the same type of personnel, equipment and procedures that will be used in that program. If the disease has a low frequency in the population, and a long incubation period (e.g., cancer) RCT may require following tens of thousands of people for 10-20 years with virtually perfect record keeping. The cost and logistics are often prohibitive.

Uncontrolled trials

Sometimes, uncontrolled trials are used to see if people with disease detected through screening appear to live longer after diagnosis and treatment than patients who were not screened. One such example is uncontrolled studies of cervical cancer screening, which indicated that deaths from the disease could be very much reduced if every woman was examined periodically.

OTHER METHODS

There are also other methods of evaluation such as case control studies and comparison in trends between areas with different degrees of screening coverage. Thus it can be determined whether intervention by screening is any better than the conventional method of managing the disease.

To conclude, the screening concept, filled with potential has been overburdened with problems, many of which remain unsolved. The construction of accurate tests that are both sensitive and specific is a key obstacle to the wide application of screening. Scientific and technical puzzles abound

CHAPTER: 11

IMMUNITY & DISEASE TRANSMISSION

1) CONCEPTS OF IMMUNITY

The Body's First Line of Defense

The immune system is a complex of organs – highly specialized cells and even a circulatory system separate from blood vessels – all of which work together to clear infection from the body.

- The organs of the immune system, positioned throughout the body, are called lymphoid organs. The word “lymph” in Greek means a pure, clear stream—an appropriate description considering its appearance and purpose.
- Lymphatic vessels and lymph nodes are the parts of the special circulatory system that carries lymph, a transparent fluid containing white blood cells, chiefly lymphocytes.
- Lymph bathes the tissues of the body, and the lymphatic vessels collect and move it eventually back into the blood circulation. Lymph nodes dot the network of lymphatic vessels and provide meeting grounds for the immune system cells that defend against invaders. The spleen, at the upper left of the abdomen, is also a staging ground and a place where immune system cells confront foreign microbes.
- Pockets of lymphoid tissues are in many other locations throughout the body, such as the bone marrow and thymus. Tonsils, adenoids, Peyer’s patches, and the appendix are also lymphoid tissues.

Both immune cells and foreign molecules enter the lymph nodes via blood vessels or lymphatic vessels. All immune cells exit the lymphatic system and eventually return to the bloodstream. Once in the bloodstream, lymphocytes are transported to tissues throughout the body, where they act as sentries on the lookout for foreign antigens

HOW IMMUNE SYSTEM WORKS

- Cells that will grow into the many types of more specialized cells that circulate throughout the immune system are produced in the bone marrow. This nutrient-rich, spongy tissue is found in the center shafts of certain long, flat bones of the body, such as the bones of the pelvis. The cells most relevant for understanding vaccines are the lymphocytes, numbering close to one trillion.
- The two major classes of lymphocytes are B cells, which grow to maturity in the bone marrow, and T cells, which mature in the thymus, high in the chest behind the breastbone.

- B cells produce antibodies that circulate in the blood and lymph streams and attach to foreign antigens to mark them for destruction by other immune cells.
- B cells are part of what is known as antibody-mediated or humoral immunity, so called because the antibodies circulate in blood and lymph, which the ancient Greeks called, the body's "humors".
- Certain T cells, which also patrol the blood and lymph for foreign invaders, can do more than mark the antigens; they attack and destroy diseased cells they recognize as foreign. T lymphocytes are responsible for cell-mediated immunity (or cellular immunity). T cells also orchestrate, regulate and coordinate the overall immune response.
- T cells depend on unique cell surface molecules called the major histocompatibility complex (MHC) to help them recognize antigen fragments.

Antibodies

- The antibodies that B cells produce are basic templates with a special region that is highly specific to target a given antigen. Much like a car coming off a production line, the antibody's frame remains constant, but through chemical and cellular messages, the immune system selects a green sedan a red convertible or a white truck to combat this particular invader.
- Antibodies produced by cells of the immune system recognize foreign antigens and mark them for destruction.
- However, in contrast to cars, the variety of antibodies is very large. Different antibodies are destined for different purposes. Some coat the foreign invaders to make them attractive to the circulating scavenger cells, phagocytes, that will engulf an unwelcome microbe.
- When some antibodies combine with antigens, they activate a cascade of nine proteins known as complement, that have been circulating in inactive form in the blood. Complement forms a partnership with antibodies, once they have reacted with antigen, to help destroy foreign invaders and remove them from the body. Still other types of antibodies block viruses from entering cells.

T Cells

- T cells have two major roles in immune defense. Regulatory T cells are essential for orchestrating the response of an elaborate system of different types of immune cells.

- Helper T cells, also known as CD4 positive T cells (CD4+ T cells), make B cells to start making antibodies; they also can activate other T cells and immune system scavenger cells called macrophages and influence which type of antibody is produced.
- Certain T cells, called CD8 positive T cells (CD8+ T cells), can become killer cells that attack and destroy infected cells. The killer T cells are also called cytotoxic T cells or CTLs (cytotoxic lymphocytes).

Immune system process

Activation of helper T cells

After it engulfs and processes an antigen, the macrophage displays the antigen fragments combined with a Class II MHC protein on the macrophage cell surface. The antigen-protein combination attracts a helper T cell, and promotes its activation.

Activation of cytotoxic T cells

After a macrophage engulfs and processes an antigen, the macrophage displays the antigen fragments combined with a Class I MHC protein on the macrophage cell surface. A receptor on a circulating, cytotoxic T cell recognize the antigen-protein complex and binds to it. The binding process and a helper T cell activate the cytotoxic T cell so that it can attack and destroy the diseased cell.

Activation of B cells to make antibody

A B-cell uses one of its receptors to bind to its matching antigen, which the B cell engulfs and processes. The B cell then displays a piece of the antigen, bound to a Class II MHC protein, on the cell surface. This whole complex then binds to an activated helper T cell. This binding process stimulates the transformation of the B cell into an antibody-secreting cell.

The immune system is a complex network of specialized cells and organs that has evolved to defend the body against attacks by “foreign” invaders. When functioning properly it fights off infections by agents such as bacteria, viruses, fungi, and parasites. When it malfunctions, however, it can unleash a torrent of diseases, from allergy to arthritis to cancer to AIDS.

The immune system evolved because we live in a sea of microbes. Like man, these organisms are programmed to perpetuate themselves. The human body provides an ideal habitat for many of them and they try to break in; because the presence of these organisms is often harmful, the body’s immune system will attempt to bar their entry or, failing that, to seek out and destroy them. The immune system, which equals in complexity the intricacies of the brain and nervous system, displays several remarkable characteristics. It can distinguish between “self” and “nonsel”. It is able to remember previous experiences and react accordingly; thus, once you have had chicken pox, your immune system will prevent you from getting it again. The immune system displays both enormous diversity and extraordinary specificity; not only is it able to recognize many millions of distinctive nonsel molecules, it can produce molecules and cells to math up with and counteract each one of them. And it has at its command a sophisticated array of weapons. The success of this system in defending the body relies on an incredibly elaborate and dynamic regulatory-communications network.

Millions and millions of cells, organized into sets and subsets, pass information back and forth like clouds of bees swarming around a hive. The result is a sensitive system of checks and balances that produces an immune response that is prompt, appropriate, effective, and self-limiting.

SELF AND NON-SELF

At the heart of the immune system is the ability to distinguish between self and nonself. Virtually every body cell carries distinctive molecules that identify it as self.

The body's immune defenses do not normally attack tissues that carry a self-marker. Rather, immune cells and other body cells coexist peaceably in a state known as self-tolerance. But when immune defenders encounter cells or organisms carrying molecules that say "foreign", the immune troops move quickly to eliminate the intruders.

Any substance capable of triggering an immune response is called an antigen. An antigen can be a virus, a bacteria, a fungus, or a parasite, or even a portion or product of one of these organisms. Tissues or cells from another individual, except an identical twin whose cells carry identical self-markers, also act as antigens; because the immune system recognize transplanted tissues as foreign, it rejects them. The body will even reject nourishing proteins unless they are first broken down by the digestive system into their primary, non-antigenic building blocks.

An antigen announces its foreignness by means of intricate and characteristic shapes called epitopes, which protrude from its surface. Most antigens, even the simplest microbes carry several different kinds of epitopes on their surface; some may carry several hundred. However, some epitopes will be more effective than others at stimulating an immune response. In abnormal situations, the immune system can wrongly identify self as nonself and execute a misdirected immune attack. The result can be a so-called autoimmune disease such as rheumatoid arthritis or systemic lupus erythematosus.

In some people, an apparently harmless substance such as ragweed pollen or cat hair can provoke the immune system to set off the inappropriate and harmful responses known as allergy in these cases the antigens are known as allergens.

Genes and the Markers of Self

Molecules that mark a cell as self are encoded by a group of genes that is contained in a section of a specific chromosome known as the major histocompatibility complex (MHC). The prefix "histo" means tissues; the MHC was discovered in the course of tissues transplantation experiments. Because MHC genes and the molecules they encode vary widely in the details of their structure from one individual to another (a diversity known as polymorphism), transplants are very likely to be identified as foreign and rejected by the immune system.

Scientists eventually discovered a more natural role for the MHC; it is essential to the immune defenses. MHC markers determine which antigens an individual can respond to, and how strongly. Moreover, MHC markers allow immune cells such as B cells, T cells and macrophages to recognize and communicate with one another.

One group of proteins encoded by the genes of the MHC are the markers of self that appear on almost all body cells. Known as class I MHC antigens, these molecules alert killer T cells to the presence of body cells that have been changed for the worse-infected with a virus or transformed by cancer-and that need to be eliminated.

A second group of MHC proteins, class II antigens, are found on B cells, macrophages, and other cells responsible for presenting foreign antigen to helper T cells. Class II products combine with particles of foreign antigen in a way that showcases the antigen and captures the attention of the helper T cell. This focusing of T cell antigen recognition through class I and class II molecules is known as MHC (or histocompatibility) restriction.

IMMUNIZING AGENTS

The immunizing agents may be classified as vaccines, immunoglobulins and antisera.

VACCINES

Vaccine is an immuno-biological substance designed to produce specific protection against a given disease.

It stimulates the production of protective antibody and other immune mechanisms. Vaccines may be prepared from live modified organism, inactivated or killed organisms, extracted cellular fractions, toxoids or a combination of these. Most recent are sub-unit vaccines and recombinant vaccines

a) Live Vaccines

Live vaccines are prepared from live (generally attenuated) organisms. These organisms have been passed repeatedly in tissue cultures in the laboratory and have lost the capacity to cause full blown disease but retain their immunogenicity. In general live vaccines are more potent immunizing agents than killed agents. This is because: –

- Live organisms multiply in the host and the resulting antigenic dose is higher than what is injected.
- Live vaccines have all the major and minor antigenic components.
- Live vaccines engage certain tissues of the body e.g. the polio vaccine engages the intestinal mucosa.
- There may be other reasons like the persistence of latent virus.

Live vaccines should not be administered to a person with immune deficiency disorders or diseases like leukaemia, lymphoma, other malignancies, corticosteroid therapy, therapy with anti-cancer drugs, treatment with radiation. Pregnancy is another contraindication unless the risk of infection is greater than the risk to the fetus.

- When two live vaccines are required to be given there should be ideally a gap of three weeks or can be given at different sites simultaneously.
- In case of live vaccines immunization is achieved generally with a single dose. Polio vaccines are an exception to this rule. Live vaccines produce a durable immunity.

- Live vaccines must be properly stored to retain effectiveness. Serious failures of immunization have occurred because failure to refrigerate properly.

Examples of live vaccines are:

1. **Bacterial:** BCG, Typhoid Oral, Plague
2. **Viral:** Oral Polio, Yellow Fever, Measles, Rubella, Mumps, Influenza
3. **Rickettsial:** Epi. Typhus

b) Inactivated or Killed vaccine

Organism killed by heat or chemicals, when injected into the body simulates active immunity.

- They are usually safe but generally less effective than live vaccines. For example cholera vaccine gives only 50 % protection.
- The efficacy of three doses Pertussis vaccine has 80% efficacy in the first three years and almost nil after 12 years of immunization.
- Such vaccines require a 2-3 dose schedule for adequate antibody response and in most cases booster injections are required.
- Killed vaccines are given subcutaneous or intramuscularly. The only contraindication to their use is a severe local or general reaction to a previous dose.

Examples of killed vaccines are:

1. **Bacterial:** Typhoid, Cholera, Pertussis, C.S.Meningitis, Plague
2. **Viral:** Rabies, Salk polio, Influenza, Hepatitis-B, Japanese, Encephalitis, Kyasanur Forest Disease
3. **Rickettsial:** Epi. Typhus

c) Toxoids

Certain organisms produce exotoxins e.g. Diphtheria, Tetanus bacilli. The toxins produced by these bacilli are detoxified and used in the preparation of vaccines. The antibodies thus produced neutralize the toxic moiety produced during infection. In general toxoid preparations are safe and efficacious immunizing agents.

d) Cellular Fractions

In some cases vaccines are prepared from extracted cellular fractions e.g from the polysaccharide cell wall fraction of the Meningococcal organism; pneumococcal vaccine from the polysaccharide contained in the capsule of the organism. Their efficacy and safety seem to be high

e) Combinations

If more than one kind of immunizing agent is included in the vaccine it is called a mixed or combined vaccine, the aim of combined vaccines is

- To simplify administration
- To reduce cost
- Minimize the number of contacts of the patient with the health system

Examples of some well known combination vaccines are,

- DPT Diphteria, Pertussis, Tetanus
- DT Diphteria, Tetanus
- DP Diphteria, Pertussis
- MMR Measles, Mumps, Rubella
- DPTP Diphteria, Pertussis, Tetanus
and Polio

Polyvalent vaccines are those, which are prepared from two or more strains of the same species.

Autogenous vaccines are prepared from samples from the same patient to whom it is administered.

Some vaccines are presented as plain vaccines, some as adjuvant vaccines and some as freeze-dried preparations.

Adjuvants are substances added to vaccines with the intent of potentiating the immune response so that a greater quantity of antibodies are produced, lesser amount of antigen is used, and fewer doses given.

Aluminium phosphate, Aluminium hydroxide, Water-in-oil are some of the adjuvants used.

Freeze-dried vaccines are more stable than liquid vaccines

IMMUNOGLOBULIN

The human immunoglobulin system is composed of 5 major classes

IgG IgM IgA IgD IgE

There are subclasses also within them,

These different classes of immunoglobulins have different functions in the body. All antibodies are immunoglobulins. The WHO recommends that all immunoglobulins be called gamma globulins.

IgG

This is the major immunoglobulin of serum. It comprises about 75% of total immunoglobulins. It has relatively smaller molecular weight (160,000). It can diffuse into interstitial fluids. It is largely extra vascular. It is the only class transported across the placenta. Antibodies to gram positive bacteria, anti-viral, and anti-toxic antibodies are among IgG immunoglobulins.

IgM

It accounts for about 10% of the immunoglobulin in the serum. It represents that antibody which is promptly formed with exposure to antigens. Its presence may be indicative of recent infection. Its half life is about 10 days.

IgA

It constitutes about 15% of the serum immunoglobulin, it has antibody activity against a wide variety of bacterial and viral antigens. It is found in body secretions like milk, colostrums, saliva, tears, bronchial secretions, nasal mucosa, prostatic fluid, vaginal secretions. It is the primary defense mechanism in the mucus membranes against local infection.

IgD

Normal serum carriers about 0.3 to 40mg per 100 ml. its half life is 2.8 days. Its main function has not been determined.

IgE

The serum level is 10-130 micrograms per 100ml. Its half life is 2.3 days. It is concentrated in sub-mucus tissues. It is the major antibody responsible for immediate allergic reactions.

Immunoglobulin Preparation

Two types of immunoglobulin preparations are available for passive immunizations. These are Normal human immunoglobulin and Specific human immunoglobulin

These are used in the prophylaxis of viral and bacterial infection. Also used in the replacement of antibodies in immuno-deficient patients.

Normal Human Immunoglobulin

It is an, antibody-rich fraction (Cohn Fraction II) obtained from a pool of at least 1000 donors. It is used to prevent measles in highly susceptible individuals. It is also used for temporary protection (upto 12 weeks) against Hepatitis-A infections for travelers to endemic areas. Live vaccines should not be given for 12 weeks after injection of normal human immunoglobulin. Also if a live vaccine has been taken the NH Ig injection should be deferred for 2 weeks.

Specific Human Immunoglobulin

The specific human immunoglobulin should have at least five times the antibody potential of the standard preparations per unit volume. These preparations are made from the plasma of patients who have recently suffered and recovered from an infection or are obtained from a patient who has been immunised recently against a specific infection. They therefore have a high antibody titre against a particular infection and provide immediate protection. It is used for chicken-pox prophylaxis and also for post-exposure prophylaxis of Hepatitis-B, rabies and Tetanus prophylaxis in the wounded. It is administered by intramuscular injection. It is painful for some. To obviate pain sometimes 1% procaine is mixed with it and it is given 4-6 gluteal sites if the total dose exceeds 5 ml peak blood level reach in 2 days after 1ml injections. Generally immunoglobulin should not be given shortly after or before active immunization. The half-life is 20-35 days.

Advantages of immunoglobulins are

- Freedom from, Hepatitis-B
- Concentration of antibodies into a small volume for intramuscular use

Stable antibody content if properly stored

Adverse reactions

Local

Local reactions like pain, sterile abscess especially with the high volume of the doses.

Systemic

It can be rapid when the reaction occurs rapidly within minutes of administering intramuscularly. Anaphylactic reactions like flushing, flank pain, dyspnoea, and signs of shock. It can be a late reaction, which may take several hours or days. These are urticaria, arthralgia, pyrexia and diarrhea.

ANTISERA OR ANTI TOXINS

The term antiserum is applied to materials prepared from animals. Originally passive immunization was performed with the help of antitoxins prepared from non-human sources. Since the human immunoglobulin preparations exist only for a small number of diseases, antitoxins prepared from non-human sources (against tetanus, diphtheria, botulism, gas gangrene, snake-bite) is still the mainstay of passive immunization. Administration of antisera may give rise to serious anaphylactic reaction leading to shock. This is due to abnormal sensitivity and is called **serum sickness**.

2) MODES OF DISEASE TRANSMISSION

The transmission of any communicable disease from a reservoir or a source of infection to a susceptible host takes place in many ways. It depends on the infectious agent, source of infection, portal of entry and the local ecological conditions.

As a rule the infectious agent is transmitted only by one route e.g. typhoid fever by vehicle or vector and common cold by direct contact, and others by several routes e.g. AIDS, Salmonellosis, Hepatitis-B, Brucellosis, and Tularemia etc.

The multiple transmission of infectious agent enhances the survival of the agent. The mode of transmission may be classified as follows:-

A. Direct Transmission

- Direct Contact
- Droplet infection
- Contact with Soil
- Inoculation into Skin or Mucosa
- Transplacental

B. Indirect Transmission

- Vehicle-borne
- Vector-borne
 - 1. Mechanical
 - 2. Biological
- Air-borne
- Fomite borne

A. DIRECT TRANSMISSION

Direct contact

Infection may be transmitted by direct contact from skin to skin or mucosa to skin of the same person.

This implies direct and essentially immediate transfer of infecting agent from the reservoir or the source to the susceptible host without an intermediate agency e.g. by touching, kissing, sexual intercourse or continued close contact. Direct contact not only ensures a larger dose of infection but also that the organism does not have to remain outside the human host. Diseases transmitted by direct contact are STD, AIDS, Leprosy, Skin infections, Eye infections.

Droplet infection

This is direct projection of a spray of droplets of saliva and Nasopharyngeal secretions during coughing and sneezing, speaking, spitting, talking into the surrounding atmosphere. The expelled droplets may come into contact with eyes, skin etc. The nose filters off particles of 10 micro millimeters. Those of 5 micro millimeters can pass into the lung alveoli. The droplet spread is limited to a distance of 30-60 cm between source and the host.

In infectious diseases these droplets may contain millions of bacteria or viruses and therefore can be a potent source of infection. When a healthy susceptible person comes in the range of such infected droplets he is likely to inhale these droplets and get infection. Diseases spread by droplet nuclei are many respiratory infections, eruptive fevers, many infections of the

nervous system, common cold, diphtheria, whooping cough, tuberculosis, Meningococcal meningitis etc.

Close proximity, overcrowding and lack of ventilation are factors, which facilitate infection spread by droplets or by direct contact.

Contact with Soil

This means the spread of the disease causing agent directly from the soil, compost or decaying matter e.g. hookworm disease, tetanus, mycosis etc.

Inoculation into skin or mucosa

The disease agent may be inoculated directly into the skin or the mucosa of the individual e.g. rabies virus through dog bite, hepatitis-B virus through contaminated needles and syringes etc.

Transplacental

Transplacental or vertical transmission is the passage of the infecting agent from the mother to the fetus through placental circulation. This is another form of direct transmission, Examples include the TORCH agents like Toxoplasma Gondii, Rubella virus, Cytomegalovirus and Herpes virus, the Varicella virus, Syphilis, Coxsackie-B virus, AIDS

B. INDIRECT TRANSMISSION

This encompasses a variety of mechanisms like the traditional five F's – Flies, Fingers, Fomites, Food and Fluid.

An essential requirement for indirect transmission is that the host should be capable of surviving outside the human host in the external environment and should be able to retain its basic properties of pathogenesis and virulence till it finds a new host. This depends on the characteristics of the agent, the inanimate object and the influence of environmental factors like temperature and humidity.

1. Vehicle-born

This implies transmission of the infective agent through the agency of water, food, ice, blood, serum, plasma and other biological products such as tissues and organs. The infectious agent may have multiplied or developed in the vehicle before being transmitted (e.g. Staphylococcus Aureus in food) or may only or passively transmitted in the vehicle (e.g. Hepatitis-A virus in water).

Disease transmitted by water or food include acute diarrhea, typhoid fever, cholera, polio, Hepatitis-A, intestinal parasites. Those transmitted by blood are Hepatitis-B, malaria, syphilis, Brucellosis, infectious mononucleosis, Cytomegalovirus infection. Organ transplantation may result in transmission of disease e.g. Cytomegalovirus transmission during kidney transplant.

The epidemiological features of vehicle transmission are that,

- If the dose of contamination is heavy the outbreak may be explosive like in case of cholera and hepatitis-A infections
- When secondary cases occur the primary cases may remain obscure
- The distance traveled by the infectious agent may be great
- It is not always possible to isolate the infectious agent, e.g. typhoid bacillus in contaminated water
- When the vehicle is controlled or withdrawn the epidemic subsides
- Common source of infection is traceable

2. Vector-borne

- In epidemiology vector is defined as an arthropod or any living creature at carrier that transports the infectious agent to the susceptible host. Transmission by a vector may be mechanical or biological. In biological transmission the disease agent passes through a development cycle or multiplication in the vector.

Epidemiological classification of vector-borne disease

a) By Vector

Invertebrate type,

Arthropod vectors fall into seven orders	
• Diptera	flies and mosquitoes
• Siphonoptera	fleas
• Orthoptera	cockroaches
• Anoplura	sucking lice
• Hemiptera	bugs.
• Acarina	ticks and mites
• Copepods	Cyclops

Vertebrate type,

- Mice, Rodents and Bats

b) By, Transmission chain

Vector-borne diseases are classified under heterogeneous infection chain and involve three principal patterns:-

- Man and Non-vertebrate host

Man → Arthropod → Man. E.g. Malaria
 Man → Snail → Man, E.g. Schistosomiasis

- Man, another Vertebrate host and Non-vertebrate host

Man → Arthropod → Mammal. E.g. Plague
 Man → Arthropod → Bird. E.g. Encephalitis

- Man and two intermediate hosts

Man → Cyclops → Fish → Man. E.g. Fish tapeworm
 Man → Snail → Fish → Man. E.g. Clonorchis Sinensis
 Man → Snail → Crab → Man. E.g. Paragonimiasis

c) Methods in which vectors transmit the agent

- By biting
- By regurgitation
- Scratching in of infective feces
- Contamination of host with body fluids of vectors

d) Methods in which vectors are involved in the transmission and propagation of parasites

- Mechanical transmission

The infectious agent is mechanically transmitted by a crawling or flying arthropod through soiling of its feet or proboscis or passage of the organisms through its gastro-intestinal tract and passively excreted. There is no development or multiplication of the agent on or within the vector.

- Biological transmission

The infectious agent undergoes multiplication and development inside the vector before vector can transmit

Propagative	The agent merely multiplies in vector but no change in form occurs for example plague bacilli in rat fleas.
Cyclo-propagative	The agent changes in form and number e.g. malarial parasite in mosquito.
Trans-ovarian	When the agent is transmitted vertically from the infected female to her progeny in the vector.

Trans-stadial transmission	Transmission of the agent from one stage of the life cycle to another is valued trans-stadial transmission e.g. nymph to adult.
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Factors, which influence the ability of vectors to transmit disease

- Host feeding preferences
- Infectivity that is the ability to transmit the agent
- Susceptibility that is the ability to become infected
- Survival rate of vectors in the environmental
- Domesticity, that is the degree of association with man
- Suitable environmental factor

3. Air-borne

Airborne Diseases.

You can catch some diseases simply by breathing. These are called airborne diseases. Airborne disease can spread when people with certain infections cough, sneeze, or talk, spewing nasal and throat secretions into the air. Some viruses or bacteria take flight and hang in the air or land on other people or surfaces. When you breathe in airborne pathogenic organisms, they take up residence inside you. You can also pick up germs when you touch a surface that harbors them, and then touch your own eyes, nose, or mouth. Because these diseases travel in the air, they're hard to control.

Types of airborne diseases.

Coronavirus and COVID-19

A rapidly spreading coronavirus, SARS-CoV-2, and the disease it causes, COVID-19, has been responsible for millions of infections and hundreds of thousands of deaths globally in 2020. While the coronavirus that causes COVID-19 is not generally considered to be airborne, there may be some situations in which the virus can act like an airborne disease. These include certain clinical settings in which people are receiving intensive medical treatment. In usual situations, SARS-CoV-2 is spread through respiratory droplets after a person coughs or sneezes, but these droplets are larger than what is considered airborne. The most common symptoms of COVID-19 include fever, cough, fatigue, and shortness of breath.

The common cold

Millions persons get the common cold each year in the United States. Most adults get two or three colds a year. Children tend to get them more frequently. The common cold is the top

reason for absences at school and work. There are many viruses that can cause a cold, but it's usually a rhinovirus.

Influenza

Most of us have some experience with the flu. It spreads so easily because it's contagious about a day before you notice the first symptoms. It remains contagious for another 5 to 7 days. If you have a weakened immune system for any reason, you can spread it to others longer than that. There are many strains of the flu, and they are constantly changing. That makes it difficult for your body to develop immunities.

Chickenpox

Chickenpox is caused by the varicella-zoster virus. If you have chickenpox, you can spread it for a day or two before you get the telltale rash. It takes up to 21 days after exposure for the disease to develop. Most people get chickenpox only once, and then the virus goes dormant. Should the virus reactivate later in life, you get a painful skin condition called shingles. If you haven't had chickenpox, you can contract it from someone with shingles.

Mumps

Mumps is another very contagious viral disease. You can spread it before symptoms appear and for up to 5 days after. Mumps used to be quite common in the United States, but rates have declined 99% due to vaccination. From January 1 to January 25, 2020, 70 cases in the United States were reported to the CDC. Outbreaks tend to occur in densely populated environments.

Measles

Measles is a very contagious disease, particularly in crowded conditions. The virus that causes measles can remain active in the air or on surfaces for up to 2 hours. You're able to transmit it to others up to 4 days before and 4 days after the measles rash appears. Most people get the measles only once.

Measles is a leading cause of death among children worldwide and was responsible for 140,000 deaths in 2018. It's estimated that the measles vaccine prevented around 23 million deaths from 2000 to 2018. The disease is less common in the United States and occurs mostly in people who haven't been vaccinated. There were 1,282 cases reported in 2019. As of March 2, 2020, there have been 12 confirmed cases in 2020.

Whooping cough (pertussis)

This respiratory illness causes swelling of the airways that results in a persistent hacking cough. It's at the height of contagiousness for about 2 weeks after the coughing starts. Worldwide, there are about 24.1 million cases of whooping cough every year, resulting in 160,700 deaths. In 2018, there were 15,609 reported cases in the United States.

Tuberculosis (TB)

TB, also known as consumption, is an airborne disease. This is a bacterial infection that doesn't spread easily. You generally have to be in close contact with a person who has it for a long time. You can contract TB without becoming ill or transmitting it to others. About 1.4 billion people worldwide have TB. Most aren't sick. About 10 million people worldwide have active TB.

People with a weakened immune system have the greatest risk of developing the disease. Symptoms can appear within days of exposure. For some, it takes months or years to activate. When the disease is active, bacteria rapidly multiply and attack the lungs. It can spread through your bloodstream and lymph nodes to other organs, bones, or skin.

Diphtheria

Once a major cause of sickness and death in children, diphtheria is now rare in the United States. Due to widespread vaccination, fewer than five cases have been reported in the past decade. Worldwide, there were about 7,100 cases of diphtheria in 2016, but it may be underreported. The disease injures your respiratory system and can damage your heart, kidneys, and nerves.

Symptoms. Airborne diseases usually result in one or more of the following symptoms:

- inflammation of your nose, throat, sinuses, or lungs
- coughing
- sneezing
- congestion
- runny nose
- sore throat
- swollen glands
- headache
- body aches
- loss of appetite
- fever
- fatigue

Complications from airborne diseases are more likely to affect the very young, the very old, and people with a compromised immune system.

Treatment

For most airborne diseases, you'll need plenty of rest and fluids. Further treatment depends on your specific illness.

Some airborne diseases, such as chickenpox, have no targeted treatment. However, medications and other supportive care can help relieve symptoms.

Some, such as the flu, can be treated with antiviral drugs.

Treatment for infants with whooping cough can include antibiotics, and hospitalization is often needed.

There are drugs to treat and cure TB, although some strains of TB are drug resistant. Failure to complete the course of medicine can lead to drug resistance and return of symptoms.

If caught early enough, diphtheria can be successfully treated with antitoxins and antibiotics.

Incidence

Airborne diseases happen all around the world and affect virtually everyone. They spread easily in close quarters, such as schools and nursing homes. Large outbreaks tend to occur under crowded conditions and in places where hygiene and sanitation systems are poor. Incidence is lower in countries where vaccines are widely available and affordable.

Outlook

Most airborne diseases run their course within a few weeks. Others, like whooping cough, can last for months.

Serious complications and longer recovery time are more likely if you have a weakened immune system or if you don't have access to good medical care. In some cases, airborne diseases can be fatal.

What you can do to prevent spread.

Although it's impossible to completely avoid airborne pathogens, there are some things you can do to lower your chances of getting sick:

Avoid close contact with people who have active symptoms of disease.

Stay home when you're sick. Don't let vulnerable people come in close contact with you.

If you must be around others, wear a face mask to prevent spreading or breathing in germs.

Cover your mouth when you cough or sneeze. Use a tissue or your elbow to cut down on the possibility of transmitting germs on your hands.

Wash your hands thoroughly (at least 20 seconds) and often, especially after sneezing or coughing.

Avoid touching your face or other people with unwashed hands.

Vaccines can reduce your chances of getting some airborne diseases. Vaccines also lower the risk for others in the community. Airborne diseases that have vaccines include:

Chickenpox

Diphtheria

Influenza: vaccine updated every year to include strains most likely to spread in the coming season

Measles: usually combined with vaccine for mumps and rubella, and is known as the MMR vaccine

Mumps: MMR vaccine

TB: not generally recommended in the United States

Whooping cough.

In developing countries, mass immunization campaigns are helping to lower the transmission rates of some of these airborne diseases.

4. Fomite borne pathogens

A fomite is any inanimate object (also called passive vector) that, when contaminated with or exposed to infectious agents (such as pathogenic bacteria, viruses or fungi), can transfer disease to a new host. Many common objects can sustain a pathogen until a person comes in contact with the pathogen, increasing the chance of infection. The likely objects are different in a hospital environment than at home or in a workplace.^[1] In the 21st century, the role of fomites in disease transfer is higher than ever in human history because of the indoor lifestyle.

In a systematic review of the literature, German researchers explored the ability of infectious organisms to survive on inanimate surfaces.¹ They found that most gram-positive bacteria, can survive for months on dry surfaces. Climactic factors can play a role in persistence as well humid conditions were found to increase survival times for most types of bacteria.

Hospital fomites

For humans, skin cells, hair, clothing, and bedding are common hospital fomites.

Fomites are associated particularly with hospital-acquired infections (HAIs), as they are possible routes to pass pathogens between patients. Stethoscopes and neckties are common fomites associated with health care providers. It worries epidemiologists and hospital practitioners because of the growing selection of microbes resistant to disinfectants or antibiotics (so-called antimicrobial resistance phenomenon).

Basic hospital equipment, such as IV drip tubes, catheters, and life support equipment, can also be carriers, when the pathogens form biofilms on the surfaces. Careful sterilization of such objects prevents cross-infection. Used syringes, if improperly handled, are particularly dangerous fomites.

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In the hospital environment, surfaces with which hands come in contact are often contaminated with nosocomial pathogens, and may serve as vectors for cross-transmission. A single incidence of hand contact with a contaminated surface results in a variable degree of pathogen transfer, say the researchers. Contaminated hands can transfer viruses to five more surfaces or 14 other subjects. Contaminated hands can also be the source of recontaminating at around 50 percent. Due to the overwhelming evidence of low compliance with hand hygiene, the risk from contaminated surfaces cannot be overlooked.

It is clear that inanimate objects and the hospital environment can become contaminated with dangerous pathogens, and that these organisms can persist for long periods of time if not eradicated. Can fomites be a direct link to patient infection? Due to the many ways in which transmission is possible, and the many interventions employed in the case of an outbreak, consensus on this question remains elusive.

Blood pressure cuffs have also been scrutinized. One study assessed the level of bacterial contamination on blood pressure cuffs in use on hospital wards. Viable organisms were recovered from all the 24 cuffs sampled at a density of between 1,000 and more than 25,000 colony-forming units per 100 cm². Another study investigated the role of blood pressure cuffs in the spread of bacterial infections in 18 hospital units. Potentially pathogenic microorganisms were isolated from 27 (13 percent) of the 203 blood pressure cuffs evaluated. The highest rates of contamination were observed on cuffs used in intensive care units and those kept on nurses carts. For four patients with a personal sphygmomanometer, the authors found a genetic link between the strains isolated from the blood pressure cuffs and the strains isolated from the patients.

Computer equipment may be a culprit as well. A study examined the microbial contamination of computer user interfaces with potentially pathogenic microorganisms, compared with other fomites in a surgical intensive care unit of a teaching hospital. The authors acquired sterile swab samples from a patient's bedside computer keyboard and mouse, and three other sites in the patient's room in a 14-bed surgical intensive care unit. Samples from the keyboard and mouse of the physician's workstation, as well as control buttons of the ward's intercom and telephone receiver, were obtained. Analysis from samples in the patient's room yielded 26 contaminated samples from keyboard and mouse (5.9 percent) compared with 18 positive results from other fomites within patient's rooms (3.0 percent).

Everyday life

In addition to objects in hospital settings, other common fomites for humans are cups, spoons, pencils, bath faucet handles, toilet flush levers, door knobs, light switches, handrails, elevator buttons, television remote controls, pens, touch screens, common-use phones, keyboards, and computer mice, coffeepot handles, countertops, and any other items that may be frequently touched by different people and infrequently cleaned.

When two children in one household have influenza, more than 50% of shared items are contaminated with virus. In 40-90% cases, an adult infected with rhinovirus has virus on their hands.

In 1916 in Lille authorities were warned by health official Dr Niessen that transmission of typhoid could occur during religious ceremonies via spread of contaminated holy water, or via the kiss on the bishop's ring or monstrance, especially as the priests were in frequent contact with the sick and dying.

Researchers have discovered that smooth (non-porous) surfaces like door knobs transmit bacteria and viruses better than porous materials like paper money because porous, especially fibrous, materials absorb and trap the contagion, making it harder to contract through simple touch. Nonetheless, fomites may include soiled clothes, towels, linens, handkerchiefs, and surgical dressings.

The 2007 research showed that influenza virus was still active on stainless steel 24 hours after contamination. Though on hands it survives only for five minutes, the constant contact with a fomite almost certainly means catching the infection. Transfer efficiency depends not only on surface, but mainly on pathogen type. For example, avian influenza survives on both porous and non-porous materials for 144 hours.

In this study, transfer efficiency from nonporous surfaces was calculated differently than from porous surfaces, due to the nature of the two types of surfaces. Porous surfaces can be inoculated with, and hold, a known volume of pooled bacteria and phage. Most of a measured volume of inoculum will run off of hard, smooth, curved, nonporous surfaces. Hence transfer efficiency rates must be calculated in a different manner for these two types of surfaces. Transfer rates from hard, nonporous surfaces were more efficient than from porous surfaces. A porous surface, such as a sponge, offers many deep recesses in which bacteria and viruses reside becoming less accessible to the human hand. A hard smooth surface does not offer crevices or passages in which microorganisms may hide, hence higher transmission. However, high levels of hand contamination occurred in spite of poor transfer rates from some of the porous fomites.

Contaminated needles are the most common fomite that transmits HIV.

DISINFECTION AND HYGIENE INTERVENTION

Like epidemiological studies, many disinfection and hygiene intervention studies lack microbial specificity and identify diseases by symptoms (gastrointestinal, respiratory, or cold symptoms). For example, research by Krilov et al. demonstrated that when environmental surfaces (school bus, toys, etc.) were regularly cleaned or disinfected there was a reduction in gastrointestinal and respiratory illness among children attending the day care center . A study in 1980 by Carter et al. found that families using an iodine-based hand wash had lower rates of respiratory disease. In addition, a review article by Barker et al. cited over 15 research studies that indicated a decrease in viral contamination and viral infection when hand washing was used regularly as an intervention. Subsequently, disinfection and hygiene intervention studies, which have cited a reduction in nonspecific illnesses, only support interruption of disease transmission.

CHAPTER: 12

COMMUNICABLE DISEASES

Introduction

Communicable (also known as infectious or transmissible) diseases are caused by microorganisms such as bacteria, viruses, parasites and fungi that can be spread, directly or indirectly, from one person to another. Some are transmitted through bites from insects while others are caused by ingesting contaminated food or water.

How these diseases spread depends on the specific disease or infectious agent. Some ways in which communicable diseases spread are by:

1. Physical contact with an infected person, e.g. through touch (staphylococcus), sexual contact (gonorrhoea, HIV), faecal/oral transmission (hepatitis A), or droplet (influenza)
2. Contact with a contaminated surfaces or objects (Norovirus), food (salmonella, E. coli), blood (HIV, hepatitis B), or water (botulism)
3. Insect or animal bites capable of transmitting the disease (Malaria caused by mosquitos and Lyme disease caused by tick bites)
4. Airborne, such as tuberculosis or measles.

Over the past two centuries there have been tremendous achievements in control of infectious diseases. Simple measures such as improved sanitation and food safety, along with modern advances in antimicrobials and vaccination programmes have dramatically reduced, and irradiated, many communicable diseases in Northern Ireland; However, with the constant emergence of new organisms and diseases it is important to remain vigilant.

Because communicable diseases can have so much impact on the population, their surveillance and control is an important part of protecting the public's health. Reporting cases of communicable disease is important in the planning and evaluation of disease prevention and control programs and in the detection of common-source outbreaks.

It is likely that everyone will be affected with a communicable disease at some point in their lives. It is important to learn about the causes of communicable diseases and ways to prevent their spread

A) ACQUIRED IMMUNE DEFICIENCY SYNDROME (AIDS)

Human Immunodeficiency Virus (HIV disease) is a continuum of progressive damage to the immune system from the time of infection to the manifestation of severe immunological damage by opportunistic infections (OI), neoplasms, wasting, or low CD4 lymphocyte count that defines AIDS. The time it takes to traverse this spectrum varies greatly, ranging from 1 year or less in some persons to a still unknown upper limit in others that has reached nearly 20 years in a few individuals. The period from infection to development of AIDS is known as the incubation period. The period from an AIDS diagnosis to death has been studied separately as AIDS survival time. The epidemiology of HIV disease progression has attempted to characterize the lengths of the incubation period and the AIDS survival period, to identify laboratory tests useful for prognosis and treatment decisions, and to determine what cofactors accelerate or retard the rate of disease progression.

INCUBATION PERIOD

The median incubation period from HIV infection until development of AIDS is estimated at approximately 10 years for young adults. The estimate varies with the age at which infection occurs and is significantly shorter in infants and in older adults and varies even between infection at age 20 and infection at age 40. Whether the incubation period varies by mode of HIV acquisition has been more difficult to determine, but the preponderance of evidence now indicates that, after adjustment for age, the incubation period is similar in injecting drug users, those infected sexually, and hemophiliacs, whereas incubation time in transfusion recipients is shorter, probably because of the large HIV inoculum in infected blood transfusions. The incubation period is significantly shorter in infants and in older adults and varies even between infection at age 20 and infection at age 40. Whether the incubation period varies by mode of HIV acquisition has been more difficult to determine, but the preponderance of evidence now indicates that, after adjustment for age, the incubation period is similar in injecting drug users, those infected sexually, and hemophiliacs, whereas incubation time in transfusion recipients is shorter, probably because of the large HIV inoculum in infected blood transfusions. The incubation period does not appear to vary significantly in men and women or in different racial groups. Rates of progression to AIDS are very low in the first 2 years after infection and increase thereafter. Although patients infected by transfusion, especially infants, have developed AIDS in the first year following infection, progression to clinical AIDS in healthy adults is rare within 2 years of seroconversion.

The rate of long-term survival after an initial AIDS diagnosis has been very low. Some persons, nearly all with a diagnosis of Kaposi's sarcoma (KS), have survived for more than 5 years after diagnosis, but survival rates are significantly lower in patients with an OL or a neoplasm other than KS.

Age is a cofactor for shorter survival. In the San Francisco study of the first 505 cases, survival was significantly shorter among all patients over 40 years old. An association between older age and shorter survival was also observed in the study of U.S. hemophiliacs with AIDS; those aged 13 to 29 years having the longest survival and those over age 60 years having the shortest survival.

Fewer data are available concerning from a CD4 lymphocyte count of 200/ml to death. An analysis of time from a CD4 lymphocyte count of 200/ml to death among two cohorts of homosexual men in San Francisco found the median survival time was 38 months and had increased about 12 months over the median time in the period from 1983. Comparable estimates were reported from the Multi center AIDS Cohort Study; 53% of subjects with a CD4 count in the range 101 to 200 cells/m survived 30 months in the period from 1985 to 1988 and 71% in the period from 1989 to 1993.

MODES OF TRANSMISSION

The main methods of transmission in case of HIV virus causing AIDS are.

- Through homosexual and heterosexual routes when unsafe sex is resorted to.
- Through placental circulation when an HIV carrier woman becomes pregnant and gives birth to a child.

- Through infected blood contaminating the needles and syringes in case of intravenous drug users.

The current worldwide expansion of the AIDS epidemic is primarily driven by the sexual transmission of human immunodeficiency virus type 1 (HIV-1), and its future will be determined largely by the degree to which sexual transmission can be reduced. Sexual transmission among homosexual males is still a significant part of epidemic spread in the United States and Europe, but now most experts estimate that homosexual males account for fewer than 50% of new infections in the most populous regions of the world, sexual transmission among heterosexuals is the dominant mode of spread in the United States AIDS epidemic is above all a problem of controlling a sexually transmitted infection. The infectivity of HIV-1 is low compared to sexually transmit bacterial infections such as gonorrhea, Chlamydia, cancroids, and syphilis, and it is less easily transmitted sexually than the hepatitis B virus. HIV-2 is though to be less infectious than HIV-1, although few data are available. HIV-2 infected individuals generally have a lower viral titer in peripheral blood samples than those infected with HIV-1, and incidence rates of infection appear lower in cohorts at risk for HIV-2 than among comparable populations at risk for HIV-1. The probability of infection is altered by differences in host factors and by the infectiousness of the carrier. Cell surface receptors that act with the CD4 receptor are necessary for HIV infection, and genetic differences in these co-receptors in the host appear to play a role in sexual transmission. Infectiousness in the carrier is related to disease stage and the level of viremia and is probably also altered by antiretroviral therapy, which reduces viremia and viral levels in semen. Antiretroviral treatment, when taken as post-exposure prophylaxis by the host soon after sexual exposure to an infected partner, may also reduce the probability of transmission. Transmission could theoretically occur from sexual behaviour involving contact with any of the fluids in which it has been found, but the concentration of HIV found in saliva and tears is extremely low. Infectious virus is rarely recovered from saliva.

Moreover, no cases of HIV infection have been traced to saliva or tears. Rare cases of transmission by human bites have been reported, but saliva from the infected person probably contained HIV-infected blood. To the best of current knowledge, HIV infection is lifelong, and all persons testing positive for HIV antibodies have to be regarded as potentially infectious.

Individuals have been identified who were infected by a single unprotected sexual contact whereas others have remained uninfected after hundreds of unprotected sexual contacts or years of frequent high risk sexual behaviour with probable exposure to many infected individuals. These observations suggest that behaviour alone does not explain the variation. They suggest a wide variation in the infectiousness of the carrier and / or host resistance to infection.

HIV is commonly transmitted sexually by penile-anal intercourse and penile-vaginal intercourse and infrequently by fellatio. Sexual behaviour that is accompanied by bleeding appears to increase the risk of transmission substantially. Other sexual practices may transmit infection, but so few data are available that it is difficult to quantify risk associated with these practices. Increasing numbers of sexual partners increases the risk, but risk varies significantly by geographic region and by sexual mixing within a region, because the prevalence of infection among the pool of sexual partners strongly affects the probability of encountering an infected partner and therefore the probability of transmission.

