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DIPLOMA IN PUBLIC HEALTH

INSTITUTE OF HUMANITARIAN AGENDA

MODULE 3: ASSIGNMENT

DATE OF SUBMISSION:

20th /January/ 2020

1. Distinguish between descriptive epidemiology and analytical epidemiology

The difference between descriptive and analytical epidemiology (Centre for Disease Control and Prevention, 2013) is that descriptive generates hypotheses on risk factors whereas analytical epidemiology tests hypothesis by assessing the determinants of diseases while focusing on risk factors and causes, at the same time analyzes the distribution of exposures and diseases. In essence the descriptive epidemiology is small and less complex study compared to analytical. Similarities however remain in the domain of areas of epidemiology that studies distribution, pattern, and determinants of health and diseases in a defined population.

Thus a descriptive epidemiology identifies patterns in persons, place and time such as case report, case scenario and incidence whereas a distinctive expression of the analytical epidemiology is the use of comparison groups.

2. Write down and explain the mathematical expression of the following.

(<https://hqlo.biomedcentral.com/articles/10.1186/1477-7525-10-109>)

i. Incidence

ii. Prevalence

i. Mathematical expression of incidence is:

a

$$\text{Incidence} = \frac{\text{new cases}}{\text{total population}}$$

Incidence refers to new cases of a disease in a given population over a specified period of time.

Thus an incidence rate describes how quickly a disease occurs in a population and the numerator consists only of persons whose illness began during the specified interval. In summary an incidence reflects the occurrence of new disease in a population.

ii. Mathematical expression of prevalence is:

$$\frac{\text{number of cases}}{\text{population}} \times 100$$

Prevalence is a proportion of persons in a population with a particular disease or attribute at a specified point in time or over a specified period of time. Thus prevalence includes all cases of a subject of interest over a specified time interval. It is based on both incidence and duration of

illness. High incidence within a population might reflect high incidence or prolonged survival without cure or both. Unlike incidence, prevalence includes chronic diseases such as diabetes, osteoarthritis etc and reflects the presence of a disease amongst the population

3. Apart from Randomized trials, describe four (4) other epidemiological research designs

Four other epidemiological researches (Greenland S & Pearce N, 1988:Vol.41 -pg.715-16)

1. Descriptive studies:

These are studies that focus on characterizing morbidity of a population by person, place or time variable. This type of studies has no priority hypotheses. They include case reports, case series, some cross-sectional studies and some ecologic studies.

The case reports have detailed presentation of a single case while generally report a new or unique finding giving information on previous undescribed disease, unexpected link between disease, etc. The reports are useful for hypothesis generation because they are informative for very rare cases, easy to understand and takes a short time to write. They are however limited to study cause and effect relationship as they cannot assess disease frequency.

Case series on the other hand provides experience of a group of patients with a similar diagnosis. The cases maybe identified from a single multiple sources such as water points and presents a general report on a new or unique condition that may only be the realistic design for a rare disorder. Case reports describe an observation in a single patient whereas case series has similar observation but in more cases/patients.

2. Cross sectional Studies:

These studies assess both exposure and outcome at the same time often referred to as Snapshot. They are generally surveys or interviews and are used to determine prevalence of a condition as well as identify possible causative factors in a disease. These type of studies are a snapshot, relatively easy, quick and inexpensive, estimates disease prevalence, useful for planning services, has a good design for hypothesis generation while relies on questionnaires requiring less follow up. The disadvantage of this type of study is that it is only representative of participants, and may not address if the disease is rare, not useful to establish causal relationship.

3. Ecologic studies:

This is a unit of analysis. The ecological unit under epidemiological study represents aggregate individuals such as countries, provinces, cities, hospitals etc. Hypothesis building of data is easy to obtain with no follow up or individual contact is required. It can suggest avenues of research that may cast light on etiological relationship between exposure and disease but as well does not demonstrate existence of a causal relationship.

4. Analytical Studies

These are designed to test hypothesis about an exposure of interest for a particular outcome. Examples are the case control studies and cohort studies. Cohort studies are either retrospective or prospective studies.

Incidence studies:

Incidence studies measure exposure, confounders and outcome times of all population. The studies look at both cohort and descriptive studies with reference population being defined and enumerated in the former whereas in the latter an investigator has to enumerate the cohort. In principle there is no fundamental distinction between incidence studies based on broad population and incidence studies involving sampling on the basis of exposure because the latter procedure simply redefines the study population referred herein as cohort.

