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EPIDEMIOLOGY AND DISEASES CONTROL

300L

1. Define Epidemiology and explain it's main objective

Ans: Epidemiology is the study of how diseases and health conditions are distributed among populations and the factors that determine or influence this distribution.It’s a key branch of public health that helps us understand who gets sick, why they get sick, where, and when and how to prevent it.

The objective's are:

1) To Identify the Causes and Risk Factors of Diseases:This is finding out why disease occurs,(WHO, WHERE,WHEN)and find what increases or decrease disease risk e.g Infectious diseases like Malaria, Finding that stagnant water breeds mosquitoes that transmit malaria.

2. To Determine the Extent (Frequency and

Distribution) of Disease in a Population:This measure how many people a common disease affected,in which age group,where and when it affected them,it helps the Public health authorities understands the burden and take proper action to prevent them and control it.

3. To Study the Natural History and Progression of Diseases:This objective focuses on understanding how a disease develops, progresses, and ends from the moment a person is exposed to the cause (agent) until recovery, disability, or death. This helps understand the stages of a disease (incubation, symptoms, recovery, etc.)

4. To Evaluate the Effectiveness of Health Interventions and Programs:Epidemiology assesses whether public health measures, treatments, or policies are working.

This includes evaluating,Vaccines and medications,Health education

programs,Screening and control strategies

are scaled up

5. To Provide Data for Planning, Policy, and Public Health Decision-Making :Example: During COVID-19, epidemiological data helped governments decide when to implement lockdowns, vaccination drives, and social distancing rules.

2..Differentiate between descriptive and analytical epidemiology, providing one example of each.

Ans: Descriptive epidemiology involves describing the distribution of diseases within a population in terms of person, place, and time.

:It tells us how often a disease occurs and who is affected, but not necessarily why.

:It provides a broad picture of a health problem and helps to generate hypotheses for further

analytical studies.

Example: Cholera Outbreak in a Town
Epidemiologists record that between June and August 2024, 150 people developed cholera in Lagos State, mostly from areas with poor sanitation.

Most cases occurred among young adults aged 20–40.

- Analytical epidemiology is concerned with examining the determinants (causes or risk factors) of diseases.It tests why and how a disease occurs by comparing groups usually a group with the disease and a group without it.

Example: In 1854, Dr. John Snow studied a cholera outbreak in London.He observed that people who drank from the Broad Street pump were getting sick, while those who drank from other water sources were not.He compared the two groups and found a strong association

between water source and disease.

3: Discuss the components of the epidemiologic triangle and how they interact in the spread of an infectious disease.

Ans: The epidemiologic triangle is a model that explains how infectious diseases occur and spread in a population. It has three main components: the Agent, the Host, and the Environment. These three factors work together to determine whether or not a disease will occur which are Agent,Host, Environment

1. Agent: The agent is the microorganism or factor that actually causes the disease.It can be:Biological: such as bacteria (Vibrio cholerae), viruses (HIV, influenza), or parasites (Plasmodium causing malaria).

:Chemical: such as toxins or poisons.

:Physical: such as radiation or injury.

2. Host:The host is the person or animal that can be infected by the agent.Certain host factors increase or decrease the risk of infection. These include:

:Age: children and the elderly are more prone to infections.

:Immunity: people with weak immune systems get sick more easily.

:Nutrition: malnourished individuals are more vulnerable.

:Behavior: poor hygiene or risky habits can increase exposure.

3. Environment:The environment refers to all external factors that affect the agent and the host.It includes physical, biological, and social conditions such as:Poor sanitation, dirty water, overcrowding, and climate.

:Presence of vectors like mosquitoes or rats.

: Lack of healthcare facilities or low public awareness.

:The environment can either help or hinder disease transmission.

Interaction of the Three Components

A disease occurs only when the agent, host, and environment interact under favorable conditions:

The agent must be present and capable of causing infection.

:The host must be susceptible to the agent.

:The environment must support the transmission of the agent to the host.

If any one of these components is missing or controlled, the disease will not occur.

4. Explain the concept of determinants in epidemiology and give two examples of biological and environmental determinants

Ans. :In epidemiology, determinants are the factors or conditions that influence the occurrence, distribution, and severity of diseases in a population.They are the causes, risk factors, or exposures that determine why some people get sick while others remain healthy.