Studies of homosexual men have shown consistently that the receptive partner in anal intercourse is at the highest risk of HIV infection and that risk is strongly related to the number of male sexual partners. The efficiency of transmission to the receptive partner during anal intercourse may be explained by the fact that viral access to the bloodstream through small tears in the rectal mucosa may be more common with this practice than with other types of sexual intercourse. Trauma is not necessary for transmission, however, as direct infection of bowel mucosal cells has been observed. The layer of endothelial cells in the rectum is thinner than in the vagina and although the target cells for infection have not been determined, lymphocytes that could act as targets for HIV are plentiful in rectal mucosa, and Langerhans cells are found throughout squamous-cell epithelial tissue.

Risk for incentive anal intercourse has usually been substantially lower than for receptive anal intercourse but higher than for oral intercourse. Most cross-sectional studies of HIV transmission in homosexual men have not reported an elevated relative risk associated with oral intercourse, but in addition to case reports of seropositive men whose only reported risk is oral intercourse, receptive oral intercourse has been identified as a risk in studies of homosexual men seroconverting while under prospective study, although a significantly lower risk than anal intercourse.

Two reports of possible female-to-female HIV transmission have appeared in the literature. In the more persuasive of the two, transmission apparently occurred during a 4-to 6-week's period after a woman began a relationship with another woman who was a seropositive injection drug user (IDU). Sexual activities were at times traumatic, resulting in vaginal bleeding, and had also occurred during menses; sexual practices included digital and oral contact with the vagina and oral contact with the anus. The second case was a seropositive 24-years-old female who denied any heterosexual contact or injection drug use, but who reported orogenital contact with a number of female partners in the years prior to her positive antibody test.

Vaginal intercourse can transmit HIV to either the male or the female partner, but a number of studies have shown that the risk is higher to the female partner. Anal intercourse has also been shown to be a risk factor for the female partner in heterosexual studies. Post-coital vaginal bleeding has been associated with a higher risk of infect Sexually Transmitted Diseases (STD)

Other STD has been associated with risk of HIV infection in a number of studies in both Western and African countries. STD may increase susceptibility to infection by causing genital lesions that facilitate viral entry or by increasing the number of target cells for HIV (activated lymphocytes or monocytes). Genital ulcers in particular have been identified as a risk factor in Africa. In studies conducted in African STD clinics, these ulcers were often caused by *Hemophilus ducreyi* infection (chancroid), which is seen less frequently in Western countries. Syphilis and herpes simplex infection – STDs that can cause genital ulceration – have also been reported as possible cofactors of infection, although not all studies agree. In one African study, both *Chlamydia trachomatis* infection and the presence of genital ulcer were risk factors for HIV infection and were independently significant in a multivariate analysis.

The strongest demonstration to date of the potential importance of STD in amplifying the HIV epidemic comes from a randomized, controlled trial of improved treatment of STD in rural Tanzania. HIV incidence over a 2-year period was reduced by about 40% (1.2% versus 1.9% per year) in six villages randomized to case management of STD at the primary health

care level compared to six villages in the same geographic region randomized to regular care. This study suggests that interventions using STD control may also have a significant effect on HIV sexual transmission

DIAGNOSIS

WHO case definition for AIDS Surveillance

For the purposes of AIDS surveillance an adult or adolescent (greater than 12 years) is considered to have AIDS if at least two of the following major signs are present in combination with at least one of the minor signs listed below and if these signs are not known to be due to a condition unrelated to HIV infection.

Major signs

- Weight loss more than 10% of body weight
- Chronic diarrhea for more than a month
- Prolonged fever for than a month (intermittent or constant)

Minor signs

- Persistent cough for more than a month
- Generalized pruritic dermatitis
- History of Herpes Zoster
- Oropharyngeal Candidiasis
- Chronic progressive or disseminated Herpes Simplex infection
- Generalized Lymphadenopathy

The presence of either generalized Kaposi's sarcoma or Cryptococcal Meningitis is sufficient for the diagnosis of HIV / AIDS for surveillance purposes.

For patients of Tuberculosis cough for more than a month should not be considered as minor sign.

Not all HIV related opportunistic infections are in the AIDS definition. Tuberculosis is widely prevalent in Africa and Asia and with AIDS associated with this infection the cough, fever and wasting triad cannot differentiate between the HIV-positive case and the HIV-negative TB patient.

However for clinical purposes it is useful to be able to diagnose whether illness may be related to HIV infection because

- Clinical manifestations can be a reliable indicator of underlying HIV infection
- Over-use of HIV testing is avoided; testing is rather used to confirm suspected HIV infection than as a diagnostic tool in the first instance.
- A patient with suspected HIV infection can be counseled about having an HIV test, the implications for them and their sexual partners, self-care and nutrition.

- Many HIV related illnesses can be treated improving the patient's quality of life.
- Certain drugs like Thiacetazone cause severe side effects in people with HIV infection and these drugs can be avoided in them.

Expanded WHO case definition for AIDS Surveillance

For the purpose of AIDS surveillance an adult or an adolescent above 12 years is considered to have AIDS if a test for HIV antibody gives a positive result and one or more of the following conditions are present: –

- More than 10% of body weight lost, cachexia, diarrhea for more than a month not known to be due to a condition unrelated to HIV infection.
- Cryptococcal meningitis
- Pulmonary or extra-pulmonary tuberculosis
- Kaposi's sarcoma
- Neurological impairment that is sufficient prevent daily independent activities not to be known due to a condition unrelated to HIV infection
- Candidiasis of the esophagus
- Clinically diagnosed life-threatening or recurrent episodes of pneumonia with or without etiological confirmation.
- Invasive cervical cancer

LABORATORY DIAGNOSIS

Screening test

As antibodies to HIV virus are far easier to detect as on today than the virus itself the presence or absence of these antibodies in the blood stream is most widely used for the diagnosis.

A person whose blood contains HIV antibodies is said to be HIV positive. There is now a wide variety of screening tests based on this available now. To be reliable the screening test should be sensitive, enough to identify all true positives while being specific enough to record a few false positives. The ideal test needs both the attributes. At present two types are applied. At first a sensitive test is used to detect the HIV antibodies while a confirmatory test is used to weed out any false positives. The first kind is normally the ELISA. The confirmatory test is usually the Western Blot test, which is a highly specific test. It is based on detection of antibody to the viral core protein (p24) and envelope glycoprotein (gp41). This is a more difficult test to perform and requires trained and experienced lab technicians and experienced pathologists to interpret.

Virus isolation

A test for the virus isolation would end the painful uncertainty of AIDS infection. The virus can be recovered from cultured lymphocytes. This type of testing is extremely costly and requires extensive laboratory support.

The current trend is towards using a reliable but portable kit, which can help do this test anywhere and can reliably detect HIV antibody.

Non – specific laboratory findings in HIV infection

- Anemia
- Leucopenia (particularly lymophocytopenia)
- Thrombocytopenia
- Polyclonal hypergammaglobinemia

LABORATORY MARKERS

CD4 Lymphocyte count

- Healthy people have a cell count > 950 cells per micro liter of blood. The number falls over the course of HIV infection. People with AIDS have a cell count of < 200. In US a cell count less than 200 is taken as diagnostic of AIDS.
- Threshold for antiviral therapy is 500cells per micro liter of blood. People with counts above 500 should perform the test every 3 months; some suggest that a percentage of the CD4 lymphocytes are better indicator than the absolute count. Risk of progression to AIDS is high with CD4 percent of less than 20

CLINICAL MANIFESTATION

The clinical features have been classified into four main categories: –

- Initial infection with the virus and development of antibodies.
- Asymptomatic carrier state
- Aids related complex
- AIDS

Initial infection

More than 70% of cases just experience mild symptoms like fever, sore throat and rash and the rest do not even have these. They look healthy and feel well although right from the start they can transmit the virus to others. Once infected people are infected for life. HIV antibodies take 2-12 weeks to appear in the infected individual though it can take longer also. The period before the antibodies appear is called the window period during which the person is particularly infectious because of the high virus load in the blood. At this stage he will test negative for the antibodies in the standard test. Though the body responds to the viral attack in the form of antibody production yet these do not inactivate the virus in the usual way.

Asymptomatic carrier state

Infected people have antibodies but no overt signs of the disease except persistent generalized lymphadenopathy. It is not clear how long a carrier state lasts

AIDS Related Complex

A person with ARC has illness caused by damage to the immune system but without the opportunistic infections and cancers associated with AIDS. They show the following signs and symptoms: –

- Unexplained Diarrhea lasting more than a month,
- Fatigue,
- Malaise
- Loss of more than 10% of body weight,
- Fever,
- Night sweats,
- Other mild opportunistic infections like Oral thrush,
- Generalized lymphadenopathy
- Splenomegaly

Persons from high risk group having two or more than two of these manifestations and a decreased number of T-helper lymphocytes are considered to have AIDS related complex. Some patients of AIDS related complex subsequently develop AIDS

AIDS

AIDS is the end stag of HIV infection. A number of opportunistic infections occur at this time. Due to the damage of the immune system there occur many cancers also. Death occurs due to uncontrollable infection.

Tuberculosis and Kaposi's sarcoma are usually seen relatively early. Serious fungal infections such as Candida esophagitis, Cryptococcus meningitis and penicilliosis as well as parasitic infections such as pneumocystis carinii pneumonia and Toxoplasma gondii encephalitis tend to occur when the T-helper lymphocytes count have dropped below 100. People with T-helper cell count below 50 develop late infections like Cytomegalovirus retinitis.

Many people with AIDS are afflicted with muscle wasting syndrome called 'slim disease' in Africa. It involves chronic diarrhea and weight loss.

AIDS encephalopathy is another condition associated with the disease at this stage. In this case the HIV virus crosses the blood brain barrier. In this late stage it resembles senile dementia and Alzheimer's.

AIDS dementia seemingly occurs not by opportunistic infection but due to the virus itself. An alarming factor in AIDS is the development of Multi-drug Resistant Tuberculosis. In endemic areas it occurs in early childhood.

When the system breaks down as in HIV infection tuberculosis becomes active. Hence the AIDS epidemic is silently reviving an old public health problem that was very vigorously controlled. Some of the AIDS related ailments include,

Persistent Generalized Lymphadenopathy

Lymph nodes are larger than 10mm in diameter in two or more sites other than the groin area for a period of at least three months.

Kaposi's sarcoma

A tumor featuring reddish brown or purplish plaques or nodules on the skin and mucus membranes. It used to affect many older men in Africa. With HIV / AIDS it affects both sexes and at any age and characterized by ulcerations in the mouth. Lesions may be generalized and rapidly progressive.

Oropharyngeal Candidiasis

A yeast fungus causes it. It presents with soreness and redness on the tongue along with white plaques. It extends to the mouth and the throat also.

Cytomegalovirus Retinitis

Inflammation of the retina of the eye and may lead to blindness

Pneumocystis carnii pneumonia

Dry non-productive cough inability to take a full breath and occasional pain on breathing weight loss and fever are some of the signs and symptoms of this disease

CONTROL

There are four basic approaches to the control of aids.

1. Prevention
2. Anti Retroviral Treatment
3. Specific Prophylaxis
4. Primary Health Care

1. Prevention

At present the only way to control it, is to educate people about the modes of transmission and the role that they can play in preventing it by adopting safety orientation in their daily lives like.

- Avoid indiscriminate sex
- Use condoms (There is however no 100% guarantee that a condom affords full protection every time)
- Avoid use of shared razors and toothbrushes
- Intravenous drug users should be educated to, in the first place give up the habit, but at least avoid using used needles and syringes.
- From Women suffering AIDS or who are at risk should avoid becoming pregnant.
- Educational material and guidelines should be made available everywhere.
- All mass media channels should be used to educate the public on this issue.
- Corporate sector to be motivated to recognize its role and start proactively putting in its efforts.
- People at high risk should be discouraged from donating blood. All blood should be screened for HIV 1 and HIV 2 before transfusion.

Strict sterilization practices should be strengthened in hospitals and clinics. Pre sterilized needles and syringes should be used as much as possible.

2. Antiretroviral treatment

At present there is no vaccine or cure for the HIV infection or AIDS. The development of drugs that suppress the HIV infection itself has been a great help in improving the quality of life in such people. This antiviral chemotherapy though not a cure has proved to be useful in prolonging the life of AIDS patients.

These drugs neither improve nor restore the immune system nor do they destroy the virus installed in the cells.

3. Specific Prophylaxis

Until more effective cure is available the attempt will be to treat the manifestations of AIDS.

Pneumocystis carnii – Primary prophylaxis against P.carnii infection should be offered to patient with CD4 count below 200. The regimens available are,

1. Trimethoprim-sulphamethoxazole
2. Aerosolized Pentamidine
3. Dapsone

M. Avium Complex – occurs in at least one third of AIDS patients especially with CD4 counts <200. Rifampicin has been found to help in such cases. Only one has to ascertain that the patient does not have TB infection.

M. Tuberculosis – prophylaxis against this organism is given in the form of Isoniazid 300 mg daily for nine months. It should be given to all HIV infected patients with positive PPD reaction.

Kaposi's Sarcoma – should be treated with interferon chemotherapy or radiation.

Cytomegalovirus Retinitis – can be controlled with Ganciclovir

Cryptococcal Meningitis – can be controlled with Fluconazole

Esophageal Candidiasis and Vaginal Candidiasis – can be controlled with Fluconazole or Ketoconazole.

Herpes Simplex and Herpes Zoster – can be treated with Acyclovir or Foscamet.

4. Primary Health Care

Because of wide ranging health implications AIDS touches all aspects of primary health care including reproductive and child health, family education, population management etc.

It is therefore important that the AIDS control programs are not planned in isolation. Integration into the nation's primary health care programs is essential. Constant surveillance, record keeping and reporting is necessary.

B) . CHICKENPOX OR VARICELLA

Chickenpox or Varicella is an acute, highly infectious disease caused by Varicella Zoster (V-Z) virus. It is characterized by vesicular rash that may be accompanied by fever and malaise. It is worldwide in distribution and occurs in both epidemic and endemic forms. Chickenpox and herpes Zoster are now regarded as different host responses to the same etiological agent

EPIDEMIOLOGICAL DETERMINANTS

I.Agent Factors

(a) Agent: The causative agent of chickenpox, V-Z virus is also called "Human (alpha) herpes virus 3". Primary infection causes chickenpox. Recovery from primary infection is commonly followed by the establishment of latent infection in the sensory ganglia often for decades, without clinical manifestations. When the cell-mediated immunity wanes with age or following immuno-suppressive therapy, the virus may be reactive, resulting in Zoster, a painful, vesicular, pustule eruption in the distribution of one or more sensory nerve roots. The virus can be grown in tissue culture.

(b) Source of infection: Usually a case of chickenpox. The virus occurs in the Oropharyngeal secretions and lesions of skin and mucosa. Rarely the source of infection may be a patient with herpes Zoster. The virus can be readily isolated from the vesicular fluid during the first 3 days of illness. The scabs however are not infective.

(c) Infectivity: The period of communicability of patients with Varicella is estimated to range from 1 to 2 days before the appearance of rash, and 4 to 5 days thereafter. The virus tends to die out before the pustule stage. The patient ceases to be infectious once the lesions have crusted.

(d) Secondary attack rate: Chickenpox is highly communicable. The secondary attack rate in household contacts approaches 90 per cent

II.Host Factors

(a) Age: Chickenpox occurs primarily among children under 10 years of age. Few persons escape infection until adulthood. The disease can be severe in normal adults.

(b) Immunity: One attack gives durable immunity; second attacks are rare. The acquisition of maternal antibody protects the infant during the first few months of life. No age, however, is exempt in the absence of immunity. The IgG antibodies persist for life and their presence is correlated with protection against Varicella. The cell-mediated immunity appears to be

important in recovery from V-Z infections and in protection against the reactivation of latent V-Z.

(c) Pregnancy: Infection during pregnancy presents a risk for the fetus and the neonate.

(d) Transmission: Chickenpox is transmitted from person to person by droplet infection and by droplet nuclei. Most patients are infected by “face-to-face” (personal) contact. The portal of entry of the virus is the respiratory tract. Since the virus is extremely labile, it is unlikely that fomites play a significant role in its transmission. Contact infection undoubtedly plays a role when an individual with herpes Zoster is an index case. The virus can cross the placental barrier and infect the fetus, a condition known as congenital Varicella.

(e) Incubation period: Usually 14 to 16 days, although extremes as wide as 7 to 21 days have been reported.

Chickenpox shows a seasonal trend in India, the disease occurring mostly during the first six months of the years. Overcrowding favors its transmission. In temperate climates, there is little evidence of any seasonal trend

CLINICAL FEATURES

The clinical spectrum of chickenpox may vary from a mild illness with only a few scattered lesions to a severe febrile illness with widespread rash. Apparent infection is estimated to occur in no more than 5 per cent of susceptible children. In the majority of cases, the disease tends to be mild and typical. The clinical course of chickenpox may be divided into two stages.

I. Pre-eruptive stage: Onset is sudden with mild or moderate fever, pain in the back, shivering and malaise. This stage is very brief, lasting about 24 hours. In adults, the prodromal illness is usually more severe and may last for 2-3 days before the rash comes out.

II. Eruptive stage: In children the rash is often the first sign. It comes on the day the fever starts. The distinctive features of the rash are:

- **Centripetal distribution:** The rash is symmetrical. It first appears on the trunk where it is abundant, and then comes on the face, arms and legs where it is less abundant. Mucosal surfaces (e.g., buccal, pharyngeal) are generally involved. Axilla may be affected, but palms and soles are not usually affected. The density of the eruption diminishes centrifugally.
- **Rapid evolution:** The rash advances quickly through the stages of macule, papule, vesicle and scab. In fact, the first to attract attention are often the vesicles filled with clear fluid and looking like “dew-drops” on the skin. They are superficial in site, with easily ruptured walls and surrounded by an area of inflammation. Usually they are not

umbilicated. The vesicles may form crusts without going through the pustule stage. Many of the lesions may abort. Scabbing begins 4 to 7 days after the rash appears.

- **Fever:** The fever does not run high but shows exacerbations with each fresh crop of eruption

COMPLICATIONS

In most cases, chickenpox is a mild, self-limiting disease. The mortality is less than 1 per cent in uncomplicated cases.

However, Varicella may be accompanied by severe complications particularly in immuno suppressed patients and may also occur in normal children and adults. These include hemorrhages (Varicella hemorrhagic), pneumonia, encephalitis, acute cerebeller ataxia and Reye's syndrome (acute encephalopathy associated with fatty degeneration of the viscera especially liver). Maternal Varicella during pregnancy may cause fetal wastage and birth defects such as cutaneous scars, atrophied limbs, microcephaly and low birth weight. Intrauterine infection occurring near term may cause typical Varicella in the newborn with varying degrees of severity depending upon the transfer of maternal specific IgG antibody. The virus has a potential for oncogenicity

LABORATORY DIAGNOSIS

During the smallpox post-eradication era the diagnosis of chickenpox is of great importance because of its resemblance of mild smallpox. Laboratory diagnosis is rarely required as clinical signs are usually clear-cut.

The most rapid and sensitive means of diagnosis is examination of vesicle fluid under the electronic microscope, which shows round particles (brick-shaped in smallpox) and may be used for cultivation of the virus. Scrapings of floor of vesicles show multinucleated giant cells colored by Giemsa stain (not in smallpox). Serology is used mainly for epidemiological surveys.

PREVENTION AND CONTROL

There is no specific treatment for chickenpox. The usual control measures are notifications, isolation of cases for about 6 days after onset of rash and disinfection of articles soiled by nose and throat discharges.

Varicella Zoster Immunoglobulin (VZIG):

Varicella Zoster Immunoglobulin (VZIG) given within 72 hours of exposure has been recommended for prevention. A dose of 1.25 to 5 ml given intramuscularly will modify or prevent the disease. The current recommendation is that it should be reserved for immuno suppressed contacts of acute cases or newborn contacts. It has also been shown to provide some improvement in high-risk children with Varicella.

Vaccine:

No serious attempt was made in the past of develop a vaccine against chickenpox probably because the disease, in general, was not considered a health priority. A live attenuated vaccine

(OKA strain) developed by Takashasi in Japan has been extensively studied in field trials. The frequency of mild local reactions at the site of inoculation is about 1 per cent. A general reaction to the vaccine, mainly rash or mild Varicella may occur. Sero conversion, after vaccination, in healthy sero-negative children is over 90 per cent. The vaccine has proved safe and effective in preventing the disease.

However, opinion is divided about the need for a vaccine against chickenpox. Some consider that since chickenpox is a relatively mild illness, there is little need for a vaccine. Further, it may be disastrous if chickenpox is postponed from children, when it is mild, to adulthood when it is more severe. One of the major objections to a live vaccine is the potential of the chickenpox virus to establish a latent infection; this may produce Zoster in later years more frequently, or in a more severe form, than natural disease.

C) FOOD POISONING

Food poisoning is an acute gastro-enteritis caused by ingestion of food or drink contaminated with either living bacteria or their toxins or inorganic chemical substances and poisons derived from plants and animals. The condition is characterized by (a) history of ingestion of a common food (b) attack of many persons at the same time and (c) similarity of the signs and symptoms in the majority of cases.

Types of Food Poisoning

Food poisoning may be of two types: non-bacterial and bacterial.

(a) Non-bacterial: Caused by chemicals such as arsenic, certain plant and seafood. In recent years, there has been a growing incidence of pesticide, cadmium, mercury poisoning.

(b) Bacterial: Caused by the ingestion of foods contaminated by living bacteria or their toxins. The conventional classification of bacterial food poisoning into toxic and infective types is becoming increasingly blurred with the knowledge that in some types, both multiplication and toxin production are involved. Bacterial food poisoning may be of the following types:

SALMONELLA FOOD POISONING

An extremely common form of food poisoning. Five reasons have been given for its increase in recent years: (a) an increase in communal feeding (b) increase in international trade in human food (c) a higher incidence of Salmonellosis in farm animals (d) widespread use of house-hold detergents interfering with sewage treatment, and (e) wide distribution of "prepared foods".

Agent: The species most often incriminated in human outbreaks are *S. typhimurium*, *S. cholera-suis* and *S. enteritidis*, besides many others.

Source: Salmonellosis is primarily a disease of animals. Man gets the infection from farm animals and poultry – through contaminated meat, milk and milk products, sausages, custards egg and egg products. Rates and mice are another source; they are often heavily infected and contaminate foodstuffs by their urine and faeces. Temporary human carriers can also contribute to the problem.

Incubation Period: 12 to 24 hours commonly.

Mechanism of Food Poisoning: The causative organisms, on ingestion, multiply in the intestine and give rise to acute enteritis and colitis. The onset is generally sudden with chills, fever, nausea, vomiting, and profuse watery diarrhea, which usually lasts 2-3 days. Mortality is about 1 per cent. A convalescent carrier state lasting for several weeks may occur.

STAPHYLOCOCCAL FOOD POISONING

This form of food poisoning is about as common as salmonella food poisoning.

Agent: Enterotoxins of certain strains of coagulase-positive *Staphylococcus Aureus*. At least 5 different Enterotoxins have been identified, and a sixth may exist. Toxins can be formed at optimum temperatures of 35 deg to 37 deg c. These toxins are relatively heat stable and resist boiling for 30 minutes or more.

Source: Staphylococci are ubiquitous in nature, and are found on the skin and in the nose and throat of men and animals. They are a common agent of boils and pyogenic infections of man and animals. Cows suffering from mastitis have been responsible for outbreaks of food poisoning involving milk and milk products. The foods involved are salads, custards, milk and milk products, which get contaminated by staphylococci.

Incubation Period: 1-6 hours. The incubation period is short because of “performed” toxin.

Mechanism of Food Poisoning: Food poisoning results from ingestion of toxins preformed in the food in which bacteria have grown (“intradietetic” toxins). Since the toxin is heat-resistant, it can remain in food after the organisms have died. The toxins act directly on the intestine and CNS. The illness becomes manifest by the sudden onset of vomiting, abdominal cramps and diarrhea. In severe cases, blood and mucus may appear. Unlike salmonella food poisoning, staphylococcal food poisoning rarely causes fever. Death is uncommon.

BOTULISM

This is the most serious type of food poisoning it is rare, but it kills two-thirds of its victims.

Agent: Exotoxins of *Clostridium botulinum* are generally known as Type A, B or E.

Source: The organism is widely distributed in soil, dust and the intestinal tract of animals and enters food as spores. The foods most frequently responsible for botulism are home preserved foods such as home-canned vegetables, smoked or pickled fish, homemade cheese and similar low acid foods. In fact, botulism derives its name from the Latin word for sausage (botulus).

Incubation Period: 12 to 36 hours.

Mechanism of Food Poisoning: The toxin is preformed in food (“intradietetic”) under suitable anaerobic conditions. It acts on the parasympathetic nervous system. Botulism differs from other forms of food poisoning in that the gastrointestinal symptoms are very slight. The prominent symptoms are dysphagia, diplopia, ptosis, dysarthria, blurring of vision, muscle weakness and even quadriplegia. Fever is generally absent, and consciousness is retained. The condition is frequently fatal, death occurring 4-8days later due to respiratory or cardiac failure. Since the toxin is thermo labile, the heating of food, which may be subjected to 100 deg. C for a few minutes before use, will make it quite safe for consumption.

Botulism occurring in infants is called “infant botulism”. It is due to infection of the gut by Cl. Botulinum with subsequent in vivo production of toxin.

Antitoxin is of considerable value in the prophylaxis of botulism. When a case of botulism has occurred, antitoxin should be given to all individuals partaking of the food. The dose varies from 50,000 to 100,000 units IV. The antitoxin will be of no avail if the toxin is already fixed to the nervous tissue. Guanidine hydrochloride given orally in doses of 15 to 40 mg/kg of body weight has been shown to reverse the neuromuscular block of botulism. When combined with good medical and nursing care, the drug can be a useful adjunct in the treatment of botulism. Active immunization with botulinum toxoid to prevent botulism is also available

CL. PERFRINGES FOOD POISONING

Agent: Cl. Perfringens (Welchi).

Source: The organism has been found in faeces of humans and animals, and in soil, water and air. The majority of outbreaks have been associated with the ingestion of meat, meat dishes and poultry. The usual story is that the food has been prepared and cooked 24 hours or more before consumption, and allowed to cool slowly at room temperature and then heated immediately prior to serving.

Incubation Period: 6 to 24 hours, with a peak from 10 to 14 hours

Mechanism of Food Poisoning: The spores are able to survive cooking, and if the cooked meat and poultry are not cooled enough, they will germinate. The organisms multiply between 30 deg. to 50 deg. C and produces a variety of toxins, e.g., alpha toxin, theta toxin, etc. Prevention consists either by cooking food just prior to its consumption or, if it has to be stored, by rapid and adequate cooling.

Clinical Symptoms: The most common symptoms are diarrhea, abdominal cramps and little or no fever, occurring 8 to 24 hours after consumption of the food. Nausea and vomiting are rare. Illness is usually of short duration, usually 1 day or less. Recovery is rapid and no deaths have been reported

B.CEREUS FOOD POISONING

Bacillus cereus is an aerobic, spore-bearing, motile, gram positive rod. It is ubiquitous in soil, and in raw, dried and processed foods. The spores can survive cooking and germinate and multiply rapidly when the food is held at favorable temperatures. B. cereus has been recognized as a cause of food poisoning with increasing frequency in recent years.

Recent work has shown that B. cereus produces at least 2 distinct Enterotoxins, causing 2 distinct forms of food poisoning. One, the emetic form with a short incubation period (1-6 hours) characterized by predominantly upper gastro-intestinal tract symptoms, rather like staphylococcal food poisoning. The other, the diarrhea form with a longer incubation period (12-24 hours) characterized by predominantly lower intestinal tract symptoms like Cl perfringens food poisoning (diarrhea, abdominal pain, nausea with little or no vomiting and no fever. Recovery within 24 hours is usual). The toxins are performed and stable.

Diagnosis can be confirmed by isolation of 10 or more B. cereus organisms per gram of epidemiologically incriminated food. Treatment is symptomatic

INVESTIGATION OF FOOD POISONING

(a) **Secure complete list of people involved and their history:** All the people who have partaken of the food should be interviewed. They may be supplied questionnaires concerning the foods eaten during the previous 2 days and place of consumption; time of onset of symptoms; symptoms of illness (e.g., nausea, vomiting, diarrhea, abdominal pain, headache, fever, prostration, etc.) in order of occurrence; personal data such as age, sex, residence, occupation, and any other helpful information. Questionnaires may be administered to kitchen employees and those working in the dining halls.

(b) **Laboratory investigations:** An important part of the investigation. The object is not only to incriminate the causative agent from stool, vomit or remnants of food by inoculating into appropriate media, but also to determine the total number of bacteria and the relative numbers of each kind involved. Stool samples of the kitchen employees and food handlers should also be investigated. The samples should be examined aerobically and anaerobically. Phage typing of the organisms should be done to complete the laboratory investigation.

(c) **Animal experiments:** It may be necessary to feed rhesus monkeys with the remnants of food. Protection tests are useful in the case of botulism; in this, a saline filtrate of foodstuff is injected subcutaneously into mice protected with antitoxic sera, keeping suitable controls.

(d) **Blood for antibodies:** This is useful for retrospective diagnosis.

(e) **Environmental study:** This includes inspection of the eating place, kitchen, and questioning of food handlers regarding food preparation.

(f) **Data analysis:** The data should be analyzed according to the descriptive methods of time, place and person distribution. Food-specific attack rates should be calculated. A case control study may be undertaken to establish the epidemiological association between illness and the intake of a particular food.

PREVENTION AND CONTROL

(i) **Meat inspection:** The food animals must be free from infection. This can be ensured by their examination by veterinary staff both before and after slaughter.

(ii) **Personal hygiene:** A high standard of personal hygiene among individuals engaged in the handling, preparation and cooking of food is needed.

(iii) **Food handlers:** Those suffering from infected wounds, boils, diarrhea, dysentery, throat infection, etc should be excluded from food handling. The medical inspection of food handlers is required in many countries; this is of limited value in the detection of carriers, although it will remove some sources of infection.

(iv) **Food handling techniques:** The handling of ready-to-eat foods with bare hand should be reduced to a minimum. Time between preparation and consumption of food should be kept short. The importance of rapid cooling and cold storage must be stressed. Milk, milk products and egg products should be pasteurized. Food must be thoroughly cooked. The heat must penetrate the center of the food leaving thereby no cool spots. Most food poisoning organisms are killed at temperatures over 60 deg. C.

(v) **Sanitary improvements:** Sanitization of all work surfaces, utensils and equipment must be ensured. Food premises should be kept free rats, mice, flies and dust.

(vi) **Health education:** Food handlers should be educated in matters of clean habits and personal hygiene such as frequent and thorough hand washing.

(vii) **Refrigeration:** In the prevention of bacterial food poisoning, emphasis must be placed on proper temperature control. Food should not be left in warm pantries; a few germs can multiply to millions by the next morning. Foods not eaten immediately should be kept in cold storage to prevent bacterial multiplication and toxin production, “Cook and eat the same day” is a golden rule. When foods are held between 10 deg. C (50 deg. F) and 49 deg. C (120 deg. F) they are in the danger zone for bacterial growth. Cold is bacteriostatic at temperature below 4 deg. C (40 deg. F), and refrigeration temperature should not exceed this level.

Food samples must be obtained from the food establishments periodically and subjected to laboratory analysis if they were unsatisfactory. Continuing surveillance is necessary to avoid outbreaks of food-borne diseases.

D) HANSEN'S DISEASE OR LEPROSY

This is a chronic infectious disease caused by *Mycobacterium Leprae*. It affects mainly the peripheral nerves. It also affects the skin, muscles, eyes, bones, testes and the internal organs. The disease manifests itself in two polar forms namely the Lepromatous leprosy and the Tuberculoid leprosy lying at the two ends of the spectrum of the disease. Between these two types are the Borderline and the Intermediate forms of leprosy.

Leprosy is clinically characterized by the following cardinal features:-

- Hypo pigmented patches
- Partial or total loss of cutaneous sensation in the affected areas
- Presence of thickened nerves
- Presence of acid-fast bacilli in the skin or nasal smears

It is a disease bedeviled by classifications e.g. the Madrid classification, Ridley-Joplin classification, the Indian classification; these classifications are based on clinical, bacteriological, immunological and histological status of the patients. The Indian and the Madrid classifications are most widely used in field leprosy programs.

Indian classification

Indeterminate — Tuberculoid — Borderline — Lepromatous — Pure Neuritic

Madrid classification

Indeterminate — Tuberculoid (flat and raised types) — Borderline — Lepromatous. In the pure Neuritic forms according to the Indian classification no skin lesions occur.

In the Ridley Joplin classification

The five types are based on histo-pathology; Tuberculoid TT — borderline Tuberculoid BL — Borderline BB — Borderline Lepromatous BL — Lepromatous LL

MANAGEMENT OF HANSEN'S DISEASE

This is basically done at the individual case level and also the community level. Diagnosis and treatment and rehabilitation at individual level and detection, surveillance of incidence and prevalence as well as control of the disease at the community level.

DIAGNOSIS

Clinical examination

In the majority of cases it can be diagnosed by proper clinical examination alone. The procedure is called “case taking” in leprosy, which comprises of

Interrogation

- Collection of biodata of the patient like the name, age, sex, occupation and place of residence.
- Family history of leprosy.
- History of contact with leprosy cases.
- Details of previous history of treatment of leprosy, if any.
- Presenting complaint or symptom.

Physical examination

A thorough examination of the body surface (skin) to the extent permissible in good natural light for the presence of suggestive or telltale evidence of leprosy. Palpation of the commonly involved peripheral cutaneous nerves like the ulnar nerve for the presence of thickening or tenderness. These areas are the ulnar nerve near the medial epicondyle, the greater auricular nerve as it turns over the sternomastoid, lateral popliteal and the dorsal branch of the radial.

Testing for sensation of heat, cold, pain, light touch in the skin patches. It may be noted that not all hypo pigmented patches show sensory impairment.

Testing for the paresis or paralysis of the muscles of the hands and feet leading to deformities like the foot-drop.

At least one of the cardinal signs should be present for a clinical diagnosis to be made.

Bacteriological examination

Such an examination of the skin smears or the nasal smears is essential for classifying cases whether they are multibacillary or paucibacillary. It is also necessary for monitoring progress and defining end-point of treatment.

The glass slides used should be clean. They should not be reused for making films. Before a smear is declared negative at least 200 fields should be examined.

Skin smears

Material from skin is obtained from an active lesion and from both ear lobes by the ‘slit and scrape method’. Conventionally six sites are examined.

Nasal smears or blows

These can be easily prepared by taking the early morning mucus material. The patient is asked to blow into a clean plastic or cellophane dry sheet. The smear should be taken straight away and fixed. This should be done early morning from the first blowing of the nose. These smears are used also to assess patient’s infectivity. In patients with untreated lepromatous leprosy these nose blowing smears may show a higher percentage of solid-staining bacilli than skin smears.

Nasal scrapings

An alternative is to use a nasal scraper. After going in about 4.5 cm the blade of the scrapper is rotated towards the septum and scrapped a few times and withdrawn. A small ball of cotton is introduced into the nostril to absorb any blood that may ooze out. Nasal scraping is not recommended for routine use as they may be a little painful and also that some normal persons may have non-pathogenic atypical mycobacterium in the nose. Leprosy bacilli are not present in the nose if they are absent in the skin.

Bacterial Index

Only objective way of monitoring the treatment and hence should be done at regular intervals. The grading of smears for BI is as follows: –

- Negative no bacilli found in 100 fields
- One plus one or less than one bacillus is each microscopic field
- Two plus bacilli found in all field
- Three plus many bacilli found in all fields

Bacterial index is calculated by totaling the number of pluses given to each smear and dividing this number by the smears collected. A minimum of seven sites should be examined – 4 smears from skin lesions, one nasal swab and smears from both ear lobes.

For example

Right ear	+++
Left ear	+++
Nasal smear	+++
First skin lesion	+++
Second skin lesion	++
Third skin lesion	+++
Fourth skin lesion	++

Bacterial Index = 19(19 pluses) / 7 (seven sites of examination) in paucibacillary leprosy the BI is less than 2 and in multibacillary leprosy the BI is greater than 2.

Morphological Index

During the course of examination there are solid staining organisms that stain completely and irregularly staining bacilli. The percentage of solid staining bacilli in a smear is referred to as Morphological Index (MI) the total number of MI's for all sites divided by the number of sites gives the average MI for the body.

Foot-Pad Culture

The only certain way of demonstrating the Lepra bacilli is to inoculate the foot-pad of mice the material taken from the lesion. Mouse foot-pad inoculation is 10 times more sensitive at detecting *M. Leprae* than are slit-skin smears. The drawback in this method is that it takes 6-9 months before results are obtained. Newer methods such as in vitro macrophage culture have been evolved which take only 3-4 weeks to obtain results.

Histamine Test

This test is a very reliable method for detecting early stage peripheral nerve damage due to leprosy. It is carried out by injecting intradermally 0.1 ml of 1:1000 solution of Histamine phosphate or chlorhydrate into hypo pigmented patches or in areas of anesthesia. In normal persons it gives rise to a wheel surrounded by an erythematous flare within a few minutes (Lewis Triple response). In case of Leprosy where the nerve supply is destroyed flare response is lost. It is very useful in case of indeterminate Leprosy.

Biopsy

When the examinations mentioned above do not yield results or diagnosis a histopathological examination may be required.

Immunological Tests for detecting Cell-Mediated Immunity

Lepramint Test, LT. This is unique among all CMI test this is not only a test which detects previous immunity but is in fact a mini-dose vaccine. A Japanese, scientist Mitsuda first reported it in 1916. A positive Lepramint reaction either in a leprosy patient or a healthy person shows presence of immunity and resistance to disease. The various responses are: –

The test is performed by injecting intradermally 0.1 ml of Lepramint into the inner aspect of the forearm of the individual. As a routine the reaction is read in 48 hrs and 21 days.

- **Early reaction:** The early reaction is also called Fernandez reaction. An inflammatory response develops within 24-48 hrs and disappears within 4-6 days. It is evidence by redness and induration at the site. If the red area is more than 10 mm after 48 hrs then it is Positive.
- **Late reaction:** This is a classical Mitsuda reaction. The reaction develops late, becomes apparent in 7-10 days following the injection and reaches its maximum in 3-4 weeks. At the end of 21 days if there is a nodule more than 5 mm in diameter the reaction is said to be Positive.

In the first six months of life children are Lepramint negative. It is not a good diagnostic test because of both false positives and false negative. It however has value as a test to detect immune status in a leprosy patient.

Lepramin negative individuals have a higher risk of developing multibacillary leprosy. The Lepramin test is now used increasingly in epidemiological studies combined with serological tests such as FLA-ABS to identify healthy persons who are at risk of developing serious forms of the disease. This group would need preventive measures the most.

LTT and LMIT

In recent years newer in vitro tests like the Lymphocyte Transformation Test and the Leukocyte Migration Inhibitory Test have been developed. They give a measure of the cell mediated immunity. These cannot be applied on a mass scale.

TREATMENT

Chemotherapy is the mode of treatment for leprosy. In the absence of a vaccine it is also the mode of secondary prevention.

Recommended regimens of therapy

I. WHO Recommendations

The proper application of Multidrug therapy is crucial to the success of leprosy control.

Multibacillary Leprosy

The following combination of drugs is recommended

- Rifampicin 600 mg once monthly under supervision
- Dapsone 100 mg daily self administered
- Clofazimine 300 mg once monthly supervised and 50 mg daily self-administered

Where Clofazimine is unacceptable, it is replaced by 250-375 mg of Ethionamide or Prothionamide.

Dapsone should strictly be given according to body weight since a higher dose may cause hemolysis.

Paucibacillary Leprosy

The following is the recommended regimen

- Rifampicin 600 mg once a month for 6 months
- Dapsone 1-2 mg/kg body weight daily single dose for 6 months

The Leprologists opine that in Indian conditions treatment should even continue beyond six

months if all signs of activity have not subsided. Multidrug therapy is cost-effective.

The duration of treatment should depend on the clinical activity of the disease.

For multibacillary disease the therapy is best continued for two years at least and reach smear negatively before stopping the medication.

When slit-skin smears are negative the treatment is discontinued and patient observed for a period of 5 years at least.

II. Govt. of India working group recommendations

For paucibacillary smear negative but active cases

- Dapsone 100 mg daily
- Rifampicin 600 mg once a month supervised for 6 months
- At the end of six months Dapsone may be continued for sometimes depending on disease activity.

Multibacillary smear positive cases

- Dapsone 100 mg daily
- Rifampicin 600 mg daily for initial two weeks and then once a month supervised
- Clofazimine 100 mg alternate days or 50 mg daily at least for two years.

Children and adults with small build and less weight should accordingly receive lesser doses. After completion of treatment clinical and bacteriological surveillance is very important. It is essential for the assurance of long-term treatment success and for early detection of relapses.

Paucibacillary leprosy

It is recommended that these cases be examined clinically at least once a year for a minimum of two years after completion of treatment.

Multibacillary leprosy

In these cases it is recommended that they be examined clinically and bacteriologically at least once a year for a minimum period of five years after completion of therapy.

A patient who has completed the Multidrug therapy and the treatment has been terminated and he or she subsequently develops signs and symptoms of this disease either during

surveillance period or thereafter is said to have Relapsed.

Immunoprophylaxis

There is now considerable evidence that BCG vaccine provides some protection against clinical leprosy. But results have been variable in different places. Trials in Chingleput in Tamilnadu were not promising and protection rate was only 23%.

Under the circumstances certain vaccines are under development and are called Candidate Vaccines.

Long term Dapsone chemoprophylaxis has been found to be helpful in giving some protection to the contact cases. Ace Dapsone which is a long acting repository Sulphone is given to contacts one injection every 10 weeks i.m. this was found to be giving 78 percent protection.

Rehabilitation

It is estimated that at least 25% of patients who are not treated at an early stage develop anesthesia and / or deformities of the hands and feet. As a single disease entity Leprosy is one of the foremost causes of deformities and crippling.

Mask-face, sagging face, lagophthalmos, loss of eyebrows and eyelashes (superciliary and ciliary madarosis), corneal ulcers and opacities, depressed nose, claw hand, foot drop, wrist drop, thumb web contracture, swollen foot and callosities, perforation of the palate and gynecomastia are some of the well known deformities associated with untreated or late treated leprosy.

Rehabilitation is herewith defined by WHO as the physical and mental restoration as far as possible, of all treated patients to normal activity so that they may be able to resume their place in the home, society and industry.

Rehabilitation is therefore an integral part of leprosy control. It must begin as soon as the disease is diagnosed. Early diagnosis and prompt treatment is the best method to actually prevent and reduce the deformities that would otherwise ensure. The measures that are taken in this direction are called ‘preventive rehabilitation’. Rehabilitation actually requires planned and systematic actions – medical, surgical, social, educational and vocational – consistently over a period of years with sustained counseling and health education for training and retraining of individual to the highest possible level of functional ability.

Protection of people at risk.

Preventing contact with infections cases can fomites is an accepted method for controlling the spread of disease.

It is difficult to envisage effective leprosy control without significant improvement in the socio-economic conditions of the affected communities.

Last but not in the least it is important to mention that better social support according to local requirements, better program management of leprosy control program and continuous evaluation of the impact of the program is an essential part of the management of Hansen’s disease

E) INFLUENZA

Influenza is an acute respiratory tract infection caused by influenza virus, of which there are 3 types – A, B and C. All known pandemics were caused by Influenza A strains. The disease is characterized by sudden onset of chills, malaise, fever, muscular pains and cough.

PROBLEM STATEMENT

Influenza is worldwide in distribution. It occurs in all countries and affects millions of people. Outbreaks of influenza A occur virtually every year. Major epidemics occur at intervals of 2–3 years, and pandemics at intervals of 10-15 years. The first pandemic during the present century occurred in 1918-19 which affected an estimated 50 millions people and killed more than 20 million. In India alone, over 6 million people died during this pandemic. This pandemic was caused by what is now known as Swine influenza virus. Recent pandemics occurred in 1957-58 owing to influenza A (H2N2) and in 1968 owing to influenza A (H3N2).

In 1977 a new antigenic type (H1N1) appeared. The virus resembled a previously known virus, which prevailed during 1946-1957. In other words, in 1977, the A (H1N1) virus reappeared after a lapse of 20 years. This virus created an unusual situation in that it did not cause a severe pandemic inspite of major shifts in both the surface antigens. This was attributed to the fact that much of the population alive had already experienced this virus during 1946-1957 and thus possessed protective immunity. Outbreaks of influenza B also occur annually with epidemics occurring at intervals of 4-7 years. Influenza due to type C virus occurs sporadically as small outbreaks.

EPIDEMIC BEHAVIOR

Influenza is truly an international disease. It occurs in all countries and affects millions of people every year. Its behavior is unpredictable. It may occur in several forms. It may smolder in a community without clinical recognition, being manifest only by serological surveys. It may occur in pandemics every 10-15 years due to major antigenic changes, as occurred in 1957 and 1968. In between pandemics, epidemics tend to occur at intervals of 2-3 years in case of influenza A and 4-7 years in the cases of influenza B – but the periodicity is not regular as in the case of measles or whooping cough because several strains of the virus may be in simultaneous circulation which means that there may be outbreaks of influenza practically every year, and sometimes even twice a year.

Once an epidemic begins, the picture is quite characteristic. Preceded by a few early cases, there is a sudden outburst of the disease. This may be indicated by reports of increased febrile respiratory illness in children, followed by the same in adults. The next event is increased hospitalization of cases and sickness-absenteeism in schools and places of work. Attack rates tend to be high, varying from 10-50 per cent. The peak of the epidemic is reached in 3-4 weeks, before tending to decline. The time scale is compressed for smaller geographic areas. The unique features of influenza epidemics are the suddenness with which they arise, and the speed and ease with which they spread. The short incubation period, large number of sub-clinical cases, high proportion of susceptible population, short duration of immunity, and absence of cross-immunity, all contribute to its rapid spread. The fate of the virus during inter-epidemic periods is also not known. Possible explanations include transmission of virus to extra-human reservoirs (pigs, horses, birds), latent infection in humans or continuous transfer from one human to another. This explains the occurrence of sporadic cases.