Incidence case control studies

These are studies used to determine if there is an association between an exposure and a specific health outcome. The studies are believed to proceed from effect of disease such as health outcome, prognosis or condition and the disease itself versus the cause which in this case is the exposure. The studies assess whether exposure is disproportionately distributed between the cases and controls that may indicate risk factor for the exposure to health outcome under study.

These studies are often used to study rare health outcomes or diseases such as Cancer and the relation between the disease outcome and drinking coffee or eating a fatty diet. Specific subjects under case control studies are selected based on interests of health outcomes. The study aims to achieve the same goals between comparison of exposed and unexposed as a cohort study by use of sampling method for efficiency.

The case control studies can either use incidence or prevalence cases to define an outcome.

(Lewallen, 1998: case control studies) referred herein and used these studies, first is the incidence rate which relates to person and time, and is the most common. Second is the average risk which defines the incidence as the proportion of study subject who experience the outcome of interest at any given time during the cohort period. Lastly is the incidence odd which is the ratio of the number of subjects who experience the outcome to the number of subjects who do not. All the three measures involve the same numerator with a difference in denominator representation either person –time at risk, persons at risk or survivors. Thus the effect measure that corresponds to the three are rate ratio, risk ratio and odds ratio.

4. a. Limitations of using Hospital data (Bennett, 2012)

Distortion in the data may lead to false conclusion. This happens when artifacts arise from changing definitions or varying classifications or coding practices which is a common practice among hospitals. Often the doctor's assessment of the relative needs and priorities influence the knowledge of service constraints.

Most of the factors related to hospital data such as personal, social, environmental, seasonal, residential, weather, availability of services and day of the week cannot be viewed independently. This is because Hospital detected cases are not inclusive and are selected according to personal characteristics i.e. age, race, sex, socio-economic status or severity of disease with a tendency to advanced cases.

Hospital data is difficult to find control groups except in cases where one can choose a control disease that has the same independent probability of causing the patient to be admitted to the hospital as a disease under study. The ideal situation is to pick the controls so that important variables affecting the frequency of the attribute under study are adequately matched with cases.

Hospital records are not primarily designed for research due to incomplete and sub standardized information, and diagnostic variability among hospitals. As well can be selected based on associated conditions or differential diagnosis or on administrative admission procedures that makes the choice of a proper control group difficult.

While using hospital data, the community population at risk cannot be precisely defined. This is because duplicate admission/readmissions raise problems in determining incidence and prevalence rates.

b. Describe the possible interview error in a survey (Lavrakas, 2008)

where possible interview error is defined as a form of measurement error and variance that interviewers can contribute to the data gathered through face to face and telephone surveys. The common error occurs in coverage mostly with sampling. The error here is a form of measurement and includes both bias and variance that interviewers can contribute to.

In interviewer-administered surveys, although interviewers can contribute much to the accuracy of the data that are gathered, they also can contribute much of the non-sampling error that finds its way into those data. Thus, interviewers can contribute to data quality, but they can also contribute to measurement error. Interviewers can affect respondents' answers through their mere presence as well as their behaviours when administering the survey.

There are several ways in which interviewers seem to influence respondents' answers. First, the presence of an interviewer can stimulate respondents to take social norms into account when answering a survey question. Pressure to conform to social norms can lead to the underreporting of socially undesirable behaviour and the over reporting of socially desirable behaviour.

5. The determinants of health (WHO, 2013)

Introduction

There are many factors that combine together to affect the health of individuals and communities. The environment and circumstances determine the health status of individuals. Factors such as where we live, the state of our environment, genetics, our income and education level, and our relationships with friends and family all have considerable impacts on health. The frequently considered factors such as access and utilization of health services have less impact compared to afore mentioned factors. It is imperative considering the behaviour change related to health seeking practices before addressing the issue of access and utilization. There must be a demand at individual level to influence the decision to access and utilize services.

Below are different determinants of health:

- **Overall, the social- economic and physical environment, as well as the person's individual characteristics and behaviours are the greater determinants of health.** Here the context of people's lives determines their health without blaming individuals for having poor health or crediting them for good health as individuals are unlikely to be able to directly control many of the health determinants.