We have types of Determinants which are :
Biological determinants

Environmental determinants

Social and behavioral determinants

Economic and cultural determinants

1. Biological Determinants:These are factors within the human body that influence health and

disease.They include genetics, age, sex, immune status, and physiological conditions.

Examples:Genetic inheritance: A person with a family history of diabetes has a higher risk of developing it.

Immune status: Individuals with weak immunity (e.g., HIV patients) are more susceptible to infections like tuberculosis.

2. Environmental Determinants:These are external conditions surrounding a person that affect health.they include physical, chemical, biological,and social factors in one’s surroundings.

Examples:Poor sanitation and contaminated water: Can lead to cholera or typhoid fever.

Climate and living conditions: Warm, humid environments encourage mosquito breeding, increasing malaria transmission.

Environmental determinants influence the spread of infectious diseases and the overall health of a community.

5. Describe the three levels of prevention in public health, and provide a real-life example for each.

Ans: In public health, prevention refers to measures taken to stop diseases from occurring, progressing, or causing complications.There are three main levels of prevention primary, secondary, and tertiary prevention each aimed at a different stage in the disease process.

1. Primary Prevention:This is to prevent the occurrence (onset) of disease before it happens.It focuses on health promotion and specific protection to reduce risk factors in healthy individuals.

Main goal is to stop disease from developing in the first place.

Examples:Vaccination against measles, polio,

or COVID-19 to prevent infection.

:Use of mosquito nets to prevent malaria.

:Health education on good nutrition and hygiene.

:Regular exercise to prevent obesity and heart disease.

2. Secondary Prevention:This aims is to detect and treat a disease early before it causes serious complications.It involves screening, early diagnosis, and prompt treatment.

Some diseases are identify disease in its early stage and stop it from getting worse.

Examples:Blood pressure screening to detect hypertension early.

:Pap smear test for early detection of cervical cancer.

:Blood sugar testing to find diabetes before symptoms appear.

3. Tertiary Prevention: This aims is to reduce the impact or complications of an already established disease.It focuses on rehabilitation, disability limitation, and improving quality of life.

The main goal is to Prevent disability, restore function, and help patients live as normally as possible.

Examples:Physiotherapy for stroke patients to regain movement.

:Rehabilitation programs for drug addicts.

:Foot care and insulin therapy for people with diabetes to prevent amputation.

:Support groups for cancer survivors.

6. How did John Snow contribute to the development of modern epidemiology? Describe the

method he used during the cholera outbreak.

Ans.Johnson snow(1854) frequently called the father of modern epidemiology,He investigated a cholera heartbreak in London and trace it source to a contaminated water pump,using early forms and statistics analysis

John Snow modern epidemiology contribution are: Introducing data-based investigation: He relied on observation, data collection, and mapping, rather than just theory or speculation.

:Demonstrating the role of environment and transmission: At the time, many people believed in the miasma theory (that diseases were spread by “bad air”). Snow provided strong evidence that cholera was transmitted through contaminated water, not air.

:Laying the foundation for epidemiologic methods: His approach combined descriptive and analytical epidemiology, which are still used today.

The Method He Used During the Cholera Outbreak are:

a. Observation and Data Collection: When cholera broke out in Soho, London (1854), Snow carefully observed the distribution of cases and collected detailed information about the victims where they lived, worked, and got their water.

b. Mapping the Cases :He created a map of cholera deaths in the affected area. The map showed that most cases were clustered around a public water pump on Broad Street (now Broadwick Street).

c. Hypothesis Formation:Based on the pattern, he hypothesized that cholera was spread through water contaminated with human waste, not through the air as widely believed.

d. Testing the Hypothesis:To test his theory,He compared households that used different water sources.He found that people who drank water from the Broad Street pump were far more likely to get cholera than those who used other sources.

e. Intervention: JohnSnow convinced the local

authorities to remove the handle of the Broad Street pump, preventing people from using it. Afterward, cholera cases declined sharply, supporting his hypothesis.

7. Compare and contrast incidence and prevalence. Why is it important to understand both when studying a disease like diabetes?