I. AGENT FACTORS

Agent: Influenza viruses are classified within the family Orthomyxoviridae. There are three viral subtypes, namely influenza type A, type B and type C. These three viruses are antigenically distinct. There is no cross immunity between them. Of importance are the influenza A and B viruses, which are responsible for epidemics of disease throughout the world. Both influenza A and B viruses have 2 distinct surface antigens – the haemagglutinin (H) and the neuraminidase (N) antigens. The H antigen initiates infection following attachment of the virus to susceptible cells. The N antigen is responsible for the release of the virus from the infected cell.

The influenza A virus is unique among the viruses because it is frequently subject to antigenic variation, both major and minor. When there is a sudden complete or major change, it is called a shift, and when the antigenic changes are gradual over a period of time, it is called a drift. Antigenic shift appears to result from genetic recombination of human with animal or avian virus, providing a major antigenic change. This can cause a major epidemic or pandemic involving most or all age groups. Antigenic drift involves “point mutation” in the gene owing to selection pressure by immunity in the host population. Antigenic changes occur to a lesser degree in the B group influenza viruses. Influenza C appears to be antigenically stable.

Since the isolation of the virus A in 1933, major antigenic changes have occurred twice – once in 1957 (H2N2) and again in 1968 (H3N2). Strains occurring between 1946 and 1957 have been called H1N1 strains. The shift in 1968 involved only the H antigen.

At present three types of influenza virus – A (H1N1), A (H3N2) and B are circulating in the world. Influenza viruses of the H1N1 subtype have caused epidemics of disease in two periods of this century – from about 1946 until 1957, and from 1977 until the present.

Reservoir of infection: It has become increasingly evident that a major reservoir of influenza virus exists in animals and birds. Many Influenza viruses have been isolated from a wide variety of animals and birds (e.g., swine, horses, dogs, cats, domestic poultry, wild birds, etc). Some of these include the major H and N antigens related to human strains. It is hypothesized. There is increasing evidence that the animal reservoirs provide new strains of influenza virus by recombination between the influenza viruses of man, animals and birds.

Source of infection: The secretions of the respiratory tract are infective. During epidemics, a large number of mild and asymptomatic infections occur, which play an important role in the spread of infection

Period of infectivity: Virus is present in the Nasopharynx from 1 to 2 days, before and 1 to 2 days after onset of symptoms

II. HOST FACTOR

Age and Sex: Influenza affects all ages and both sexes. In general, the attack rate is lower among adults. Children constitute an important link in the transmission chain. The highest mortality rate during an epidemic occurs among certain high-risk groups in the population such as old people (generally over 65 years of age), children under 18 months, and persons with diabetes or chronic heart disease, kidney and respiratory ailments.

Human mobility: This is an important factor in the spread of infection. Immunity: Antibodies are important in immunity against influenza. Antibody to H neutralizes the virus; antibody to N modifies the infection. Secretory antibodies develop in the respiratory tract after infection and consist predominantly of IgG. Antibodies must be present in sufficient concentration at the superficial cells (site of virus invasion) of the respiratory tract. This is possible only if the antibody titer is high in the blood or if the antibody is secreted locally. Antibodies appear in about 7 days after an attack and reach a maximum level in about 2 weeks. After 8 to 12 months, the antibody level drops to pre-infection levels.

Mode of transmission. Influenza is spread mainly from person to person by droplet infection or droplet nuclei created by sneezing, coughing or talking. The portal of entry of the virus is the respiratory tract.

Incubation period. 18 to 72 hours

III. ENVIRONMENTAL FACTORS

Season: The seasonal incidence is striking, epidemics usually occurring in winter months in the Northern Hemisphere and in the winter or rainy season in the Southern Hemisphere. In India, epidemics have often occurred in summer.

Over-crowding: Enhances transmission. The attack rates are high in close population groups, e.g., schools, institutions, ships, etc

Pathogenesis and Clinical Features

The virus enters the respiratory tract and causes inflammation and necrosis of superficial epithelium of the tracheal and bronchial mucosa, followed by secondary bacterial invasion. There is no viremia. Both the viruses cause much the same symptoms – fever, chills, aches and pains, coughing and generalized weakness. Fever lasts from 1-5 days, averaging 3 days in adults. The most dreaded complication is pneumonia, which should be suspected if fever persists beyond 4 or 5 days or recurs abruptly after convalescence

LABORATORY DIAGNOSIS

Since clinical diagnosis is difficult except during epidemics, laboratory methods are needed to confirm the diagnosis. There are: (a) Virus isolation: Nasopharyngeal secretions are the best specimens for obtaining large amounts of virus-infected cells. The virus can be detected by the indirect fluorescent antibody technique. However egg inoculation is required for virus isolation and antigenic analysis. (b) Paired sera: A serodiagnosis of influenza A or B can be made by the examination of two serum specimens from a patient, one taken as early as possible in the acute phase of the disease (not later than the fifth day), and another taken 10-14 days after the onset. i.e., convalescent stage of illness. The titer of influenza antibodies in the human sera is so variable that only by detecting a rise in complement-fixing (CF) antibodies in the course of illness can a diagnosis be established, hence the need for two specimens. Fourfold or greater rise in titer are considered diagnostic of infection. At least 2 ml, preferably 5 ml, of each serum should be sent, the serum being removed from the clot before dispatch. The two sera should be sent together to the testing laboratory (the first serum should be kept in the refrigerator till the second is available to send with it). Six pairs of sera from any one locality will suffice, unless the testing laboratory asks for more. Serological

examination is fairly satisfactory but slower and does not provide information about the new strains, which are wanted for study in relation to the spread of the disease.

In India, facilities for isolation of influenza virus are available at the (a) Govt. of India, Influenza Centre, Pasteur Institute, Coonoor, South India (b) Haffkine Institute, Bombay (c) School of Tropical Medicine, Calcutta (d) All India Institute of Medical Sciences, New Delhi (e) Vallabhbhai Patel Chest Institute, Delhi, and (f) Armed Forces Medical College, Poona

PREVENTION OF INFLUENZA

All attempts to control influenza epidemics have so far met with little success and the prospects of achieving control remain poor. Good ventilation of public buildings, the avoidance of crowded places during epidemics, encouraging sufferers to cover their faces with a handkerchief when coughing and sneezing and to stay at home at the first sign of influenza are all sensible precautions. The vaccine is not recommended to control spread in the general population.

Immunization, in theory, offers the best prospect of controlling influenza at the present times. In view of the changing antigenic characteristics of the virus (antigenic drift and antigenic shift) new vaccines are constantly required, and they should contain the H and N components of the prevalent strain or strains to keep the vaccines up to date. The WHO makes recommendations every years as to what strains should be included in the vaccine. A number of field trials have shown that vaccines so constituted are highly effective (70-90%). To be effective the vaccine must be administered at least two weeks before the onset of an epidemic, or preferably 2 to 3 months before influenza is expected. Since epidemics of influenza are unpredictable, the hope of preventing influenza epidemics by prophylactic mass vaccination is remote.

Since influenza vaccines will not control epidemics, they are recommended only in certain selected population groups – e.g., in industry to reduce absenteeism and in public servants to prevent disruption of critical public services, such as the police, fire protection, transport and medical care. Also, certain groups e.g. the elderly and individuals in any age group who have a known underlying chronic or debilitating disease are selectively immunized because of the high risk of severe complications including death.

Influenza vaccines

Killed vaccines. Most influenza vaccination programs make use of inactivated vaccines. The recommended vaccine strains for vaccine production are grown in the allantoic cavity of developing chick embryos, harvested, purified, killed by formalin or beta-propiolactone, and standardized according to the haemagglutinin content.

The vaccine is conventionally formulated in aqueous or saline suspension. One dose of the vaccine contains approximately 15 micrograms of HA. The vaccine is administered by the subcutaneous route. A single inoculation (0.5 ml) is usually given. However, in persons with no previous immunological experience (unprimed individuals) 2 doses of the vaccine, separated by an interval of 3 to 4 weeks are considered necessary to induce satisfactory antibody levels. After vaccination, there is an increase in serum antibodies in about one week, which reach a maximum in about 2 weeks. The protective value of the vaccine between 70-90 per cent and immunity lasts for only 3 to 6 months. Revaccination on an annual basis is recommended

The killed vaccine can produce fever, local inflammation at the site of injection, and very rarely Guillain-Barre syndrome (an ascending paralysis). Since the vaccine strains are grown in eggs, persons allergic to eggs may develop symptoms and signs of hypersensitivity.

Live attenuated vaccines. Live attenuated vaccines based on temperature-sensitive (TS) mutants have been extensively used in USSR. They may be administered as “nose drops” into the respiratory tract. They stimulate local as well as systemic immunity. The frequent antigenic mutations of the influenza virus present difficulties in the production of effective vaccines particularly live vaccines.

Newer vaccines. (i) Split-virus vaccine. Also known as sub-virion vaccine. It is a highly purified vaccine, producing fewer side effects than the “whole virus” vaccine. Because of its lower antigenicity, it requires several injections instead of a single one. It is recommended for children. (ii) Neuraminidase-specific vaccine It is sub-unit vaccine containing only the N antigen, which induces antibodies only to the neuradiminase antigen of the prevailing influenza virus. Antibody to neuradiminase reduces both the amount of virus replicating in the respiratory tract and the ability to transmit virus to contacts. It significantly reduces clinical symptoms in the infected person, but permits sub clinical infection that may give rise to lasting immunity. (iii) Recombinant vaccine. By recombinant techniques, the desirable antigenic properties of a virulent strain can be transferred to another strain known to be of low virulence. Efforts to improve influenza vaccine are continuing in several directions.

Antiviral drugs

Because of limitations in the efficacy of influenza vaccine anti-viral drugs have been tried for the prophylaxis and therapy of influenza type A infections. Controlled clinical trials have demonstrated the efficacy of both amantadine and rimantidine in the prophylaxis and therapy of influenza virus A infections. These drugs block penetration of influenza A virus in the host cell and prevent virus replication. These compounds shorten the duration of fever, headache, cough, sore throat, general malaise and also reduce virus shedding. A dose of 100 mg of amantadine or rimantidine twice a day for 3 to 5 days has been found effective for treatment, and a much longer period (throughout the period of exposure to the virus) for prophylaxis as the person becomes fully susceptible when the drug is stopped. These drugs may also modify the severity of influenza – if started within 24 to 28 hours of onset of illness. Side effects are less with rimantidine. The proper use of these drugs requires laboratory evidence of an outbreak of influenza A in the community, since these drugs are not effective against influenza B. However these drugs have not been used as a public health measure for the widespread control of influenza A

F) LYMPHATIC FILARIASIS

The term “lymphatic filariasis” covers infection with three closely related nematode worms – W. Bancrofti, B. Malayi and B. Timori. All three infections are transmitted to man by the bites of infective mosquitoes. All three parasites have basically similar life cycles in man – adult worms living in lymphatic vessels whilst their offspring, the microfilariae circulate in peripheral blood and are available to infect mosquito vectors when they come to feed. The disease manifestations range from none to both acute and chronic manifestations such as lymphangitis, lymphadenitis, and elephantiasis of genitals, legs and arms or as a hypersensitivity state such as tropical pulmonary eosinophilia or as an atypical form such as

filarial arthritis. Though not fatal, the disease is responsible for considerable suffering, deformity and disability

PROBLEM STATEMENT

Filariasis is a global problem. A WHO Committee has estimated that 751 million people are at “risk” of infection, and that 120 million are actually infected – 72.8 million with *W. Bancrofti* and 5.8 million with *B. malayi* and *B. timori*.

W. Bancrofti has the widest distribution and occurs in Africa, the Caribbean, Latin America and many islands of the Western and South Pacific Ocean.

B. Malayi is geographically more restricted, being found in South-West India, China, Indonesia, Malaysia, Korea, the Philippines and Vietnam. *B. Timoria* is confined to small foci in Indonesia.

Numerically, the public health problem of lymphatic filariasis is greatest in China, India and Indonesia. These three countries account for about two-thirds of the estimated world total of persons infected.

Lymphatic filariasis is a major public health problem in India. The problem is increasing every year due to gross mismanagement of the environment. The population exposed to the risk of infection was 25 million in 1953, 64 million in 1958, 136 million in 1968, 236 million in 1976, 304 million in 1981, 396 million in 1993 and 420 million in 1995. The disease is endemic all over India except in Jammu and Kashmir, Himachal Pradesh, Punjab, Haryana, Delhi, Chandigarh, Rajasthan, Nagaland, Manipur, Tripura, Meghalaya, Sikkim, Arunachal Pradesh, Mizoram and Dara and Nagar Haveli. However, surveys carried out during the past two filariasis are showing evidence of low degrees of transmission. Heavily infected areas are found in Uttar Pradesh, Bihar, Andhra Pradesh, Orissa, Tamil Nadu, Kerala and Gujarat.

Present estimates indicate that about 420 million people are living in zones where lymphatic filariasis is endemic – of which 109 million are living in urban areas and the rest in rural areas. There are estimated to be at least 6 million attacks of acute filarial disease per year, and at least 45 million persons currently have one or more chronic filarial lesions.

Two types of filarial infection, viz. *W. Bancrofti* and *B. malayi* occur in India. Bancroftian filariasis is widely distributed and is responsible for 98 per cent of the infection. Brugian filariasis has a localised and restricted distribution. It occurs mainly in the central part of Kerala along the coast stretching over an area of about 1790 sq.km covering Quillon, Alleppey, Kottayam, Ernakulum and Trichur districts – covering about 3 million population. Recent reports indicate a reduction in *B. malayi* infection in Kerala due to vector control with or without chemotherapy. Smaller pockets of *B. malayi* infection are known to exist in Andhra Pradesh, Tamil Nadu, Assam, Orissa and Madhya Pradesh. It is now reported that *B. malayi* has disappeared from some Indian states e.g., Madhya Pradesh, Orissa and Tamil Nadu and new foci of *W. Bancrofti* have become established in these areas. Recently a third type of infection (i.e., *W. Bancrofti* diurnal sub-periodic form) has been reported from the Nicobar group of islands, covering about 2000 population

I. AGENT FACTORS

There are at least 8 species of filarial parasites that are specific to man. These are shown in the Table. The first three worms are responsible for lymphatic filariasis; and the rest for “non-lymphatic filariasis”. The parasites causing non-lymphatic filariasis will not be described, as they are not found in India. Table 2 shows the differences between the Microfilariae (Mf) of *W. Bancrofti* and *B. malayi*

Human Filarial Infections

Organism		Vectors	Disease produced
1	<i>Wuchereria bancrofti</i>	Culex Mosquitoes	Lymphatic filariasis
2	<i>Brugia malaya</i>	Mansonia Mosquitoes	Lymphatic filariasis
3	<i>Brugia timori</i>	Anopheles Mosquitoes	Lymphatic filariasis
4	<i>Onchocerca volvulus</i>	Simulum flies	Subcutaneous nodules; River blindness
5	<i>Loa loa</i>	Chrysops flies	Recurrent transient subcutaneous swellings
6	<i>T. perstans</i>	Culicoides	Probably rarely any clinical illness
7	<i>T. Streptocerca</i>	-do-	-do-
8	<i>Mansonella ozzardi</i>	-do-	-do-

Periodicity: The Mf of *W. bancrofti* and *B. malayi* occurring in India display a nocturnal periodicity, i.e., they appear in large numbers at night and retreat from the blood stream during day. This is a biological adaptation to the nocturnal biting habits of the vector mosquitoes. The maximum density of Mf in blood is reported between 10 pm and 2 am. When the sleeping habits of the host are altered, a reversal in periodicity has been observed.

In most parts of the world, Mf are nocturnally periodic but in the South Pacific islands and in limited foci in the Nicobar islands, Thailand and Vietnam *W. Bancrofti* Mf are non-periodic (sub-periodic), being detectable throughout the 24 hours with a slight peak during day or night. Sub-periodic *B. malayi* is found in parts of Malaysia and Indonesia.

Life Cycle: Man is the definitive host and mosquito the intermediate host of Bancroftian and Brugian filariasis. The adult worms are usually found in the lymphatic system of man. The males are about 40 mm long and the females 50 to 100 mm long. The females are viviparous. They give birth to as many as 50,000 Mf per day, which find their way into blood circulation via the lymphatic. The life span of the Mf is not exactly known, probably up to a year or more. The adult worms may survive for 15 years or more. There is a case on record of a woman in whom live Mf were present 40 years after she left an endemic area

The mosquito cycle begins when the Mf are picked up by the vector mosquito during feeding. The following stages of development take place in the vector: (a) Unsheathing: The larva comes out of the sheath in which it is enclosed, within 1 to 2 hours of ingestion. This is known as unsheathing which takes place in the stomach of the mosquito. (b) First Stage Larva: After unsheathing, the larva is able to penetrate the stomach wall of the mosquito which it does in 6 to 12 hours and migrate to the thoracic muscles where it grows and develops into a sausage-shaped (short, thick) form. (c) Second Stage Larva: The larva moults and increase in length (long, thick form) with the development of an alimentary canal, but is relatively inactive. (d) Third Stage Larva: There is a final moult to the third stage or infective larva (long, thin form) which may be found in any part of the insect. It is highly active or motile. When it migrates to the proboscis of the mosquito, it is ready to be transmitted to a new host, and the mosquito is said to be infective. Under optimum conditions of temperature and humidity, the duration of mosquito cycle (extrinsic incubation period) is between 10 and 14 days. In the human host, the infective larvae develop into adult male and female worms.

Reservoir of infection: Although filarial infections occur in animals, human filariasis is not usually a zoonosis (subperiodic *B. malayi* and *T. Perstans* are exceptions). Animals reservoirs of *Brugia* are present in monkeys, cats and dogs; these animals are believed to acquire their infections from man, and they are not regarded as important sources of infection to man. There is no evidence that *W. Bancrofti* has animal reservoirs in India.

In humans the source of infection is a person with circulating Mf in peripheral blood. In filarial disease (late obstructive stages) Mf are not found in the blood.

The minimum level of Mf, which will permit infection of mosquitoes, is not known. It was reported that a man with one Mf per 40 c.mm of blood was infective to 2.6 per cent of the mosquitoes fed on carriers having as many as 80 or more Mf per 20 c. Mm of blood, the heavily infected mosquitoes did not survive when a number of Mf began to reach maturity.

II. HOST FACTORS

Man is a natural host.

Age: All ages are susceptible to infection. In endemic areas, filarial infection has been found even in infants aged less than 6 months. Infection rates rise with age up to the age of 20-30 years and then level off. After a few years at this plateau level, Mf rates may decline in middle and old age. Filarial disease appears only in a small percentage of infected individuals, commonly in the age group over 10 years, although there may be exceptions.

Sex: In most endemic areas the Mf rate is higher in men.

Mode of transmission: Filariasis is transmitted by the bite of infected vector mosquitoes. The parasite is deposited near the site of puncture. If it passes through the punctured skin or may penetrate the skin on its own and finally reach the lymphatic system. The dynamics of transmission depends upon the man-mosquito contact (e.g., infective biting rate)

Incubation period: The time interval between inoculation of infective larvae and the first appearance of detectable Mf is known as “pre-patent period”. Direct information on the duration of the prepatent period is lacking.

The time interval from invasion of infective larvae to the development of clinical manifestations is known as the “clinical incubation period”. This period, most commonly, is 8 to 16 months. This period may, however, be longer.

Migration: The movement of people from one place to another has led to the extension of filariasis into areas previously non-endemic.

Immunity: Man many develop resistance to infection only after many years of exposure. The immunological basis of this resistance is not known.

Social Factors: Lymphatic filariasis is often associated with urbanization, industrialization, migration of people, illiteracy, poverty and poor sanitation

III. ENVIRONMENTAL FACTORS

Climate: Climate is an important factor in the epidemiology of filariasis. It influences the breeding of mosquitoes, their longevity and also determines the development of the parasite in the insect vector. The maximum prevalence of *Culex quinquefasciatus* (previously known as *C. Fatigans*) was observed when the temperature was between 22 to 38 deg. C and optimum longevity when the relative humidity was 70 per cent.

Drainage: Lymphatic filariasis is associated with bad drainage. The vectors breed profusely in polluted water.

Town Planning: Inadequate sewage disposal and lack of town planning have aggravated the problem of filariasis in India by increasing the facilities for the breeding of *C. Quinquefasciatus* (*C. Fatigans*). The common breeding places are cesspools, soakage pits, ill maintained drains, septic tanks, open ditches, burrow pits, etc.

VECTORS OF LYMPHATIC FILARIASIS

All three infections (*W. Bancrofti*, *B. malayi* and *B. timori*) are transmitted to man by the bites of infective mosquitoes. No less than 5 genera are involved in different areas of the world – *Culex*, *Anopheles* and *Aedes* serve as vectors for *W. bancrofti*; and *Mansonia*, *Anopheles* and *Coquillettidia* serve as the vectors of the *Brugia* species.

The main vectors in India are: *C. Quinquefasciatus* (*C. Fatigans*) for Bancroftian filariasis, and *Mansonia* (*Mansonoides*) mosquitoes (e.g., *M. Annulifera* and *M. Uniformis*) for Brugian filariasis. The breeding of *Mansonia* mosquitoes is associated with certain aquatic plants such as *Pistia stratiotes*. In the absence of these plants, these mosquitoes cannot breed

CLINICAL MANIFESTATIONS

Only a small proportion of infected individuals exhibit clinical signs. The disease manifestations can be divided into two distinct clinical types: (a) lymphatic filariasis caused by the parasite in the lymphatic system, and (b) occult filariasis caused by an immune hyper responsiveness of the human host (e.g., tropical pulmonary eosinophilia).

1. Lymphatic filariasis:

The following stages have been described:

1. Asymptomatic amicrofilaraemia: In all endemic areas a proportion of population does not show Mf or clinical manifestations of the disease although they have the same degree of exposure to infective larvae as those who becomes infected. With presently available diagnostic procedures it is not possible to determine whether persons in this group have detectable infections or whether they are free from infection.
2. Asymptomatic microfilaraemia: A considerable proportion of people are asymptomatic, although their blood is positive for Mf. They may remain without any symptoms for years. They are an important source of infection in the community. These carriers are usually detected by night blood examination.
3. Stage of acute manifestations: In the first months and years there are recurrent episodes of acute inflammation in lymph glands and vessels. The clinical manifestations comprise filarial fever, lymphangitis, lymphadenitis, lymph edema of the various parts of the body and of epididymo-orchitis in the male.
4. Stage of chronic obstructive lesions: The chronic stage usually develops 10-15 years from the onset of the first acute attack. This phases due to fibrosis and obstruction of lymphatic vessels causing permanent structural changes.

The Brugian filariasis is generally similar to Bancroftian filariasis, but strangely the genitalia are rarely involved, except in areas where Brugian filariasis occurs together with Bancroftian filariasis.

Not all elephantiasis is caused by lymphatic filarial infection. Even in endemic areas, a small proportion of cases may be due to other causes – i.e., due to obstruction following infection (such as tuberculosis), tumors, surgery or irradiation. In Ethiopia, endemic leg elephantiasis is caused by silica in the iliac lymph glands.

2. Occult filariasis

The term occult or cryptic filariasis refers to filarial infections in which the classical clinical manifestations are not present and Mf are not found in the blood. Occult filariasis is believed to result from a hypersensitivity reaction to filarial antigens derived from Mf. The best known example is tropical pulmonary eosinophilia.

FILARIA SURVEY

The size of the sample to be examined in a filaria survey varies with the type of survey, whether it is routine survey or survey for evaluation. The NICD (National Institute of Communicable Diseases, Delhi) standard is to examine 5-7 per cent of the population for routine surveys, and at least 20 per cent for evaluation studies. The sample must be random, representative and cover all ages and both sexes. Statistical advice should be obtained when surveys are being planned. A standardized schedule for conducting filaria surveys is given in WHO Expert Committee Report on Filariasis. A filaria survey comprises the following elements.

1. Mass blood survey

The definitive diagnosis of lymphatic filariasis depends upon the demonstration of living parasites in the human body. This calls for a night blood survey.

1. **The thick film:** The thick film made from capillary blood is still the most commonly used method for epidemiological assessment. 20 c. Mm of blood is collected by a deep finger prick between 8:30 pm and 12 mid-night. A thick smear is prepared on a glass slide, and the slide is dried and serially numbered. The age, sex and other host factors are recorded on the survey card or register. On the next day or so, the blood films are dehaemoglobinised, stained, dried and examined for Mf under low power. The usual technique for enumeration of Mf on slides is to start at one end of the smear and work across to the other end, moving the slide field by field till the smear is covered.
2. **Membrane filter concentration (MFC) methods:** The most sensitive method currently available for detecting low-density microfilaremia in the blood is by concentration techniques. It requires collection of blood by venepuncture and filtering large volumes of blood. Although MFC is the most sensitive method available, some very-low density carriers will still not be detected.
3. **DEC provocation test:** Mf can be induced to appear in blood in the daytime by administering diethylcarbamazine (DEC) 100 mg orally. Mf begin to reach their peak within 15 minutes and begin to decrease 2 hours later. The blood may be examined one hour after administration of DEC

2. Clinical survey

At the same time when blood is collected, the people are examined for clinical manifestations of filariasis, which should be recorded in the suggested schedule

3. Serological tests

Serological tests to detect antibodies to Mf and adults using immunofluorescent and complement-fixing techniques cannot distinguish between past and present infection, and heavy and light parasite loads in the human hosts. Recent interest has focused on the direct detection of parasite antigens in patient's blood or urine

4. Xenodiagnosis

The mosquitoes are allowed to feed on the patient, and then dissected 2 weeks later. Where other techniques may fail, this may succeed in detecting low-density microfilaremia

5. Entomological survey

This comprises of general mosquito collection from houses, dissection of female vector species for detection of developmental forms of the parasite, a study of the extent and type of breeding places and other bionomics of mosquitoes.

The data are assembled, analyzed and the results are expressed in terms of certain parameters (clinical, parasitological and entomological) as described below

CONTROL MEASURES

The current strategy of filariasis control is based on:

1. **I. Chemotherapy**

2. Vector control

Many years of experience with DEC chemotherapy has shown that, even after the full regimen of treatment, some microfilariae still persist in the body. Due to this and other reasons (e.g., toxic effects), it has not been possible to prevent the spread of filariasis by the administration of DEC alone. An effective vector control program must therefore supplement chemotherapy, if the disease transmission has to be effectively prevented.

1. I. Chemotherapy

Diethylcarbamazine (DEC) is the only drug available at present against lymphatic filariasis. It is both safe and effective. The dose of DEC that is most generally accepted for the treatment of Bancroftian filariasis is 6 mg/kg body weight per day orally for 12 days, given preferably in divided doses after meals. This amounts to a total of 72 mg of DEC per kg of body weight. For Brugian filariasis, recommended doses range from 3 to 6 mg of DEC/kg body weight per day, up to a total dose of 18-72 mg DEC/kg body weight.

DEC is rapidly absorbed after oral administration, reaching peak blood levels in 1-2 hours. It is also rapidly excreted – the blood half-life is only 2-3 hours in alkaline urine and about 10-20 hours in acid urine.

DEC causes rapid disappearance of Mf from the circulation. It is effective in killing Mf. The effect of the drug on the adult worm is uncertain. It has probably no effect on the infective stage larvae.

Toxic reaction: DEC may produce severe side reactions. The reactions may be of two kinds: (a) those due to the drug

itself, e.g., headache, nausea, vomiting, dizziness, etc. These reactions are observed a few hours after the first dose of DEC and generally do not last for more than 3 days, and (b) those which are allergic reactions due to destruction of microfilariae and adult worms, e.g., fever, local inflammations around dead worms, orchitis, lymphadenitis, transient lymphoedema and hydrocele. The local reactions tend to occur later in the course of treatment and to last longer. If the drug is given in spaced doses, systemic reactions are much less frequent and less intense after the second dose and are rare after subsequent doses. These reactions disappear spontaneously and interruption of treatment is not necessary.

Filaria control in the community:

There are three reasons why filariasis never causes explosive epidemics: (a) the parasite does not multiply in the insect vector, (b) the infective larvae do not multiply in the human host, and (c) the life cycle of the parasite is relatively long, 15 years or more. These factors favor the success of control program.

DEC is still the only drug available for chemotherapeutic control of filariasis. The administration of DEC can be carried out in various ways:

(i) Mass therapy. In this approach, DEC is given to almost everyone in the community irrespective of whether they have microfilaraemia, disease manifestations or no signs of infection. It is generally accepted that mass therapy is indicated in highly endemic areas.

Mass treatment control projects using DEC have markedly reduced prevalence of *W. Bancrofti* in many of the Pacific islands. On the other hand, the result of mass chemotherapy in India during 1958-60 has met with little success. This was due to poor population compliance. For mass chemotherapy to be accepted, a good rapport must be established with the community before the treatment begins. This requires intensive health education of the general public. Mass chemotherapy approach was abandoned in India.

(ii) Selective treatment. DEC is given only to those who are Mf positive. It is generally accepted that selective treatment may be more suitable in areas of low endemicity than in highly endemic areas.

In India the current strategy is based on detection and treatment of human carriers and filaria cases. The recommended dose in the India programs 6 mg DEC per kg of body weight daily for 12 doses, to be completed in 2 weeks (i.e., 6 days in a week). Dosing once a week or once a month has also been recommended, but it is operationally difficult and not practicable excepting in individual patients who are highly motivated. In endemic areas, treatment must be repeated at specific intervals, usually every 2 years. This is partly because, despite remarkable antimicrofilarial properties, expected microfilaria clearance with DEC is incomplete at times even after adequate treatment. The other reason is that people living in endemic areas are exposed to reinfection.

(iii) DEC medicated salt. The use of DEC-medicated salt is a special form of mass treatment using very low doses of the drug over a long period of time. Common salt medicated with 1-4g of DEC per kg has been used for filariasis control in some endemic areas of *W. bancrofti* and *B. malayi*,

particularly after an initial reduction in prevalence has been achieved by mass or selective treatment of Mf-carriers. Treatment should be continued for at least 6 to 9 months. In the Lakshadweep islands, this regimen has been shown to be safe, cheap and effective.

The combination of the long life of the adult parasite for several years and infectiousness of a patient with low parasitaemia represents a serious obstacle to control programmes based on chemotherapy alone.

1. Vector control

Where mass treatment with DEC is impracticable, the control of filariasis must depend upon vector control. Vector control may also be beneficial when used in conjunction with mass treatment. The most important element in vector control is the reduction of the target mosquito population in order to stop or reduce transmission quickly. The techniques for controlling mosquitoes are given in.

Antilarval measures.

The ideal method of vector control would be elimination of breeding places by providing adequate sanitation and underground wastewater disposal system. This involves considerable expenditure amounting to several crores of rupees. Because of financial constraints, this may not be feasible in developing countries such as India in the near future. For the time being, therefore, vector control must be based on temporary or recurrent methods.

The current approach in India is to restrict the antilarval measures to urban areas, because it is operationally difficult and very costly to cover the vast rural areas of the country. The urban areas include an extra 3-km peripheral belt because the flight range of *Culex quinquefasciatus* (*C. Fatigans*) is about 3 km.

The anti-larval activities comprise the following.

(i) Chemical Control. (a) Mosquito larvicidal oil: Mosquito larvicidal oil (MLO) is active against all pre adult stages. It has been the main chemical used to control *C. Quinquefasciatus* for some time. Since it has proved to be less efficient under field conditions and more expensive than other chemical preparations, it is being replaced by pyrethrum oil, temephos and fenthion. (b) Pyrosens oil-E: This is a pyrethrum – based emulsifiable larvicide. The emulsion concentrate contains 0.1 to 0.2 percent pyrethrins by weight and is required to be diluted with water before use. The emulsion is diluted in the ratio of 1:4, (c) Organophosphorus larvicides: During the past 10 years, organophosphorus larvicides (e.g., temephos, fenthion) have been widely used with successful results. However, the vector mosquito has developed resistance to many of these chemicals. The frequency of application is once weekly on all breeding places.

(ii) Removal of Pistia plant. In the case of *Mansonia* mosquitoes, removing the supporting aquatic vegetation such as the pistia plant from all water collections and converting the ponds to fish or lotus culture best controls breeding. Alternatively, certain herbicides such as phenoxylen 30 or Shell Weed Killer D may be used for destroying the aquatic vegetation.

(iii) Minor environmental measures. Lar vicidal operations are complemented by minor engineering operation such as filling up of ditches and cesspools, drainage of stagnant water, adequate maintenance of septic tanks and soakage pits, etc. Environmental management is the most efficient approach to the problem of controlling mosquito breeding.

Anti-Adult measures:

The most effective preventive measure is avoidance of mosquito bites (reduction of man-mosquito contact) by using mosquito nets. Screening of houses can substantially reduce transmission, but it is expensive.

(i) Integrated vector control. None of the above vector control measures applied alone is likely to bring about sustained control of filariasis vectors. An integrated or combined approach is needed to control filariasis using all the above strategies and approaches in optimum combination.

(ii) Primary health care. Since the vertical approach to the control of filariasis has had very limited success in India in terms of coverage of the population at risk, it is now recognized that a horizontal approach making use of the primary health care system is essential, in the context of the WHO's goal of "Health for All" by 2000 AD. The Village Health Guide is the key person who should be trained and involved in anti-filaria activities, with community support, at the village level.

In filariasis four major breakthroughs have occurred. The first of these is the development of safe, single-dose, and annual drug treatment. Trials have proved that a single dose of DEC is very effective even two years after treatment. A single dose of Ivermectin has proved to be equally effective. A combination of single dose of both drugs reduced microfilaraemia more

than 95 percent 2 years after treatment. Secondly, intensive local hygiene on the affected limb, with or without the use of antibiotic and antifungal creams, has been shown to have dramatic effects by halting the progression of, or even reversing elephantiasis and lymph edema. Thirdly, DEC-medicated table or cooking salt has been introduced in India. The carefully controlled addition of very low concentration of DEC has long been recognized as an effective means of eliminating lymphatic filariasis infections in communities. However, the addition increases the price of the salt. During 1994, the first commercially prepared DEC salt went on sale in India, at about twice the price of ordinary salt. Finally, there has been the development of insecticide sprays and polystyrene beads to seal latrines and rooftop water-storage tanks, to eliminate or reduce populations of urban Culex mosquitoes.

G) MALARIA

Malaria is a serious fatal disease caused by a parasite. There are four kinds of malaria that can infect humans: *Plasmodium falciparum*, *P. vivax*, *P. ovale*, *P. malariae*.

Malaria occurs in over 100 countries and territories. More than 40% of the people in the world are at risk. Large areas of Central and South America, Hispaniola, Africa, the India subcontinent, Southeast Asia, the Middle East, and Oceania are considered malaria – risk areas (areas of the world that have malaria).

The World Health Organization estimates that yearly 300 – 500 million cases of malaria occur and more than 1 million people die of malaria. About 1,200 cases of malaria are diagnosed in the United States each year.

At present Malaria is a major public health problem in the developing world. The scenario in India is as follows

Tribal Malaria	About 44 million population of tribal areas of Andhra Pradesh, Madhya Pradesh, Gujarat, Maharashtra, Bihar, Rajasthan, Orissa and North Eastern states are contributing about 50% of <i>P. Falciparum</i> cases of the country.
Rural Malaria	These include irrigated areas of arid and semi-arid plains of Haryana, Punjab, Western Uttar Pradesh, part of Rajasthan, and Madhya Pradesh, plain desert areas and coastal areas of Orissa, Andhra Pradesh, and Tamil Nadu. <i>Anopheles Culex</i> is the main vector and <i>Plasmodium vivax</i> is predominant during the lean period and <i>Plasmodium falciparum</i> during exacerbation.
Urban Malaria	15 major cities and 4 metropolitans account for nearly 80% of urban cases. Humans get malaria from the bite of a malaria – infected mosquito. When a mosquito bites an infected person, it ingests microscopic malaria parasites found in the person's blood. The malaria parasite must grow in the mosquito for a week or more

	before infection can be passed to another person. If, after a week, the mosquito then bites another person the parasites transfer in to the blood of this person and he / she develops malaria.
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SIGNS AND SYMPTOMS

Symptoms of malaria include fever and flu-like illness, including shaking chills, headache, muscle aches, and tiredness. Nausea, vomiting, and diarrhea may also occur. Malaria may cause anemia and jaundice (yellow coloring of the skin and eyes) because of the loss of red blood cells. Infection with one type of malaria, *P. falciparum*, if not promptly treated, may cause kidney failure, seizures, mental confusion, and coma

DIAGNOSIS

The diagnosis depends on the demonstration of the malarial parasite in blood.

Two types of blood films are useful in searching for and identification of the malarial parasite. These are the ‘Thick film’ and the ‘Thin film’. It is recommended that both types of films be made on a single glass slide. When scanty, the parasite is more likely to be seen in a thick film than a thin film. The thin slide is more helpful in detecting aspects of the parasite.

The malarial fluorescent antibody test usually becomes positive two weeks after primary infection by which time the infection may have been cured. The test is therefore of significance only in epidemiological studies. The latest, simple and rapid diagnostic test is the Dipstick (antigen capture) assay for detection of plasmodium falciparum evaluated in field trials and compared favorably with microscopy.

All fever cases attending PHCs dispensaries and hospitals should be presumed to be suffering from malaria. Therefore in case laboratory facilities are not available the differential diagnosis on clinical grounds should be made

TREATMENT

Under the revised Malarial Eradication Program (1958 to date) the need for malaria treatment is realized to be immense.

Presumptive Treatment: This means that all fever cases are assumed to be of Malaria. This is often the only practical and effective way in community-based program in the Indian context, the Surveillance Worker administers a single dose of Chloroquine Phosphate 600mgm dose for an adult and proportionate dose for children and a Smear is obtained for confirmation of diagnosis. Unless resistance to Chloroquine occurs, this single dose can save lives in all types of Malaria.

The presumptive treatment is to be given to all age groups. Even pregnant ladies in any month of pregnancy or post-partum period should receive presumptive treatment.

Radical Treatment: If the blood smear is positive for malarial parasite, the surveillance worker \ MPW should return to the patient and administer ‘radical treatment’ for malaria. It is to ensure a complete cure for malaria, prevention of relapse, and to make the patient non – infective to mosquitoes.

Higher Chloroquin dosage for Radical treatment: Under the NMEP Drug Policy 600mg chloroquine along with 15mg of primaquine per day for five days has been found to be effective in vivax malaria. WHO recommends 1500 mgs of total Chloroquine (600 mg on day 1, 600 mg on day two and 300 mg on day three)

Radical treatment for P. falciparum cases in areas with resistant strains of P. falciparum: As per revised policy the regimen consists of Suphalene 1000mgm + 50 mg Primaquine as single dose thereafter Primaquine 45 mg single dose. These drugs may cause hemolysis especially in patients with G6PD deficiency

MASS DRUG ADMINISTRATION

WHO is currently emphasizing malaria eradication in which drug treatment is a very important component. As per the revised strategy mass drug treatment is recommended in highly endemic areas (API more than 5 per 1000 population)

Mass prophylaxis in children under 5 years is no longer advised. It has been shown that it is impossible to achieve continuous suppression in a significant proportion of population.

It may lead to interference with development of protective immunity. It may accelerate the development of drug resistance. It uses scarce resources that may be better utilized. **Chemoprophylaxis.** With the development of drug resistance this method was more and more unreliable. It is still not clear whether well conducted prophylaxis has got a beneficial role when effective treatment is already available

Drugs	Usual amount per Tb./Cp.	Prophylactic dose
CHLOROQUINE	100 or 150 mg base 300 mg	base same day every week.
PROGUANIL	100 mg 200 mg	per day.
MEFLOQUINE	250 mg 250 mg	once weekly.
DOXYCYCLINE	100 mg 100 mg	daily

In the face of mounting resurgence of malaria a revised strategy of malaria control become necessary. The majority of south East Asian countries have switched over to open ended flexible malaria control from the time – bound eradication program although some countries like India still retain the word ‘eradication’. The wheel has turned full circle from control to eradication to control again in 15 years

MANAGEMENT OF MALARIA PATIENT

Malaria can be cured with prescription drugs. The type of drugs and length of treatment depend on which kind of malaria is diagnosed, where the patient was infected, the age of the patient, and how severely ill the patient was at start of treatment.

The clinical diagnosis and treatment of malaria in a patient is to reduce the morbidity and mortality of malaria. It is well within the capability of the existing primary health care system. The health guides and the multipurpose workers are fully trained to detect and treat cases of malaria at the community level with support from the referral system

Prevention Startegy

1. Objectives

The Modified Plan of Operation under the NMEP came into force in April 1977 with following objectives.

- To prevent deaths due to malaria.
- To reduce malaria morbidity.
- To maintain agricultural and industrial production by undertaking intensive Anti malarial measures in such areas.
- To consolidate the gains so far achieved

2. Reclassification of endemic areas

- Experts suggested after careful study that areas with API of 2 and above should be taken up for spraying operations

3. Areas with API more than 2

- **Spraying:** All areas with API more than 2 are brought under regular insecticide spray with 2 rounds of DDT, unless the vector is refractory. When the vector is refractory to DDT then 3 rounds of HCH are used. Areas refractory both to DDT and HCH are to be treated with 3 rounds of Malathion spray at intervals of 6 weeks
- **Entomological assessment:** This is done by entomological teams. They carry out tests and finally recommend appropriate insecticides to be used in a given area.
- **Surveillance:** The collection and examination of blood smears is a key element of the modified plan. Active and passive surveillance activities are carried out in areas with $API > 2$
- **Treatment of cases.** Great emphasis is laid on the presumptive and radical treatment of cases

4. Areas with API<2

- **Spraying:** These areas will not be under regular insecticide spraying. However ‘focal spraying’ is to be undertaken in areas where falciparum cases are detected. As these areas will not be under regular spraying active and passive surveillance operations will have to be carried out vigorously.
- **Treatment:** All detected cases shall be given radical treatment.
- **Follow-up:** Follow-up blood smears are to be collected from all positive cases on completion of radical therapy and thereafter for 12 months every month.
- **Epidemiological investigation:** All malaria positive cases are to be investigated

5. Drug distribution centers (DDC) and fever treatment depots (FTD)

- With the increasing number of malaria cases the demand for anti-malarial drugs has increased tremendously. It became clear that drug supply through surveillance workers and medical institutions was not enough. This led to the establishment of DDC’s and FTD’s about 3.57 lacs of such centers are functioning throughout the country.

6. Urban Malaria Scheme

- As the cities grow the urban malaria poses an increasing problem. Poorly maintained water tanks on the roofs are one great nuisance and breeding place for vectors.
- The urban malaria scheme was introduced in 1971 to reduce or interrupt malaria transmission.
- The methodology consists of intensive anti-larval measures and drug treatment.
- The urban component of NMEP covers 181 cities and towns including New Delhi, Mumbai and Calcutta and Madras

7. P. Falciparum containment

- Within the modified plan of operation an additional component known as ‘P. Falciparum containment program’ has been introduced from October 1977 through the assistance of SIDA (Swedish International Development Agency)

8. Research

- Six monitoring teams are now working in different parts of India to identify P. Falciparum sensitivity to Chloroquine. One team is working on the testing of alternative drugs in chloroquine resistant pockets which are found in several states like Orissa, Bihar, Maharashtra, Assam, Madhya Pradesh, Andhra Pradesh and Nicobar and Andaman island

9. Health Education

- In the modified plan due emphasis has been laid on the awareness and education of the public regarding various issues in malaria prevention

10. Reorganization

- Earlier the NMEP was based on population distribution but did not conform to administrative boundaries. This has now been remedied and it has been reorganized with anti-malarial Units made according to the geographic boundaries. The district health officer is responsible for the implementation of the program. The officer in-charge of these units are called District Malaria Officers (DMO). They are posted in district head quarters, they have been entrusted with evaluation and operational aspects of the program. Assistant Malaria Officer usually assists the DMO.
- Laboratory services have been decentralized,
- Laboratory technicians are posted to each primary health center.
- Entomological teams have been posted to all the 72 zones in the country. The Chief Medical Officer and the Medical Officers at the Primary Health Centers have to play a key role in the execution of the program.
- The program, which was vertical earlier, has now been made horizontal and integrated with the general health services from the district level to the periphery and gradually surveillance workers are being replaced by Multipurpose Workers

SURVEILLANCE

It is aimed at case detection through laboratory services and providing facilities for treatment.

The timely collection of blood smears is a key element of Modified Plan of Operation. If all detected cases given radical therapy it will lead to depletion of human reservoir.

Active surveillance

- Paid workers called ‘surveillance workers’ who are now being replaced by MPW or Multi Purpose Workers who are allotted a population of 10,000 or approximately 2000 houses carry this out.
- For every 4 surveillance workers there is a Surveillance Inspector.
- In difficult terrains there is a surveillance worker for 8000 population.
- The surveillance worker visits each house in his area once in 15 days and enquires.

Whether there is a fever cases in the house including guests and visitors,

Whether there was a fever case between his previous visit and now if the answer to any of these is a yes the surveillance worker collects a blood film, thick and thin on the same slide and administers a single dose (600 mg for adult) of Chloroquine according to prescribed NMEP schedule. This is known as presumptive treatment. The surveillance worker makes necessary entries in the house register and sends the slides at least twice a week to the laboratory of the PHC for microscopic examination.

He is required to collect blood slides from the sub-centers and the fever treatment depots and send these to the laboratory.

If the blood film is reported positive for malaria, the surveillance worker returns to the patient and administers a course of radical therapy as prescribed.

Passive Surveillance

The search for malaria by the primary health centers, sub-centers, hospitals, dispensaries and local medical practitioners is termed passive surveillance.