Other descriptive determinants are as follows:

- **Income and social status** - higher income and social status are linked to better health. The greater the gap between the richest and poorest people, the greater the differences in health.
- **Education** – low education levels are linked with poor health, more stress and lower self-confidence.
- **Physical environment** – safe water and clean air, healthy workplaces, safe houses, communities and roads all contribute to good health. Employment and working conditions – people in employment are healthier, particularly those who have more control over their working conditions
- **Social support networks** – greater support from families, friends and communities is linked to better health. Culture - customs and traditions, and the beliefs of the family and community all affect health.
- **Genetics** - inheritance plays a part in determining lifespan, healthiness and the likelihood of developing certain illnesses. Personal behaviour and coping skills such as balanced diet, exercise, behaviours such as smoking, drinking, and coping mechanism to life's stresses and challenges all affect health.
- **Health services** - access and utilization of services that are integrated to prevent and treat disease influences health
- **Gender** - Men and women suffer from different types of diseases at different ages. Their vulnerability to infections including the physiological status and workload.

Evidence base of health determinants

Further to the above mentioned health determinants, are the evidence based impacts of projects, programs and policies. The available evidence used in appraisal stage determines what impact may occur either positively or negatively, the size of the population to be affected and the distribution impact of different population groups. Unfortunately, the health based evidence is not always available due to long casual pathway between the implementation of project/ program/ policy and any other potential impact on population and confounding factors that make determination of a link difficult. Instead it requires to be explicit about sources of evidence and identify missing or incomplete information.

It is true that providing a comprehensive review of the evidence base is not simple as it needs to draw on the best available evidence from reviews and research papers, including qualitative and quantitative evidence. This information must be supplemented with local and expert knowledge, policy information, and proposal specific information.

However, there are examples where the best available evidence has been documented, and in some cases summarised. These are presented below:

1. Transport
2. Food and Agriculture
3. Housing
4. Waste
5. Energy/radiation
6. Industry
7. Urbanization
8. Water
9. Nutrition and health

1. Transport (WHO, http://www.who.dk/transport/HIA/20021009_2, 1999)

Evidence of health impact focus on:

Negative impact includes accidents between motor vehicles, bicycles and pedestrians (particularly children and young people), pollution from burning fossil fuels such as particulates and ozone, noise from transportation, psychosocial effects such as severance of communities by large roads and the restriction of children's movement, climate change due to Carbon dioxide emission and loss of land. Positive impact of transport includes, improved physical activity from cycling or walking, increased access to employment, shops and support services, recreational uses of road spaces, contributes to economic development and vector borne disease control, example control of mosquito breeding grounds by use of used engine oil.

The reference here is cited from documents on the evidence of health impacts of transport as detailed below:

Food and Agriculture (WHO, WHO/FAO release independent Expert Report on diet and chronic disease, 2002)

a. This is linked to agricultural production issues and manufacturing.

Tobacco farming and its impact on heart disease, stroke, certain cancers and chronic respiratory disease including passive smoking and impact of foetal development while on the other hand pesticide policies on tobacco crops require consideration in terms of its impacts on health. The changes in land use, soil quality, choice of crop, use of agricultural labour and occupational health plus mechanisation of work previously done by hand, and plantation agriculture one has affected the economy of individuals who depend on casual labour while on the other hand changes in land use, soil quality and choice of crop affects the nutritional values of the production in terms of quantities and quality. Fisheries have bio toxins, cause pollution, involves chemical use and the wastewater affects the environment through pollution and plant growth, processing provides employment but exposes the employees to occupational health hazards.

Forestry contributes to vector borne diseases as breeding grounds, occupational health, and positively contributes to food security to rains while at the same time limits the access to farming as land allocate to forestry can not be accessed for farming purposes.

Livestock use increases the risk of vector borne diseases such as tick borne diseases, while drug residues during fumigation may have a negative impact on the individual and environment. The animal feed, on the other hand increases milk production to improve the nutritional status of the population, animal waste is used as fertilizers in some contexts and food security direct or indirect by either selling the livestock products or use at household example milk, meat, hides and skins etc. Fertiliser use increases nitrate levels in food, pollution of waterways, re-use of agricultural waste contributes to pollution of the environment.

Positively, sustainable farming including chemical and energy use, biodiversity, organic production methods, and diversity of foods produced improve the health of the population while water for irrigation use and its impact on river/water-table levels improve the production outputs. Food packaging, preservation and safety, and avoidance of long storage, and travel prevent contamination hence keeping the population safe.

b. Access to, and distribution of food: (WHO, https://www.who.int/images/default-source/imported/maldives-vegetables-market-healthy-diet.tmb-1920v.jpg?sfvrsn=97257d1f_15%201920w)

Household food security is improved based on appropriate food being available, with adequate access and affordable with ease access to markets and adequate food supplies, including national and regional food security, and regional production. The National food security should be able to provide adequate nutrition within a country without relying heavily on imported products while cold-chain reliability promotes the safety of transporting products that deteriorate microbiologically in the heat.

c. Dietary patterns, diversity of food available and home production, (WHO, <https://www.who.int/fsf/>)

Particular focus is on fruit and vegetable consumption to reduce stroke, heart disease and risk of certain cancers, while total, saturated and polyunsaturated fat, carbohydrates and sugars consumption is controlled to reduce risks associated with obesity, heart disease, stroke and other vascular diseases. Micronutrients such as iron, vitamin A, zinc and iodine is monitored to sustain their impact on deficiency syndromes.