Cases that escape the attention of active surveillance workers are generally deleted by passive surveillance the rest of the procedure followed is the same as in active surveillance

H) POLIOMYELITIS

Poliomyelitis is an acute viral infection caused by an RNA virus. It is primarily an infection of the human alimentary tract but the virus may infect the central nervous system in a very small percentage (about 1 per cent) of cases resulting in varying degrees of paralysis, and possibly death

GEOGRAPHIC DISTRIBUTION

In the pre-vaccination era, poliomyelitis was found in all countries of the world. The extensive use of polio vaccine since 1954 has virtually eliminated the disease in developed countries. For instance, before the introduction of polio vaccines, there were approximately 2,00,000 cases of polio occurring each year in the United States; the virus has now disappeared from Americas, the last case was reported from Peru in 1991. An outbreak of poliomyelitis in the Netherlands, with 68 confirmed cases in June 1993 after a gap of 15 years, led to a warning on the dangers of incomplete immunization. As long as even small pockets of unvaccinated persons exist, even the most developed countries will be at risk of sudden outbreak of poliomyelitis. During the year 1996, 20,000 cases of poliomyelitis were reported to WHO, with about 7,000 deaths. Tragic as the figure is, it still represents remarkable progress. In some countries, the decline has been spectacular. The OPV3 immunization coverage have gone up and during 1995, 83 per cent of the children upto 12 months were immunized world wide

WHO's campaign for the global eradication of this crippling disease by the year 2000 looks likely to be achieved. To mark WHO's World Health Day in 1995, 18 contiguous countries in the Middle East, and Central Asia immunized over 63 million children – the biggest multi-country effort of its kind. In a single day, China immunized more than 80 million children, and India 87 million. During 1995, more than 300 million children were immunized in 51 countries during mass campaigns aimed at eradicating poliomyelitis

"Lameness" surveys in several North Indian states showed annual incidence rates of 2 to 5 per 1000 rural pre-school children and 1 to 3 per 1000 urban pre-school children. Surveys in South India suggest that the prevalence of polio lameness among school children is about 3.5 per 1000 implying an annual incidence in the whole population of around 15 per 100,000

The first reported epidemic of polio occurred in 1949 in and around Bombay city. Since then, more epidemics have occurred at various times in Andhra Pradesh, Uttar Pradesh, Gujarat, Maharashtra, Rajasthan, Tamil Nadu and Delhi. More recently, widespread epidemics have occurred in 1981 and 1987, despite the fact that a national immunization program (EPI) has been in operation since 1978. The official statistics grossly underreport the number of cases,

since they are limited for the most part of hospitalized cases. The present situation of poliomyelitis in India is as seen in the table. The declining trends of poliomyelitis are encouraging and make the goal of polio eradication by the end of the century a realistic target

Reported cases of Poliomyelitis in India

Year	No. Of cases
1986	20169
1987	28264
1988	24257
1989	13866
1990	10408
1991	6028
1992	9390
1993(Prov)	7576
1994(Prov)	5881
1995(Prov)	3406

India plays an important role in the global eradication of poliomyelitis because of the presence of a large number of children under 5 years of age in the country (over 110 million). Surveys based on lameness due to poliomyelitis in children have been found to provide the simplest procedure for estimating the magnitude of problem

PREVALENCE

In developing countries such as India where the polio endemicity is stable, virtually all cases of polio have an onset before the fifth year of life. The most accurate technique to measure the prevalence of polio in a community therefore is a house to house survey of lameness and muscle wasting due to polio in children aged 5-10 years. Alternatively, surveys of school children may be taken up, less accurate though they may be. It has been found that surveys based on identifying lameness of the leg as a sole criterion for diagnosis of paralytic polio will identify about 80 per cent of cases. The total prevalence of residual paralysis due to poliomyelitis could be estimated by multiplying the prevalence of lameness due to polio by 1.25 and reported as cases per 1,000, usually in children older than 5 years. This prevalence rate represent the sum of all cases, almost all of which occurred from 0-4 years of age.

About one-fourth of cases (deaths, patients will complete recovery, change of residence) are not detected in clinical surveys for residual polio paralysis. A rough estimate of all clinical cases of poliomyelitis could be made by multiplying the prevalence rate of residual paralysis due to poliomyelitis by 1.33.

INCIDENCE

The prevalence rate of residual paralysis can be used to estimate annual incidence of paralytic cases. For example, if a prevalence rate of 10 cases per 1,000 is found in a cohort of children 5-10 years of age, correction for those cases not involving the lower extremities is done by multiplying the prevalence rate by 1.25, which gives a prevalence rate of 12.5 per 1,000. This can be translated into average annual incidence by dividing the prevalence rate (12.5) by the number of years at risk (i.e., five), giving an average annual incidence of 2.5 per 1,000 in the age group 0-4 years.

If the 0-4 years population is known (usually 20%) the annual incidence of polio for the whole population can be determined as follows:

$$\text{Annual incidence Per 1,000 in total} = \frac{\text{Annual incidence in the age group 0-4 years} \times \text{Distribution of 0-4 year age group in general population}}{\text{Population}}$$

Continuing the above example, if the 0-4 year-old population makes up 20 per cent of the population, the annual incidence is $2.5 \times 0.2 = 0.5$ per 1,000 population or 50 per 100,000 population. An estimate of all cases of paralytic poliomyelitis can be made by multiplying annual incidence by 1.33 to correct for those cases that completely recovered or died after onset of disease

EPIDEMIOLOGICAL TRENDS

Poliomyelitis can occur sporadically endemically or epidemically. During the past century or so, the epidemiological behavior of polio has considerably changed: (a) what was originally a sporadic disease, has evolved itself into an epidemic disease of varying degrees of severity, (b) what was predominantly a disease of infants (infantile paralysis), has shown a tendency to affect higher age-groups, and (c) epidemic poliomyelitis which was earlier confined to countries with temperate climate is now being increasingly reported from tropical countries, probably as a result of rising standards of living

I. Agent factors

Agent: The causative agent is the poliovirus, which has three sero types 1,2 and 3. Most outbreaks of paralytic polio are due to type-1 virus. Poliovirus can survive for long periods in the external environment. In a cold environment, it can live in water for 4 months and in faeces for 6 months. It is therefore well adapted for the faecal-oral route of transmission. However, the virus may be rapidly inactivated by pasteurization, and a variety of physical and chemical agents.

Reservoir of infection: Man is the only known reservoir of infection. Most infections are sub clinical. It is the mild and sub clinical infections that play a dominant role in the spread of infection; they constitute the submerged portion of the iceberg. It is estimated that for every clinical cases, there may be 1000 sub clinical cases in children and 75 in adults. There are no chronic carriers. No animal source has yet been demonstrated.

Infectious material: The virus is found in the faeces and Oropharyngeal secretions of an infected person.

Period of communicability. The cases are most infectious 7 to 10 days before and after onset of symptoms. In the faeces, the virus is excreted commonly for 2 to 3 weeks, sometimes as long as 3 to 4 months

II. Host factors

Age: In India, polio is essentially a disease of infancy and childhood. About 50 per cent of cases are reported in infancy. The most vulnerable age is between 6 months and 3 years.

Sex: Sex differences have been noted in the ratio of 3 males to one female.

Risk factors: Several provocative or risk factors have been found to precipitate an attack of paralytic polio in individuals already infected with polioviruses. They include fatigue, trauma, intramuscular injections, operative procedures such as tonsillectomy undertaken especially during epidemics of polio and administration of immunizing agents particularly alum-containing DPT.

Immunity: The maternal antibodies gradually disappear during the first 6 months of life. Immunity following infection is fairly solid although reinfection can occur since infection with one type does not protect completely against the other two types of viruses. Type 2 virus appears to be the most effective antigen. Neutralizing antibody is widely recognized as an important index of immunity to polio after infection

Age distribution of polio cases

Age group (years)	Institute of Child Health Madras(1983)		Kasturba Hospital Bombay (1984)		Kalawati Saran Children's Hospital, New Delhi (1983)	
	No.	%	No.	%	No.	%
Below 1	423	36.7	307	49.0	749	49.0
1+	487	41.9	235	37.6	445	37.6
2+	148	12.7	60	9.6	127	9.6
3+	65	5.6	15	2.4	31	2.4
4+	17	1.5	6	0.9	6	0.9
5+	18	1.6	3	0.5	4	0.5
Total	1158		626		1362	

Mode of transmission: (a) Faecal-oral route: This is the main route of spread in developing countries. The infection may spread directly through contaminated fingers where hygiene is poor, or indirectly through contaminated water, milk, food, flies and articles of daily use. (b) Droplet infection: This may occur in the acute phase of disease when the virus occurs in the

throat. Close personal contact with an infected person facilitates droplet spread. This mode of transmission may be relatively more important in developed countries where faecal transmission is remote.

Incubation period. Usually 7 to 14 days (range 3 to 35 days)

III. Environmental factors

Polio is more likely to occur during the rainy season. Approximately 60 per cent of cases recorded in India were during June to September. The environmental sources of infection are contaminated water, food and flies. Poliovirus survives for a long time in a cold environment. Overcrowding and poor sanitation provide opportunities for exposure to infection

CLINICAL FEATURES

When an individual susceptible to polio is exposed to infection, one of the following responses may occur

(i) In apparent (sub clinical) infection: This occurs approximately in 95 per cent of poliovirus infections. There are no presenting symptoms. Recognition only by virus isolation or rising antibody titers.

(ii) Abortive polio or minor illness: Occurs in approximately 4 to 8 per cent of the infections. It causes only a mild or self-limiting illness due to viraemia. The patient recovers quickly. The diagnosis cannot be made clinically. Recognition only by virus isolation or rising antibody titre.

(iii) Non-paralytic polio: Occurs in approximately 1 per cent of all infections. The presenting features are stiffness and pain in the neck and back. The disease lasts 2 to 10 days. Recovery is rapid. The disease is synonymous with aseptic meningitis.

(iv) Paralytic polio: Occurs in less than one per cent of infections. The virus invades CNS and causes varying degrees of paralysis. The predominant sign is asymmetrical flaccid paralysis. A history of fever at the time of onset of paralysis is suggestive of polio. The other associated symptoms are malaise, anorexia, nausea, vomiting, headache, sore throat, constipation and abdominal pain. There might be signs of meningeal irritation, i.e., stiffness of neck and back muscles. Tripod sign may be present, i.e., the child finds difficulty in sitting and sits by supporting hands at the back and by partially flexing the hips and knees. Progression of the paralysis to reach its maximum in the majority of cases occurs in less than 4 days (may take 4-7 days). The paralysis is characterized as descending, i.e., starting at the hip and then moving down to the distal parts of the extremity. As it is asymmetrical patchy paralysis, muscle strength varies in different muscle groups of different limbs. However, proximal muscle groups are more involved as compared to distal ones. Deep tendon reflexes (DTRs) are diminished before the onset of paralysis. There is no sensory loss. Cranial nerve involvement is seen in bulbar and bulbospinal forms of paralytic poliomyelitis. There might be facial asymmetry, difficulty in swallowing, weakness or loss of voice. Respiratory insufficiency can be life threatening and is usually the cause of death. After the acute phase, atrophy of the affected muscles lead to a life with residual paralysis, which is typical and relatively easy to identify as poliomyelitis.

Progressive paralysis, coma or convulsions usually indicate a cause other than polio, as does a very high case fatality rate.

There is no specific treatment for polio. Good nursing care from the beginning of illness can minimize or even prevent crippling. Physiotherapy is of vital importance. It can be initiated in the affected limb immediately. It helps the weakened muscles to regain strength. Very probably, the child may have to put on metal calipers.

POLIOMYELITIS ERADICATION

Poliomyelitis is eradicable because man is the only host. A long-term carrier state is not known to occur. The half-life of excreted virus in the sewage is about 48 hours and spread can only occur during this period. Oral polio vaccine, which is easy to administer and relatively cheap, is ideally suited for poliomyelitis eradication strategies because the live vaccine virus, by multiplying in the intestine can interrupt the transmission of the wild polioviruses. As this vaccine contains live attenuated poliovirus, when administered orally it mimics the natural route of infection, and it can also be transmitted from a recently vaccinated child to close contacts who have not been immunized. The simultaneous administration of OPV within a short period of time by mass immunized campaigns (as by Pulse Polio Program) interrupts transmission of wild poliovirus by displacing it from intestine, where the wild poliovirus multiplies. This effect is enhanced if the vaccination coverage is 100 per cent of the population at risk, i.e. children below 3 years of age. The net result is abrupt interruption of transmission of wild poliovirus in the community, a result that cannot be otherwise achieved.

PREVENTION

Immunization is the sole effective means of preventing poliomyelitis. Both killed and live attenuated vaccines are available and both are safe and effective when used correctly. It is essential to immunize all infants by 6 months of age to protect them against polio. Two types of vaccine are used throughout the world; they are:

II. Oral (Sabin) polio vaccine (OPV)

I. Inactivated (Salk) polio vaccine

This vaccine contains all the three types of poliovirus, inactivated by formalin. The primary or initial course of immunization consists of 4 inoculations. The first 3 doses are given at intervals of 1-2 months and 4th dose 6-12 months after the third dose. First dose is usually given when the infant is 6 weeks old. Additional doses are recommended prior to school entry and then every 5 years until the age of 18. Alternatively, one or two doses of live vaccine (OPV) can be given safely as boosters after an initial course of immunization with inactivated vaccine.

IPV induces, humoral antibodies (IgM, IgG and IgA serum antibodies) but does not induce intestinal or local immunity. The circulating antibodies protect the individual against paralytic polio, but do not prevent reinfection of the gut by wild viruses. For the individual, it offers nothing because the wild viruses can still multiply in the gut and be a source of infection to others. This is a major drawback to IPV. Further, in the case of an epidemic, IPV is unsuitable because: (i) immunity is not rapidly achieved, as more than one dose is required to induce

immunity, and (b) injections are to be avoided during epidemic times as they are likely to precipitate paralysis. Therefore, IPV is not efficacious in combating epidemics of polio.

Advantages: Inactivated polio vaccine, because it does not contain living virus, is safe to administer (i) to persons with immune deficiency disease (ii) to persons undergoing corticosteroid and radiation therapy (iii) to those over 2 years who are receiving vaccine for the first time, and (iv) during pregnancy.

Associated risks: No serious adverse reactions to IPV vaccines currently in use have been reported.

Improved IPV

More recently, a modified and improved IPV has become available. It has enhanced potency and better antigen stabilization than the classical Sabin vaccine. The vaccine is effective immediately after the first administration in 90 per cent of the children, even if they are still protected by their mother's immunity. The vaccine is 100 per cent effective after the second dose. The vaccine may be stored in a simple refrigerator, like the diphtheria and tetanus toxoids. Furthermore, it can be combined with DPT into a quadruple vaccine which simplifies the immunization schedule.

II. Oral (Sabin) polio vaccine (OPV)

Oral polio vaccine (OPV) was described by Sabin in 1957. It contains live attenuated virus (type 1,2 and 3) grown in primary monkey kidney or human diploid cell cultures. Ideally each virus type should be given separately as monovalent vaccine, but for administrative convenience, rather than efficacy, it is given as trivalent (TOPV) vaccine. The vaccine contains (i) over 3,00,000 TCID 50 of type 1 poliovirus (ii) over 1,00,000 TCID 50 of type 2 virus, and (iii) over 3,00,000 TCID 50 of type 3 virus per dose.

NATIONAL IMMUNIZATION SCHEDULE

The WHO Program on Immunization and the National Immunization Program in India recommend a primary course of 3 doses of OPV at one-month intervals, commencing the first dose when infant is 6 weeks old. OPV is given concurrently with DPT; BCG can be given simultaneously with the first dose of OPV. It is very important to complete vaccination of all infants before 6 months of age. This is because most polio cases occur between the ages of 6 months and 3 years. One booster dose of OPV is recommended 12 to 18 months later.

Dose and Mode of administration. The dose is 3 drops or as stated on the label. WHO recommends that vaccinators use dropper supplied with the vial of oral polio vaccine. This is the most direct and effective way to deliver the correct drop size. Tilt the child's back, and gently squeeze the cheeks or pinch the nose to make the mouth open. Let the drops fall from the dropper onto the child's tongue. Repeat the process if the child spits out the vaccine.

If the vaccine is spoon-fed there is a chance that it will not all be licked up by the child. Disinfectant like dettol or lysol should not be used from sterilizing the spoon. The ideal way would be to boil the spoon in water and cool it in ice water before administering the vaccine.

Development of immunity: On administration, the live vaccine strains infect intestinal epithelial cells. After replication, the virus is transported to the Payer's patches where a

secondary multiplication with subsequent viremia occurs. The virus spreads to other areas of the body, resulting in the production of circulating antibodies, which prevent dissemination of the virus to the nervous system and prevent paralytic polio. Intestinal infection stimulates the production of IgA Secretory antibodies, which prevent subsequent infection of the alimentary tract with wild strains of poliovirus, and thus is effective in limiting virus transmission in the community. Thus OPV induces both local and systemic immunity.

The vaccine progeny is excreted in the faeces and secondary spread occurs to household contacts and susceptible contacts in the community. Non-immunized persons may therefore be immunized. Thus widespread “herd immunity” results, even if only approximately 66 per cent of the community is immunized. This property of OPV has been exploited in controlling epidemics of polio by administering the vaccine simultaneously in a short period to all susceptible in a community. This procedure virtually eliminates the wild polio strains in the community and replaces them by attenuated strains. The duration of immunity produced by the OPV is not known, it may possibly even be lifelong.

Failure of 3-dose regimen: While 3 doses of OPV have been shown to be highly effective in inducing immunity in developed countries lower efficacy has been reported in a number of developing countries. This was amply demonstrated in the Delhi epidemic of 1971. The data showed that the proportion of children developing antibody after 3 doses of trivalent vaccine could be as low as 30 per cent in tropical countries, as against the more usual 90 per cent in temperate climate countries. This has been ascribed to various possible factors, e.g., interference by antibodies in breast milk, inter current enterovirus infections, and the presence of non-specific inhibitors in saliva of infants etc. None of these hypotheses has been definitely proved. Further, the frequency of OPV failure has increased gradually from about 5 per cent in late 1960s to about 30 per cent currently. This failure indicates a serious problem. In order to overcome this problem, the Indian Academy of Pediatricians has recommended 5 doses of OPV in clinic-based programs, and 3 doses in community campaigns. Some have recommended yearly doses up to the age of 8 years. More recently it is recommended that a dose of OPV is required to be given to all children delivered in health institutions before their discharge from the hospital. The vaccine should be given in the maternity wards. The child should not be taken to regular immunization sessions to avoid risk of infection. Breast – feeding does not interfere with OPV administration.

Advantages: The advantages of OPV are: (i) since given orally, it is easy to administer and does not require the use of highly trained personnel (ii) induce both humoral and intestinal immunity. (iii) antibody is quickly produced in a large proportion of vaccines, even a single dose elicits (except in tropical countries) substantial immunity (iv) the vaccine excretes the virus and so infects others who are also immunized thereby (v) useful in controlling epidemics (vi) relatively inexpensive.

Complications.

OPV is remarkably free from complications. However being living viruses, the vaccine viruses, particularly type 3 do mutate in the course of their multiplication in vaccinated children, and rare cases of vaccine-associated paralytic polio have occurred in (a) recipients of the vaccine, and (b) their contacts. The WHO has estimated the risk of vaccine-associated paralysis to be about 1 cases per million vaccines, and the risk of a close contact of a vaccine developing paralytic polio about 1 case per 5 million doses of vaccine.

Contraindications:

The contraindications for the administration of OPV are acute infectious disease, fevers, diarrhea and dysentery. Patients suffering from leukaemias and malignancy and those receiving corticosteroids may not be given OPV. There is as yet no indication that polio immunization may pose any danger to a pregnant mother or developing fetus. However, OPV should be delayed until after pregnancy unless immediate protection is required, when IPV is indicated.

Storage:

Stabilized vaccine: Recent oral polio vaccines are heat stabilized. They can be kept without losing potency for a year at 4 deg. C, and for a month at room temperature.

Non-stabilized vaccine: The vaccine should be stored at -20 deg C in a deep freeze. In case a deep freeze is not available, it might be stored temporarily in the freezing chamber of the refrigerator. During transport, the vaccine must be kept either on dry ice (solid carbon dioxide) or a freezing mixture (equal quantities of wet ice and ammonium chloride).

At the vaccination clinic, the bottle containing the OPV should not be frozen and thawed repeatedly since repeated freezing and thawing has a deleterious effect on the potency of live polio vaccine. It would be preferable to keep the vials of the vaccine in ice during its administration to children.

Recent studies indicate that breast-feeding does not impeded the effectiveness of oral poliovirus vaccine. Breast milk can be given whenever the child is hungry. However, hot water, hot milk or hot fluids should be withheld for about half an hour after the administration of the vaccine. The vaccine should be administered preferably in a cool room, rather than in a hot, humid and crowded room.

The problems with OPV may be summarized as follows,

(a) A primary problem is the instability of the vaccine at high ambient temperatures. The vaccine has to be kept frozen during storage, and kept cold during transportation, right up to the point of administration. This is not yet possible at the level of subcentres/primary health centers in most parts of India. Therefore, OPV remains largely an “urban” vaccine. (b) A second problem is the frequent vaccine failures even with fully potent vaccines. Children developing polio in spite of 3 doses of OPV is a common observation (c) A third problem is the very small neurovirulence in OPV

EPIDEMIOLOGICAL INVESTIGATIONS

The occurrence of a single case of polio should prompt an immediate epidemiological investigation, including an active search for other cases. An epidemic is defined now as 2 or more local cases caused by the same virus type in any 4-week period. Samples of faeces from all cases or suspected cases of polio should be collected and forwarded to the laboratory for virus isolation. In addition, where possible, paired sera should be collected, the first specimen at the clinical suspicion of paralytic polio and the second at the period of convalescence. A rising titer of poliovirus neutralizing antibody provides useful confirmatory evidence. The Indian Council of Medical Research has set up National Enterovirus Units at Bombay, Coonoor, Chennai, Delhi and Kasauli where samples may be sent for examination.

Under the International Health Regulations, polio is subject to international surveillance. The WHO should be notified as soon as possible of the occurrence of paralytic polio and to supplement reports on such outbreaks with additional epidemiological information such as the type of virus, and the number of cases and deaths reported. In addition a quarterly report (on prescribed form) should be sent to HO, Geneva. The WHO has prepared guidelines to poliovirus isolation and serological techniques for polio surveillance.

Strategies for polio eradication in India

1. Conduct Pulse Polio Immunization days every year for 3-4 years or until poliomyelitis is eradicated.
2. Sustain high levels of routine immunization coverage.
3. Monitor OPV coverage at district level and below.
4. Improve surveillance capable of detecting all cases of AFP due to polio and non-polio etiology.
5. Ensure rapid cases investigation, including the collection of stool samples for virus isolation.
6. Arrange follow-up of all cases of AFP at 60 days to check for residual paralysis.
7. Conduct outbreak control for cases confirmed or suspected to poliomyelitis to stop transmission.

Even a single case is treated as an outbreak and preventive measures are initiated, usually within 48 hours of notification of the case. The complete and timely reporting of cases of poliomyelitis is an important element for the eradication of poliomyelitis. Reporting of all cases of acute flaccid paralysis in children under 15 years of age is mandatory and line list of all reported cases of poliomyelitis is maintained. Since 1992, the active surveillance has been extended to all cases of acute flaccid paralysis, including causes other than poliomyelitis.

Within an epidemic area, OPV should be provided for all persons over 6 weeks of age who have not completely immunized or whose immune status is unknown.

PULSE POLIO IMMUNIZATION

Marking the largest single-day public health event ever, the Government of India conducted the first round of the Pulse Polio Immunization (PPI) on 9 December 1995, immunizing more than 87.81 million children with OPV. Of the children immunized, 73.33 million (90 per cent) were aged under 3 years and 8.48 million (10 per cent) 3 years or more. Six weeks later on 20 January 1996, 93.58 million children were immunized with OPV. Of the children immunized in second round, 85.42 million (91 per cent) were under 3 years of age (exceeding the estimated pre-campaign target of 80 million children under the age of 3 years) and 8.16 million (9 per cent) aged 3 years or more. Nearly 2 million health workers and volunteers conducted this Pulse Polio Immunization, using a network of approximately 0.5 million vaccination posts.

The first PPIs conducted in India targeted all children under 3 years of age (irrespective of their immunization status). Government of India has recently decided to increase the age

group for next PPI phase from under 3 years to under 5 years as recommended by WHO. The decision increases the total number of children in the target group from 80 million to 125 million. The second phase of PPI was conducted on 7th December 1996 and 18th January 1997 immunizing about 120 million children in a single day during each round. India is committed to sustaining these massive efforts for yearly PPIs during at least 3 consecutive years or until wild poliovirus circulation is interrupted

I) TYPHOID FEVER

Typhoid fever is the result of systemic infection mainly by *S. typhi* found only in man. The disease is clinically characterized by a typical continuous fever for 3 to 4 weeks, relative bradycardia with involvement of lymphoid tissues and considerable constitutional symptoms. The term "enteric fever" includes both typhoid and paratyphoid fevers. The disease may occur sporadically, epidemically or endemically

Typhoid fever occurs in all parts of the world where water supplies and sanitation are sub-standard. The disease is now uncommon in the developed countries where most of the cases that occur are either acquired abroad or imported by immigrants. In UK, typhoid fever has been brought very close to eradication with approximately one case per 1,000,000 population, which is perhaps the lowest incidence of typhoid in the world. Typhoid fever continues to be unabated in the developing countries of Africa, Asia and Latin America. World-wide typhoid fever affects about 6 million people with more than 600,000 deaths a year. Almost 80 per cent of cases and deaths are in Asia, and most of the others occur in Africa and Latin America. Since 1950, the organism's resistance to antibiotics has also been a growing problem; by 1989 resistance was reported in a number of countries, particularly in Asia and Middle East. Resistant strains have caused outbreaks of the disease in India and Pakistan in recent years. Without effective antibiotic treatment, typhoid fever kills almost 10 per cent of those infected. In South-East Asia, 50 per cent or more of the strains of the bacteria may already be resistant to several antibiotics. The socio-economic impact of the disease is huge, because typhoid survivors may take several months to recover and resume work.

Typhoid fever is endemic in India. Health surveys conducted by the Central Ministry of Health in the community development areas indicated a morbidity rate varying from 102 to 2219 per 100,000 population in different parts of the country. Patnaik (1967) reported an incidence of 110 among males and 75 among females per 100,000 population in Delhi. A limited study in an urban slum showed 1 per cent of children up to 17 years of age suffer from typhoid fever every year. Statistics for the period 1980-1986 showed on average more than 3,00,000 cases of enteric fever each year. Reported data for the year 1992 shows the same picture with 3,52,980 cases and 735 deaths

I. Agent factors

Agent: *S. Typhi* is the major cause of enteric fever. *S. para A* and *S. para B* are relatively infrequent

S. Typhi has three main antigens – O H and Vi and a number of phage types (at least 80). Phage typing has proved a useful epidemiological tool in tracing the source of epidemics. *S. Typhi* survives intracellularly in the tissues of various organs. It is readily killed by drying,

pasteurization, and common disinfectants. The factors that influence the onset of typhoid fever in man are infecting dose and virulence of the organism

Reservoir of infection: Man is the only known reservoir of infection, viz cases and carriers.

(i) Cases: The case may be mild, missed or severe. A case (or carrier) is infectious as long as bacilli appear in stools or urine.

(ii) Carriers: The carriers may be temporary (incubatory, convalescent) or chronic. Convalescent carriers excrete the bacilli for 6 to 8 weeks, after which their numbers diminish rapidly. By the end of three months, not more than 4 per cent of cases are still excreting the organisms; and by the end of one year, the average carrier rate is around 3 per cent. Persons who excrete the bacilli for more than a year after a clinical attack are called chronic carriers. In most chronic carriers, the organisms persist in the gall bladder and in the biliary tract. A chronic carrier state may be expected to develop in 2 to 5 per cent of cases. A chronic carrier may excrete the bacilli for several years (may be as long as 50 years) either continuously or intermittently. The famous case of "Typhoid Mary" who gave rise to more than 1300 cases in her lifetime is a good example of a chronic carrier. Faecal carriers are more frequent than urinary carriers.

Chronic urinary carrier state is often associated with some abnormality of the urinary tract.

Source of infection: The primary sources of infection are faeces and urine of cases or carriers; the secondary sources contaminated water, food, fingers and flies. There is no evidence that typhoid bacilli are excreted in sputum or milk

II. Host factors

Age: Typhoid fever may occur at any age. Highest incidence of this disease occurs in the 5-19 years of age group. After the age of 20 years, the incidence falls probably due to acquisition of immunity from clinical or sub clinical infection.

Sex: More cases are reported among males than females, probably as a result of increased exposure to infection. But carrier rate is more in females.

Immunity: All ages are susceptible to infection. Antibody may be stimulated by the infection or by immunization; however, the antibody to the somatic antigen (O) is usually higher in the patient with the disease, and the antibody to the flagellar antigen (H) is usually higher in immunized individuals. Serum antibodies are not the primary defenses against infection; *S. typhi* being an intracellular organism, cell-mediated immunity plays a major role in combating the infection. Natural typhoid fever does not always confer solid immunity; second attacks may occur when challenged with a large oral dose. Among the host factors that contribute to resistance to *S. typhi* are gastric acidity and local intestinal immunity.

Incubation period: Usually 10-14 days. But it may be as short as 3 days or as long as three weeks depending upon the dose of the bacilli ingested.

Mode of transmission: Typhoid fever is transmitted via the faecal-oral route or urine-oral routes. This may take place directly through soiled hands contaminated with faeces or urine of cases or carriers, or indirectly by the ingestion of contaminated water, milk and / or food, or through flies.

There are numerous sources of infection and many vehicles of transmission, each making its own contribution to the total magnitude of the problem. The situation is rendered more complex by the web of social, cultural and economic factors, which determine the quality of life of the people.

III. Environmental and social factors

Enteric fevers are observed all through the year. The peak incidence is reported during July-September. This period coincides with the rainy season and an increase in fly population.

Outside the human body, the bacilli are found in water, ice, food, milk and soil for varying periods of time. Typhoid bacilli do not multiply in water; many of them perish within 48 hours, but some may survive for about 7 days. They may survive for over a month in ice and ice cream. They may survive for up to 70 days in soil irrigated with sewage under moist winter conditions, and for half that period under drier summer conditions. Food being a bad conductor of heat provides shelter to the bacilli, which may multiply and survive for sometime in food. Typhoid bacilli grow rapidly in milk without altering its taste or appearance in anyway. Vegetables grown in sewage farms or washed in contaminated water are a positive health hazard. These factors are compounded by such social factors as pollution of drinking water supplies, open air defecation and urination, low standards of food and personal hygiene and health ignorance. Typhoid fever may therefore be regarded as an index of general sanitation in any country.

CONTROL OF TYPHOID FEVER

The control or elimination of typhoid fever is well within the scope of modern public health. This is an accomplished fact in many developed countries. There are generally three lines of defense against typhoid fever:

1. Control of reservoir
2. Control of sanitation, and
3. Immunization

1. Control of reservoir

The usual methods of control of reservoir are their identification, isolation, treatment and identification, isolation, treatment and disinfection.

Cases: (i) Early diagnosis: This is of vital importance as the early symptoms are non-specific. Culture of blood and stools are important investigations in the diagnosis of cases (ii) Notification: This should be done where such notification is mandatory (iii) Isolation: Since typhoid fever is infectious and has a prolonged course, the cases are better transferred to a hospital for proper treatment as well as to prevent the spread of infection. As a rule, cases should be isolated till three bacteriologically negative stools and urine reports are obtained on three separate days (iv) Treatment: Chloramphenical remains the drug of choice, if the bacilli are sensitive to it. For adults, the dose is 500 mg (approximately 50 mg per kg. of body weight per day) 4-hourly while febrile, and thereafter 500 mg 6-hourly for a total period of 14 days. Co-trimoxazole, amoxycillin and trimethoprim are equally effective. Patients seriously ill and profoundly toxic may be given an injection of hydrocortisone 100 mg daily for 3 to 4

days. (v) Disinfection: Stools and urine are the sole sources of infection. They should be received in closed containers and disinfected with 5 per cent cresol for at least 2 hours. All soiled clothes and linen should be soaked in a solution of 2 per cent chlorine and steam-sterilized. Nurses and doctors should not forget to disinfect their hands. (vi) Follow up: Follow-up examination of stools and urine should be done for S. Typhi 3 to 4 months after discharge of the patient, and again after 12 months to prevent the development of the carrier state. With early diagnosis and appropriate treatment, mortality has been reduced to about 1 per cent compared to about 30 per cent in untreated cases.

Carriers: Since carriers are the ultimate source of typhoid fever, their identification and treatment is one of the most radical ways of controlling typhoid fever. The measures recommended are: (i) Identification: Carriers are identified by cultural and serological examinations. Duodenal drainage establishes the presence of salmonella in the biliary tract in carriers. The Vi antibodies are present in about 80 per cent of chronic carriers (ii) Treatment: The carrier should be given an intensive course of ampicillin (4-6 g a day) together with probenecid (2 g/day) for 6 weeks. These drugs are concentrated in the bile and may achieve eradication of the carrier state in about 70 per cent of carriers. Chloromycetin is considered worthless for clearing the carrier state. (iii) Surgery: Cholecystectomy with concomitant ampicillin therapy has been regarded as the most successful approach to the treatment of carriers. Cure rate may be as high as 80 per cent. Urinary carriers are easy to treat, but refractory cases may need nephrectomy when one kidney is damaged and the other is healthy. (iv) Surveillance: The carriers should be kept under surveillance. They should be prevented from handling food, milk or water for others (v) Health education: Health education regarding washing of hands with soap after defecation or urination and before preparing food is an essential element. In short, the management of carriers continues to be an unsolved problem. This is the crux of the problem in the elimination of typhoid fever

2. Control of sanitation

Protection and purification of drinking water supplies, improvement of basic sanitation, and promotion of food hygiene are essential measures to interrupt transmission of typhoid fever. For instance, typhoid fever is never a major problem where there is a clean domestic water supply. Sanitary measures not followed by health education may produce only temporary results. However, when sanitation is combined with health education, the effects tend to be cumulative, resulting in a steady reduction of typhoid morbidity.

3. Immunization

While ultimately, control of typhoid fever must take the form of improved sanitation and domestic and personal hygiene, these are long-term objectives in many developing countries. A complementary approach to prevention is immunization, which is the only specific preventive measure likely to yield the highest benefit for the money spent. Immunization against typhoid does not give 100 per cent protection, but it definitely lowers both the incidence and seriousness of the infection. It can be given at any age upwards of one year. It is recommended to (i) those living in endemic areas (ii) household contacts (iii) groups at risk of infection such as school children and hospital staff (iv) travelers proceeding to endemic areas, and (v) those attending meals and yatras

ANTI-TYPHOID VACCINES

Although Wright introduced typhoid vaccine in 1896, it was not until the 1960s, its effectiveness was established by controlled field trials. These trials showed that 2 doses of phenol-killed typhoid vaccine gave better protection (70-75 per cent for about 3 years) than 2 doses of the alcohol-killed vaccine (60 per cent protection for 1-2 years). Later studies showed that 2 doses of acetone-killed vaccine was superior to both phenol and alcohol vaccines, giving about 70-85 per cent shown that a live attenuated oral vaccine prepared from a mutant strain gave a clinical protection of 95 per cent.

The anti-typhoid vaccines currently available in India are:

1. Monovalent anti-typhoid vaccine
2. Bivalent anti-typhoid vaccine
3. TAB vaccine

Monovalent Vaccine: Since *S. typhi* is the major cause of typhoid fever in India, the vaccine of choice is naturally the monovalent typhoid vaccine, which is an agar-grown, heat killed and phenol-preserved vaccine, containing 1,000 million of *S. typhi* per ml. It may also be prepared by inactivation of the organisms with acetone and the vaccine is known as AKD (acetone killed and dried) anti-typhoid vaccine.

Bivalent Vaccine: The bivalent vaccine contains *S. typhi* and *S. paratyphi A* in the proportion of 1,000 million and 500 million organisms respectively. The organisms are killed and preserved by heating at 54C for one hour and by the addition of 0.5 per cent phenol. The bivalent vaccine may also be prepared by the inactivation of the organisms with acetone in the dried form (AKD vaccine).

TAB Vaccine: The traditional TAB vaccine contained *S. typhi* (1,000 million), *S. paratyphi A* (500-750 million) and *S. paratyphi B* (500-750 million) organisms per ml. The paratyphi antigens in the vaccine are not only though to be of doubtful effectiveness, but their presence enhanced reactions caused by extra proteins of paratyphoid A and B components. Therefore the traditional TAB vaccine has fallen into disfavor. The WHO recommended that the TAB vaccine should be discontinued.

DOSAGE AND MODE OF ADMINISTRATION

Primary immunization: Primary immunization should consist of 2 doses (each of 0.5 ml) of vaccine, given subcutaneously, at an interval of 4-6 weeks. Children between 1 and 10 years are to be given smaller doses (i.e., 0.25 ml). A special diluted vaccine is available for children, and should be used when available. The usual site of the injection is the outer aspect of the upper arm, behind the posterior border of the distal part of the deltoid muscle. Immunity develops 10-21 days after inoculation, and the protection is maintained for at least 3 years. (b) Booster doses: Booster doses are recommended every 3 years. If booster is allowed to lapse for more than 3 years it is necessary to repeat the full primary course. Some individuals do not develop immunity against typhoid fever even though they may have received two or more injections of typhoid vaccine.

Reactions: Typhoid vaccine generally causes local reactions (pain, swelling and tenderness) and also very frequently constitutional symptoms such as malaise, headache, and pyrexia, which however, usually subside within 36 hours. To reduce the severity of reactions, it has

been advised that the vaccine be administered late in the afternoon or evening. Aspirin or other antipyretic drugs may be administered to mitigate the unpleasant reactions. Women should not be injected during late pregnancy.

Storage: Anti-typhoid vaccines should be stored in a refrigerator at 2 to 4 °C. They should not be frozen. Under conditions of storage, potency is retained for a period of 18 months.

LIVE ORAL Ty 21a VACCINE

Live oral vaccines against typhoid are on the scene. Two attenuated strains of *S. typhi* – *S. typhi*, Ty 21a developed by Swiss, and 541 Ty by US scientists, are being evaluated as live oral vaccines. Extensive trials in Chile and Egypt have demonstrated the safety of Ty 21a in more than 500,000 school children. In Egypt, 3 doses of liquid formulation gave 96 per cent protection for at least 3 years. Clinical trials with attenuated *S. typhi* strain 541 Ty have only recently begun, but in these initial studies the vaccine has been safe and highly immunogenic.

Typhoral (oral typhoid vaccine): Based on the results of Chile and Egypt trials, Ty21a vaccine is registered in more than 5 countries including India. Typhoral is an enteric-coated capsule of lyophilized vaccine. It contains not less than 10 viable organisms of the attenuated *Salmonella typhi* strain Ty21a. This registered strain is completely devoid of pathogenicity due to an irreversible change in cell-wall biosynthesis. It is indicated for immunization of adults and children aged more than 6 years. One capsule is administered on days 1, 3 and 5 irrespective of age, one hour before a meal with cold or lukewarm milk or water. Protection commences 2 weeks after taking the last capsule, and lasts for at least 3 years. Therefore a booster (same 3 doses) is recommended once every three years.

The vaccine is not recommended in congenital or acquired immunodeficiency including treatment with immunosuppressive and antimitotic drugs, acute febrile illness and acute intestinal infections.

J) TUBERCULOSIS

Tuberculosis is a specific infectious disease caused by *M. Tuberculosis*. The disease primarily affects lungs and causes pulmonary tuberculosis. It can also affect intestine, meninges, bones and joints, lymph glands, skin and other tissues of the body. The disease is usually chronic with varying clinical manifestations. The disease also affects animals like cattle; this is known as “bovine tuberculosis”, which may sometimes be communicated to man. Pulmonary tuberculosis, the most important form of tuberculosis, which affects man, will be considered here.

Tuberculosis remains a world-wide public health problem despite the fact that the causative organism was discovered more than 100 years ago and highly effective drugs and vaccine are available making tuberculosis a preventable and curable disease. According to conservative estimates, there are 15-20 million cases of infections tuberculosis in the world. This “infectious pool” is maintained by the occurrence of 4-5 million new cases and 3 million deaths each year.

Technologically advanced countries have achieved spectacular results in the control of tuberculosis. For example, from 1900 to the 1980 tuberculosis death rate declined from 199 to 0.5 per 100,000 in the United States. This decline started long before the advent of BCG or chemotherapy and has been attributed to changes in the “non-specific” determinants of the

disease such as improvements in the standard of living and the quality of life of the people coupled with the application of available technical knowledge and health resources

The problem of tuberculosis is acute in the developing countries which account for more than three fourths of the cases in the world and where the majority of cases are never diagnosed at all, still less get correctly treated. In the majority of developing countries there has been little, if any, improvement in the epidemiological situation. In fact there has been an overall increase in the absolute number of tuberculosis cases in these countries during the last three decades, because of the population explosion during this period. In many developing countries, particularly in Asia, acquired drug resistance remains high, because national tuberculosis control programs in these countries have not been able to achieve a high cure rate over a very long period of time, even after the introduction of short-course chemotherapy. Poverty, economic recession, and malnutrition make populations more vulnerable to tuberculosis. Recent increase in human migration has rapidly mixed infected with uninfected communities

In the absence of reliable data and standardized procedures in many countries, the global situation of tuberculosis may be summarized, at best, as in. The presents tuberculosis case notifications and the corresponding rate per 100,000 population by WHO Region, comparing the average of 1984-1986 and that of 1990-1993, with the percentage change between the two periods. The notification rates (per 100,000 population) increased by 14.2 per cent between 1984-86 and 1990-93 period. All Regions except the America and Europe shared this increase.

Overall, an average 3.8 million cases of tuberculosis were reported in the period 1990-93. The magnitude of the problem is such that WHO declared it a global emergency in 1993. More recently during 1996, an estimated 7.4 million people developed tuberculosis bringing the global total of sufferers to about 22 million, of whom about 3 million will have died in the same space of time. This huge toll is the price the world is paying for complacency. It is the cost of learning that tuberculosis is not, after all, a disease of the past. If the effectiveness and availability of tuberculosis control measures do not improve substantially, more than 30 million tuberculosis deaths and nearly 90 million new cases are expected to occur in the last decade of this century.

Eight out of ten of all those struck by tuberculosis are in the economically productive age group of 15-49 years. About 95 per cent are in the developing world, with South-East Asia, the Western Pacific and Africa the worst affected regions. Out-breaks are occurring in the United States where the number of cases increased by 14 per cent. To make the global situation worse, tuberculosis has formed a lethal combination with HIV. At the same time, drug-resistant tuberculosis is a growing threat worldwide. Incomplete or inappropriate treatment of the disease has spawned the development of strains that are resistant to drugs that once destroyed the bacteria in 100 per cent of cases. Cure rates of up to 95 per cent fell to 56 per cent or less with Isoniazid and Rifampicin resistance, and among AIDS patients infected with bacilli resistant to both drugs, a case-fatality rate of 91 per cent has been reported in one study.

On the basis of the criterion laid down by the WHO, no single country in the world has succeeded in reaching the point of control, i.e., less than 1 per cent tuberculin-positive among children in the age-group, 0-14 years.

Tuberculosis continues to be major public health problem in India. Since the national reporting system is defective, the only reliable source of information on the magnitude of the tuberculosis problem has been the population sample surveys. Many such surveys have been conducted in the country during the past two decades or so.

The only authentic survey on a countrywide basis is the National Sample Survey (1955-1958) conducted by the Indian council of Medical Research. Even this survey has its lacunae-the sample was drawn from less than 50 per cent of the country's population; large tracts of the country could not be included in the survey; tuberculin testing was not included in the survey since extensive tuberculin-testing and BCG vaccination has already been carried out in large parts of the country. After 1958, no representative survey has been carried out.

The National Tuberculosis Institute, Bangalore undertook three longitudinal surveys – at Delhi, Bangalore, and Chingleput. These surveys were also not representative of the entire country.

Several other small scale surveys have been carried out by interested workers – Raj Narain, Frimodt-Moller, Pamra, Gothi, to mention a few. Although unrepresentative, all these surveys taken together have thrown considerable light on the tuberculosis problem in India. Briefly, the findings were:

Frequency of Infection:

(a) **Prevalence of infection:** The overall prevalence of infection (as judged by the standard tuberculin test) was about 30 per cent: males 35 per cent, and females 25 per cent. Shows the prevalence of infection as reported by the National Tuberculosis Institute, Bangalore, in their longitudinal survey, fourth round. Thus about 30 per cent of the population was infected in contrast to 2-3 per cent in developed countries. (b) Incidence of infection: As per the prevalence studies done between 1961 to 1989 the annual risk of infection among unvaccinated children 0-9 year olds ranges from 0.6% to 2.3%. According to experts it is safe to estimate that at least 50% of the population above the age of 20 years is infected and will remain at risk of the disease throughout their lifetime. A conservative estimate is that currently the rate of infection for India is 1 to 2%.

Frequency of Disease:

(a) **Prevalence of disease:** The prevalence of bacteriologically confirmed disease was 4 cases per 1,000 population, four times as high as incidence. (b) Incidence of new cases: The incidence of new cases of tuberculosis (confirmed by culture) was about 1 per 1,000 (excluding children below the age of 5 years).

Age and Sex trends:

(a) **Age:** Prevalence of infection increased with the age up to the age of 45-54 years in males. Tuberculosis is becoming a disease of elderly males. (b) **Sex:** In females, the peak of tuberculosis prevalence is below 35 years. There was a fall in the prevalence rates in higher age group in women.

Time trend:

The trend of tuberculosis appears to be almost constant over the years except in some cities where better services for diagnosis and treatment have been available for sometimes.

Rural-urban differences:

Tuberculosis infection as well as disease is more or less uniformly distributed in urban, semi-urban and rural areas. Thus the vast majority of cases are to be found in rural and semi-urban areas, where more than 80 per cent of the country's population lives. In urban areas, tuberculosis is found more frequently in slum dwellers and lower socio-economic groups than in well – to – do groups.

Non-specific sensitivity:

Non-specific sensitivity is highly prevalent in the entire country, but it is definitely lower in areas situated at higher altitudes.

Mortality:

Death rates are declining. The rough estimate of mortality from tuberculosis per 100,000

Population was 400 in 1920-1921; 200 in 1950-1951; 100 in 1964; and 60 to 80 estimated now. Life span of tuberculosis patients has increased.