Alcohol consumption on the other hand has an impact on social wellbeing related to behaviour. Evidence shows that consumption of alcohol leads to increased traffic accidents, work/home accidents, violence, strained social relations, unwanted pregnancy and STDs, and toxic effects results to mortality, addiction, certain cancers, liver cirrhosis, psychosis, poisoning, gastritis, stroke, foetal alcohol syndrome and others.

d. Food safety and foodborne illness hazards

Food and water are the major sources of exposure to both chemical and biological hazards. They impose a substantial health risk to consumers and economic burdens on individuals, communities and nations. Microorganisms such as salmonella, campylobacter, E. coli O157, listeria, cholera, Viruses such as hepatitis A are related to water contamination, and parasites such as trichomonosis in pigs and cattle, naturally occurring toxins such as mycotoxins, marine biotoxins and glycosides, unconventional agents such as the agent causing bovine spongiform encephalopathy (BSE, or "mad cow disease"), persistent organic pollutants such as dioxins and PCBs, metals such as lead and mercury, new foods developed from biotechnology such as crops modified to resist pests, changes in animal husbandry, antibiotic use and new food additives are related to both chemical and biological hazards.

Housing (WHO, WHO HEALTH DETERMINANTS, 2002)

Evidence of health impacts focus on:

Improvements in housing leads to improved mental health through relieving stress related to rent rises that impacts negatively on the general health. During movement of original tenants after housing improvement does not benefit them as often they have to move to new locations. Other factors related to housing include housing tenure, outdoor temperature, indoor air quality, dampness, housing design, rent subsidies, relocation, allergens and dust mites, home accident prevention, and fire prevention. On the other hand, homelessness exposes families to high vulnerabilities to diseases at times forcing families to move to streets or live in deplorable conditions that in the end has a negative impact including exposure to Sexual and Gender based violence.

Waste (WHO, <http://www.swpho.org.uk/waste/index.htm>, 2002)

Evidence of health impacts focuses on environmental and social determinants related to the transmission of agents of infectious disease from human and animal excreta (sanitation, hygiene and water-related); exposure to toxic chemicals in human and animal excreta; and in industrial wastes discharged into the environment. The environmental degradation, direct and indirect impacts on health through the exposure to radioactive wastes, exposure to health-care wastes, exposure to solid wastes and involvement in informal waste recycling, and breeding of disease vectors such as mosquitoes.

Energy/Radiation (WHO, http://www.who.dk/informationSources/publications/catalogue/20010911_1)

- Evidence of health impacts focus on health hazards such as fossil fuels, biomass fuels, hydropower and pollution due to the emissions of carbon-dioxide gases inhaled by the population and their impact on vector borne diseases that helps in destruction of breeding grounds such as mosquitoes. Electricity generation and transmission helps in lighting system for hospitals and operation of health related machinery in diagnostics and operation procedures. Nuclear power has a negative impact on the health due to pollution and emission of nuclear substances in the air while other energy sources such solar are substitutes to electricity in rural areas with a local cost and can be used for other purposes such pumping water. There are also occupational health effects of energy workers due to exposure rays at the same time provides as source of employment. Other negative impacts include noise pollution, visual impact and global warming that has led to extreme weather conditions such as drought, floods and wild fires for example in Australia. Impacts on ecosystems, agriculture, forests, fisheries promote the nutritional value of plants, animals and human being building materials helps improve the housing to provide shelter and a source of income to families. Energy evidence documents herein is cited from European Commission on [The Externe project](#)

Industry (WHO, http://www.who.dk/InformationSources/Publications/Catalogue/20010911_12, 1994)

Evidence of health impacts focus on industrial sectors such as asbestos that are responsible for causing many forms of cancers and man made fibres such as polyester provide employment and clothing. Basic chemicals on the other hand such as chlorine is used in hospitals for decontamination of water sources, widely used in infection prevention for example during an outbreak such as cholera, ammonia used in plants to improve the production hence improve the nutrition value etc. Cement, glass and ceramics plus Iron and steel used in housing and employment. Additional industrial impacts include mining with an economic impact but has a negative occupational impact to exposed high risks of the miners on the raw substances and collapsing mining sites while pesticides, paints and pharmaceuticals have a positive impact on the prevention, management and control of diseases.