Pulmonary tuberculosis is thus India's biggest public health problem. The number of cases of any one time has been estimated to be at least 1.5 per cent of the population suffering from radiologically active tuberculosis, with about one fourth of the cases being sputum positive or infectious. It is estimated that there are 500,000 deaths annually due to this disease, while a similar number of persons get cured. This is more than balanced by an addition of about 2-2.5 million sputum positive cases annually.

Since death rate is declining and the disease is showing a decline in younger age groups, epidemiologists are beginning to think that perhaps we may have crossed the peak of the secular epidemic curve and are somewhere at the beginning of the declining limb.

I. AGENT FACTORS

Agent: M. Tuberculosis is a facultative intracellular parasite, i.e., it is readily ingested by phagocytes and is resistant to intracellular killing. Of importance to man are the human and bovine strains. The human strain is responsible for the vast majority of cases. The bovine strain affects mainly cattle and other animals. Regarding virulence, the Indian tubercle bacillus is said to be less virulent than the European bacillus. In recent years, a number of "atypical" mycobacteria have been isolated from man. These have been classified into four groups. (i) photochromogens (e.g., M. Kansae); (ii) scotochromogens (e.g., M. scrofulaceum); (iii) non-photochromogens (e.g., M. fortuitum). All these are mainly saprophytic. Diseases attributed to them have resembled pulmonary tuberculosis and chronic cervical lymphadenitis. Non-specific infections have been reported to be widely prevalent in the southern part of India.

Source of Infection: There are two sources of infection – human and bovine. (i) Human source: The most common source of infection is the human case whose sputum is positive for tubercle bacilli and who has either received no treatment or not treated fully. Such sources can discharge the bacilli in their sputum for years. The tubercle bacilli in a human case are

usually a mixed group-some multiply very rapidly and some slowly. The more rapidly a bacillary strain multiplies the more susceptible it is to the bactericidal action of chemotherapeutic drugs. The slow multipliers are the source of persistent or dormant bacilli; they can remain alive for years without causing harm to the host, but when conditions are favorable they may start multiplying again and cause active disease. That is, they are the seeds of a future relapse. (ii) Bovine source: The bovine source of infection is usually infected milk. There is no definite evidence that bovine tuberculosis is a problem in this country because of the practice of boiling milk before consumption

Communicability: Patients are infective as long as they remain untreated. Effective antimicrobial treatment reduces infectivity by 90 per cent within 48 hours

II. HOST FACTORS

Age: Tuberculosis affects all ages. Developing countries show a sharp rise in infection rates from infancy to adolescence. In India, from an average of 1 per cent in the "under 5 age group", the infection index climbs to about 30 per cent at age 15 years. In the developed countries, the disease is now more common in the elderly.

Sex: More prevalent in males than in females.

Heredity: Tuberculosis is not a hereditary disease. However, twin studies indicate that inherited susceptibility is an important risk factor.

Nutrition: Malnutrition is widely believed to predispose to tuberculosis, but the available evidence on this point is only indirect. Pioneering studies in India at the Tuberculosis Chemotherapy Center, Madras showed that diet had no discernible influence on the recovery of patients in the context of potent chemotherapeutic drugs.

Immunity: Man has no inherited immunity against tuberculosis. It is acquired as a result of natural infection or BCG vaccination. Past infection with atypical mycobacterium is also credited with certain amount of naturally acquired immunity. It is now known that both delayed hypersensitivity and acquired resistance to tuberculosis are cell-mediated responses. In most cases, the cellular immunity proves adequate to limit further multiplication and spread of bacilli.

In the pre-chemotherapy era, the treatment of tuberculosis was directed mainly at strengthening the host's resistance to disease by altering the general host factors (e.g., rest, fresh air, nutrition). With the advent of chemotherapy host factors are considered to be less relevant in the epidemiology of tuberculosis.

Social factors: Tuberculosis is a social disease with medical aspects. It has also been described as a barometer of social welfare. The social factors include many non-medical factors such as poor quality of life, poor housing, and overcrowding, population explosion, under nutrition, lack of education, large families, early marriage, lack of awareness of causes of illness, etc. All these factors are interrelated and contribute to the occurrence and spread of tuberculosis. In fact, tuberculosis began to decline in the western world long before the advent of chemotherapeutic drugs. This has been attributed to improvements in the quality of life.

Mode of Transmission: Tuberculosis is transmitted mainly by droplet infection and droplet nuclei generated by sputum-positive patients with pulmonary tuberculosis. To transmit infection, the particles must be fresh enough to carry a viable organism. Coughing generates the largest number of droplets of all sizes.

The frequency and vigour of cough and the ventilation of the environment influence transmission of infection. Tuberculosis is not transmitted by fomites, such as dishes and other articles used by the patients. Sterilization of these articles is therefore of little or no value. Patients with extrapulmonary tuberculosis or smear-negative tuberculosis constitute a minimal hazard for transmission of infection

Incubation period

The time from receipt of infection to the development of a positive tuberculin test ranges from 3 to 6 weeks, and thereafter, the development of disease depends upon the closeness of contact, extent of the disease and sputum positivity of the source case (dose of infection) and host-parasite relationship. Thus the incubation period may be weeks, months or years

CONTROL OF TUBERCULOSIS

Tuberculosis control means reduction in the prevalence and incidence of disease in the community. The WHO defines that tuberculosis “control” is said to be achieved when the prevalence of natural infection in the age group 0-14 years is of the order of 1 per cent. This is about 40 per cent in India. It means we have to go a long way to reach the goal of control set by the WHO.

Since tuberculosis is an infectious disease, the basic principles of prevention and control are the same as for any other infectious disease. The control measures consist of a curative component-namely case finding and treatment; and a preventive component-namely BCG vaccination. These are the two fundamental component of a national tuberculosis program. The most powerful weapon, however, is the combination of case finding and treatment

DISEASE PREVENTION

Case finding

The first step in a tuberculosis control program is early detection of sputum-positive cases. This should be an intensive, on-going program. For the purpose of tuberculosis control, a “case” is defined by WHO as a patient whose sputum is positive for tubercle bacilli, and such cases are the target of case finding. All other possible sufferers from tuberculosis whose sputum is negative but who show suggestive shadows in chest X-rays are reckoned as “suspects”.

Target group

Sociological studies carried out in India have shown that an overwhelming majority of patients of pulmonary tuberculosis have one or more of the symptoms referable to chest, such as persistent cough and fever, and many of them (over 60 per cent) seek medical advice on their own initiative. The chest symptoms often develop early, that is before the disease has gone on to an advanced stage. This is the most fertile group for case finding.

Case finding tools

(i) Sputum examination: Sputum smear examination by direct microscopy is now considered the method of choice. The reliability, cheapness and ease of direct microscopic examination has made it number one case-finding method all over the world. It enables us to discover the epidemiologically most important cases of pulmonary tuberculosis, i.e., those excreting tubercle bacilli in their sputum. This is the group which contribute most of the new cases to the “pool of infection” every year”.

Studies have shown that examination of two consecutive specimens (e.g., of on-the-post and overnight sputum) is sufficient to detect a large number of infectious cases in the community.

Under India’s District Tuberculosis Program (DTP), the first priority is given to direct smear examination of sputum of patients who, of their volition, attend hospitals and health centers with the following persistent chest symptoms:

1. Persistent cough of about 3 or 4 weeks duration
2. Continuous fever
3. Chest pain
4. Haemoptysis

Sputum culture: Culture examination of sputum is only second in importance in a case-finding program. It is not only difficult, tedious, lengthy (takes at least 6 weeks) and expensive but also needs special training and expertise. It is therefore offered as a centralized service at district and regional chest clinic laboratories. This method of examination is offered only to patients presenting themselves with chest symptoms, whose sputum smear is negative by direct microscopic examinations. Culture of sputum is necessary for carrying out sensitivity tests and monitoring drug treatment.

(ii) Mass miniature radiography: Mass miniature radiography examinations have been stopped as a general measure of case finding. The short-comings of mass radiography are: (a) lack of definitiveness, i.e., the mere presence of X-ray shadows is not indicative of a “case” unless the presence of tubercle bacilli are demonstrated; (b) high cost (c) high proportion of erroneous interpretation of films, and (d) very low yield of cases commensurate with the effort involved. In view of these disadvantages, the WHO Expert Committee on Tuberculosis (1974) concluded that indiscriminate tuberculosis case finding by mass miniature radiography should be abandoned.

(iii) Tuberculin test: As the diagnostic value of tuberculin test is invalidated, this test has little value as a case-finding tool.

Case finding should not be an end in itself. It is of little value as a control measure unless followed by chemotherapy. Resources and efforts should be directed towards primary health care, rather than irrational case finding.

Chemotherapy

The development of effective treatment for tuberculosis has been one of the most significant advances during this century. With the evolution of controlled trials, the chemotherapy of tuberculosis is not more rationally based than in the treatment of other infectious diseases.

Chemotherapy is indicated in every case of active tuberculosis. The objective of treatment is cure – that is, the elimination of both the fast and slowly multiplying bacilli (including the persisters) from the patient's body. The effects of chemotherapy are judged not by the anatomic healing of lesions, but mainly by the elimination of bacilli from the patient's sputum. Chemotherapy should be easily available, free of charge to every patient detected. It should be adequate, appropriate and applied to the entire pool of infectors in the community. Patient compliance is critically important; the patient must take the correct drugs at the correct dosage for the correct length of time. Incomplete treatment puts the patient at risk of relapse and the development of bacterial resistance and, importantly, the community at risk of infection with resistant organisms.

ANTI-TUBERCULOSIS DRUGS

There are now twelve or thirteen drugs active against M. Tuberculosis, of which, six are considered to be essential. An antitubercular drug should satisfy the following criteria: (a) highly effective (b) free from side effects (c) easy to administer, and (d) reasonably cheap. The currently used drugs may be classified into two groups: bactericidal and bacteriostatic. The bactericidal drugs kill the bacilli in vivo. The bacteriostatic drugs inhibit the multiplication of the bacilli and lead to their destruction by the immune mechanism of the host. A brief review of these drugs is given below

BACTERICIDAL DRUGS	BACTERIOSTATIC DRUGS
Rifampicin (RMP) INH Thioacetazone Streptomycin Pyrazinamide	Ethambutol

K) NOSOCOMIAL INFECTIONS

It is an infection acquired by a patient in a hospital or health care facility. It denotes a new disorder unrelated to the patient's primary condition. That is, it was not present or incubating at the time of admission. It is also not the residual of an infection acquired during a previous admission.

It includes infections acquired in the hospital but appearing after discharge. Examples include infections of surgical wounds, Hepatitis-B and Urinary tract infections. Nosocomial infections may arise because three main factors

Host factors: This is mainly reflected in the genetic predisposition, hereditary factors, and previous medical history of the host.

Environment factors: This is reflected in the hospital hygiene and sanitation and also the infection control processes in place Agent factors. This is reflected in the ability of the organisms to breach the infection control devices and processes of the hospital as also the resistance it acquires against antibiotics

The Nosocomial infections may occur in the form of:

- Infections due to antibiotic resistance
- Infections transmitted through blood transfusion
- Airborne infections
- Waterborne infections
- Food borne infections
- Vector borne infections
- Every disease has certain weak points and this susceptibility is used to break the chain of transmission. This requires sound epidemiological knowledge of the disease. Frequently it may be required to institute more than one method of control simultaneously. Although effective control of a disease requires knowledge of it a multifactorial causality, removal of a single known essential link or the weakest link may be sufficient to control the disease. Infections due to anti microbial resistance

STEPS OF CONTROL

Disease control implies all the measures designed to prevent or reduce as much as possible the incidence, prevalence and consequences of disease. This includes community participation, political support and inter-sectoral co-ordination.

Hand Washing and Skin Antisepsis

A number of factors are associated with poor adherence to hand hygiene, including:

- MD status;
- Male gender,
- Less knowledge about hand hygiene; and refractory noncompliance.

Use of alcohol-based hand rubs improved hand hygiene from 48% to 70%. There is widespread belief among healthcare workers that alcohol-based hand rinses and gels dry out hands. However, both subjective and objective evaluations of hand condition by volunteers and healthcare personnel using alcohol-based hand rubs have shown that alcohol rubs or gels were better accepted and less harsh than soap-and-water hand washes.

Alcohol-based hand rubs for hand hygiene

A control measure that was particularly emphasized this year was the use of alcohol-based hand rubs for hand hygiene, aimed at improving the more than 150 years of dismal adherence of healthcare workers to hand washing recommendations.

A major gap in hospital hygiene is failure of hospital personnel to practice adequate hand hygiene. A multitude of studies over the past 20-30 years have demonstrated compliance with hand hygiene to be in the 20% to 50% range for most hospital workers, despite much higher self-reported adherence. There is widespread belief among healthcare workers that alcohol-based hand rinses and gels dry out hands. However, both subjective and objective evaluations of hand condition by volunteers and healthcare personnel using alcohol-based hand rubs have shown that alcohol rubs or gels were better accepted and less harsh than soap-and-water hand washes.

Universal gloving

William Trick, MD, Hospital Infections Program, CDC, reported on a comparison of universal gloving to contact isolation precautions (i.e., use of gown and gloves) to prevent transmission of multidrug-resistant bacteria in a long-term care facility. He noted a 60% compliance rate with universal gloving, and a 96% compliance rate with removing gloves. While data are still in analysis, there did not appear to be a major difference in acquisition of resistant organisms between the 2 groups, suggesting the potential benefit of universal gloving over use of gown and gloves.

Skin and catheters

Dennis G. Maki, MD, University of Wisconsin, Madison, discussed the role of skin antisepsis in the prevention of Nosocomial infections. He emphasized the improved outcomes related to use of tincture of chlorhexidine should be in the concentration range of approximately 2%. In evaluating other measures for skin antisepsis, he noted the general lack of benefit of povidone-iodine ointment for care of central venous catheter sites. By contrast, the use of mupirocin decreases infection rates, but at the risk of emergence of resistant strains. In addition, a biopatch of polyurethane foam with chlorhexidine as an impregnated disk for covering central venous catheter insertion sites appears to be beneficial.

Challenges

Dr.Hierholzer noted that the major priority and challenge for infection control is the full application of computer systems and related technology to infection-control pursuits. Infection control and quality improvement activities must be integrated. In addition, prevention and public health activities must be linked with infection control, and the growing tide of antibiotic-resistance. Dr. Wenzel extended this type of modern analysis to the issue of bloodstream infections. Septicemia now accounts for 1% of all deaths in the United States He cited bloodstream infections as ranking somewhere between the 4th and 13th leading causes of death in the United States. This estimate is based on the following assumptions:

- Bloodstream infections represent 10% of total Nosocomial infections;
- The overall Nosocomial infection rate is between 2.5% and 10%; and the attributable mortality of bloodstream infections is between 10% and 30%

L) COVID 19

What is coronaviruses?

Coronaviruses are a large family of viruses which may cause illness in animals or humans. In humans, several coronaviruses are known to cause respiratory infections ranging from the common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS). The most recently discovered coronavirus causes coronavirus disease COVID-19.

What is COVID 19?

COVID-19 is the infectious disease caused by the most recently discovered coronavirus. This new virus and disease were unknown before the outbreak began in Wuhan, China, in December 2019. COVID-19 is now a pandemic affecting many countries globally.

What are the symptoms of COVID 19?

The most common symptoms of COVID-19 are fever, dry cough, and tiredness. Other symptoms that are less common and may affect some patients include aches and pains, nasal congestion, headache, conjunctivitis, sore throat, diarrhea, loss of taste or smell or a rash on skin or discoloration of fingers or toes. These symptoms are usually mild and begin gradually. Some people become infected but only have very mild symptoms.

Most people (about 80%) recover from the disease without needing hospital treatment. Around 1 out of every 5 people who gets COVID-19 becomes seriously ill and develops difficulty breathing. Older people, and those with underlying medical problems like high blood pressure, heart and lung problems, diabetes, or cancer, are at higher risk of developing serious illness. However, anyone can catch COVID-19 and become seriously ill. People of all ages who experience fever and/or cough associated with difficulty breathing/shortness of breath, chest pain/pressure, or loss of speech or movement should seek medical attention immediately. If possible, it is recommended to call the health care provider or facility first, so the patient can be directed to the right clinic.

What should I do if I have COVID – 19 symptoms and when should I seek medical care?

If you have minor symptoms, such as a slight cough or a mild fever, there is generally no need to seek medical care. Stay at home, self-isolate and monitor your symptoms. Follow national guidance on self-isolation.

However, if you live in an area with malaria or dengue fever it is important that you do not ignore symptoms of fever. Seek medical help. When you attend the health facility wear a mask if possible, keep at least 1 metre distance from other people and do not touch surfaces with your hands. If it is a child who is sick help the child stick to this advice.

Seek immediate medical care if you have difficulty breathing or pain/pressure in the chest. If possible, call your health care provider in advance, so he/she can direct you to the right health facility.

How does COVID 19 spread?

People can catch COVID-19 from others who have the virus. The disease spreads primarily from person to person through small droplets from the nose or mouth, which are expelled when a person with COVID-19 coughs, sneezes, or speaks. These droplets are relatively heavy, do not travel far and quickly sink to the ground. People can catch COVID-19 if they breathe in these droplets from a person infected with the virus. This is why it is important to stay at least 1 meter) away from others. These droplets can land on objects and surfaces around the person such as tables, doorknobs and handrails. People can become infected-by touching these objects or surfaces, then touching their eyes, nose or mouth. This is why it is important to wash your hands regularly with soap and water or clean with alcohol-based hand rub.

WHO is assessing ongoing research on the ways that COVID-19 is spread and will continue to share updated findings

Can COVID – 19 be caught from a person who has no symptoms?

COVID-19 is mainly spread through respiratory droplets expelled by someone who is coughing or has other symptoms such as fever or tiredness. Many people with COVID-19 experience only mild symptoms. This is particularly true in the early stages of the disease. It is possible to catch COVID-19 from someone who has just a mild cough and does not feel ill.

Some reports have indicated that people with no symptoms can transmit the virus. It is not yet known how often it happens. WHO is assessing ongoing research on the topic and will continue to share updated findings.

How can we protect others and ourselves if we don't know who is infected?

Practicing hand and respiratory hygiene is important at ALL times and is the best way to protect others and yourself-

When possible maintain at least a 1 meter distance between yourself and others. This is especially important if you are standing by someone who is coughing or sneezing. Since some infected persons may not yet be exhibiting symptoms or their symptoms may be mild, maintaining a physical distance with everyone is a good idea if you are in an area where COVID-19 is circulating.

What should I do if I have come in close contact with someone who has COVID 19?

If you have been in close contact with someone with COVID-19, you may be infected.

Close contact means that you live with or have been in settings of less than 1 metre from those who have the disease. In these cases, it is best to stay at home.

However, if you live in an area with malaria or dengue fever it is important that you do not ignore symptoms of fever. Seek medical help. When you attend the health facility wear a mask if possible, keep at least 1 metre distant from other people and do not touch surfaces with your hands. If it is a child who is sick help the child stick to this advice.

If you do **not** live in an area with malaria or dengue fever please do the following:

If you become ill, even with very mild symptoms you must self-isolate

Even if you don't think you have been exposed to COVID-19 but develop symptoms, then self-isolate and monitor yourself

You are more likely to infect others in the early stages of the disease when you just have mild symptoms, therefore early self-isolation is very important.

If you do not have symptoms, but have been exposed to an infected person, self-quarantine for 14 days?

If you have definitely had COVID-19 (confirmed by a test) self-isolate for 14 days even after symptoms have disappeared as a precautionary measure – it is not yet known exactly how long people remain infectious after they have recovered. Follow national advice on self-isolation.

What does it mean to self-isolate?

Self-isolation is an important measure taken by those who have COVID-19 symptoms to avoid infecting others in the community, including family members.

Self-isolation is when a person who is experiencing fever, cough or other COVID-19 symptoms stays at home and does not go to work, school or public places. This can be voluntarily or based on his/her health care provider's recommendation. However, if you live in an area with malaria or dengue fever it is important that you do not ignore symptoms of fever. Seek medical help. When you attend the health facility wear a mask if possible, keep at least 1 metre distant from other people and do not touch surfaces with your hands. If it is a child who is sick help the child stick to this advice.

If you do not live in an area with malaria or dengue fever please do the following:

- If a person is in self-isolation, it is because he/she is ill but not severely ill (requiring medical attention)

have a large, well-ventilated with hand-hygiene and toilet facilities

If this is not possible, place beds at least 1 metre apart

Keep at least 1 metre from others, even from your family members

Monitor your symptoms daily

Isolate for 14 days, even if you feel healthy

If you develop difficulty breathing, contact your healthcare provider immediately – call them first if possible

Stay positive and energized by keeping in touch with loved ones by phone or online, and by exercising yourself at home

What should I do if I have no symptoms, but I think I have been exposed to COVID 19? What does it mean to self-quarantine?

To self-quarantine means to separate yourself from others because you have been exposed to someone with COVID-19 even though you, yourself, do not have symptoms. During self-quarantine you monitor yourself for symptoms. The goal of the self-quarantine is to prevent transmission. Since people who become ill with COVID-19 can infect people immediately self-quarantine can prevent some infections from happening. .

In this case:

- Have a large, well-ventilated single room with hand hygiene and toilet facilities
- If this is not available place beds at least 1 metre apart.
- Keep at least 1-metre distance from others, even from your family members.
- Monitor your symptoms daily
- Self-quarantine for 14 days, even if you feel healthy
- If you develop difficulty breathing, contact your healthcare provider immediately – call them first if possible.
- Stay positive and energized by keeping in touch with loved ones by phone or online, and by exercising yourself at home.

However, if you live in an area with malaria or dengue fever it is important that you do not ignore symptoms of fever. Seek medical help. When you attend the health facility wear a mask if possible, keep at least 1 metre distant from other people and do not touch surfaces with your hands. If it is a child who is sick help the child stick to this advice

What is the difference between self-isolation, self-quarantine and distancing?

Quarantine means restricting activities or separating people who are not ill themselves but may have been exposed to COVID-19. The goal is to prevent spread of the disease at the time when people just develop symptoms..

Isolation means separating people who are ill with symptoms of COVID-19 and may be infectious to prevent the spread of the disease.

Physical distancing means being physically apart. WHO recommends keeping at least 1-metre distance from others. This is a general measure that everyone should take even if they are well with no known exposure to COVID-19.

Can children or adolescents catch COVID – 19?

Research indicates that children and adolescents are just as likely to become infected as any other age group and can spread the disease.

Evidence to date suggests that children and young adults are less likely to get severe disease, but severe cases can still happen in these age groups.

Children and adults should follow the same guidance on self-quarantine and self-isolation if there is a risk they have been exposed or are showing symptoms. It is particularly important that children avoid contact with older people and others who are at risk of more severe disease

What can I do to protect myself and prevent the spread of disease?

Stay aware of the latest information on the COVID-19 outbreak, available on the WHO website and through your national and local public health authority. Most countries around the world have seen cases of COVID-19 and many are experiencing outbreaks. Authorities in China and some other countries have succeeded in slowing their outbreaks. However, the situation is unpredictable so check regularly for the latest news.

You can reduce your chances of being infected or spreading COVID-19 by taking some simple precautions:

- Regularly and thoroughly clean your hands with an alcohol-based hand rub or wash them with soap and water. Why? Washing your hands with soap and water or using alcohol-based hand rub kills viruses that may be on your hands.
- Maintain at least 1 metre distance between yourself and others. Why? When someone coughs, sneezes, or speaks they spray small liquid droplets from their nose or mouth which may contain virus. If you are too close, you can breathe in the droplets, including the COVID-19 virus if the person has the disease.
- Avoid going to crowded places. Why? Where people come together in crowds, you are more likely to come into close contact with someone that has COVID-19 and it is more difficult to maintain physical distance of 1 metre.
- Avoid touching eyes, nose and mouth. Why? Hands touch many surfaces and can pick up viruses. Once contaminated, hands can transfer the virus to your eyes, nose or mouth. From there, the virus can enter your body and infect you.
- Make sure you, and the people around you, follow good respiratory hygiene. This means covering your mouth and nose with your bent elbow or tissue when you cough or sneeze. Then dispose of the used tissue immediately and wash your hands. Why? Droplets spread virus. By following good respiratory hygiene, you protect the people around you from viruses such as cold, flu and COVID-19.
- Stay home and self-isolate even with minor symptoms such as cough, headache, mild fever, until you recover. Have someone bring you supplies. If you need to leave your house, wear a mask to avoid infecting others. Why? Avoiding contact with others will protect them from possible COVID-19 and other viruses.

- If you have a fever, cough and difficulty breathing, seek medical attention, but call by telephone in advance if possible and follow the directions of your local health authority. Why? National and local authorities will have the most up to date information on the situation in your area. Calling in advance will allow your health care provider to quickly direct you to the right health facility. This will also protect you and help prevent spread of viruses and other infections.
- Keep up to date on the latest information from trusted sources, such as WHO or your local and national health authorities. Why? Local and national authorities are best placed to advise on what people in your area should be doing to protect themselves.

Is there a vaccine, drug or treatment for COVID 19?

While some western, traditional or home remedies may provide comfort and alleviate symptoms of mild COVID-19, there are no medicines that have been shown to prevent or cure the disease. WHO does not recommend self-medication with any medicines, including antibiotics, as a prevention or cure for COVID-19. However, there are several ongoing clinical trials of both western and traditional medicines. WHO is coordinating efforts to develop vaccines and medicines to prevent and treat COVID-19 and will continue to provide updated information as soon research results become available.

The most effective ways to protect yourself and others against COVID-19 are to:

- Clean your hands frequently and thoroughly
- Avoid touching your eyes, mouth and nose
- Cover your cough with the bend of elbow or tissue. If a tissue is used, discard it immediately and wash your hands.
- Maintain a distance of at least 1 metre from others

Does WHO recommend wearing medical masks to prevent the spread of COVID 19?

Currently, there is not enough evidence for or against the use of masks (medical or other) in healthy individuals in the wider community. However, WHO is actively studying the rapidly evolving science on masks and continuously updates its guidance.

Medical masks are recommended primarily in health care settings, but can be considered in other circumstances (see below). Medical masks should be combined with other key infection prevention and control measures such as hand hygiene and physical distancing.

Healthcare workers

Why? Medical masks and respirators such as N95, FFP2 or equivalent are recommended for and should be reserved for, healthcare workers while giving care to patients. Close contact with people with suspected or confirmed COVID-19 and their surrounding environment are the main routes of transmission, which means healthcare workers are the most exposed.

People who are sick and exhibiting symptoms of COVID-19

Why? Anyone who is sick, with mild symptoms such as muscle aches, slight cough, sore throat or fatigue, should isolate at home and use a medical mask according to WHO's recommendation on home care of patients with suspected COVID-19. Coughing, sneezing or talking can generate droplets that cause can spread the infection. These droplets can reach the face of others nearby and land on the surrounding environment. If an infected person coughs, sneezes, or talks while wearing a medical mask, this can help to protect those nearby from infection. If a sick person needs to go to a health facility they should wear a medical mask.

Anyone taking care of a person at home who is sick with COVID-19

Why? Those caring for individuals who are sick with COVID-19 should wear a medical mask for protection. Again, close, frequent and prolonged contact with someone with COVID-19 puts caretakers at high risk. National decision makers may also choose to recommend medical mask use for certain individuals using a risk-based approach. This approach takes into consideration the purpose of the mask, risk of exposure and vulnerability of the wearer, the setting, the feasibility of use and the types of masks to be considered.

How to properly wear a medical mask?

If you choose to wear a mask:

1. Before touching the mask, clean hands with an alcohol-based hand rub or soap and water
2. Take the mask and inspect it for tears or holes.
3. Orient which side is the top side (where the metal strip is).
4. Ensure the proper side of the mask faces outwards (the coloured side).
5. Place the mask to your face. Pinch the metal strip or stiff edge of the mask so it moulds to the shape of your nose.
6. Pull down the mask's bottom so it covers your mouth and your chin.
7. Do not touch the mask while you are wearing it for protection.
8. After use, take off the mask with clean hands; remove the elastic loops from behind the ears while keeping the mask away from your face and clothes, to avoid touching potentially contaminated surfaces of the mask.
9. Discard the mask in a closed bin immediately after use. Do not reuse the mask.
10. Perform hand hygiene after touching or discarding the mask – Use alcohol-based hand rub or, if visibly soiled, wash your hands with soap and water.

Be aware that there is a global shortage of medical masks (both surgical masks and N95 masks). These should be reserved as much as possible for health care workers.

Remember that masks are not a substitute for other, more effective ways to protect yourself and others against COVID-19 such as frequently washing your hands, covering your cough with the bend of elbow or tissue and maintain a distance of at least 1 meter from others. See basic protective measures against the new coronavirus for more information.

Follow the advice of your national health authority on the use of masks.

How long does it take after exposure to COVID 19 to develop symptoms?

The time between exposure to COVID-19 and the moment when symptoms start is commonly around five to six days but can range from 1 – 14 days.

What is the connection between COVID 19 and animals?

COVID-19 is spread through human-to-human transmission.

We already know a lot about other viruses in the coronavirus family and most of these types of viruses have an origin in animals. The COVID-19 virus (also called SARS-CoV-2) is a new virus in humans. The possible animal source of COVID-19 has not yet been confirmed but research is ongoing.

WHO continues to monitor the latest research on this and other COVID-19 topics and will update, as new findings are available.

Can I catch COVID 19 from my pet or other animals?

Several dogs and cats (domestic cats and tigers) in contact with infected humans have tested positive for COVID-19. In addition, ferrets appear to be susceptible to the infection. In experimental conditions, both cats and ferrets were able to transmit infection to other animals of the same species. However, there is no evidence that these animals can transmit the disease to humans and spread COVID-19. COVID-19 is mainly spread through droplets produced when an infected person coughs, sneezes, or speaks.

Minks raised in farms have also been detected with the virus. Most likely, they have been infected by farm workers. In a few instances, the minks that were infected by humans have transmitted the virus to other people. These are the first reported cases of animal-to-human transmission.

It is still recommended that people who are sick with COVID-19 and people who are at risk limit contact with companion and other animals. When handling and caring for animals, basic hygiene measures should always be implemented. This includes hand washing after handling animals, their food or supplies, as well as avoiding kissing, licking or sharing food.

WHO continues to monitor the latest research on this and other COVID-19 topics and will update as new findings are available.

How long does the virus survive on surface?

The most important thing to know about coronavirus on surfaces is that they can easily be cleaned with common household disinfectants that will kill the virus. Studies have shown that the COVID-19 virus can survive for up to 72 hours on plastic and stainless steel, less than 4 hours on copper and less than 24 hours on cardboard.

As, always clean your hands with an alcohol-based hand rub or wash them with soap and water. Avoid touching your eyes, mouth, or nose.

How to grocery shop safely

When grocery shopping, keep at least 1-metre distance from others and avoid touching your eyes, mouth and nose. If possible, sanitize the handles of shopping trolleys or baskets before shopping. Once home, wash your hands thoroughly and also after handling and storing your purchased products.

There is currently no confirmed case of COVID-19 transmitted through food or food packaging.

How to wash fruits and vegetables

Fruits and vegetables are important components of a healthy diet. Wash them the same way you should do under any circumstance: before handling them, wash your hands with soap and water. Then, wash fruits and vegetables thoroughly with clean water, especially if you eat them raw

Are antibiotics effective in preventing or treating COVID 19?

No. Antibiotics do not work against viruses; they only work on bacterial infections. COVID-19 is caused by a virus, so antibiotics do not work. Antibiotics should not be used as a means of prevention or treatment of COVID-19. In hospitals physicians will sometimes use antibiotics to prevent or treat secondary bacterial infections which can be a complication of COVID-19 in severely ill patients. They should only be used as directed by a physician to treat a bacterial infection.

Can I catch COVID 19 from the faeces of someone with the disease?

While initial investigations suggest the virus may be present in faeces in some cases, to date, there have not been reports of faecal-oral transmission of COVID-19. Additionally, there is no evidence to date on the survival of the COVID-19 virus in water or sewage.

WHO is assessing ongoing research on the ways COVID-19 is spread and will continue to share new findings on this topic.

CHAPTER: 13

NON COMMUNICABLE DISEASES

Introduction

- Noncommunicable diseases (NCDs) kill 41 million people each year, equivalent to 71% of all deaths globally.
- Each year, 15 million people die from a NCD between the ages of 30 and 69 years; over 85% of these "premature" deaths occur in low- and middle-income countries.
- Cardiovascular diseases account for most NCD deaths, or 17.9 million people annually, followed by cancers (9.0 million), respiratory diseases (3.9million), and diabetes (1.6 million).
- These 4 groups of diseases account for over 80% of all premature NCD deaths.
- Tobacco use, physical inactivity, the harmful use of alcohol and unhealthy diets all increase the risk of dying from a NCD.
- Detection, screening and treatment of NCDs, as well as palliative care, are key components of the response to NCDs.

Noncommunicable diseases (NCDs), also known as chronic diseases, tend to be of long duration and are the result of a combination of genetic, physiological, environmental and behaviours factors. The main types of NCDs are cardiovascular diseases (like heart attacks and stroke), cancers, chronic respiratory diseases (such as chronic obstructive pulmonary disease and asthma) and diabetes.

Who is at risk of such diseases?

People of all age groups, regions and countries are affected by NCDs. These conditions are often associated with older age groups, but evidence shows that 15 million of all deaths attributed to NCDs occur between the ages of 30 and 69 years. Of these "premature" deaths, over 85% are estimated to occur in low- and middle-income countries. Children, adults and the elderly are all vulnerable to the risk factors contributing to NCDs, whether from unhealthy diets, physical inactivity, exposure to tobacco smoke or the harmful use of alcohol.

These diseases are driven by forces that include rapid unplanned urbanization, globalization of unhealthy lifestyles and population ageing. Unhealthy diets and a lack of physical activity may show up in people as raised blood pressure, increased blood glucose, elevated blood lipids and obesity. These are called metabolic risk factors that can lead to cardiovascular disease, the leading NCD in terms of premature deaths.

Risk factors

Modifiable behavioural risk factors

Modifiable behaviours, such as tobacco use, physical inactivity, unhealthy diet and the harmful use of alcohol, all increase the risk of NCDs.

- Tobacco accounts for over 7.2 million deaths every year (including from the effects of exposure to second-hand smoke), and is projected to increase markedly over the coming years. (1)
- 4.1 million annual deaths have been attributed to excess salt/sodium intake. (1)
- More than half of the 3.3 million annual deaths attributable to alcohol use are from NCDs, including cancer. (2)
- 1.6 million deaths annually can be attributed to insufficient physical activity. (1)

Metabolic risk factors

Metabolic risk factors contribute to four key metabolic changes that increase the risk of NCDs:

- raised blood pressure
- overweight/obesity
- hyperglycemia (high blood glucose levels) and
- hyperlipidemia (high levels of fat in the blood).

In terms of attributable deaths, the leading metabolic risk factor globally is elevated blood pressure (to which 19% of global deaths are attributed), (1) followed by overweight and obesity and raised blood glucose.

nnually and stifle development.

Prevention and control of NCDs

An important way to control NCDs is to focus on reducing the risk factors associated with these diseases. Low-cost solutions exist for governments and other stakeholders to reduce the common modifiable risk factors. To lessen the impact of NCDs on individuals and society, a comprehensive approach is needed requiring all sectors, including health, finance, transport, education, agriculture, planning and others, to collaborate to reduce the risks associated with NCDs, and promote interventions to prevent and control them.

Investing in better management of NCDs is critical. Management of NCDs includes detecting, screening and treating these diseases, and providing access to palliative care for people in need.. Evidence shows such interventions are excellent economic investments because, if provided early to patients, they can reduce the need for more expensive treatment.

WHO's leadership and coordination role

To support countries in their national efforts, WHO developed a *Global action plan for the prevention and control of NCDs 2013-2020*, which includes nine global targets that have the greatest impact on global NCD mortality. These targets address prevention and management of NCDs.

A) CANCER

EPIDEMIOLOGY OF CANCER

Cancer as discussed earlier in the book on Cancer Risk Factor Management, is regarded as a group of diseases characterized by an,

1. Abnormal growth of cells
2. Ability to invade adjacent tissues and even distant organs, and
3. The eventual death of the affected patient if the tumor has progressed beyond that stage when it can't be successfully removed

Cancer can occur at any or tissue of the body and may involve any types of cells. The major categories of cancer are: (a) Carcinomas, which arise from epithelial cells lining the internal surfaces of the various organs (e.g. mouth, esophagus, intestines, uterus) and from the skin epithelium; (b) Sarcomas, which arise from mesodermal cells constituting the various connective tissues (e.g. fibrous tissue, fat and bone); (c) Lymphomas, myeloma and Leukemias arising from the cells of bone marrow and immune systems.

The term "primary tumor" is used to denote cancer in the organ of origin, while "secondary tumor" denotes cancer that has spread to regional lymph nodes and distant organs. When cancer cells multiply and reach a critical size, the cancer is clinically evident as a lump or ulcer localized to the organ of origin in early stages. As the disease advances, symptoms and signs of invasion and distant metastases becomes clinically evident. Cancers in all forms are causing about 12 per cent of deaths throughout the world. When the global figures are broken down between the developed and developing countries, the ranking changes. In the developed world, cancer is the second leading cause of death, next to cardiovascular diseases, accounting for 21 per cent (2.5 million) of all mortality. In the developing world, cancers rank third as a cause of death and accounts for 9.5 per cent (3.8 million) of all deaths. Although cancer is widely perceived to be a disease of industrialized nations the majority of deaths from cancer occurred in the developing world

Out of an estimated total of 51.3 million deaths during 1996 in the world, more than 7.1 million are attributed to cancer. According to WHO estimated by the year 2000 the number of cancer deaths may go up to 8 million annually (2). If the present trends continue it is predicted that the incidence of cancer will rise in almost all parts of the world, notably because of increases in life expectancy and changes in life style and changes in the environment.

In 1996 there were an estimated 17.9 million persons with cancer surviving up to five years after diagnosis. Of these, 10.5 million were women, 5.3 million of whom had cancer either of the breast, cervix or colon rectums. Among men, prostate, colorectal and lung cancer were the most prevalent.

The eight leading cancer killers worldwide are also the eight most common in terms of incidence. Together, they account for about 60% of all cancer cases and deaths. An analysis of the risk factors involved in the development of these cancers shows that a few major factors dominate: diet, tobacco, alcohol, infections and hormones all of which lend themselves to preventive actions.

Among men, the leading eight cancer killers are lung, stomach, liver, colon-rectum, esophagus, mouth-pharynx, prostate and lymphoma. Among women, they are cancers of the breast, stomach, colon-rectum, cervix, lung, ovary, esophagus and liver.

Of more than 10 million cancer cases newly diagnosed in 1996 worldwide, 57% occurred in developing countries. For both developed and developing countries the most common cancer site in men was the lung. In developed regions it is followed by prostate cancer (2, 89,000 new cases), colorectal cancer (2, 73,000), and stomach cancer (2, 26,000). In developing regions stomach cancer is second with 4, 08,000 new cases per year, followed by cancer of the liver (3, 09,000) and cancers of the mouth and pharynx (2, 88,000).

In women, breast cancer is the most common in affluent populations with 4, 94,000 cases followed by colon and rectum (2, 82,000) and then by cancer of the lung (1, 68,000) and of the stomach (1, 47,000). In developing areas, cancer of the cervix is the most common (4, 21,000 cases), but breast cancer is almost as common (4, 16,000). Third is cancer of the stomach (2,31,000) and fourth is cancer of the lung (1,64,000).

The most remarkable changes in the ranking compared to 10 years ago are the steep upward trend of prostate cancer (partly due to the introduction of programs for early detection), the increase in breast cancer (a site more common in high-income populations), and the increase in lung cancer in women worldwide.

With the control of communicable diseases and increase in life expectancy, cancer in the country is rising. Jussawala observes the cancer is one of the 10 leading causes of death today in India, and is advancing in rank year by year. The incidence of cancer during 1992 in Bangalore, Bombay and Madras was about 80 per 100,000 populations as against 289 per 100,000 populations in developed countries. This is almost one-fourth of the reported incidence from the industrialized countries of the West. The data from the population-based registries under the NCRP (National Cancer Registry Program) show that the leading sites of cancer have remained the same over the years, generally being oral cavity, lung esophagus and stomach among men, and cervix, breast and oral cavity among women.

Over 5 lakh new cases of cancer and 3 lakh deaths are estimated in the country every year. With an average survival of 3 years after diagnosis, nearly 15 lakh patients require facilities for diagnosis, treatment and follow-up at any given time

TIME TRENDS

At the beginning of this century, cancer was the sixth cause of death in industrialized countries; today, it is the second leading cause of death. There are a number of reasons for this increase, the three main ones being a longer life expectancy, more accurate diagnosis and the rise in cigarette smoking, especially among males since World War I. The overall rates do not reflect the different trends according to the type of cancer. For example, there has been a large increase in lung cancer incidence since the 1930s on the other hand stomach cancer has shown a declining trend in most developed countries for reasons not clearly understood

CANCER PATTERNS

There are wide variations in the distribution of cancer throughout the world. Data shows that cancer of the stomach is very common in Japan, and has a low incidence in United States. The cervical cancer is high in Columbia and has a low incidence in Japan. In South East Asia

the great majority are cancers of the oral cavity and uterine cervix. These and other international variations in the pattern of cancer are attributed to multiple factors such as environmental factors, food habits, life style, genetic factors or even inadequacy in detection and reporting of cases.

Hospital data clearly indicate that the two organ sites most commonly involved are: (i) the uterine cervix in women and (ii) the oropharynx in both sexes. These two sites represent approximately 50 per cent of all cancer cases. Both these cancers are predominantly environment related and have a strong socio-cultural relationship. It is also important to note that these two kinds of cancer are easily accessible for physical examination and amenable to early diagnosis by knowledge already available. i.e., good clinical examination and exfoliative cytology. The cure rate for these neoplasms is also very high if they are treated surgically at stages I and II. But unfortunately, in most cases, the patients present themselves to a medical facility when the disease is far advanced and is not amenable to treatment. This is the crux of the problem

SEX DIFFERENCES

On a global basis, the first 8 ranking cancer sites in males and females are shown. When the two sexes are combined, cancer lung ,heads the list, followed closely by stomach cancer.

Burden of cancer, 1996 (in thousands)

Site								
	Male	Females	Male	Females	Male	Females	Male	Females
Lung	510	168	477	164	760	229	743	461
Stomach	226	147	408	231	486	290	557	411
Colon-	273	282	171	149	243	252	900	949
Liver	65	34	309	131	263	123	88	175
Breast	—	494	—	416	—	376	—	2810
Esophagus	54	20	266	141	235	123	120	151
Mouth-	96	32	288	160	207	117	728	345
Cervix	—	102	—	421	—	247	—	1558
Prostate	289	—	111	—	194	—	1014	—
Bladder	128	41	108	33	105	38	593	188

Ovary	—	91	—	100	—	—	129	453
Body of the uterus	—	104	—	68	—	67	—	598

Ranking order by site of 8 selected cancers

Rank	Males	Females	Total (Both sexes)
1	Lung	Breast	Lung
2	Stomach	Cervix	Stomach
3	Colon/rectum	Colon/rectum	Liver
4	Prostate	Stomach	Colon/rectum
5	Oral	Lung	Esophagus
6	Liver	Oral	Breast
7	Esophagus	Ovary	Oral
8	Bladder	Body of the uterus	Cervix

Most major cancers of non-sexual sites occur more frequently in men than in women, exceptions being carcinoma of the thyroid, gall bladder and extra hepatic bile duct. Smoking-related cancers occur more frequently in men, at least in part because of their earlier and greater exposure to tobacco smoke. Some other cancers such as carcinoma of bladder and mesothelium are more frequently in men because of their occupational exposure

CANCER CONTROL

Cancer control consists of a series of measures based on present medical knowledge in the fields of prevention, detection, diagnosis, treatment, after care and rehabilitation, aimed at reducing significantly the number of new cases, increasing the number of cures and reducing the invalidism due to cancer.

The basic approach to the control of cancer is through primary and secondary prevention. It is estimated that at least one-third of all cancers are preventable

1. Primary Prevention

Cancer prevention until recently was mainly concerned with the early diagnosis of the disease (secondary prevention), preferably at a precancerous stage. Advancing knowledge has increased our understanding of causative factors of some cancers and it is now possible to control these factors in the general population as well as in particular occupational group. They include the following:

(a) Control of tobacco and alcohol consumption: Primary prevention offers the greatest hope for reducing the number of tobacco-induced and alcohol related cancer deaths. It has been estimated that control of tobacco smoking alone would reduce the total burden of cancer by over a million cancers each year. Some countries (e.g., Norway) have developed ambitious programs to eradicate tobacco smoking by the year 2000. (b) Personal hygiene: Improvements in personal hygiene may lead to declines in the incidence of certain types of cancer, e.g., cancer cervix. (c) Radiation: Special efforts should be made to reduce the amount of radiation (including medical radiation) received by each individual to a minimum without reducing the benefits. (d) Occupational exposures: The occupational aspects of cancer are frequently neglected. Measures to protect workers from exposure to industrial carcinogens should be enforced in industries. (e) Immunization: In the case of primary liver cancer, immunization against hepatitis B virus presents an exciting prospect. (f) Foods, drugs and cosmetics: These should be tested for carcinogens. (g) Air pollution: Control of air pollution is another preventive measure. (h) Treatment of precancerous lesions such as cervical tears, intestinal polyposis, warts, chronic gastritis, and chronic cervicitis, is one of the cornerstones of cancer prevention. (i) Legislation: Legislation has also a role in primary prevention. The solution to cancer control problems is not to be found in research laboratories, but in legislatures. For example, legislation to control known environmental carcinogens (e.g., tobacco, alcohol, air pollution) is inadequate or only moderately enforced in a number of countries. (j) Cancer education: An important area of primary prevention is cancer education. It should be directed at "high-risk" groups. The aim of cancer education is to motivate people to seek early diagnosis and early treatment. Cancer organizations in many countries remind the public of the early warning signs ("danger signals") of cancer.