Urbanisation (WHO, <http://www.euro.who.int/en>)

Urban housing problems is an evidence of health impact with an increased rent, overcrowding leading to rationalized services such as water, electricity and not enough space to manage the urban wastes

increases the risks to non-communicable diseases such as hypertension as a result of stress related to living conditions, communicable diseases such as cholera directly related to overcrowding and poor water and sanitation conditions, increased risks of road accidents as a result of sustainable urban development, psychosocial disorders such as drug addiction. On the other hand, urbanization can lead to better health services due to distribution and integration of public and private sectors that increases access and utilization of health care services leading to fairly adequate coverage.

Water: (<https://www.wma.net/policies-post/wma-statement-on-water-and-health/>)

The World Medical Association issued a statement on Water and Health stating that an adequate supply of fresh (i.e. clean potable and uncontaminated) water is essential for individual and public health, as well as being a social determinant of health. It is central to living a life in dignity and health and upholding human rights. Many individuals, families and communities do not have access to such a supply, and even in those places where there is an abundance of fresh water, it is threatened by pollution, activities such as industry and waste, inadequate or ineffective sanitation and other negative forces.

A recent review of the evidence demonstrates that inadequate access to clean water, sanitation and soap for hand washing is the norm in many healthcare facilities worldwide, even in normal operating conditions. Natural and manmade major events, including war, flooding, reduce access to clean water still further. War events leads to displacement with high exposure to SGBV while flooding directly increases the vulnerability of contamination leading to increased risks of disease outbreaks with high fatality rates.

The statement underpins the responsibility of health actors to consider the importance and work towards achieving universal access to water, sanitation and hygiene for individual and public health. Thus, hygiene, sanitation and water (HSW) are important determinants of health and are key intervention strategies for reducing preventable morbidity, mortality and health care costs.

Considering that water-borne diseases account for a large proportion of mortality and morbidity, especially in developing countries, the problems are accentuated in times of disasters such as conflicts nuclear and man-made accidents with oil and/or chemicals, earthquakes, epidemics, droughts and floods.

An anthropogenic change to ecosystems, lowered retention by the earth's surface, and the limitation of the inherent capacity of nature to filter dirt from the water are causing increasing damage to the natural environment, especially the water environment. On the other hand, fracking for fossil fuels may have a significant effect on ground water as does the accumulation of micro pollutant substances including pharmaceuticals and pesticides.

As a result of commodification of water to provide profit rather than as a public service, it will have potentially significant negative implications for access to an adequate supply of drinking water.

The development of sustainable infrastructure for the provision of safe water and adequate sanitation contributes greatly to sound public health and national well-being. Curtailing infectious diseases and other ailments that are caused by unsafe water lowers the burden of health care costs and improves productivity. This creates a positive ripple effect on national economies. However, water as a vital and necessary resource for life has become scarce in many parts of the world and therefore must be used reasonably and with care.

Water and effective sanitation are assets that are shared by humanity and the earth. Thus, water-related issues should be addressed collaboratively by the global community in promoting the ecosystem as well.

Finally, water, sanitation and hygiene are essential to the safe and effective provision of health care services, and are fundamental to public health. This statement is part of Standard guidelines for settling up health care services and are embedded in the standard operating procedures for health care.

An individual's nutrition status is a greater determinant of health. This is because body tissues are developed based on the dietary intake and the contrary weakens the immune system thus predisposing the body to increased vulnerability to infections. The most vulnerable being children under five years, elderly and pregnant women whose dietary intake is solely for growth, development, tissue repair and maintenance with high mineral demands such iron for pregnant women, calcium for the elderly and balanced diet for children. Individuals suffering from frequent infections develop weakened immunity hence have high probability of developing malnutrition whereas already malnourished individuals are highly susceptible to infections. This is a cycle that is addressed in established treatment centres. Thus even though disease, a health outcome is a direct cause of malnutrition, the nutritional status counteracts the health status as well. On the other physical well being of an individual determines the well being of an individual. For example obesity and its determinants behaviours, physical inactivity and poor diet are major public health concerns with significant determination of quality of life among the ageing population.

Thus the proportion of nutrition and physical activity is a key strategy for the prevention of a range of chronic diseases such as diabetes mellitus, obesity, cardiovascular disease, osteoporosis, mental dementia and colony cancer. To summarize, promoting physical activity and a healthy diet has the potential to substantially reduce the burden of disease and improve the quality of life.

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