These are:

1. A lump or hard area in the breast
2. A change in a wart or mole
3. A persistent change in digestive and bowel habits
4. A persistent cough or hoarseness
5. Excessive loss of blood at the monthly period or loss of blood outside the usual dates
6. Blood loss from any natural orifice
7. A swelling or sore that does not get better
8. Unexplained loss of weight

There is no doubt that the possibilities for primary prevention are many. Since primary prevention is directed at large population groups (e.g., high risk groups, school children, occupational groups, youth clubs), the cost can be high and programs difficult to conduct. Primary prevention, although a hopeful approach, is still in its early stages. Major risk factors have been identified for a small number of cancers only and far more research is needed in that direction.

2. Secondary Prevention

Secondary prevention comprises the following measures:

(i) Cancer Registration

Cancer registration is a sine qua non for any cancer control program. It provides a base for assessing the magnitude of the problem and for planning the necessary services. Cancer registries are basically of two types: hospital-based and population based

Hospital-based registries: The hospital-based registry includes all patients treated by a particular institution, whether in-patients or outpatients. Registries should collect the uniform minimum set of data recommended in the: WHO Handbook for Standardized Cancer Registers". If there is a long-term follow-up of patients, hospital-based registries can be of considerable value in the evaluation of diagnostic and treatment programs. Since hospital population will always be a selected population, the use of these registries for epidemiological purposes is thus limited.

Population-based registries: A right step is to set up a "hospital-based cancer registry" and extend the same to a "population-based cancer registry". The aim is to cover the complete cancer situation in a given geographic area. The optimum size of base population for a population based cancer registry is in the range of 2-7 million. The data from such registries alone can provide the incidence rate of cancer and serve as a useful tool for initiating epidemiological enquiries into causes of cancer, surveillance of time trends and planning and evaluation of operational activities in all main areas of cancer control.

Population-based cancer registries have been established at Bangalore, Mumbai and Chennai under the National Cancer Registry Project of the ICMR

(ii) Early Detection of cases

Cancer screening is the main weapon for early detection of cancer at a pre-invasive (*in situ*) or pre-malignant stage. Effective screening programs have been developed for cervical cancer, breast cancer and oral cancer. Like primary prevention, early diagnosis has to be conducted on a large scale; however, it may be possible to increase the efficiency of screening programs by focusing on high-risk groups. Clearly, there is no point in detecting cancer at an early stage unless facilities for treatment and aftercare are available. Early detection programs will require mobilization of all available resources and development of a cancer infrastructure starting at the level of primary health care, ending with complex cancer centers or institutions at the state or national levels.

(iii) Treatment

Treatment facilities should be available to all cancer patients. Certain forms of cancer are amenable to surgical removal, while some others respond favorably to radiation or chemotherapy or both. Since most of the known methods of treatment have complementary effect on the ultimate outcome of the patient, multi-modality approach to cancer control has become a standard practice in cancer centers all over the world. In the developed countries today, cancer treatment is geared to high technology. For those who are beyond the curable stage, the goal must be to provide pain relief. A largely neglected problem in cancer care is

the management of pain. The WHO has developed guidelines on relief of cancer pain. "Freedom from cancer pain", is now considered a right for cancer patients

CANCER SCREENING

In the light of present knowledge, early detection and prompt treatment of early cancer and precancerous conditions provide the best possible protection against cancer for the individual and the community. Now a good deal of attention is being paid to screening may be defined as the "search for unrecognized malignancy by means of rapidly applied tests".

Cancer screening is possible because, (a) in many instances, malignant disease is preceded for a period of months or years by a premalignant lesion, removal of which prevents subsequent development of cancer; (b) most cancers begin as localized lesions and if found at this stage a high rate of cure is obtainable; and (c) as much as 75 per cent of all cancers occur in body sites that are accessible.

Methods of cancer screening.

(a) Mass screening by comprehensive cancer detection examination: a rapid clinical examination and examination of one or more body sites by the physician is one of the important approaches for screening for cancer (b) Mass screening at single sites: This comprises examination of single sites such as uterine cervix, breast or lung. (c) Selective screening: This refers to examination of those people thought to be at special risk, for example, parous women of lower socio-economic strata upwards of 35 years of age for detection of cancer cervix, chronic smokers for lung cancer, etc

B) CORONARY HEART DISEASE

Coronary Heart Disease or Ischaemic Heart Disease has been defined as an impairment of heart function due to inadequate blood flow to the heart compared to its needs, caused by obstructive changes in the coronary circulation to the heart.

It is the cause of 25 to 30 per cent of deaths in most developed countries. The WHO has drawn attention to the fact that CHD is our modern "epidemic", i.e., a disease that affects population, and not as an unavoidable attribute of ageing. CHD in humans can present itself in the following ways

- 1.Angina pectoris
- 2.Myocardial infarction
- 3.Irregularities of heart rhythm
- 4.Cardiac failure
- 5.Sudden death

Myocardial infarction is a specific presentation of CHD where as angina pectoris and sudden death are not. Rheumatic heart disease and cardiomyopathy are potential sources of diagnostic confusion. The natural history of CHD is very variable. Death may occur in the first episode or after a long history of disease.

The burden of CHD may be estimated in various ways, each providing a different view of the situation. They are as follows,

Proportional mortality ratio.

The simplest measure is the proportional mortality ratio that is the proportion of all deaths currently attributed to it. For example, CHD is held responsible for about 30 per cent of deaths in men and 25 per cent of deaths in women in most western countries.

Loss of life expectancy

CHD cuts short the life expectancy Calculations have been made for the average gain in life expectation that would follow a complete elimination of all cardio vascular deaths if other mortality rates remain unchanged. The benefit would range for men from 3.4 years to 9.4 years, and even greater for women.

CHD incidence rate

This is the sum of fatal and non-fatal attack rates. Because of its different manifestations, accurate CHD incidence rate is difficult to compute. Mortality rates can be used as a crude indicator of incidence.

Age specific death rates

When analysis is planned to throw light on etiology, it is essential to study the age-specific rates. Age specific death rate suggests a true increase in incidence.

Prevalence rate

The prevalence of CHD can be estimated from cross sectional surveys using ECG for evidence of infarction and history of prolonged chest pain.

Case fatality rate

This is defined as the proportion of attacks that are fatal within 28 days of onset. The International Society and Federation of Cardiology has suggested that sudden deaths, be defined to include deaths, occurring instantly or within an estimated 24 hours of the onset of acute symptoms or signs.

Data collected in many industrialized countries indicate that 25 to 28 per cent of patients who suffer a heart attack die suddenly. In about 55 per cent of all cardiac deaths mortality occurs within the first hour.

EPIDEMICITY

Epidemic of CHD began at different times in different countries. In the United States, epidemics began as early as 1920. In Britain they began in the 1930s, and in several European countries, still later. Now it is the turn of the developing countries to catch up. Taking the example of Singapore we see that, the standardized death rate from CHD has more than doubled in the past 20 years, rising from 22 per 100,000 populations in 1957 to 59 per 100,000 populations in 1979. Similar trends exist in Mauritius and Sri Lanka.

Countries where the epidemic began earlier are now showing a decline. Like, in United States, where the epidemic began in the early 1920s, a steady decline was evident by 1968, and a 25 per cent fall in mortality by 1980. Substantial declines in mortality have also occurred in Australia, Canada and New Zealand.

Several European countries like Hungary and Poland where the epidemic came later, have registered little or no change in rate. In Great Britain, the epidemic has not shown any decline.

The decline in CHD mortality in US and other countries has been attributed to changes in the life style of the people and a decreased exposure to related risk factors like those of, diet and diet-dependent serum cholesterol, cigarette use and exercises habits plus better control of hypertension.

The reasons for the changing trends in CHD are not precisely known. The WHO has completed many projects, including, a project known as MONICA, meaning multinational monitoring of trends and determinants in cardiovascular diseases, on this issue.

When CHD emerged as the modern epidemic, it was the disease of the higher social classes in the most affluent societies. Fifty years later the situation is changing; there is a strong inverse relation between social class and CHD in developed countries.

To summarize, in many developed countries, CHD still poses the largest public health problem. But even in those showing a decline CHD is still the most frequent single cause of death among men under 65

INTERNATIONAL VARIATIONS

CHD is a worldwide disease. Mortality rates vary widely in different parts of the world. The highest coronary mortality is seen at present in Northern Europe and in the English speaking countries of which, Scotland, Northern Ireland, and Finland are noteworthy.

On the other hand rates in southern Europe in countries like Italy and France are much lower, and those in Japan, although a rich industrialized country, are extremely low.

Rose calculated the “incubation period” of CHD to be 10 years or more. This may explain the currently puzzling position of Japan. The Japanese smoke like chimneys, and have increased their fat intake by 200 per cent in recent years, yet have the lower incidence of CHD in the industrialized world. If Rose is right CHD is still incubating in Japan and will be rampant in another few years.

Age standardized death rate of CHD per 100,000 populations in selected countries

Country	Total	Male	Female
Scotland (1983)	192.3	283.9	124.0
Finland (1980)	176.5	283.7	101.7
Sweden (1982)	158.4	231.5	98.0

Australia (1981)	155.9	223.7	100.0.
England & Wales (1982)	154.7	231.4	94.9
USA (1980)	154.6	219.7	104.1
Denmark (1982)	153.4	220.6	99.6
Canada (1982)	145.1	205.2	94.7
Italy (1980)	79.6	113.8	51.9
France (1981)	47.3	71.5	28.1
Japan (1982)	29.3	39.3	22.0

CORONARY HEART DISEASE IN INDIA

A large body of data exists on the occurrence of CHD in hospital patients. However, there are only two studies on its prevalence in the general population. When the screening of persons over the age of 30 years by a 12-lead ECG, was done in an urban population in Chandigarh the prevalence was found to be 65.4 and 47.8 per 1000 males and females respectively. In a village in Haryana the prevalence was 22.8 and 17.3 per 1000 males and females respectively.

The pattern of CHD in India has been reported to be as follows,

- CHD appears a decade earlier compared with the age incidence in developed countries. The peak period is attained between 51-60 years.
- Males are affected more than females.
- Hypertension and diabetes account for about 40 percent of all cases.
- Heavy smoking is responsible etiologically in a good number of cases

RISK FACTORS

- The etiology of CHD is multifactorial. Apart from the obvious ones such as increasing age and male sex, studies have identified several important “risk” factors (i.e., factors that make the occurrence of the disease more probable). Some of the risk factors are modifiable, others immutable. Presence of any one of the risk factors places an individual in a high-risk category for developing CHD. The greater the number of risk factors present, the more likely one is to develop CHD. The principal risk factors are discussed below:

Risk factors for CHD

Not modifiable	Modifiable
Age	Cigarette smoking
Sex	High blood pressure
Family history	Elevated serum cholesterol
Genetic factors	Diabetes
Lifestyle	Obesity Sedentary habits Stress

1. Smoking

Some people commit suicide by drowning, but many by smoking. A uniquely human habit, smoking has been identified as a major CHD risk factor with several possible mechanisms – carbon monoxide induced atherogenesis, nicotine stimulation of adrenergic drive raising both blood pressure and myocardial oxygen demand; lipid metabolism with fall in “protective” high-density lipoprotein, etc.

It has been calculated that in countries where smoking has been a widespread habit, it is responsible for 25 per cent of CHD deaths under 65 years of age in men. Cigarettes seem to be particularly important in causing sudden death from CHD especially in men less than 50 years of age.

The degree of risk of developing CHD is directly related to the number of cigarettes smoked per day. Filter cigarettes are probably not protective. There is evidence that the influence of smoking is not only independent of, but also synergistic with other risk factors such as hypertension and elevated serum cholesterol. This means that the effects are more than additive.

The risk of death from CHD decreases on cessation of smoking. The risk declines quite substantially within one year of stopping smoking and more gradually thereafter until, after 10 years, it is the same as that of non-smokers. For those who have had a myocardial infarction, the risk of a fatal recurrence may be reduced by 50 per cent after giving up smoking. For more on cigarette smoking please refer to the book on Cancer Risk Factor Management.

2. Hypertension

The blood pressure is the single most useful test for identifying individuals at a high risk of developing CHD. Hypertension accelerates the atherosclerotic process, especially if hyperlipidaemia is also present and contributes importantly to CHD. In the past, emphasis

was placed on the importance of diastolic blood pressure. Many investigators feel that systolic blood pressure is a better predictor of CHD than is the diastolic. However, both components are significant risk factors. The risk role of "mild" hypertension above 140/90mm/hg is generally accepted.

3. Serum cholesterol

It is nearly three decades since it became clear that elevation of serum cholesterol was one of the factors, which carried an increased risk for the development of myocardial infarction. Today, there is a vast body of evidence showing a triangular relationship between a high fat diet, blood cholesterol-lipoprotein levels and CHD and that these relationships are judged to be causal. There is no population, in which CHD is common, that does not also have a relatively high, mean level of cholesterol (i.e., greater than 200 mg/dl in adults). This is illustrated in which shows the cultural differences in serum cholesterol levels between two countries, Japan and Finland – Japan having the lowest incidence and Finland the highest incidence of CHD.

That the risk of CHD rises steadily with the serum cholesterol concentration. The 10-years experience of the seven countries study showed that serum cholesterol concentration is an important risk factor for the incidence of CHD at levels perhaps 220 mg/dl or more. This supports the notion of a "threshold level" of cholesterol, that is, a certain level beyond which there is an association.

The strength of the dietary – fat hypothesis is that observations in the seven countries study (among others) fitted it well – that is, the Japanese had low fat diets, low serum cholesterol and low incidence of CHD while the East Fins were at the other extreme. The weakness of the hypothesis is that studies of individuals have not shown such a relationship. This has been attributed to genetic and dietary intake difference between individuals.

When we look at the various types of lipoproteins, it is the level of low-density lipoprotein (LDL) cholesterol that is most directly associated with CHD. While very low-density lipoprotein (VLDL) has also been shown to be associated with premature atherosclerosis, it is more strongly associated with peripheral vascular disease (e.g., intermittent claudicating) than with CHD. High-density lipoprotein (HDL) cholesterol is protective against the development of CHD – the higher its mean level in a group of individuals, the lower than incidence of infarction in that group. HDL should be more than 35 mg/dl.

To further refine CHD risk prediction based on serum lipid levels, a total "cholesterol/HDL ratio" has been developed. A rate of less than 3.5 has been recommended as a clinical goal for CHD prevention.

With newer techniques, high-density and low-density lipoproteins have been further subdivided into sub-fractions. Recent evidence indicates that levels of plasma apolipoprotein-A-1 (the major HDL protein) and apolipoprotein-B (the major LDL protein) are better predictors of CHD than HDL cholesterol of LDL cholesterol respectively. Therefore measurement of apolipoproteins may replace lipoprotein cholesterol determinations in assessing the risk of CHD

4. Other risk factors

1. **Diabetes:** The risk of CHD is 2-3 times higher in diabetics than in non-diabetics. CHD is responsible for 30 to 50 per cent of deaths in diabetics over the age of 40 years in industrialized countries.
2. **Genetic factors:** A family history of CHD is known to increase the risk of premature death. Genetic factors are probably the most important determinants of a given individual's TC and LDL levels. However, the importance of genetic factors in the majority of cases is largely unknown.
3. **Physical activity:** Sedentary life-style is associated with a greater risk of the development of early CHD. There is evidence that regular physical exercise increases the concentration of HDL and decreases both body weight and blood pressure which are beneficial to cardiovascular health/
4. **Hormones:** The pronounced difference in the mortality rates for CHD between males and female subjects suggests that the underlying factor may have a hormonal basis. It has been hypothesized that hyperoestrogenemia may be the common underlying factor that leads both to atherosclerosis and its complications such as CHD, stroke and peripheral vascular disease.
5. **Type A personality:** Type A behavior is associated with competitive drives, restlessness, hostility and a sense of urgency or impatience. Type – A individuals are more coronary prone to CHD than the calmer, more philosophical Type B individuals.
6. **Alcohol:** High alcohol intake, defined as more than 60ml or more per day is independent risk factors for CHD, hypertension and all cardio-vascular diseases. The evidence that moderate alcohol intake leads to a reduction in the risk of CHD is unsubstantiated.
7. **Oral contraceptives:** Women using oral contraceptives have higher systolic and diastolic blood pressure. The risk of myocardial infarction in women seems to be increased by oral contraceptives, and cigarette smoking compounds the risk.
8. **Miscellaneous:** The possible role of a high fat diet & obesity with a BMI of above 30, have also been cited as possible risk factors

Prevention

In the 1960s the issue was whether CHD could be prevented or not. Studies were launched, reported and debated. The accumulated evidence led to a broad consensus of expert opinion that CHD is preventable. This is best expressed in a report of the WHO Expert Committee on the Prevention of CHD. This report recommended the following strategy,

1. POPULATION STRATEGY

Prevention in whole population

Primordial prevention in whole population

2. HIGH RISK STRATEGY

3. SECONDARY PREVENTION

I. POPULATION STRATEGY

(i) Prevention in whole populations.

CHD is primarily a mass disease. The strategy should therefore be based on mass approach focusing mainly on the control of underlying causes, which are the risk factors of the whole population and not merely of the individual in particular. This approach is based on the principle that small changes in risk factor levels in total populations can achieve the biggest reduction in mortality. The aim should be to shift the whole risk factor distribution in the direction of “biological normality”.

This cannot obviously be done by medical means alone; it requires the mobilization and involvement of the whole community to alter its life style practices that are associated with CHD. The population strategy centers round the following key areas,

Dietary changes. Dietary modification is the principal preventive strategy in the prevention of CHD. The WHO Expert Committee considered the following dietary changes to be appropriate for high incidence populations.

1. Reduction of fat intake to 20-30 per cent of total energy intake
2. Consumption of saturated fats must be limited to less than 10 per cent of total energy
3. Some of the reduction in saturated fat may be made up by mono and poly unsaturated fats.
4. A reduction of dietary cholesterol to below 100 mg per 1000 kcal per day
5. An increase in complex carbohydrate consumption like, vegetables, fruits, whole grains
6. And legumes
7. Avoidance of alcohol consumption; reduction of salt intake to 5 g daily or less

Smoking. As far as CHD is concerned, present evidence does not support promotion of the so-called “safer cigarette”. The goal should be to achieve a smoke free society. Some governments like those of Norway and the US have declared a smoke free society by the year 2000. Several countries are now after seeing their achievements in this field are progressing towards this goal.

To achieve the goal of a smoke free society, a comprehensive health program would be required which includes effective information and education activities, legislative restrictions, fiscal measures and smoking cessation programs.

Blood Pressure. It has been estimated that even a small reduction in the average blood pressure of the whole population by a mere 2 or 3 mm Hg would produce a large reduction in the incidence of cardiovascular complications. The goal of the population approach to high blood pressure would thus be to reduce mean population blood pressure levels. This involves a multifunctional approach based on a “prudent diet”, reduced salt intake, and avoidance of a high alcohol intake, regular physical activity and Stress management. The potential benefits and the safety and low cost of this advice would justify its implementation

Physical Activity. Regular physical activity should be a part of normal daily life. The American Heart Association recommends 30 minutes of Physical Activity & Exercise daily. It is particularly important to encourage children to take up physical activities that they can continue throughout their lives

(ii) Primordial Prevention in whole populations

A novel approach to primary prevention of CHD is primordial prevention. It involves preventing the emergence and spread of CHD risk factors and life styles that have not yet appeared or become endemic. As opposed to the prevention of the disease it self, this applies to developing countries in particular. These countries should seek to preserve their traditional eating patterns and life style associated with low levels of CHD risk factors.

Since the etiology of CHD is multifactor the approach to prevention should also be multifactor aimed at controlling or modifying as many risk factors as possible. The aim should be to change the community as a whole, not the individual subjects living in it. Several well planned risk factor intervention trials for example MRFIT, the, multiple risk factor intervention trial conducted in the US, the Stanford Heart Disease Prevention Program in California, and The North Kerelia Project in Finland have demonstrated that primary prevention can achieve substantial reduction in the incidence of coronary heart disease

II. HIGH RISK STRATEGY

Identifying risk. High risk intervention can only start once those at high risk have been identified. By means of simple tests such as blood pressure and serum cholesterol measurement it is possible to identify individuals at special risk. Individuals at special risk also include those who smoke, those with a strong family history of CHD, diabetes and obesity and young women using oral contraceptives.

Specific advice. Having identified those at high risk, the next step will be to bring them under preventive care and motivate them to take positive action against all the identified risk factors which may be an elevated blood pressure that should be treated or a smoking habit the patient may be helped to break, serum cholesterol concentration should be reduced in those in whom it is raised etc.

Several well planned high risk intervention studies for example the Oslo Heart Study, Lipid Research Clinics Study, conducted in the US have shown that it is feasible to reduce the CHD risk factors.

From a methodological point of view, however, high risk approach suffers from the disadvantages that the intervention may be effective in reducing the disease in a high risk group, but it may not reduce the disease to the same extent in the general population which consists of symptomatic and asymptomatic, high risk and low risk people. Further, unfortunately more than half of the CHD cases occur in those who are not apparently at special risk, and this is one limitation of the high-risk strategy. Nevertheless, recognition and treatment of high risk cases do make an important contribution towards prevention

III. SECONDARY PREVENTION

Secondary prevention must be seen as a continuation of primary prevention. It forms an important part of an overall strategy. The aim of secondary prevention is to prevent the recurrence and progression of CHD.

Secondary prevention is a rapidly expanding field with much research in progress.

The principles governing secondary prevention are the same as those already set out in the above sections, which include, cessation of smoking, control of hypertension and diabetes, healthy nutrition, exercise promotion, etc. The most promising results to date have come from beta-blockers, which appear to reduce the risk of CHD mortality in patients who have already suffered at least one infarct in the order of 25 per cent. None of the preventive measures discussed earlier lose their importance even after, the first attack.

For example, cessation of smoking is the most effective single means of intervention currently available in the management of patients after a heart attack. The risk of fatal infarction or sudden death is reduced by 20-50 per cent.

Despite advances in treatment, the mortality of an acute heart attack is still high. Among survivors, around 10 per cent in the first year, and 5 per cent, per year thereafter. Delay in reaching hospitals is still considerable even in big cities in the West and may be as much as 3.5 hours. About 30 per cent of all deaths occur within 30 minutes of onset. This is one of the reasons why coronary care units have failed to make impact on the total coronary mortality in the community.

Secondary prevention trials are aimed at preventing a subsequent coronary attack or sudden death. Wide ranges of clinical trials have been performed with four main groups of drugs, anti-coagulants, lipid-lowering agents, anti-thrombotic agents and beta-blockers. The most promising results to date have come from beta-blockers.

In general the above studies and similar others show that it is feasible through well planned intervention programs to reduce the risk factors in the populations studies. The primary and secondary prevention studies promise at present to be the main contribution in the conquest of chronic diseases

RISK FACTOR INTERVENTION TRIALS

For many years now, one of the best known large prospective studies, the Framingham Study, has played a major role in establishing the nature of CHD risk factors and their relative importance.

Risk factor trials can be either single factor trials or multifactor trials. Both the approaches are complementary and both are needed.

Some of the well known intervention trials are

The Stanford Heart Disease Prevention Program in California

The North Kerelia Project in Finland,

The Oslo Study,

The Multiple Risk Factors Intervention Trial MRFIT in USA, and

The Lipid Research Clinics Study.

A brief account of some of these trials is given below.

1. The Stanford – Three – Community Study

To determine whether community health education can reduce the risk of cardiovascular disease, a field experiments was undertaking in 1972 in three northern California towns with populations varying between 12,000 and 15,000. In two of these towns intensive mass education campaigns were conducted against cardiovascular risk factors over a period of 2 years. The third community served as a control. People from each community were interviewed and examined before the campaign began and one and two years afterwards to assess knowledge and behavior related to cardiovascular diseases and also to measure physiological indicators of risk. In the control community, the risk of cardiovascular disease increased over the two years, but in the intervention communities there was a substantial and sustained decrease in risk. The net difference in estimated total risk between control and intervention samples was 23 to 28 per cent

2. The North Kerelia Project

North Kerelia is a country in the eastern part of Finland, where CHD is particularly common. Its 185,000 inhabitants work mostly in farming and forestry and live in the countryside. A multiple risk factors intervention trial was started in 1972. The project had two aims,

1. To reduce the high levels of risk factors for cardiovascular disease.
 2. To promote the early diagnosis, treatment and rehabilitation of patients with CV disease.
- A control population was established in a neighboring country that has similar CV mortality. The main strategy employed was mass community action against risk factors and advice on their avoidance.

Follow up surveys at 5 years demonstrated a significant reduction in all three major risk factors. By 1979, mortality began to decline by 24 per cent in men and 51 per cent in women in North Kerelia, compared with 12 per cent in men and 26 per cent in women in rest of Finland. A further representative sample was studied in 1982. It exhibited its effect on CHD deaths more than twice the reduction achieved in the rest of Finland during the same period. Thus it took 10 years, Rose's 10 years incubation period to exhibit its effect on CHD deaths.

3. MRFIT

The multiple risk factor intervention trial carried out in USA was aimed at high risk adult males aged 35 to 57 years. A total of 12,866 men who showed no evidence of CHD either clinically or on ECG were enrolled for the study. Half the group was randomly allocated to an intensive intervention program, being seen at least every four months to ensure adequate control of risk factors. The other half the control group received a medical examination once yearly, and no specific advice was given to them about the control of smoking, controlling blood pressure and altering diet to reduce hypercholesterolemia.

Over the 7 years follow up period, IHD mortality was reduced by 22 per cent more in the intervention group but this was not statistically significant. This was because the control

group had also changed their habits and lifestyle to a far greater extent than anticipated by the designers of the trial. The trial produced no significant changes at all in mortality or risk factors in as much as the control group was not properly chosen.

4. Oslo Intervention Study

This study began in 1973. 16,202 Norwegian men aged 40 to 49 years were screened for coronary risk factors; of these 1232 healthy normotensive men at high risk of CHD were selected for a 5 years randomized trial. The aim of the study was to determine whether lowering of serum lipids and cessation of smoking would reduce the incidence of first attack of CHD in males aged 40 to 50.

The intervention group underwent techniques designed to lower serum cholesterol level through dietary means and to decrease or eliminate smoking. At the end of 5 years, the incidence of myocardial infarction both fatal and nonfatal was lower by 47 per cent in the intervention group than in the control group.

With this study, primary prevention of CHD entered the practical field of preventive medicine in an impressive manner.

5. Lipid Research Clinics Study

This double blind randomized clinical trial involved 3806 asymptomatic and high-risk American men aged 35 to 59 years with type II hyperlipoproteinemia. The trial was designed to test whether reducing serum cholesterol would prevent CHD events.

The men were randomized into two groups, one receiving cholestyramine and the other receiving a placebo. Both the groups were followed for an average of 7.4 years.

The treatment group has an 8.5 per cent and 12.6 per cent greater reduction in total cholesterol and LDL cholesterol levels respectively than the placebo treated group. This difference resulted in a 24 per cent reduction in death from decline CHD and a 19 per cent reduction in non fatal myocardial infarction. The findings of this study have resulted in enthusiasm for the drug treatment of those men with considerably elevated serum cholesterol level.

C) DIABETES MELLITUS

Once regarded as a single disease entity, diabetes is now seen as a heterogeneous group of disease, characterized by a state of chronic hyperglycemia, resulting from a diversity of etiologies, environmental and genetic, acting jointly. The underlying cause of diabetes is the defective production or action of insulin, a hormone that controls glucose, fat and amino acid metabolism. Characteristically, diabetes is a long-term disease with variable clinical manifestations and progression. Chronic hyperglycemia, from whatever cause, leads to a number of complications – cardiovascular, renal, neurological, and ocular and others such as intercurrent infections.

Classification

The classification adopted by WHO is given in the following Table.

Clinical classification of diabetes mellitus

1. Diabetes mellitus (DM)
 - i) Insulin-dependent diabetes mellitus (IDDM, Type 1)
 - ii) Non-insulin dependent diabetes mellitus (NIDDM, Type 2)
 - iii) Malnutrition-related diabetes mellitus (MRD)
 - iv) Other types (secondary to pancreatic, hormonal, drug-induced, Genetic and other abnormalities)
2. Impaired glucose tolerance (IGT)
3. Gestational diabetes mellitus (GDM)

Diagnostic values for the glucose tolerance test

	GLUCOSE (mg/dl)			
	Whole blood		Plasma	
	Venous	Capillary	Venous	Capillary
Diabetes Mellitus				
Fasting value	>120	>120	>140	>140
2 hrs after glucose load	>180	>200	>200	>200

IDDM is the most severe form of disease. Its onset is typically abrupt and is usually seen in individuals less than 30 years of age. It is lethal unless promptly treated.

NIDDM is much more common than IDDM. It is often discovered by chance. It is typically gradual in onset and occurs mainly in the middle-aged and elderly, frequently mild, slow to ketosis and is compatible with long survival if given adequate treatment. Its clinical picture is usually complicated by the presence of other disease processes.

Impaired glucose tolerance (IGT) describes a state intermediate “at risk” group – between diabetes mellitus and normality. It can only be defined by the oral glucose tolerance test

The commonly accepted readings are.

Fasting, below 110mgdl, Normal

Random, below 140mgdl , Normal

HbA1c, below 6, Normal

Mortality

Diabetes is one of the leading causes of death in the developed countries. In the USA, it is the fourth leading cause of death, and in at least 30 other developed countries it is also a leading cause of death.

Table 3 shows the mortality rates as a result of diabetes. The high rates for some countries (e.g., Trinidad, Belgium, Greece) are notable.

In all societies ketoacidosis is a significant cause of death in diabetes. Severe hypoglycemia also figures as a cause of death and disability. Epidemics of diabetes have been described among populations in the Pacific region

Rate of diabetes mortality (per 100,000) by age group

	Age group (years)					
	All ages	35-44	45-54	55-64	65-74	75 +
1. Trinidad and Tobago (1977)	48.6	21.6	91.7	276.9	429.0	883.0
2. Barbados (1980)	48.2	5.2	15.6	62.8	339.9	638.6
3. Belgium (1978)	33.3	2.7	8.7	28.3	120.7	342.8
4. Greece (1981)	30.8	1.6	6.4	36.1	136.4	298.5
5. USA (1979)	14.8	3.6	9.0	25.8	61.3	148.5
6. France (1980)	13.1	1.0	4.0	11.4	42.8	128.0
7. Eng & Wales (1981)	9.3	1.4	3.4	10.3	29.6	79.9
8. Sri Lanka (1977)	9.2	4.7	17.7	40.6	90.2	162.1
9. Japan (1981)	7.1	1.6	5.1	12.2	38.3	83.6

Morbidity

Diabetes is an “iceberg” disease, affecting at least 30 million people throughout the world. Its prevalence in most adult populations is 2 to 5 percent, in some populations, the rate is considerably higher at 10%. In some developing countries (e.g., Philippines) the disease prevalence is increasing rapidly due to rapid changes in life style. IDDM affects between 1 in 500 and 1 in 200 children and adolescents respectively. In some population IDDM is very uncommon, as for example in Chinese, Japanese and American Indians who have retained their traditional life style.

The major cause of prolonged ill health in diabetics is coronary heart disease, glomerulosclerosis, and retinopathy, gangrene of a lower extremity, neuropathy, stroke and cataract. Rates of disability are in general about 2 to 3 times as great in diabetics as in non-diabetics.

Epidemiological studies in 1996, have established a prevalence of diabetes mellitus in India as 1-2 per cent. Well-organized multi-center study finance by the Indian Council of Medical Research in Ahmedabad, Calcutta, Cuttack, Delhi, Pune and Trivandrum showed that in persons over 15 years of age, the overall prevalence rate for India as a whole was 1.73 per cent. The prevalence rates in urban population ranged between 0.95 per cent in Delhi and 3.8 per cent in Ahmedabad; in the rural population, the prevalence rates ranged between 0.60 per cent in Cuttack and 1.93 per cent in Ahmedabad. The Diabetes ratio's in the years 2005-7, were in the range of 9-10%.

In the ICMR study, the subjects were given 75 g of oral glucose load on an empty stomach in early morning. After two hours, blood and urine samples were collected for sugar estimation. Subjects having blood sugar value above 100 mg per cent were subjected to a standard oral glucose tolerance test (SOGTT) by giving 40 mg of glucose per square meter of body surfaces. The results are shown in the table

Prevalence of diabetes mellitus in India

	Total Subject's Studied	Prevalence rate per cent
Ahmedabad		
Urban	3508	3.80
Rural	3483	1.93
Calcutta		
Urban	3489	1.78
Rural	3578	1.48
Cuttack		
Urban	3858	2.02
Rural	3000	0.62
Delhi		
Urban	2358	0.95
Rural	2308	1.53
Pune		
Urban	2804	1.86
Rural	2822	1.10

Trivandrum		
Urban	3092	1.83
Rural	100	1.00

Natural History

I. Causative Factors.

The underlying cause of diabetes is insulin deficiency, which is absolute in IDDM and partial in NIDDM. This may be due to a wide variety of mechanisms.

Pancreatic disorders. Inflammatory, neoplastic and other disorders such as cystic fibrosis, Defects in the formation of Insulin. Synthesis of an abnormal, biologically less active insulin molecule.

Destruction of beta cells. Vital infections and chemical agents.

Decreased insulin Sensitivity. Due to decreased numbers of adipocyte and monocyte insulin receptors.

Genetic effects. Mutation of insulin gene.

Auto-immunity. Evidence is accumulating that the insulin response to glucose is genetically controlled. The overall effect of these mechanisms is reduced utilization of glucose, which leads to hyperglycemia accompanied by glycosuria.

II. Host factors

Age. Although diabetes may occur at any age, surveys indicate that prevalence rises steeply with age; NIDDM usually comes to light in the middle years of life and thereafter begins to rise in frequency. Malnutrition related diabetes affects large numbers of young people. The prognosis is worse in younger diabetics who tend to develop complications earlier than older diabetics.

Sex. In some countries (e.g., UK) the overall male-female ratio is about equal. In South-East Asia, an excess of male diabetics has been observed, but this is open to question.

Genetic factors. The genetic nature of diabetes is undisputed. Twin studies showed that in identical twins that developed NIDDM, concordance was approximately 90 per cent, thus demonstrating a strong genetic component. In IDDM (type 1 diabetes), the concordance was only about 50 per cent indicating that IDDM is not totally a genetic entity.

Immune mechanisms. There is some evidence of both cell-mediated and of humoral activity against islet cells. Some people appear to have defective immunological mechanisms, and under the influence of some environmental “trigger”, attack their own insulin producing cells.

Obesity. Obesity has long been accepted as a risk factor for NIDDM and the risk is related to both the duration and degree of obesity. In some instances, obesity reduces the number of insulin receptors on target cells, but in most cases, it produces resistance to the action of insulin. However, many obese subjects are not diabetic. Thus obesity by itself is inadequate to account for all, or even most, cases of NIDDM; physical inactivity and / or deficiencies of specific nutrients may also be involved. Obesity appears to play no role in IDDM pathogenesis.

III. Environmental risk factors

Susceptibility to diabetes appears to be unmasked by a number of environmental factors acting on genetically susceptible individuals. They include.

Sedentary life style. Sedentary life style appears to be an important risk fact for the development of NIDDM. Lack of exercise may alter the interaction between insulin and its receptors and subsequently lead to NIDDM.

Diet. Studies indicated that the diet of diabetics did not appear to differ in any marked way from that of non-diabetics except in quantity. There is sound evidence that diabetes is specifically associated with high intake refined carbohydrates including white rice & white bread.

Malnutrition. Malnutrition (PEM) in early infancy and childhood may result in partial failure of beta-cell function. Damage to beta cells may well explain the associated impaired carbohydrate tolerance in kwashiorkor. Excessive intake of alcohol can increase the risk of diabetes by damaging the pancreas and liver and by promoting obesity.

Viral infection. Among the viruses that have been implicated are rubella, mumps, and human Coxsackie's virus B4. Viral infections may trigger in immunogenetically susceptible people a sequence of events resulting in B-cell destruction.

Stress. Surgery, trauma, and stress of situations, internal or external, may "bring out" the disease.

Other factors. High and low rates of diabetes have been linked to a number of social factors such as occupation, marital status, religion, economic status, education, urbanization and changes in life style which are elements of what is broadly known as social class. One of the most important epidemiological features of diabetes is that it is now common in the lower social classes whereas 50 years ago, the gradient was the reverse. One reason could b rapid changes in life style in lower classes

SCREENING OF DIABETES

In the past, the commonest approach to diabetes screening was a preliminary, semi-quantitative test for glucose in a urine sample, followed by an oral glucose tolerance test for those found to have glycosuria. The underlying assumption is that early detection and effective control of hyperglycemia in asymptomatic diabetics reduces morbidity.

1. Urine examination

Urine test for glucose, 2 hours after meal, is commonly used in medical practice for detecting cases of diabetes. All those with glycosuria are considered diabetic unless otherwise proved

by a standard oral glucose tolerance test. Most studies now confirm that although glucose is found in urine in the most severe cases of diabetes, it is often absent in milder forms of the disease, and such cases are likely to be missed by urine test. This is known as lack of "sensitivity". To be more precise, the sensitivity of the test (i.e., proportion of people with disease who have a positive test) varies between 10-50 per cent. The lack of sensitivity means that many diabetics would have been missed if this had been the only test. That is, the test yields too many "false-negative". Further, glycosuria may be found in perfectly normal people; this gives rise to "false-positives". Since the specificity of the test is over 90 per cent, the yield of false-positives is not very high. For those reasons, urine testing is not considered an appropriate tool for case-finding or epidemiological surveys of the population.

2. Blood sugar testing

Because of the inadequacies of urine examination, "standard oral glucose test" remains the cornerstone of diagnosis of diabetes. Mass screening programs have used glucose measurements of fasting, post-prandial or random blood sample. The measurement of glucose levels in random blood samples is considered unsatisfactory for epidemiological use; at the most, it can give only a crude estimate of the frequency of diabetes in a population. The fasting value alone is considered less reliable since true fasting cannot be assured and spurious diagnosis of diabetes may more readily occur. Therefore, for epidemiological purposes, the 2-hour value after 75g oral glucose maybe used either alone or with the fasting value. Automated biochemistry has now made it possible to screen thousands of samples for glucose estimation. The criteria for the diagnosis of diabetes, proposed by WHO is 140 mgd

TARGET POPULATION

Screening of the whole population for diabetes is not considered a rewarding exercise. However, screening of "high-risk" groups is considered more appropriate. Those groups are: (i) those in the age group 40 and over (ii) those with a family history of diabetes (iii) the obese (iv) women who have had a baby weighing more than 4.5 kg (or 3.5 kg in constitutionally small populations) (v) women who show excess weight gain during pregnancy, and (vi) patients with premature atherosclerosis.

Prevention and Care

1. Primary prevention.
 - (i) Population strategy
 - (ii) High risk strategy
2. Secondary prevention.
3. Tertiary prevention.

1. Primary prevention.

Population strategy. The scope for primary prevention of IDDM is limited on the basis of current knowledge and is probably not appropriate. However, the development of prevention programs for NIDDM based on elimination of environmental risk factors is possible. There is pressing need for primordial prevention – that is, prevention of the emergence of risk factors

in countries in which they have not yet appeared. The preventive measures comprise maintenance of normal body weight through adoption of healthy nutritional habits and physical exercise. The nutritional habits include an adequate protein intake, a high intake of dietary fiber and avoidance of sweet foods. Elimination of other less well defined factors such as protein deficiency and food toxins may be considered in some populations. These measures should be fully integrated into other community-based programs for the prevention of non-communicable disease (e.g., coronary heart disease).

High-risk strategy. There is no special high-risk strategy for IDDM diabetes. At present, there is no practical justification for genetic counseling as a method of prevention.

Since NIDDM appears to be linked with sedentary life-style, over nutrition and obesity, correction of these may reduce the risk of diabetes and its complications. Since alcohol can indirectly increase the risk of diabetes, it should be avoided. Subjects at risk should avoid diabetogenic drugs like oral contraceptives. It is wise to reduce factors that promote atherosclerosis, e.g., smoking, high blood pressure, elevated cholesterol and high triglyceride levels. These programs may most effectively be directed at target population groups.

2. Secondary prevention

When diabetes is detected, it must be adequately treated. The aims of treatment are: (a) to maintain blood glucose levels as close within the normal limits as is practicable ie fasting 100 mgdl, Random 140mgdl & HbA1c at below 6.5, and (b) to maintain ideal body weight, ie BMI between 18-25. Treatment is based on (a) diet alone small balanced meals frequently, (b) diet oral antidiabetic drugs, or (c) diet and insulin. Good control of blood glucose protects against the development of complications. Proper management of the diabetic is most important to prevent complications.

Routine checking of blood sugar, of urine for proteins and ketones, of blood pressure, visual acuity and weight should be done periodically. The feet should be examined for any defective blood circulation (Doppler ultrasound probes are advised), loss of sensation and the health of the skin. Primary health care is of great importance to diabetic patients since most care is obtained at this level.

Glycosylated hemoglobin: There should be an estimation of glycated (glycosylated) hemoglobin at half-yearly intervals. This test provides a long-term index of glucose control. This test is based on the following rationale: glucose in the blood is complexed to a certain fraction of hemoglobin to an extent proportional to the blood glucose concentration. The percentage of such glycosylated hemoglobin reflects the mean blood glucose levels during the red cell life-time (i.e., about the previous 2-3 months).

Self-care: A crucial element in secondary prevention is self-care. That is, the diabetic should take a major responsibility for his own care with medical guidance – e.g., adherence to diet and drug regimens, examination of his own urine and where possible blood glucose monitoring; self administration of insulin, abstinence from alcohol, maintenance of optimum weight, attending periodic check-ups, recognition of symptoms associated with glycosuria and hypoglycemia, etc.

Home blood glucose monitoring: Assessment of control has been greatly aided by the recent facility of immediate, reasonably accurate, capillary blood glucose measurements either by one of the many meters now available or the direct reading Haemogluco test strips.

The patient should carry an identification card showing his name, address, telephone number (if any) and the details of treatment he is receiving. In short, he must have a working knowledge of diabetes. All these mean education of patients and their families to optimize the effectiveness of primary health care services.

3. Tertiary prevention

Diabetes is a major cause of disability through its complications, e.g., blindness, kidney failure, coronary thrombosis, gangrene of the lower extremities, etc. The main objective at the tertiary level is to organize specialized clinics (Diabetic clinics) and units capable of providing diagnostic and management skills of a high order. There is a great need to establish such clinics in large towns and cities. The tertiary level should also be involved in basic, clinical and epidemiological research. It has also been recommended that local and national registries for diabetics should be established

D) HYPERTENSION

Blood pressure is continuously variable in populations. There is no natural dividing line between “high” and “normal” blood pressure. The eternal question is at what level the pressure should be labeled as hypertension?

The definition of blood pressure, therefore, using any specific cut-off point is arbitrary. There have been multiple proposed cut-off points for the definition of high blood pressure. The WHO in its Expert Committee report (1978) has arbitrarily defined hypertension in adults as “a systolic pressure equal to or greater than 160 mm Hg and/or a diastolic pressure (phase V) equal to or greater than 95 mm Hg. The term Mild hypertension in adults has been defined as “a diastolic pressure (phase V) persistently between 140 and 90 mm Hg

BLOOD PRESSURE MEASUREMENT

Despite more than 75 years of experience with the measurement of blood pressure, discussion continues about its reliability and wide variability in individual subjects. Accurate measurements are essential under standardized conditions for valid comparison between persons or groups over time. Three sources of errors have been identified in the recording of blood pressure: (a) Observer errors: e.g., hearing acuity, interpretation of Korotkow sounds. (b) Instrumental errors: e.g., leaking valve, cuffs that do not encircle the arm. If the cuff is too small and fails to encircle the arm then too high a reading will be obtained; and (c) Subject errors: e.g., the circumstances of examination. These include the physical environment, the position of the subject, external stimuli such as fear, anxiety, and so on.

A few salient points need be mentioned about measuring blood pressure. A WHO Study Group recommended the sitting position than the supine position for recording blood pressure. In any one clinic a uniform policy should be adopted, using either the right or left arm consistently. The pressure at which the sounds are first heard is taken to indicate the systolic pressure. Near the diastolic pressure the sounds first become muffled and then disappear. Most of the studies have used to measure diastolic blood pressure. The systolic and diastolic pressures should be measured at least three times over a period of at least 3 minutes and the lowest reading recorded. For reasons of comparability, the data should be recorded everywhere in a uniform way.

For details of measurement procedure, such standard reference as those published by WHO and the American Heart Association should be consulted

CLASSIFICATION

Hypertension is divided into primary (essential) and secondary. Hypertension is classified as "essential" when the causes are generally unknown. Essential hypertension is the most prevalent form of hypertension accounting for 90 per cent of all cases of hypertension. Hypertension is classified as "secondary" when some other disease process or abnormality is involved in its causation. Prominent among these are disease of kidney (chronic glomerulonephritis and chronic pyelonephritis), tumors of the adrenal glands, congenital narrowing of the aorta and toxemias of pregnancy. Altogether, these are estimated to account for about 10 per cent or less of the cases of hypertension

MAGNITUDE OF THE PROBLEM

Although blood pressure is easily measured, it has taken several decades to realize that arterial hypertension is a frequent, worldwide health disorder.

"Rule of halves"

Hypertension is an "iceberg" disease. It became evident in the early 1970s that only about half of the hypertensive subjects in the general population of most developed countries were aware of the condition, only about half of those treated were considered adequately treated. Illustrates this situation. If this was the situation in countries with highly developed medical services, in the developing countries, the proportion treated would be far too less.

The areas of the circles correspond to the actual proportions observed in several population based studies and number wise represent the following:

1. The whole community
2. Normotensive subjects
3. Hypertensive subjects
4. Undiagnosed hypertension
5. Diagnosed hypertension
6. Diagnosed but untreated
7. Diagnosed and treated
8. Inadequately treated
9. Adequately treated

Incidence: The concept of incidence has limited value in hypertension because of the variability of consecutive readings in individuals, ambiguity of what are “normal” blood pressure and the insidious nature of the condition.

Prevalence: In some industrialized countries, up to 25 per cent of adults have diastolic pressure above 90 mm Hg. Prevalence in the developing countries seems to be similar to that in European or other technically developed societies ranging from 10 per cent to as much as 20 per cent among adults. Only a few populations, either living at high altitudes or belonging to primitive cultures (e.g., a small number of ethnic groups living in the Pacific islands, Asia, Africa and South America) seem to have exceptionally low level of blood pressure

Prevalence in India: The data are derived from two well-planned studies, which screened all persons aged 20-60 years and followed WHO suggested criteria for diagnosis. The one in Rohtak is taken to represent the urban population, and the other in a village in Haryana to represent rural population in India. The prevalence of hypertension was 59.9 and 69.9 per 1000 males and females respectively in the urban population, and 35.5 and 35.9 per 1000 in males and females respectively in the rural population

Mortality: High blood pressure is a major risk factor for stroke, CHD, heart or kidney failure. The higher the pressure, the greater the risk and lower the expectation of life. Mortality rates from hypertension are also misleading, as hypertension is a grossly underreported factor in cardiovascular mortality. The Table shows the death rates from hypertension in selected countries. The bulk of mortality associated with hypertension is due to cardiovascular disease. In western countries, it is mainly coronary heart disease; in Japan and Taiwan and possibly in India death from stroke is more common

Death rate per 100,000 population from hypertensive disease in selected countries

Country	Total	Female	Male
USA (1980)	14.4	12.6	16.0
Japan (1982)	11.6	9.5	13.6
Eng & Wales (1982)	10.4	9.4	11.3
France (1981)	9.9	7.7	12.1
New Zealand (1981)	9.2	8.3	10.1
Scotland (1983)	8.3	7.0	9.6
Canada (1982)	6.1	5.0	7.2
Netherlands (1982)	4.8	3.9	5.7

Uniform trends

Interestingly, hypertension is one of the chronic diseases, which has shown the largest decline in mortality in some countries during the last two decades. Although the number of deaths in women exceeds those in men, the rate of fall is similar in both sexes. This fall is attributed to

the use of more effective drugs introduced during the past 15-20 years to control hypertension. It is interesting to note that the rate of fall in mortality continues

Hypertensive disease in England & Wales (Death rate per 100,000)

Year	Male	Female
1961	31.7	40.5
1966	21.6	27.7
1971	17.6	20.4
1976	14.2	16.8
1980	10.6	12.0

TRACKING OF BLOOD PRESSURE

If blood pressure levels of individual were followed up over a period of years from early childhood into adult life, then those individuals, whose pressures were initially high in the distribution, would probably continue in the same “track” as adults. In other words, low blood pressure levels tend to remain low, and high levels tends to become higher as individuals grow older. This phenomenon of persistence of rank order of blood pressure has been described as “tracking”. This knowledge can be applied in identifying children and adolescents “at risk” of developing hypertension at a future date

RISK FACTOR FOR HYPERTENSION

Hypertension is not only one of the major risk factor for most forms of cardiovascular disease, but that it is a condition with its own risk factor. A WHO Scientific Group has recently reviewed the risk factors for essential hypertension. These may be classified as:

1. Non – modifiable risk factors:

Age: Blood pressure rises with age in both sexes and the rise is greater in those with higher initial blood pressure. Age probably represents an accumulation of environmental influences and the effects of genetically programmed senescence in body systems. Some populations have now been identified whose mean blood pressure does not rise with age. Those communities are for the most part primitive societies with calorie and often salt intakes at subsistence level.

Genetic factors: There is considerable evidence that blood pressure levels are determined in part by genetic factors, and that the inheritance is polygenic. The evidence is based on twin and family studies. Twin studies have confirmed the importance of genetic factors in hypertension. The blood pressure values of monozygotic twins are usually more strongly correlated than those of zygotic twins. In contrast, no significant correlation has been noted between husbands and wives, and between adopted children and their adoptive parents.

Family studies have shown that the children of two normotensive parents have 3 percent possibility of developing hypertension, whereas this possibility is 45 percent in children of

two hypertensive parents. Blood pressure levels among first degree adult relatives have also been noted to be statistically significant.

Attempts to find genetic markers that are associated with hypertension have been largely unsuccessful. The detailed mechanism of heredity, i.e., how many genes and loci are involved and their mode of inheritance have not yet been conclusively elucidated.

2. Modifiable risk factors:

Obesity: Epidemiological observations have identified obesity as a risk factor for hypertension. The greater the weight gain, the greater the risk of blood pressure. Data also indicate that when people with blood pressure lose weight, their blood pressure generally decreases.

Salt intake: There is an increasing body of evidence to the effect that a high salt intake (i.e., 7-8 g per day) increases blood pressure proportionately. Low sodium intake has been found to lower blood pressure. For instance, the higher incidence of hypertension is found in Japan where sodium intake is above 400 mmol/day while primitive societies ingesting less than 60 mmol/day have virtually no hypertension. It has been postulated that essential hypertensives have a genetic abnormality of the kidney, which makes salt excretion difficult except at raised levels of arterial pressure.

Besides sodium, there are other mineral elements such as potassium, which are determinants of blood pressure. Potassium antagonizes the biological effects of sodium, and thereby reduces blood pressure. Potassium supplements have been found to lower blood pressure of mild to moderate hypertensives. Other cations such as calcium, cadmium and magnesium have also been suggested as of importance in reducing blood pressure levels.

Saturated fat: Recent evidence suggests that saturated fat raises blood pressure as well as serum cholesterol.

Alcohol: High alcohol intake is associated with an increased risk of high blood pressure. It appears that alcohol consumption raises systolic pressure more than the diastolic. But the finding that blood pressure returns to normal with abstinence suggests that alcohol-induced elevations may not be fixed, and do not necessarily lead to sustained blood pressure elevation.

Physical activity. Physical activity by reducing body weight may have an indirect effect on blood pressure.

Environmental stress. The term hypertension itself implies a disorder initiated by tension or stress. Since stress is nowhere defined, the hypothesis is untestable. However, it is an accepted fact that psychosocial factors, operate through mental processes, consciously or unconsciously, to produce hypertension. Virtually all studies on blood pressure and catecholamine levels in young people revealed significantly higher noradrenalin levels in hypertensives than in normotensives. This supports the contention that over activity of the sympathetic nervous system has an important part to play in the pathogenesis of hypertension.

Other factors. The commonest present cause of secondary hypertension is oral contraception, because of the estrogen component in combined preparations. Other factors such as noise, vibration, temperature and humidity require further investigation.

PREVENTION OF HYPERTENSION

The low prevalence of hypertension in some communities indicates that hypertension is potentially preventable. The WHO has recommended the following approaches in the prevention of hypertension:

1. Primary prevention
 - (i) Population strategy
 - (ii) High-risk strategy
2. Secondary prevention

1. Primary prevention

Although control of hypertension can be successfully achieved by medication (secondary prevention) the ultimate goal in general is primary prevention. Primary prevention has been defined as “all measures to reduce the incidence of disease in a population by reducing the risk of onset”. The earlier the prevention starts the more likely it is to be effective.

In connection with primary prevention, terms such as “population strategy” and “high-risk strategy” have become established. The WHO has recommended these approaches in the prevention of hypertension. Both the approaches are complementary.

Population strategy. The population approach is directed at the whole population, irrespective of individual risk levels. The concept of population approach is based on the fact that even a small reduction in the average blood pressure of a population would produce a large reduction in the incidence of cardiovascular complications such as stroke and CHD. The goal of the population approach is to shift the community distribution of blood pressure towards lower levels or “biological normality”. This involves a multifactor approach, based on the following nonpharmacotherapeutic interventions:

1. **Nutrition:** Dietary changes are of paramount importance. These comprise: (i) reduction of salt intake to an average of not more than 5 g per day (ii) moderate fat intake (iii) the avoidance of a high alcohol intake, and (iv) restriction of energy intake appropriate to body needs.
2. **Weight reduction:** The prevention and correction of obesity (Body Mass Index greater than 25) is a prudent way of reducing the risk of hypertension and indirectly CHD; it goes with dietary changes
3. **Exercise promotion:** The evidence that regular physical activity leads to a fall in body weight, blood lipids and blood pressure goes to suggest that regular physical activity should be encouraged as part of the strategy for risk-factor control.
4. **Behavioural changes:** Reduction of stress and smoking, modification of personal life-style, yoga and transcendental meditation could be profitable.
5. **Health education:** The general public requires preventive advice on all risk factors and related health behavior. The whole community must be mobilized and made aware of the possibility of primary prevention.
6. **Self-care:** An important element in community-based health programs is patient participation. The patient is taught self-care, i.e., to take his own blood pressure and keep a logbook of his readings. By doing so, the burden on the official health services would be

considerably reduced. Log-books can also be useful for statistical purposes and for the long-term follow-up of cases

7. **High-risk strategy.** This is also part of primary prevention. The aim of this approach is “to prevent the attainment of levels of blood pressure at which the institution of treatment would be considered”. This approach is appropriate if the risk factors occur with very low prevalence in the community.

Detection of high-risk subjects should be encouraged by the optimum use of clinical methods. Since hypertension tends to cluster in families, the family history of hypertension and “tracking” of blood pressure from childhood may be used to identify individuals at risk. 2.

2. Secondary Prevention

The goal of secondary prevention is to detect and control high blood pressure in affected individuals. Modern anti-hypertensive drug therapy can effectively reduce high blood pressure and consequently, the excess risk of morbidity and mortality from coronary, Cerebrovascular and kidney disease. The control measures comprise:

(i) **Early case detection:** Early detection is a major problem. This is because high blood pressure rarely causes symptoms until organic damage has already occurred, and our aim should be to control it before this happens. The only effective methods of diagnosis of hypertension are to screen the population. But screening that is not linked to follow-up and sustained care is a fruitless exercise. It is emphasized that screening should not be initiated if health resources for treatment and follow-up are not adequate.

In the developed countries, mass screening is not considered essential for the adequate control of blood pressure in the population. In Europe, the large majority of people have at least one contact in every 2 years with the health services. If blood pressure is measured at each such contact, the bulk of the problem of detecting those in need of intervention is solved.

(ii) Treatment: In essential hypertension, as in diabetes, we cannot treat the cause, because we do not know what it is. Instead, we try to scale down the high blood pressure to acceptable levels. The aim of treatment should be to obtain a blood pressure below 140/90, and ideally a blood pressure of 120/80. According to current concepts, patients, with mild hypertension (i.e., diastolic blood pressure between 90 and 105) should also be treated. They may benefit substantially from blood pressure control. Control of hypertension has been shown to reduce the incidence of stroke and other complications. This is a major reason for identifying and treating asymptomatic hypertension. Care of hypertensives should also involve attention to other risk factors such as smoking and elevated blood cholesterol levels

(iii) Patient compliance: The treatment of high blood pressure must normally be life-long and this presents problems of patient compliance, which is defined as “the extent to which patient behavior (in terms of taking medicines, following diets or executing other life-style changes) coincides with clinical prescription”. The compliance rates can be improved through education directed to patients, families and the community.

Intensive research carried out during the past decade, aiming at control of hypertension at the community level, has already provided valuable results. The studies have shown that control of hypertension in a population is feasible, that it can be carried out through the existing system of health services in different countries, and that the control of blood pressure leads to

a reduction of complications of high blood pressure – namely stroke, heart failure and renal failure. In some of the projects the incidence of myocardial infarction was also reduced. As a result of these findings some countries have launched nation-wide control programs in the field of hypertension.

E) OBESITY

Obesity may be defined as an abnormal growth of the adipose tissue due to an enlargement of fat cell size (hypertrophic obesity). Or an increase in fat cell number (hyper plastic obesity) or a combination of both. Obesity is often expressed in terms of body mass index (BMI). A BMI of 30 or more in males and 28.6 or more in females indicates obesity

The term “overweight” means a weight in excess of the average for a given sex, height and age. Overweight is usually due to obesity but can arise from other causes such as abnormal muscle development or fluid retention

PREVALENCE

Obesity is perhaps the most prevalent form of malnutrition in developed countries, both among adults and children. It is extremely difficult to assess the size of the problem and compare the prevalence rates in different countries as no exact figures are available and also because the definitions of obesity are not standardized. Further, there has been an increased awareness of the problem in recent years. However it has been estimated to affect 20 to 40 per cent of the adults and over 10 to 20 per cent of children and adolescents in developed countries. It is a misconception that obesity is primarily a problem in the affluent countries; in fact, it is found in all countries in varying degrees

EPIDEMIOLOGICAL FACTORS

The etiology of obesity is complex, and is one of multiple causation:

Age. Obesity can occur at any age, and generally increases with age. Infants with excessive weight gain have an increased incidence of obesity in later life. About one-third of obese adults have been so since childhood. It has been well established that most adipose cells are formed early in life and the obese infant lays down more of these cells (Hyper plastic obesity) than the normal infant. Hyper plastic obesity in adults is extremely difficult to treat with conventional methods.

Sex. In the Framingham, USA study, men were found to gain most weight between the ages of 29 and 35 years, while women gain most between 45 and 49 years of age.

Genetic factors. There is a genetic component in the etiology of obesity. Twin studies have shown a close correlation between the weights of identical twins even when they are reared in dissimilar environments. But it has been difficult to examine the relative contribution of genetic and environmental factors. **Physical inactivity.** Physical inactivity may cause obesity, which in turn restricts activity. This is a vicious circle. It is the reduced energy output that is probably more important in the etiology of obesity than was thought. **Socio-economic status.** The relationship of obesity to social class has been studied in some detail. There is a clear inverse relationship between socio-economic status and obesity. Within some affluent countries, however, obesity has been found to be more prevalent in the lower socio-economic groups.

Eating habits. Eating habits (e.g., eating in between meals, preference to sweets, refined foods and fats) are established very early in life. The compositions of the diet, the periodicity with which it is eaten and the amount of energy derived from it are all relevant to the etiology of obesity. A diet containing more energy than needed may lead to prolonged post-prandial hyperlipidaemia and to deposition of triglycerides in adipose tissue resulting in obesity. It has been calculated that a child whose energy requirement is 2000 kcal / day and who consumes 100 kcal / day extra will gain about 5 kg a year. The accumulation of one kilo of fat corresponds to 7,700 kcal of energy.

Psychosocial factors. Psychosocial factors (e.g., emotional disturbances) are deeply involved in the etiology of obesity. Overeating may be a symptom of depression, anxiety, frustration and loneliness in childhood as it is, in adult life. Excessively obese individuals are usually withdrawn, self-conscious, lonely and secret eaters. An insight into the circumstances in which the obesity has developed is essential for planning the most suitable management.

Familial tendency. Obesity frequently runs in families, but this is not necessarily explained solely by the influence of genes.

Endocrine factors. These may be involved in occasional cases, e.g., Cushing's syndrome, growth hormone deficiency, hypothyroidism etc

ASSESSMENT OF OBESITY

Before we consider assessment of obesity, it will be useful to first look at body composition as under;

1. The active mass (muscle, liver, heart etc.)
2. The fatty mass (fat)
3. The extra cellular fluid (blood, lymph, etc.)
4. The connective tissue (skin, bones, connective tissue)

Structurally speaking, the state of obesity is characterized by an increase in the fatty mass at the expense of the other parts of the body. The water content of the body is never increased in case of obesity.

Although obesity can easily be identified at first sight, a precise assessment requires measurements and reference standards. The most widely used criteria are:

I. Body Weight

Body weight, thought not an accurate measure of excess fat, is a widely used index. In epidemiological studies it is conventional to accept + 2 SD (standard deviations) from the median weight for height as a cut-off point for obesity.

For adults, some people calculate various other indicators such as:

(1) Body mass index (Quetelet's index)

$$= \frac{\text{Weight (kg)}}{\text{Height}^2(\text{cm})}$$

(2) Ponderal index

$$= \frac{\text{Height (cm)}}{\text{Cube root of body weight (kg)}}$$

(3) Broca index = Height (cm) minus 100

For example, if a person's height is 160 cm, his ideal weight is $(160 - 100) = 60 \text{ kg}$

(4) Corpulence index

$$= \frac{\text{Actual weight}}{\text{Desirable weight}}$$

This should not exceed 1.2

The body mass index (BMI) and the Broca index are widely used. A recent FAO / WHO / UNU Report gives the much needed reference tables for body mass index which can be used internationally as reference standards for assessing the prevalence of obesity in a community.

II. Skin fold Thickness

A large proportion of total body fat is located just under the skin. Since it is easily accessible, the method most used is the measurement of skin fold thickness. It is a rapid and "non-invasive" method for assessing body fat. Several varieties of calipers (e.g., Harpenden skin calipers) are available for the purpose. The measurement may be taken at all the four sites – mid-triceps, biceps, and sub scapular and suprailiac regions. The sum of the measurements should be less than 40 mm in boys and 50 mm in girls. Unfortunately standards for subcutaneous fat do not exist for comparison. Further, in extreme obesity, measurements may be impossible. The main drawback of skin fold measurements is their poor repeatability.

III. Others

In addition to the above, three well-established and more accurate measurements are used for the estimation of body fat. They are measurement of total body water, of total body potassium and of body density. The techniques involved are relatively complex and cannot be used for routine clinical purposes or for epidemiological studies. The introduction of measuring fat cells has opened up a new field in obesity research

HAZARDS OF OBESITY

Obesity is a health hazard and a detriment to well being, which is reflected, in increased morbidity and mortality:

Increased Morbidity. Obesity is a positive risk factor in the development of hypertension, diabetes, gall bladder disease and coronary heart disease. There are in addition, several associated diseases, which, although not usually fatal, cause a great deal of morbidity in the community, e.g., varicose veins, abdominal hernia, osteoarthritis of the knees, hips and lumbar spine, flat feet and psychological stresses particularly during adolescence. Obese persons are exposed to increased risk from surgery. Obesity may lead to lowered fertility.

Increased Mortality. The Framingham Heart Study in United States showed a dramatic increase in sudden death among men more than 20 per cent overweight as compared with those with normal weight. The increased mortality is brought about mainly by the increased incidence of hypertension and coronary heart disease. Obesity lowers life expectancy. More information is needed about the relationship between different degrees of obesity and morbidity and mortality

PREVENTION AND CONTROL

Prevention should begin in early childhood. Obesity is harder to treat in adults than it is children. The control of obesity centers round weight reduction. This can be achieved by dietary changes, increased physical activity and a combination of both.

Dietary changes: The following dietary principles apply both to prevention and treatment: the proportion of energy-dense foods such as simple carbohydrates and fats should be reduced; the fiber content in the diet should be increased through the consumption of common un-refined foods; adequate levels of essential nutrients in the low energy diets (most conventional diets for weight reduction are based on 1000 kcal daily model for an adult) should be ensured, and reducing diets should be as close as possible to existing nutritional patterns. The most basic consideration is that the food energy intake should not be greater than what is necessary for energy expenditure. It requires modification of the patient's behavior and strong motivation to lose weight and maintain ideal weight. Unfortunately, most attempts to reduce weight in obese persons by dietary advice remain unsuccessful.

Increased physical activity: This is an important part of reducing program. Regular physical exercise is the key to increased energy expenditure. This should comprise not less than one hour of moderate aerobic exercise, to lose 500 calories per day. For greater weight loss exercise may be done for an hour twice each day.

Other: Appetite suppressing drugs have been tried in the control of obesity. They are generally inadequate to produce massive weight loss in severely obese patients.

Surgical treatment: (e.g., gastric bypass, gastroplasty, jaw-wiring to eliminate the eating of solid food has all been tried with limited success. In short, one should not expect quick or even tangible results in all cases from obesity prevention programs. Health education has an important role to play in teaching the people how to reduce overweight and prevent obesity. A fruitful approach will be to identify those children who are at risk of becoming obese and find way of preventing it

F) STROKE

The term “stroke” is applied to acute severe manifestations of cerebrovascular disease. It causes both physical and mental crippling. WHO defined stroke as “rapidly” developed clinical signs of focal (or global) disturbance of cerebral function; lasting more than 24 hours or leading to death, with no apparent cause other than vascular origin”. The 24 hours threshold in the definition excludes Transient Ischaemic attacks.

The disturbance of cerebral function is caused by three morphological abnormalities, i.e., stenosis, occlusion or rupture of the arteries. Dysfunction of the brain (“neurological deficit”) manifests itself by various neurological signs and symptoms that are related to extent and site of the area involved and to the underlying causes. These include coma, hemiplegia, paraplegia, monoplegia, multiple paralysis, speech disturbances, nerve paresis, sensory impairment, etc. Of these hemiplegia constitutes the main somatoneurological disorder in about 90 per cent of patients.

Stroke includes a number of syndromes with differing etiologies, epidemiology, prognosis and treatment. These are listed in the WHO’s International Classification of Diseases (1975 revision):

1. Subarachnoid hemorrhage
2. Cerebral hemorrhage
3. Cerebral thrombosis or embolism
4. Occlusion of pre-cerebral arteries
5. Transient cerebral ischaemia (of more than 24 hours)
6. Ill defined cardiovascular disease (i.e., the underlying pathology in the brain is not determined).

Stroke is a worldwide health problem. It makes an important contribution to morbidity, mortality and disability in developed as well as developing countries. Although there are substantial differences in frequency from place to place cerebral thrombosis is usually the most frequent form of stroke encountered in clinical studies, followed by hemorrhage. Subarachnoid hemorrhage and cerebral embolism come next as regards both mortality and morbidity. However, stroke from cerebral hemorrhage is more common in Japan than elsewhere.

Morbidity. A WHO Collaborative Study in 12 countries showed, in the population studied, stroke incidence rates ranged from 0.2 to 2.5 per 1000 population per year, the variation being mainly due to differences in the age structure of the populations involved. Age-standardized rates for men were 2 per 1000 in Colombo (Sri Lanka), 4 to 8 in most European countries, but 15 in Akita (Japan). Female rates were on average 30 per cent lower. The highest morbidity figures come from Japan.

There is no reliable information on stroke in India. Analysis of data from major urban University Hospitals suggest that nearly 2 per cent of all hospitals cases, 4.5 per cent of medical and 20 per cent of neurological admissions are from stroke.

A random survey on 258,576 residents in urban areas of Vellore revealed only 147 hemiplegic subjects, presumed to be of vascular origin. Thus the prevalence rate for hemiplegia in South India was reported to be 56.9 per 100,000 as compared to 150 to 186 per 100,000 for USA and Europe.

Mortality. Stroke is one of the leading causes of death and disability throughout the world. In developed countries, coronary heart disease and cerebrovascular diseases (particularly stroke) are responsible for between 40 and 50 per cent of all deaths. Of these 10 to 12 per cent are due to stroke. There is evidence that mortality from stroke has been declining in many countries for several years. Some of the decline occurred before modern treatment methods became available, indicating that the fall in stroke was associated with social and economic changes.

The WHO Collaborative Study showed that both in developed and developing countries, nearly one-third of stroke patients died within 3 weeks and 48 per cent died within one year. The unfavorable prognostic factors were old age, hypertension and impairment of consciousness.

Epidemiological studies have indicated that stroke does not occur at random, and there are factors (risk factors), which precede stroke by several years. These are: (a) hypertension: This is considered the main risk factor for cerebral thrombosis as well as cerebral hemorrhage; (b) other factors: Additional factors contributing to risk are cardiac abnormalities (i.e., left ventricular hypertrophy, cardiac dilatation), diabetes, elevated blood lipids, obesity, smoking, glucose intolerance, blood clotting and viscosity, oral contraceptives, etc. The importance of these factors is not clearly defined. Although the risk factors for stroke are similar to those for CHD, their relative importance differs

Transient Ischaemic attacks (TIA)

One phenomenon that has received increasing attention is the occurrence of TIA in a fair proportion of cases. These are episodes of focal, reversible, neurological deficit of sudden onset and of less than 24 hours duration. They show a tendency to recurrence. They are due to micro emboli, and are a warning sign of stroke

Host Factors

Age. Stroke can occur at any age. Usually incidence rates rise steeply with age. In developed countries. Over 80 per cent of all stroke deaths occur in persons over 65 years. In India, about one-fifth of all strokes occur below the age of 40 (called "strokes in the young"). This is attributed to our "young population", and shorter life expectancy (about 65 years).

Sex. The incidence rates are higher in males than females at all ages.

Personal history. The WHO Study showed that nearly three-quarters of all registered stroke patients had associated diseases, mostly in the cardiovascular system or of diabetes. This supports the view that in most cases stroke is merely an incident in the slowly progressive course of generalized vascular diseases

Stroke Control Program

The aim of a stroke control programs is to apply at community level effective measures for the prevention of stroke. The first priority goes to control of arterial hypertension, which is a

major cause of stroke. As transient ischaemic attacks (TIA) may be one of the earliest manifestations of stroke, their early detection and treatment is important for the prevention of stroke. Control of diabetes, elimination of smoking, and prevention and management of other risk factors at the population level are new approaches. Treatment for acute stroke is largely the control of complications. Facilities for the long-term follow-up of patients are essential. The education and training of health personnel and of the public form an integral part of the program. For any such program, reliable knowledge of the extent of the problem in the community concerned is essential.

In summary, control of stroke that was once considered an inevitable accompaniment to aging is now being approached through primary prevention.

It has generated the hope that stroke can be tackled by community health action

G) ASTHMA

People who have asthma sometimes have trouble breathing. When people who have asthma have this trouble breathing, we call it an asthma attack.

Asthma is a chronic inflammatory disease of airways that affects an estimated 5% to 7% of the population, with prevalence and mortality greatest among inner city residents and increasing. A heightened appreciation for the underlying inflammatory pathophysiology of asthma has markedly altered the approach to therapy in the past decade. Anti-inflammatory agents have superseded bronchodilators as the mainstay of treatment.

Although there are no cures for asthma, effective outpatient management is available. Many exacerbations leading to emergency room visits are preventable, so much so that the frequency of emergency room visits for asthma has become a common outcome measure and proxy for quality of primary care. The primary care physician needs to be skilled in asthma management and able to design a practical, cost-effective program that minimizes side effects, maximizes functional status, and reduces the frequency and severity of flares. Because patient involvement in asthma care is essential to a good outcome, the development of a strong patient-doctor relationship and the provision of detailed patient education are extremely important

Clinical Presentation

Regardless of precipitant, the pathophysiologic final common pathway is airway inflammation, with bronchial edema, smooth-muscle contraction, and excessive mucus production. Clinical manifestations include *wheezing*, *dyspnoea*, *cough*, and *sputum*. Presentations range from pure bronchospasm, with little cough and sputum production, to a predominance of bronchorrhea and coughing that mimics bronchitis or an upper respiratory tract infection. In fact, cough and sputum production may be the initial symptoms of an asthmatic attack. *Nocturnal exacerbation* of symptoms is common, linked to the diurnal variation in blood levels of catecholamines and vagal tone.

Extrinsic Asthma

Although classifying asthma according to allergen responsiveness may be an oversimplification, the extrinsic and intrinsic categories do describe two relatively distinct clinical presentations. Patients with *extrinsic asthma* typically give a history of atopy, onset of symptoms during childhood or adolescence, predictable seasonal occurrence, and response to environmental stimuli. However, the condition can occur at any age, and attacks may take place seasonally or year-round, precipitated by such common household allergens as dust mites, animal dander, and fungal spores. Anxiety, inhalation of airway irritants, and exposure to perfumes and strong household odors can also precipitate asthmatic episodes in these patients. The course of attacks is usually self-limited, although some patients have severe bouts requiring hospitalization. Prognosis is relatively good, with 70% found to be symptom-free 20 years after onset.

Intrinsic Asthma

Patients with *intrinsic asthma* usually begin having symptoms in the third or fourth decade. Although no identifiable extrinsic allergen is associated with attacks in these patients, they do demonstrate elevations in serum IgE, similar to those of patients with intrinsic disease. Sputum production can be considerable, so that differentiation from chronic bronchitis is sometimes difficult. Minor upper respiratory tract infections often precipitate attacks. Some patients present with exertional dyspnoea or cough and no demonstrable wheezing, although expiratory flow rates are clearly reduced. Intrinsic asthma is sometimes more refractory to treatment than is extrinsic disease.

Postexertional Asthma is a form of airway hyper reactivity most common in children and adolescents. The stimulus is believed to be a reduction in the temperature of inhaled air, which leads to mediator release (especially leukotrienes) in susceptible patients. Both initial and late-phase reactions have been identified. Vigorous exercise on a cold, dry day is particularly apt to trigger an attack; airway temperature can become quite low in such circumstances. Although bronchospasm does not occur during exercise, it becomes marked shortly after exercise ends and can last for up to an hour.

Occupational Asthma has gained increasing recognition as an important cause of work-related disability. True occupational asthma involves the development of sensitization through inhalation exposure to an occupationally related allergen. Exposure to irritant or toxic pollutants in the workplace can also trigger bronchospasm, especially in a person with preexisting airway hyper responsiveness. Cold air, sulfur dioxide in low concentrations, fluorocarbons, and inert dusts are common irritants that stimulate reflex bronchospasm. Toxic gases such as sulfur dioxide in high concentrations, halogens, ammonia, acid fumes, and solvent vapors cause inflammatory bronchoconstriction.

Important allergens include animal proteins, enzymes, grain and cereal dusts, seeds, vegetable gums, and legumes. Other substances have pharmacologic activity; histamine releasing compounds are present in cotton dust, organic acids are found in wood dust, and numerous chemicals have anticholinesterase activity. Some agents provoke asthma through multiple mechanisms; toluene diisocyanate (TDI) has reflex, pharmacologic, beta blocking, and IgE effects.

Patients with occupational asthma caused by toxic or irritant substances characteristically report a direct relation between exposure and onset of symptoms. Those with allergen-

induced disease note no symptoms at the time of the first exposure but marked wheezing after even minor repeated contact with the allergen (anamnestic response). Typically, patients with occupational asthma are symptom-free during days off from work, only to have a flare-up on returning.

Nasal Polyps and Aspirin Sensitivity comprises a curious but important familial asthma syndrome. The bronchospasm associated with aspirin intake may be marked. The finding of nasal polyps in a person with a history of asthma should lead to consideration of aspirin sensitivity

CATEGORIES OF ASTHMA

For management purposes, four categories of asthma have been defined:

Mild Intermittent Asthma: Symptoms no more than twice weekly and nighttime symptoms no more than twice monthly; lung function [peak flow rate, forced expiratory volume in 1 second (FEV1) reduced to no less than 80% of predicted; patient asymptomatic between exacerbations and peak expiratory flow rates normal between attacks.

Mild Persistent Asthma: Symptomatic more than two times per week but less than once a day, and nighttime symptoms more than twice monthly; episodes may affect activity; pulmonary function is normal in between episodes and decreases to no less than 80% of normal during episodes.

Moderate Persistent Asthma: Daily symptoms, daily use of beta₂-agonists, nocturnal symptoms more than once a week; attacks limit activity; pulmonary function declines to 60% to 80% of normal and may not return to normal after an exacerbation.

Severe Asthma: Symptoms continuous; frequent acute exacerbations; frequent nocturnal symptoms; activity limited; pulmonary function always abnormal and less than 60% of normal without treatment.

Clinical Courses / Natural History

Regardless of the type of asthma, sub clinical but significant bronchospasm remains for days to weeks after the wheezing of an acute attack subsides. The continuing bronchial hyper responsiveness is believed to be related to ongoing inflammation. Often, small airways may remain constricted even after large airways have relaxed. The clinical recurrences that commonly develop shortly after the apparent resolution of an acute attack are most often not new episodes but relapses.

The natural history of asthma and the consequences of airway remodeling that result from chronic airway inflammation remain to be fully established, but in population studies with long-term follow-up, asthmatic patients demonstrate a significant and steady decline in FEV1 in comparison with those without asthma. Smoking exacerbates this decline. Overall mortality for all forms of asthma is 0.1% annually; the rate increases markedly to 3.3% for patients with episodes of status asthmaticus. A disturbing increase in asthma mortality has occurred in the past two decades despite the availability of increasingly effective therapy. The cause for this increase is unclear, but much of it is localized to inner city populations in New York and Chicago, which suggests that increased exposure to potent allergens and air pollution may be contributing, in addition to inadequate access to proper health care

H) MUSCULOSKELETAL DISORDERS

Musculoskeletal disorders (MSDs) are the most common occupational illness in the world. MSDs affect muscles, joints, tendons and other parts of the musculoskeletal system

Some of the most commonly seen musculoskeletal disorders are:

- Autoimmune Disorders of Connective Tissue like Polymyositis and Dermatomyositis, Scleroderma, Systemic Lupus Erythematosus, etc.
- Avascular Necrosis of the Bone
- Bone and Joint Infections like Infectious Arthritis, Osteomyelitis
- Bone Tumors like Metastatic Tumors, Noncancerous Tumors
- Foot Problems like Achilles Tendon Bursitis, Hallux Valgus and Bunion, Onychauxis and Onychogryphosis, Plantar Fasciitis, Tarsal Tunnel Syndrome
- Muscle, Bursa, and Tendon Disorders like Baker's Cysts, Bursitis, Fibromyalgia, Tendinitis and Teno-synovitis
- Muscular Dystrophy and Related Disorders like Duchenne and Becker Muscular Dystrophies, Myo-tonic Myopathies
- Osteoporosis
- Paget's Disease of Bone
- Arthritis like Ankylosing Spondylitis, Psoriatic Arthritis, Rheumatoid Arthritis
- Sports Injuries like Achilles Tendinitis, Hamstring Injury, Rotator Cuff Tendinitis
- Vasculitic Disorders of Connective Tissue like Polyarteritis Nodosa, Polymyalgia Rheumatica
- Fractures of bones
- Gout

Symptoms & diagnosis of musculo-skeletal disorders

The musculoskeletal system comprises muscles, joints, ligaments, tendons, and bursas. Any of these components can be injured by trauma or a number of diseases. Different diagnostic tests are available to diagnose musculoskeletal disorders

Pain

Pain is the chief symptom of most musculoskeletal disorders. The pain may be mild or severe, local or diffuse, according to where the injury occurred. Although pain may be acute and short-lived, as is the case with most injuries, pain may be ongoing with chronic illnesses, such as arthritis

Bone pain is usually a deep, penetrating, or dull pain. It commonly results from injury. Other causes of bone pain include infection and tumors

Muscle pain is often less intense than that of bone pain but can be very unpleasant. For example, a muscle spasm or cramp (a sustained painful muscle contraction) in the calf is an intense pain that is commonly called a charley horse. Pain can occur when a muscle is injured as a result of sports injury, an autoimmune reaction, loss of blood flow to the muscle, infection, or invasion by a tumor

Virtually all joint injuries and diseases produce a stiff, aching pain, often referred to as “arthritic” pain. However, because joint pain is so common, doctors usually base a specific diagnosis on the presence of other symptoms and results of laboratory tests. For example, Lyme disease is characterized by joint pain and a bull’s eye skin rash; blood tests show antibodies to the bacteria that cause Lyme disease. Gout is characterized by a sudden attack of pain in the joint at the base of the big toe; blood tests generally show high levels of uric acid

Sometimes pain can affect the tendons of the palm; this condition is called trigger finger

Inflammation

Inflammation causes swelling, warmth, and tenderness, along with pain, and impairment of function. If a large part of the musculoskeletal system is inflamed, a low-grade fever may be present. Inflammation is a very common reaction of joints to a variety of abnormal circumstances, such as infection or autoimmune disease. Rheumatoid arthritis is one of many autoimmune diseases that cause joint inflammation. For joints, the swelling is often the result of fluid inside the joint. Loss of function occurs as a reduced range of motion

Muscle inflammation (myositis) can result from a number of diseases, including a viral infection. Like any inflammation, muscle inflammation can cause pain and tenderness, swelling, warmth, and impairment of function, occurring as muscle weakness

Muscle Weakness

Weakness can occur when any part of the musculoskeletal system is abnormal. If the muscle itself cannot contract, weakness occurs. If a nerve does not adequately stimulate

the muscle, the muscle contractions are weak. If a joint is frozen and unable to move normally, the muscle may not be adequately able to cause movement. Even pain, due to inflammation, prevents normal movement, causing weakness. Weakness may be limited to one joint or limb, as is typically the case when a nerve, joint, or single muscle is diseased, or diffuse, as occurs in widespread neurologic or muscular diseases. Muscle strength may also be limited by pain in the muscles, tendons, bones, or joints, giving the impression of weakness

Weakness is a common symptom of muscle injury or disease. Muscle weakness can also result from many diseases affecting the whole body. Although many people complain of muscle weakness when they feel tired or run down, true muscle weakness means that full effort does not generate normal strength. True muscle weakness can be caused by problems in the muscle itself (such as in muscular dystrophy or polymyositis), by problems in the nervous system, which helps to control movement (such as following a stroke or after a spinal cord injury; or by disease affecting the connection between the nerve and the muscles, called the

neuro-muscular junction (such as myasthenia gravis). Muscle weakness can occur in old age because of an age-related reduction in muscle mass called sarcopenia. The word “asthenia” is sometimes used by doctors to describe weakness, but in the sense of feebleness or infirmity (debility) rather than simply muscle weakness

Joint Stiffness

Joint stiffness is common with arthritis. Disorders of joints often interfere with joint movement sufficiently to produce stiffness. A common example is the morning stiffness that occurs with rheumatoid arthritis, in which stiffness typically occurs on arising and gradually improves with activity only after an hour or two. Some conditions, such as injuries that stretch or tear ligaments, may increase joint looseness (laxity), usually allowing excessive or abnormal bending of joints and thereby making the joints unstable. Joint looseness may occur in a connective tissue disease called cutis laxa

Joint Noises

Joint noises, such as creaks and clicks, are common in many people, but they can also occur with specific problems of the joints. For example, the base of the knee cap may creak when it is damaged by osteoarthritis, and the jaw may click in a person who has temporomandibular joint disorder.

Joint Range of Motion

The range of motion in a joint may be reduced because it hurts to move the joint (such as when the joint is inflamed), because the joint itself has been damaged by disease, or because long-term lack of movement has allowed the joint to become fixed. For example, when a person's arm is paralyzed by a stroke, the joints in the shoulder and elbow may freeze in place if the arm is not regularly flexed and stretched

Classifying Muscle Weakness

Underlying Problem	Example	Description
Muscle disease	Muscular dystrophies	A group of inherited muscle disorders that lead to muscle
Disease of the neuro-muscular junction	Infections or inflammatory disorders (acute viral	Muscles tender or painful and weak

Spinal cord damage	Myasthenia gravis, curare toxicity, Eaton – Lambert syndrome, insecticide poisoning, botulism, diphtheria	Weakness or paralysis of many muscles
Degeneration of nerve cell bodies in the spinal cord	Trauma to the neck or back, spinal cord tumors, spinal stenosis, multiple sclerosis, transverse myelitis, vitamin B12 deficiency	Weakness or paralysis of the arms and legs below the level of injury, progressive loss of sensation below the level of injury, back pain. Bowel, bladder, and sexual
Spinal nerve root damage	Amyotrophic lateral sclerosis	Progressive loss of muscle bulk and strength, but no loss of sensation
Damage to a single nerve (mononeuropathy)	Ruptured disk in the neck or lower spine	Pain in the neck and weakness or numbness in an arm, low back pain shooting down the leg (sciatica), and leg weakness or numbness
Damage to many nerves (polyneuropathy)	Diabetic neuropathy, local pressure Diabetes, Guillain-Barré syndrome, folate deficiency, other metabolic diseases	Weakness or paralysis of muscles and loss of sensation in the area served by the injured nerve
Use of corticosteroid drugs	Corticosteroid myopathy	Weakness or paralysis of muscles and loss of sensation in the areas served by the affected nerves Weakness usually begins at the hips and gradually spreads to all muscles
Low blood levels of potassium	Hypokalemic myopathy	The person experiences periods of weakness throughout the body that begin rapidly

Abnormal levels of thyroid hormone	High levels of thyroid hormone (hyperthyroidism) or low levels of thyroid hormone (hypothyroidism)	High levels of thyroid hormone produce weakness that is usually more pronounced in the shoulders than in the legs. Low levels of thyroid hormone produce weakness that is usually more pronounced in the legs
Low levels of vitamin D	Osteomalacia	Pain in the back, with weakness in the legs; rarely pain throughout the body
Psychologic problems	Depression, imagined symptoms, hysteria (conversion reaction)	Complaint of whole body weakness, paralysis with no evidence of nerve damage

Diagnosis

A doctor can often diagnose a musculoskeletal disorder based on the symptoms and on the results of a physical examination. Laboratory tests, imaging tests, or other diagnostic procedures are sometimes necessary to help the doctor make or confirm a diagnosis.

Physical Examination

A doctor looks for certain things during a physical examination depending on what disorder is suspected. When evaluating bones, if a fracture is suspected, the doctor may notice that the affected part (such as an arm or a leg) is abnormally shaped, suggesting that the segments of bone are out of alignment. If a bone infection (osteomyelitis) is suspected, the doctor looks for tenderness over the infected bone, together with an elevated body temperature. The doctor may feel (palpate) the surfaces of the bones, to detect any abnormal bumps, which may indicate a tumor.

When a person complains of muscle weakness, the doctor checks muscles for bulk and texture and for tenderness. Muscles are also checked for abnormal movements, which may indicate a nerve disease rather than a muscle disease. Doctors look for wasting away of muscle (atrophy), which can result from damage to the muscle or its nerves or from lack of use (disuse atrophy), as sometimes occurs from prolonged bed rest. Doctors also look for muscle enlargement (hypertrophy), which normally occurs with an exercise such as weight lifting. However, when a person is ill, hypertrophy may result from one muscle working harder to compensate for the weakness of another. Muscles can also enlarge when normal muscle tissue is replaced by abnormal tissue (increasing the size but not the strength of the muscle), which occurs in amyloidosis and in certain inherited muscle disorders, such as Duchenne muscular dystrophy.

Doctors try to establish which (if any) muscles are weak and how weak they are. The muscles are tested systematically, usually beginning with the face and neck, then the arms, and finally the legs. Normally, a person should be able to hold the arms extended for one minute without their sagging, turning, or shaking. Downward drift of the arm+ with palms turned inward is a sign of weakness. Strength against resistance is tested by pushing or pulling while the doctor pushes and pulls in the opposite direction.

When examining joints, the doctor tests a joint's range of motion and muscle tone by moving the limb around a joint while the person is completely relaxed (passive movement).

Resistance to such movement (passive resistance) may be decreased when the nerve leading to the muscle is injured or severed; resistance may be increased when the spinal cord or brain is injured

Laboratory Tests

Laboratory tests are often helpful in making the diagnosis of a musculoskeletal disorder. For example, the erythrocyte sedimentation rate (ESR—a test that measures the rate at which red blood cells settle to the bottom of a test tube containing blood) is increased when inflammation is present. The level of creatine kinase (a normal muscle enzyme that leaks out and is released into the bloodstream when muscle is damaged) may also be tested. In rheumatoid arthritis, a blood test to identify rheumatoid factor is helpful to diagnosis. In gout, a blood test often shows a high level of uric acid

Laboratory tests are also often useful to help monitor the progress of treatment (for example, the ESR can be particularly useful in monitoring the progress of treatment in rheumatoid arthritis or polymyalgia rheumatica and in confirming the diagnosis of osteomyelitis)

Nerve Tests

Nerve conduction studies helps determine if the nerves sup- plying the muscles are functioning normally; they are used in the diagnosis of such disorders as polyarteritis nodosa and ulnar nerve palsy. Electromyography, often conducted at the same time as nerve conduction studies, is a test in which electrical impulses reaching muscles from the nerves are recorded to help determine whether the muscles and the connection between nerves and muscles (neuromuscular junc- tion) are normal. The test helps determine whether there is a problem primarily in the muscles or in the nerves supplying those muscles. It is also useful in diagnosing such disorders as amyotrophic lateral sclerosis and dermatomyositis

X-rays

X-rays are taken to evaluate painful areas of bone; often, x- rays can help to detect fractures, tumors, injuries, infections, and deformities (such as congenital hip dysplasia). To help determine whether the joint has been damaged, a doctor may use an ordinary (plain) x-ray or one taken with the joint under stress (stress x-ray)

Arthrography is an x-ray procedure in which a radiopaque dye is injected into a joint space to outline the structures, such as ligaments inside the joint. Arthrography can be used to view torn ligaments and fragmented cartilage in the joint. However, MRI is now generally used in preference to arthrography

Dual-Energy X-ray Absorptiometry

The most accurate way to evaluate bone density, which is necessary when screening for or diagnosing osteoporosis, is with dual-energy x-ray absorptiometry (DEXA). In this test, low-dose x-rays are used to examine bone at two sites: the spine and hip. Two different energies are used to distinguish between bone and soft tissue, giving a very accurate measurement of bone density at these sites.

Computed Tomography and Magnetic Resonance Imaging

Computed tomography (CT) and magnetic resonance imaging (MRI) give much more detail than conventional x-rays and may be performed to determine the extent and exact location of damage. MRI is especially valuable for imaging muscles, ligaments, and tendons; CT is best for imaging the bone. The amount of time a person spends undergoing CT is much less than for MRI. MRI is more expensive than CT and, with the exception of when the open-sided units are used, many people feel claustrophobic inside the MRI unit.

Bone Scanning

Bone scanning is an imaging procedure that is sometimes used to diagnose a fracture, particularly if other tests do not reveal the fracture. Bone scanning involves use of a radioactive substance (technetium-99m-labeled pyrophosphate) that is taken up by any healing bone. The technique can also be used when a bone infection or a metastasis (from a cancer elsewhere in the body) is suspected. The radioactive substance is given intravenously and is detected by a bone-scanning device, creating an image of the bone that can be viewed on a computer screen.

Joint Aspiration

Joint aspiration is used to diagnose joint problems. A needle is inserted into a joint space, and fluid (synovial fluid) is sucked out (aspirated) and examined under a microscope. A doctor can often make a diagnosis after analyzing the fluid. For example, a sample of synovial fluid may contain bacteria, which confirms a diagnosis of infection. Or, it may contain urate crystals, which confirms a diagnosis of gout or pseudogout. Usually performed in the doctor's office, this procedure is generally quick, easy, and almost painless. The risk of joint infection is minimal.

Arthroscopy

Arthroscopy is a procedure in which a small fiber-optic scope is inserted into a joint space, allowing the doctor to look

inside the joint, take a piece of tissue for analysis (biopsy), and, if necessary, perform surgery to correct the condition. Disorders commonly found during arthroscopy include inflammation of the synovium lining the joint (synovitis); ligament, tendon, or cartilage tears; loose pieces of bone or cartilage. All of these conditions can be repaired or removed during arthroscopy. There is a very small risk of joint infection with this procedure.

Biopsy

A biopsy is a procedure in which a small piece of tissue is taken, usually with a needle (needle biopsy), and examined under a microscope. Biopsy samples may be taken from virtually any tissue, including muscle, bone, and joints. The risk of infection is minimal.

LOW BACK PAIN

Low back pain is very common. It affects 4 of 5 people at some time during their lives. It is the leading cause of disability for those aged 19 to 45 and is the second most common cause of missed work days (after the common cold) for adults younger than 45. Low back pain becomes more common as people age. It affects half of the people older than 60 at any given time. Each year, the treatment of low back pain costs more than \$80 billion, and insurance claims for disability due to low back pain exceed \$8 billion. Thus, although low back pain rarely results from life-threatening disorders, it is a significant health problem. However, the number of back injuries in the workplace is decreasing, perhaps because awareness of the problem has increased and preventive measures have improved.

The spine (spinal column) consists of the back bones (vertebrae), which are separated and cushioned by shock-absorbing disks made of cartilage. The vertebrae are also covered by a thin layer of cartilage. They are held in place by ligaments and muscles, which help stabilize the spine. These muscles include the two iliopsoas muscles (which run along both sides of the spine), the two erector spinae muscles (which run along the length of the spine behind it), and the many short paraspinal muscles (which run between the vertebrae). The abdominal muscles (which run from the bottom of the rib cage to the pelvis) also help stabilize the spine.

Enclosed in the spine is the spinal cord. Along the length of the spinal cord, the spinal nerves emerge through spaces between the vertebrae to connect with nerves throughout the body. The part of the spinal nerve nearest the spinal cord is called the spinal nerve root. Because of their position,

spinal nerve roots can be compressed when the spine is injured, resulting in pain.

The lower (lumbar) spine consists of five vertebrae. It connects the chest to the pelvis and legs, providing mobility—for turning, twisting, and bending. It also provides strength—for standing, walking, and lifting. Thus, the lower back is involved in almost all activities of daily living. Low back pain can limit many activities and reduce the quality of life.

Causes

Low back pain has many causes, although often no specific cause can be identified.

One of the most common causes is muscle and ligament strains and sprains. Strains and sprains may result from lifting, exercising, or moving in an unexpected way (such as when falling or when in a car accident). When due to exercise, injury to the lower back is sometimes called weight lifter's back (lumbar strain). Weight lifter's back may be caused not only by snatching a heavy weight from the ground in weight lifting but also by pushing against an opposing lineman in football, suddenly turning to dribble after a rebound in basketball, swinging a bat in baseball, or swinging a club in golf. The lower back is more likely to be injured when a person's physical conditioning is poor and the supporting muscles of the back are weak. Having poor posture, lifting improperly, being overweight, and being tired also contribute.

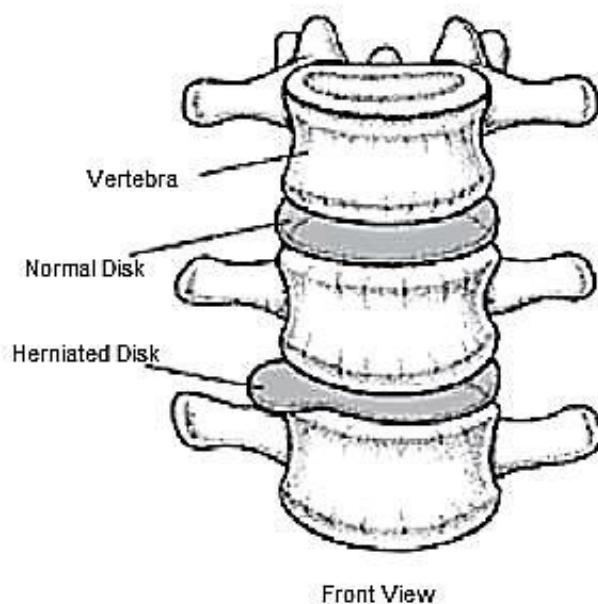
Osteoarthritis (degenerative arthritis) causes the cartilage that covers and protects the vertebrae to deteriorate. This disorder is thought to be due, at least in part, to the wear and tear of years of use. The disks between the vertebrae deteriorate, narrowing the spaces there and compressing spinal nerve roots. Irregular projections of bone (spurs) may develop on the

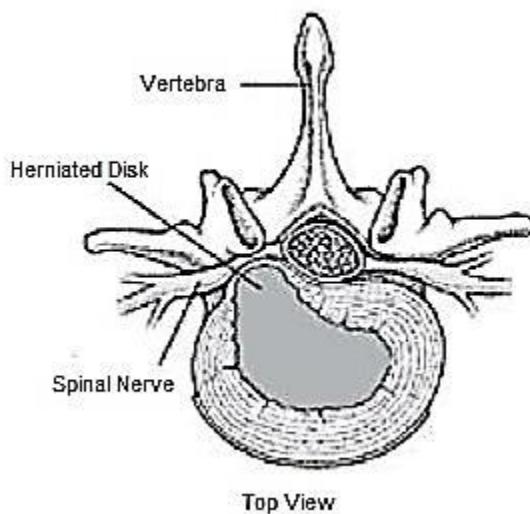
vertebrae and also compress spinal nerve roots. All of these changes can cause low back pain as well as stiffness

In osteoporosis, bone density decreases, making the bones more likely to fracture. The vertebrae are particularly susceptible to the effects of osteoporosis, often resulting in crush (compression) fractures (which may cause sudden, severe back pain) and compression of spinal nerve roots (which may cause chronic back pain). However, most fractures due to osteoporosis occur in the upper and middle back and cause upper and middle rather than low back pain

HERNIATED DISK

The tough covering of a disk in the spine can tear (rupture), causing pain. The soft, jelly-like interior may bulge out (herniate) through the covering, causing more pain. Pain occurs because the bulge puts pressure on the spinal nerve root next to it. Sometimes the nerve is damaged





More than 80% of herniated disks occur in the lower back. They are most common among people aged 30 to 50 years. Between these ages, the covering weakens. The interior, which is under high pressure, may squeeze through a tear or a weakened spot in the covering and bulge out. After age 50, the interior of the disk begins to harden, making a herniation less likely. A disk may herniate because of a sudden, traumatic injury or repeated minor injuries. Being overweight or lifting heavy objects, particularly lifting improperly, increases the risk.

Where the pain occurs depends on which disk is herniated and which spinal nerve root is affected. The pain is felt along the pathway of the nerve compressed by the herniated disk. For example, a herniated disk commonly causes sciatica. The pain varies from slight to debilitating, and movement intensifies the pain. Numbness and muscle weakness may also occur. If the pressure on the nerve root is great, the legs may be paralyzed. If the cauda equina (the bundle of nerves extending from the bottom of the cord) is affected, control of bladder and bowels can be lost. If these serious symptoms develop, medical attention is required immediately.

After about 2 weeks, many people recover without any treatment. Applying cold (such as ice packs) or heat (such as a heating pad) or using over-the-counter analgesics may help relieve the pain. Sometimes surgery to remove part or all the disk and part of a vertebra is necessary. In 10 to 20% of people who undergo surgery for sciatica due to a herniated disk, another disk ruptures.

A ruptured or herniated disk can cause low back pain. A disk has a tough covering and a soft, jelly-like interior. If a disk is suddenly squeezed by the vertebrae above and below it (as when lifting a heavy object), the covering may tear (rupture), causing pain. The interior of the disk can squeeze through the tear in the covering, so that part of the interior bulges out (herniates). This bulge can compress, irritate, and even damage the spinal nerve root next to it, causing more pain. A ruptured or herniated disk also commonly causes sciatica.

What Is Sciatica?

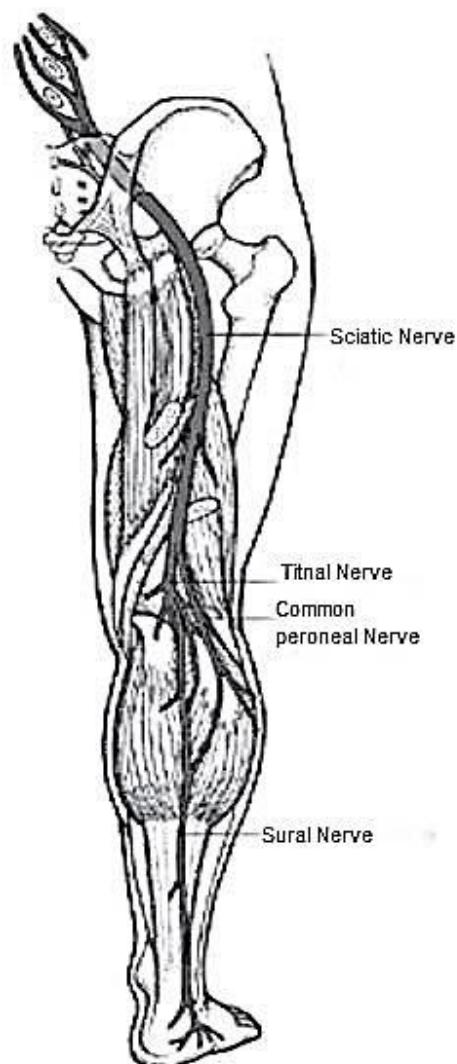
The two sciatic nerves are the largest and longest nerves in the body. Each is almost as large as a finger. On each side of the body, the sciatic nerve runs from the lower spine, behind the hip joint, down the buttock and back of the knee. There the sciatic nerve divides into several

branches and continues to the foot. When the sciatic nerve is pinched, inflamed, or damaged, pain may radiate along the length of the sciatic nerve to the foot. This is also called as sciatica pain. Sciatica occurs in about 5% of people who have back pain

In some people, no cause can be detected. In others, the cause may be a herniated disk, irregular projections of bone due to osteoarthritis, or swelling due to a sprained ligament. Rarely, spinal stenosis, Paget's disease, nerve damage due to diabetes (diabetic neuropathy), a tumor, or a blood clot causes sciatica. Some people seem to be prone to sciatica

Sciatica usually affects only one side. It may cause a pins-and- needles sensation, a nagging ache, or a shooting pain. Numb- ness may be felt in the leg or foot. Walking, running, climbing stairs, and straightening the leg worsen the pain, which is relieved by bending the back or sitting

Often, the pain goes away on its own. Resting, sleeping on a firm mattress, taking over-the-counter nonsteroidal anti-inflammatory drugs (NSAIDs), and applying heat and cold may be sufficient treatment. For many people, sleeping on their side with the knees bent and a pillow between the knees provides relief. Stretching the hamstring muscles gently after warming up may help



In older people, a common cause of low back pain is spinal stenosis (narrowing of the spinal canal, the passageway that runs through the center of the spine and contains the spinal cord). Spinal stenosis also develops in middle-aged people who were born with a narrow spinal canal. It is caused by such disorders as osteoarthritis and Paget's disease. Spinal stenosis may cause sciatica as well as low back pain.

In ankylosing spondylitis, the spine and large joints are inflamed, resulting in stiffness and back pain. This disorder is more common among men, usually starting between the ages of 20 and 40.

Sometimes low back pain is referred pain, which originates in another part of the body, such as the kidneys, bladder, uterus, or prostate, but is felt in the lower back. For example, premenstrual syndrome or a bladder infection can cause low back pain.

Other less common causes of low back pain include shingles; cancer that has spread to the spine from organs such as the breast, lung, prostate, or kidney; bone cancer (multiple myeloma); fibromyalgia; and birth defects such as scoliosis. Stress may contribute to low back pain, but how it does so is unclear. Heavy physical labor, obesity, smoking, and lack of exercise also contribute to low back pain.

SYMPTOMS OF LOW BACK PAIN

Low back pain may be intermittent or constant; superficial or deep; or dull and aching, throbbing, or sharp and stabbing, depending on the cause and type of pain. There are several types of low back pain.

Local pain occurs in a specific area of the lower back. It is usually due to sprains and strains. Sudden pain may be felt when the injury occurs. Local pain can often be relieved by changes in position or by light activity followed by stretching. Intense physical activity or inactivity tends to make it worse. Local pain may be constant and aching or, at times, can be intermittent and sharp. The lower back may be sore when touched. Muscle spasms may develop because the body moves in unusual ways as it tries to avoid the movements that trigger pain. Usually, local pain resolves gradually over days to weeks.

Pain due to compression of a spinal nerve root may be due to such disorders as a herniated disk, osteoarthritis, osteoporosis, spinal stenosis, or Paget's disease. The pain often occurs within minutes or hours of lifting a very heavy weight, but it may occur spontaneously. This type of pain tends to be a dull ache with a sharp, intense radiating pain sometimes superimposed on it. The pain can radiate to different parts of the body, depending on which nerve root is affected. Commonly, the pain extends from the lower back into the buttock and down the leg on the affected side, causing sciatica. Coughing, sneezing, straining, or bending over while keeping the legs straight can evoke the sharp, radiating pain. If a herniated disk is the cause, the pain is worsened by walking a distance. If spinal stenosis is the cause, the pain is typically increased by straightening the back (for example, when walking) and is relieved by bending the spine forward (for example, when leaning forward). If a compression fracture is the cause, the pain usually starts suddenly, stays in a particular area of the back, and worsens when a person stands or walks. The area near the fracture may be tender.

Usually, the pain and tenderness disappear gradually after a few weeks or months. If pressure on the nerve root is great, the pain may be accompanied by muscle weakness in the leg, a pins-and-needles sensation, or even loss of sensation and of bladder and bowel control.

Referred pain (which originates in other organs tends to be deep, constant aching, and relatively widespread (diffuse). Typically, movement does not affect it, and it worsens at night. For example, kidney infections can cause low back pain that is felt to the side rather than the center of the back

Diagnosis

The symptoms, history, and results of a physical examination may suggest the cause of low back pain. As part of the physical examination, a doctor may ask the person to move in certain ways to determine the type of pain. For example, a doctor may ask the person to lie flat, and then lift the leg without bending the knee. Usually no other procedures are needed if the cause is a strain or sprain. If another cause is suspected, other procedures are often needed.

X-rays of the lower back can help detect a herniated disk, degenerative changes due to osteoarthritis, compression fractures due to osteoporosis, and scoliosis. However, magnetic resonance imaging (MRI) or computed tomography (CT)

provides clearer images and can confirm or exclude the diagnosis of a herniated disk, spinal stenosis, or cancer. Rarely, when results of MRI are unclear, myelography with CT is required. Occasionally, electromyography is performed to confirm the location of nerve damage

Prevention

The most effective way to prevent low back pain is to exercise regularly. Two types of exercises – aerobic exercise and specific muscle-strengthening and stretching exercises are helpful.

Aerobic exercise, such as swimming and walking, improves general fitness, decreases obesity, and generally strengthens muscles. Specific exercises to strengthen and stretch the muscles in the abdomen, buttocks, and back can help stabilize the spine and decrease strain on the disks that cushion the spine and the ligaments that hold it in place.

Exercise can also help people maintain bone density and a desirable weight. Thus, exercise may reduce the risk of developing two conditions that can lead to low back pain – osteoporosis and obesity.

Maintaining good posture when standing and sitting reduces stress on the back; slouching should be avoided. Chair seats can be adjusted to a height that allows the feet to be flat on the floor, with the knees bent up slightly and the lower back flat against the back of the chair. If a chair does not support the lower back, a pillow can be used behind the lower back. Sitting with the feet on the floor rather than with the legs crossed is advised. People should avoid standing or sitting for long periods. If prolonged standing or sitting is unavoidable, changing positions frequently may reduce stress on the back.

Sleeping in a comfortable position on a firm mattress is recommended. Pillows under the waist and head can be used for support by people who sleep on their side, and a pillow under the knees can be used by those who sleep on their back. Pillows under the head should not force the neck to bend too much.

Learning to lift properly helps prevent back injury. The knees should be bent enough that the arms are level with the object to be lifted. The legs, not the back, should be used to lift. Lifting an object over the head increases the risk of back injury. Using a steady footstool makes such lifting unnecessary. Heavy objects should be carried close to the body. Stopping smoking is also recommended.

Treatment

For low back pain that has recently developed, treatment begins with avoiding activities that stress the spine and cause pain—such as lifting heavy objects and bending. Bed rest for a few days may relieve pain. However, it does not hasten the resolution of the pain, and most experts recommend continued activity. Bed rest, if required, should last no more

than 1 or 2 days. If a specific disorder is causing low back pain, treating that disorder—for example, giving antibiotics to treat a bladder infection—may relieve the low back pain.

Application of heat or cold and massage may help. Usually, traction is not useful. Some reports suggest that acupuncture and chiropractic manipulation hasten the resolution of pain, but others suggest little or no benefit. During recovery, a back brace or corset is sometimes recommended for a short period or for use during back-stressing activities. However, these support garments can be uncomfortable and, if worn for a long time, may weaken the back muscles by doing their work for them.

After the pain has subsided, light activity, as recommended by a doctor or physical therapist, can speed healing and recovery. Specific exercises to strengthen and stretch the back are usually recommended to help prevent low back pain from becoming chronic or recurring. Other preventive measures (maintaining good posture, using a firm mattress with appropriately placed pillows, lifting properly, and stopping smoking) should be continued or started. In response to these measures, most episodes of back pain resolve in 1 to 2 weeks. Regardless of treatment, 80 to 90% of such episodes resolve within 6 weeks.

Transcutaneous electrical nerve stimulation (TENS) is sometimes recommended. A device that produces a gentle tingling sensation by generating a low oscillating current is used. A therapist applies the device to the painful area several times a day for 20 minutes to several hours at a time, depending on the severity of the pain. People are sometimes taught to use the device themselves.

If a disorder is causing severe and constant pain or serious symptoms, surgery may be necessary. If spinal nerve root compression due to a herniated disk is causing symptoms such as relentless sciatica, weakness, loss of sensation, or loss of bladder and bowel control, surgical removal of the disk (diskectomy) and part of the vertebra (laminectomy) may be necessary. A general anesthetic is usually required. The hospital stay after surgical removal of a disk is usually 1 or 2 days. Often, microsurgical techniques, with a small incision, can be used. A local anesthetic is used, and hospitalization is not required. However, when the incision is small, the surgeon may not be able to see and therefore may not remove all

fragments of the herniated disk. After either procedure, most people can resume all of their activities after a few weeks. More than 90% of people recover fully.

For severe spinal stenosis, surgery to widen the spinal canal by removing a larger part of the vertebra may be performed. A general anesthetic is usually required. The hospital stay is usually 4 or 5 days. People may need 3 to 4 months before they can resume all of their activities. About two thirds of the people have a good or full recovery. For most of the rest, symptoms are prevented from worsening.

When the spine is unstable because of degeneration due to osteoarthritis, vertebrae may be fused together. However, fusion decreases mobility and may put additional stress on the rest of the spine.

CERVICAL SPONDYLOYSIS

Cervical spondylosis is a disorder in which the disks and vertebrae in the neck degenerate, putting pressure on the spinal cord in the neck.

Cervical spondylosis usually affects middle-aged and older people. With aging, the bone of the spine overgrows and narrows the spinal canal in the neck. As a result, the spinal cord or the spinal nerve roots (the part of spinal nerves located next to the cord) are compressed, causing dysfunction.

Symptoms

Symptoms may reflect compression of the spinal cord, the spinal nerve roots, or both. If the spinal cord is compressed, a change in walking is usually the first sign. Leg movements may become jerky (spastic), and walking becomes unsteady. The neck may be painful. If the spinal nerve roots are compressed, weakness in one or both arms may develop, and the muscles may waste away. The neck is likely to be painful. Nerve root compression may be accompanied by or progress to spinal cord compression.

Diagnosis and treatment

When doctors suspect cervical spondylosis, magnetic resonance imaging (MRI) or myelography with computed tomography (CT) is performed. MRI provides slightly more information, but myelography with CT may be more available. These procedures show where the spinal canal is narrowed, how compressed it is, and which spinal nerve roots may be affected. MRI has generally replaced x-rays of the neck.

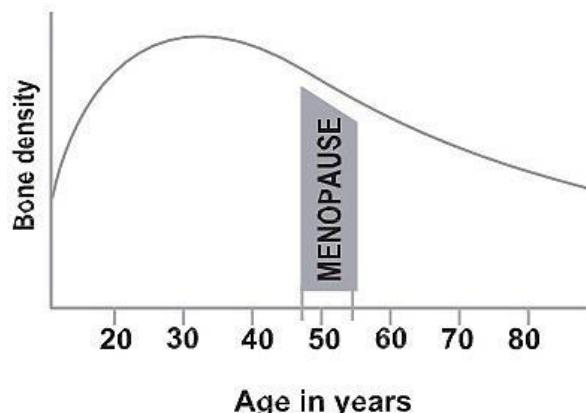
OSTEOARTHRITIS

Osteoarthritis (previously called degenerative arthritis, degenerative joint disease) is a chronic disorder of joint cartilage and surrounding tissues that is characterized by pain, stiffness, and loss of function.

Osteoarthritis, the most common joint disorder, affects most people to some degree by age 70. Before the age of 40, men develop osteoarthritis more often than do women, because of injury. From age 40 to 70, women develop the disorder more often than do men. After age 70,

the disorder develops in both sexes equally. Osteoarthritis also occurs in almost all animals with a backbone—including fish, amphibians, and birds. Because the disorder is so widespread in the animal kingdom, some authorities believe that osteoarthritis may have evolved from an ancient method of cartilage repair.

Many myths about osteoarthritis persist—for example, that it is an inevitable part of aging, like gray hair and skin changes; that it results in little disability; and that treatment is not effective. Although osteoarthritis is more common in older people, it is not caused simply by the wear and tear that occurs with years of use. Instead, microscopic changes in the structure and composition of cartilage appear to be responsible. Most people who have the disorder, especially younger people, have few if any symptoms; however, some older people develop significant disabilities.



Causes

Normally, joints have such a low friction level that they are protected from wearing out, even after years of use. Osteoarthritis probably begins most often with an abnormality of the cells that synthesize the components of cartilage, such as collagen (a tough, fibrous protein in connective tissue) and proteoglycans (substances that provide resilience). Next, the cartilage may swell because of water retention, become soft, and then develop cracks on the surface. Tiny cavities form in the bone beneath the cartilage, weakening the bone. Bone can overgrow at the edges of the joint, producing bumps (osteophytes) that can be seen and felt. Ultimately, the smooth, slippery surface of the cartilage becomes rough and pitted, so that the joint can no longer move smoothly and absorb impact. All the components of the joint—bone, joint capsule (tissues that enclose most joints), synovial tissue (tissue lining the joint), tendons, ligaments, and cartilage—fail in various ways, thus altering the joint.

Osteoarthritis is classified as primary (or idiopathic) when the cause is not known (the large majority of cases). It is classified as secondary when the cause is another disease or condition, such as Paget's disease, an infection, deformity, injury, or overuse of a joint. Some people who repetitively stress one joint or a group of joints, such as foundry workers, coal miners, and bus drivers, are particularly at risk. Much of the risk for osteoarthritis of the knee comes from occupations that involve bending of the joint. Curiously, long-distance running champions appear not to be at higher risk of developing the disorder. However, once osteoarthritis develops, this type of exercise often makes the disorder worse. Obesity may be a major factor in the development of

osteoarthritis, particularly of the knee and especially in women.

Symptoms

Usually, symptoms develop gradually and affect only one or a few joints at first. Joints of the fingers, base of the thumbs, neck, lower back, big toes, hips, and knees are commonly affected. Pain, usually made worse by activities that involve weight bearing (such as standing), is the first symptom. In some people, the joint may be stiff after sleep or some other inactivity, but the stiffness usually subsides within 30 minutes of moving the joint.

As the condition causes more symptoms, the joint may become less movable and eventually may not be able to fully straighten or bend. The attempt of the tissues to repair may lead to new growth of cartilage, bone, and other tissue, which can enlarge the joints. The irregular cartilage surfaces cause joints to grind, grate, or crackle when they are moved. Bony growths commonly develop in the joints at the ends or middle of the fingers (called Heberden's or Bouchard's nodes).

In some joints (such as the knee), the ligaments, which surround and support the joint, stretch so that the joint becomes unstable. Alternatively, the hip or knee may become stiff, losing its range of motion. Touching or moving the joint (particularly when standing, climbing stairs, or walking) can be very painful.

Osteoarthritis often affects the spine. Back pain is the most common symptom. Usually, damaged disks or joints in the spine cause only mild pain and stiffness. However, osteoarthritis in the neck or lower back can cause numbness, pain, and weakness in an arm or leg if the overgrowth of bone presses on nerves. The overgrowth of bone may be within the spinal canal, pressing on nerves before they exit the canal to go to the legs. This may cause leg pain after walking, suggesting incorrectly that the person has a reduced blood

supply to the legs (intermittent claudication). Rarely, bony growths compress the esophagus, making swallowing difficult.

Osteoarthritis may be stable for many years or may progress very rapidly, but most often it progresses slowly after symptoms develop. Many people develop some degree of disability.

How to live with Osteoarthritis:

- Exercise affected joints gently (in a pool, if possible)
- Massage at and around affected joints (this measure should preferably be performed by a trained therapist)
- Apply a heating pad or a damp and warm towel to affected joints
- Maintain an appropriate weight (so as not to place extra stress on joints)
- Use special equipment as necessary (for example, cane, crutches, walker, neck collar, or elastic knee support to protect joints from overuse; a fixed seat placed in a bathtub to enable less stretching while washing)
- Wear well-supported shoes or athletic shoes

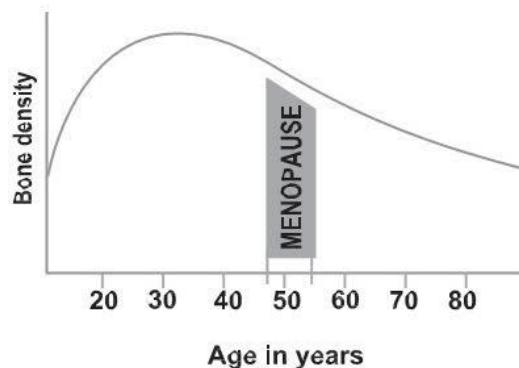
OSTEOPOROSIS

Osteoporosis is a condition in which a progressive decrease in the density of bones weakens the bones, making fractures likely.

Bones contain minerals, such as calcium and phosphorus, which make them hard and dense. To maintain bone density, the body requires an adequate supply of calcium and other minerals and must produce the proper amounts of several hormones, such as parathyroid hormone, growth hormone, calcitonin.

An adequate supply of vitamin D is also needed to absorb calcium from food and incorporate it into bones. Vitamin D is absorbed from the diet and also manufactured in the skin by sunlight so that bones can adjust to the changing demands placed on them, they are continuously broken down and reformed, or remodeled. In this process, small areas of bone tissue are removed and new bone tissue is deposited. This process is continuous and moves through healthy bone. Remodeling affects the shape and density of the bones. In youth, the bones grow in width and length as the body grows. In later life, bones may sometimes enlarge in width but do not continue to grow longer.

Loss of Bone Density in Women



In women, bone density (or mass) progressively increases until about age 30, when bones are at their strongest. After that, bone density gradually decreases. The decrease in bone loss accelerates after menopause, which occurs on average around age 51.

Because more bone is formed than is broken down in the young adult years, bones progressively increase in density until about age 30, when they are at their strongest. After that, as breakdown outstrips formation, bones slowly decrease in density. If the body is unable to maintain an adequate amount of bone formation, bones continue to lose density and become increasingly fragile, eventually resulting in osteoporosis.

Types

About 8 million women and 2 million men in the United States have osteoporosis. There are two main types of osteoporosis: primary osteoporosis, which occurs spontaneously, and secondary osteoporosis, which is caused by another disease and occurs in fewer than 5% of people who have osteoporosis. Examples of diseases that may cause secondary osteoporosis are chronic kidney failure and hormonal disorders (especially Cushing's disease, hyperparathyroidism, hyperthyroidism, hypogonadism, and diabetes mellitus). Examples of drugs that may cause secondary osteoporosis are corticosteroids, barbiturates, and anticonvulsants. Excessive alcohol consumption and cigarette smoking may worsen preexisting osteoporosis but are unlikely to cause it on their own.

Primary osteoporosis has three subtypes: postmenopausal osteoporosis, senile osteoporosis, and idiopathic osteoporosis. Most older women who have osteoporosis have a combination of postmenopausal and senile osteoporosis.

Postmenopausal Osteoporosis: Postmenopausal osteoporosis (type I osteoporosis) is caused by a lack of estrogen, the main female hormone, which helps to regulate the incorporation of calcium into bone in women. (Type I osteoporosis also occurs in men who are castrated or in men with low testosterone levels, as may occur in older men; however, it is 6 times more common in women.) Usually, postmenopausal osteoporosis develops in women after menopause, between the ages of 51 and 75, but it can begin earlier or later. Although bone loss is gradual in women leading up to menopause, it accelerates at menopause. Indeed, women can lose up to 20% of their bone mass in the 5 to 7 years after menopause. Not all women are at equal risk of developing postmenopausal osteoporosis. For example, low body weight increases the risk of postmenopausal osteoporosis, probably for two reasons:

Thin women have smaller bones than do heavier women, even at about age 30 when their bones are at their strongest.

Thin women usually have lower body fat than do heavier women; estrogen levels are lower in thin women because fat tissue activates certain forms of estrogen.

Women most at risk for osteoporosis are white, fair-skinned, and thin and/or with a light frame. Black and Hispanic women are less prone to osteoporosis than are white and Asian women. The main reason appears to be that, because black and Hispanic women have stronger bones in young adulthood, they can tolerate the bone loss that occurs with age and menopause better than other women can. Other risk factors include advanced age, menopause that occurred early or was surgically induced, abnormal absence of menstrual periods (amenorrhea), and anorexia nervosa.

Senile Osteoporosis: Senile osteoporosis (type II osteoporosis) probably results from an age-related calcium deficiency or a vitamin D deficiency and an imbalance between the rate of bone breakdown and new bone formation. Senile means only that the condition occurs in older people. It usually affects people older than 70 and is twice as common in women as in men. Women often have both senile and postmenopausal osteoporosis.

Idiopathic Osteoporosis: Idiopathic osteoporosis is a rare type of osteoporosis; the word idiopathic simply means that the cause is unknown. This type of osteoporosis occurs in children and young adults who have normal hormone levels, normal vitamin levels, and no obvious reason to have weak bones.

Risk factors for Osteoporosis in Women:

- Family members with osteoporosis
- Insufficient calcium in the diet
- Sedentary lifestyle
- White or Asian race
- Thin build
- Use of certain drugs, such as corticosteroids and excessive amounts of thyroid hormones
- Early menopause
- Cigarette smoking
- Excessive alcohol consumption

Symptoms

At first, osteoporosis produces no symptoms because bone density loss occurs very gradually. Some people never develop symptoms.

Eventually, however, bone density may decrease enough for bones to collapse or fracture, producing severe sudden pain or gradually developing aching bone pain and deformities. In long bones, such as the bones of the arms and legs, the fracture usually occurs at the ends of the bones rather than in the middle. In the bones of the spinal column (vertebrae), the fracture usually occurs in the middle to lower back; this type of bone is particularly at risk for fracture due to osteoporosis.

Vertebral crush fractures (fractures of spinal vertebrae) may occur in people who have any type of osteoporosis; these fractures are called osteoporotic fractures. The weakened vertebrae may collapse spontaneously or after a slight injury. Chronic back pain may occur because of these fractures. Usually, pain starts suddenly, stays in a particular area of the back, and worsens when a person stands or walks. The area may be tender. Usually the pain and tenderness go away gradually after a few weeks or months. If several vertebrae break, an abnormal curvature of the spine (a “dowager’s hump”) may develop, causing muscle strain and soreness as well as deformity.

COMPRESSION FRACTURE

Bones in other parts of the body may fracture, often because of a minor strain or fall. One of the most serious fractures is a hip fracture, a major cause of disability and loss of independence in older people. Wrist fractures, called Colles’ fractures, occur commonly, especially in people with postmenopausal osteoporosis. In addition, fractures tend to heal slowly in people who have osteoporosis.

Diagnosis

A doctor may suspect osteoporosis in anyone, especially an older woman, who breaks a bone with little or no force. Bone mineral density testing can be used to detect or confirm suspected osteoporosis, even before a fracture occurs. A number of rapid screening techniques are available to measure density at the wrist or the heel; however, the most useful test is the dual-energy x-ray absorptiometry (DEXA), which measures bone density at the sites at which major fractures are likely to occur: the spine and hip. This test is painless and can be performed in about 5 to 15 minutes. It is useful for people at high risk of developing osteoporosis and for those in whom the diagnosis is uncertain. It is also useful for monitoring the response to treatment.

Blood tests may be performed to measure calcium and phosphorus. Further testing may be needed to rule out treatable conditions that might lead to osteoporosis. If such a condition is found, the diagnosis is secondary osteoporosis.

Prevention

Prevention is generally more successful than treatment—it is easier to prevent loss of bone density than to restore density once it has been lost. Prevention involves maintaining or increasing bone density by consuming adequate amounts of calcium and vitamin D, engaging in weight-bearing exercise, and, for some people, taking certain drugs.

Consuming an adequate amount of calcium and vitamin D is effective, especially before maximum bone density is reached (around age 30) but also after this time. About 1500 milligrams of calcium and 400 to 800 units of vitamin D daily are recommended. Drinking two 8-ounce glasses of vitamin D-fortified milk, eating a balanced diet, and taking a vitamin D supplement are important, but many women may also need to take a calcium supplement. Many calcium preparations are available; some include supplemental vitamin D.

Weight-bearing exercise, such as walking and stair-climbing, increases bone density. Exercises that do not involve weight bearing, such as swimming, do not increase bone density. Exercise is also important to improve balance, which can help to prevent a fracture that may occur from falling. Curiously, in premenopausal women, high degrees of exercise, such as occurs in athletes, can actually cause a small reduction in bone density because such exercise suppresses the production of estrogen by the ovaries.

Estrogen replacement therapy helps maintain bone density in women. This therapy is most effective when started within

4 to 6 years after menopause, but starting it later can still slow bone loss and reduce the risk of fractures. Decisions about using estrogen replacement therapy after menopause are complex, because the treatment may have side effects and risks, including an increased risk of uterine cancer and a slightly increased risk of breast cancer. Taking progesterone with the estrogen reduces the risk of uterine cancer but not of breast cancer.

Treatment

Treatment is aimed at increasing bone density. The first step is to consume or take an adequate daily amount of calcium and vitamin D

RHEUMATOID ARTHRITIS

Rheumatoid arthritis is an inflammatory arthritis in which joints, usually including those of the hands and feet, are inflamed, resulting in swelling, pain, and often the destruction of joints.

Worldwide, rheumatoid arthritis develops in about 1% of the population, regardless of race or country of origin, affecting women 2 to 3 times more often than men. Usually, rheumatoid arthritis first appears between 25 and 50 years of age, but it may occur at any age. Rheumatoid arthritis can occur in children—the disease is then called juvenile rheumatoid arthritis, and the symptoms and prognosis are somewhat different.

The exact cause of rheumatoid arthritis is not known. It is considered an autoimmune disease. Components of the immune system attack the soft tissue that lines the joints and can also attack connective tissue in many other parts of the body, such as the blood vessels and lungs. Eventually, the cartilage, bone, and ligaments of the joint erode, causing deformity, instability, and scarring within the joint. The joints deteriorate at a highly variable rate. Many factors, including genetic predisposition, may influence the pattern of the disease.

Symptoms

People with rheumatoid arthritis may have a mild course, occasional flare-ups with long periods of remission without disease, or a steadily progressive disease, which may be slow or rapid. Rheumatoid arthritis may start suddenly, with many joints becoming inflamed at the same time. More often, it starts subtly, gradually affecting different joints. Usually, the inflammation is symmetric, with joints on both sides of the body affected. Typically, the small joints in the fingers, toes, hands, feet, wrists, elbows, and ankles become inflamed first. The inflamed joints are usually painful and often stiff, especially just after awakening (such stiffness generally lasts for at least 30 minutes and often much longer) or after prolonged inactivity. Some people feel tired and weak, especially in the early afternoon. Rheumatoid arthritis may produce a low-grade fever.

Affected joints enlarge because of swelling of the soft tissue and can quickly become deformed. Joints may freeze in one position so that they cannot bend or open fully. The fingers may tend to dislocate slightly from their normal position toward the little finger on each hand, causing tendons in the fingers to slip out of place.

Swollen wrists can pinch a nerve and result in numbness or tingling due to carpal tunnel syndrome. Cysts, which may develop behind affected knees, can rupture, causing pain and swelling in the lower legs. Up to 30% of people with rheumatoid arthritis have hard bumps (called rheumatoid nodules) just under the skin, usually near sites of pressure (such as the back of the forearm near the elbow).

Rarely, rheumatoid arthritis causes an inflammation of blood vessels (vasculitis); this condition reduces the blood supply to tissues and may cause nerve damage or leg sores (ulcers). Inflammation of the membranes that cover the lungs (pleura) or of the sac surrounding the heart (pericardium) or inflammation and scarring of the lungs can lead to chest pain or shortness of breath. Some people develop swollen lymph nodes; Sjögren's syndrome, which consists of dry eyes or mouth; or red, painful eyes due to inflammation.

Diagnosis

In addition to the important characteristic pattern of symptoms, the doctor may use the following to support the diagnosis: laboratory tests, an examination of a joint fluid sample obtained with a needle, and even a biopsy (removal of a tissue sample for examination under a microscope) of rheumatoid nodules. Characteristic changes in the joints may be seen on x-rays.

In 9 of 10 people who have rheumatoid arthritis, the erythrocyte sedimentation rate (ESR—a test that measures the rate at which red blood cells settle to the bottom of a test tube containing blood) is increased, which suggests that active inflammation is present. However, this test alone cannot identify the cause of the inflammation. Doctors may monitor the ESR when symptoms are mild to help determine whether the disease is still active.

Many people with rheumatoid arthritis have distinctive antibodies in their blood, such as rheumatoid factor, which is present in 70% of people with rheumatoid arthritis. (Rheumatoid factor also occurs in several other diseases, such as hepatitis and some other infections; some people even have rheumatoid factor in their blood without any evidence of disease.) Usually, the higher the level of rheumatoid factor in the blood, the more severe the rheumatoid arthritis and the poorer the prognosis. The rheumatoid factor level may decrease when joints are less inflamed.

Most people have mild anemia (an insufficient number of red blood cells). Rarely, the white blood cell count becomes abnormally low. When a person with rheumatoid arthritis has a low white blood cell count and an enlarged spleen, the disorder is called Felty's syndrome.

Prognosis and Treatment

Rarely, rheumatoid arthritis resolves spontaneously. Treatment alleviates symptoms in 3 of 4 people. However, at least 1 of 10 people eventually becomes severely disabled.

Treatments range from simple, conservative measures to drugs and even surgery. Simple measures are meant to help the person's symptoms and include rest and adequate nutrition. Certain drugs—the slow-acting drugs—may actually improve the disease rather than just the symptoms. Treatment starts with the least aggressive measures; however, drugs that can slow disease progression should generally be added during the first several months.

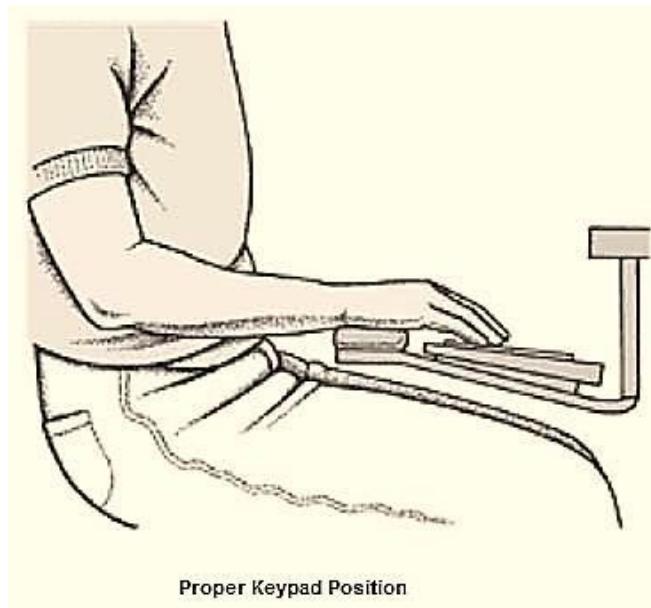
Severely inflamed joints should be rested, because using them can aggravate the inflammation. Regular rest periods often help relieve pain, and sometimes a short period of bed rest helps relieve a severe flare-up in its most active, painful stage. Splints can be used to immobilize and rest one or several joints, but some systematic movement of the joints is needed to prevent adjacent muscles from weakening and joints from freezing in place.

A regular, healthy diet is generally appropriate. A diet rich in fish and plant oils but low in red meat can have small beneficial effects on the inflammation. Rarely, people have flare-ups after eating certain foods, and if so, these foods should be avoided.

CARPAL TUNNEL SYNDROME

Carpal tunnel syndrome is a painful compression of the median nerve as it passes through the wrist.

Carpal tunnel syndrome results from compression of the median nerve, which is located at the palm side of the wrist (an area called the carpal tunnel). The median nerve serves the thumb side of the hand. The compression results when swelling or bands of fibrous tissue form for a variety of reasons on the palm side of the wrist.



Proper Keyboard Position

Carpal tunnel syndrome is common—especially in women—and may affect one or both hands. Particularly at risk are people whose work requires repeated forceful movements with the wrist extended, such as using a screwdriver. Another cause is use of a computer keyboard that is not positioned properly. Prolonged exposure to vibrations (for example, by using certain tools) has also been claimed to cause carpal tunnel syndrome. Pregnant women and people who have diabetes, an under active thyroid gland, gout, or rheumatoid arthritis are at increased risk of developing carpal tunnel syndrome.

Using a computer keyboard that is positioned improperly can result in carpal tunnel syndrome. To prevent injury, the user should keep the wrist in a neutral position. That is, the line from the hand to the forearm should be straight. The hand may be slightly lower than the forearm. But the hand should never be higher, and the wrist should not be cocked. The keyboard should be positioned relatively low, keeping the hand slightly lower than the elbow. A wrist pad can be used to support the wrist.

The symptoms, due to the nerve compression, are odd sensations, numbness, tingling, and pain in the first three fingers on the thumb side of the hand. Occasionally, there is also pain and a burning or tingling sensation in the arm and shoulder. The pain may be more severe while the person is sleeping because of the way the hand is positioned. With time, the muscles in the hand on the thumb side can weaken and shrink through lack of use (atrophy).

Diagnosis is made largely by examining the affected hand and wrist. Before surgery, a doctor may first perform nerve conduction studies to be certain that the problem is carpal tunnel syndrome.

The disorder is best treated by avoiding positions that over-extend the wrist or put extra pressure on the median nerve. Wrist splints that hold the hand in a neutral position (especially at night) and such measures as adjusting the angle of a computer keyboard may help. Treating underlying disorders (such as rheumatoid arthritis or an under active thyroid gland) can help to relieve symptoms.

Injections of a corticosteroid suspension into the carpal tunnel occasionally bring long-lasting relief. If pain is severe or if the muscle atrophies or weakens, surgery is the best way to relieve pressure on the median nerve. A surgeon can cut away the bands of fibrous tissue that place pressure on the nerve.

ROTATOR CUFF TENDINITIS

Rotator cuff tendinitis (swimmer's shoulder, tennis shoulder, pitcher's shoulder, shoulder impingement syndrome) is a tearing and swelling of the rotator cuff (the muscles and tendons that hold the upper arm in the shoulder joint).

Rotator cuff tendinitis often occurs in sports that require the arm to be moved over the head repeatedly, such as pitching in baseball, lifting heavy weights over the shoulder, serving the ball in racket sports, and swimming freestyle, butterfly, or backstroke. Repeatedly moving the arm over the head causes the top of the arm bone to rub against part of the shoulder joint and its tendons, tearing individual fibers. If the movement is continued despite the pain, the tendon can tear or actually pull off part of the bone.

s-Shoulder pain is the main symptom. Initially, the pain occurs only during activities that require lifting the arm over the head and forcibly bringing it forward. Later, pain can occur even when the arm is moved forward to shake hands. Usually, pushing objects away is painful, but pulling them in toward the body is not. The involved shoulder may be particularly painful at night, disrupting the person's sleep.

The diagnosis is made when specific movements, especially raising the arm above the shoulder, cause pain and soreness. Magnetic resonance imaging (MRI) is the best diagnostic tool for this condition.

Treatment consists of resting the injured tendons and strengthening the shoulder. Exercises that involve pushing something away or raising the elbows over the shoulder should be avoided. Another exercise consists of the person using an elastic cord; the person places the arm at the side

with the forearm parallel to the floor. The arm is then moved forward, backward, and rotated out away from the chest and then back in across the chest. This exercise program should restore balance to the rotator cuff and decrease impingement of the rotator cuff during activities that involve reaching overhead. Surgery is sometimes needed when the injury is particularly severe, the tendon is completely torn, or the injury does not heal within a year. Surgery removes excess bone from the shoulder to create a larger space for the rotator cuff. The rotator cuff is repaired at the same time.

Strengthening the Shoulders:

Four-Quadrant Therab and Exercise Tie a therapeutic rubber band at waist height to a doorknob. Facing the door with the arm at the side and the forearm parallel to the floor, pull

back on the rubber band 10 times. Rotate body 90 degrees, and with the arm parallel to the floor, rotate the arm away from the chest 10 times. Then turn 90 degrees facing away from the door; still holding the rubber band, push the arm out in front of the body with the forearm parallel to the floor 10 times. Then turn 90 degrees with the elbow against the chest, and rotate the arm across the body to the abdomen with the arm parallel to the floor. Repeat this movement 10 times. Repeat the entire set of movements 3 times. This exercise restores strength to the rotator cuff and helps with overhead reaching activities

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