Ans: Incidence refers to the number of new cases of a disease that develop in a specific population during a certain period of time. It measures how quickly new cases occur and therefore reflects the risk of developing the disease. For example, if 200 new people are diagnosed with diabetes in a city of 10,000 people in one year, that number represents the incidence of diabetes for that year. Incidence helps public health professionals identify risk factors and evaluate the effectiveness of preventive programs.

Prevalence, on the other hand, refers to the

total number of existing cases of a disease both new and old in a population at a specific point or over a period of time. It shows how widespread the disease is within a community. For instance, if 1,000 people in that same city are currently living with diabetes, that represents the prevalence of diabetes. Prevalence gives an idea of the overall burden of the disease and helps in planning for healthcare services, medication supply, and patient support.

Understanding both incidence and prevalence is very important when studying a chronic disease like diabetes. Incidence tells us how many new people are developing diabetes, which helps in finding causes and assessing preventive measures such as lifestyle changes or dietary interventions. Prevalence, meanwhile, shows how many people are living with the condition at a given time, which helps health

authorities plan for long-term care, treatment facilities, and management programs.

8.What are the common types of epidemiological study designs, and how does a cohort study differ from a case-control study?

Ans : Common Types of Epidemiological Study Designs are Descriptive, Analytical, Experimental

1. Descriptive Study Design :This are studies are used to describe the occurrence and distribution of diseases in terms of person, place, and time.

They do not test a hypothesis but help to generate one for further investigation.

These studies answer questions like

“Who is affected?”, “Where?”, and “When?”

2. Analytical Study Design:Analytical studies go a step further to find causes and risk factors of diseases.

They test hypotheses and explain why and how diseases occur.The main types include:

:Case-control study: Starts with people who already have the disease (cases) and compares them with people who do not (controls) to find past exposures.

:Cohort study: Starts with disease-free people who differ in exposure and follows them over time to see who

develops the disease.

:Cross-sectional analytical study: Examines relationships between exposure and disease

3. Experimental (Interventional) Study Design :In experimental studies, the researcher actively introduces an intervention and observes its effect on the outcome.These studies are used to test new treatments or preventive measures.

Difference Between a Cohort Study and a Case-Control Study

Cohort Study:A cohort study begins with a group of people who are disease-free but differ in their exposure

status (for example, smokers vs. non-smokers).

The groups are followed over time to see who develops the disease.

It moves forward in time from exposure to outcome, so it is prospective in nature.It can calculate incidence rates and determine the risk (relative risk) of developing the disease.

Example: Following a group of adults for 10 years to see if those who are overweight are more likely to develop diabetes than those of normal weight.

Case-Control Study:A case-control study starts with people who

already have the disease (cases) and compares them with people who do not have the disease (controls).The researcher then looks backward in time to find past exposures that might explain why some developed the disease.It is retrospective in nature.

It cannot directly measure incidence or risk, but it estimates an odds ratio, which suggests the strength of the association between exposure and disease.

Example: Comparing people who already have diabetes (cases) with those who do not (controls) to find out whether obesity or family history is more common among the cases.

9. Define and differentiate between relative risk (RR) and odds ratio (OR), including when each is typically used.

Ans: Relative Risk (RR): This is the ratio of the probability (risk) of developing a disease among the exposed group to the probability of developing the disease among the unexposed group.

\text{RR} = \frac{\text{Incidence among exposed}}{\text{Incidence among unexposed}}

The formula means:RR = 1: No association between exposure and disease.

RR > 1: Exposure increases risk of disease.

RR < 1: Exposure reduces risk (protective effect).

Example:If smokers have a 20% risk of developing lung cancer and non-smokers have a 5% risk,

Ans:RR = \frac{0.20}{0.05} = 4

It is commonly used in cohort studies and randomized controlled trials (RCTs), where the incidence of disease can be directly measured.

2. Odds Ratio (OR):

Odds Ratio is the ratio of the odds of disease occurring in the exposed group to the odds of disease occurring in the unexposed group.

$$\text{OR} = \frac{\text{(a/c)}}{\text{(b/d)}} = \frac{ad}{bc}$$

The formula means

OR = 1: No association.

OR > 1: Exposure associated with higher odds of disease.

OR < 1: Exposure associated with lower odds (protective).

Example:If among 100 people, 40 of 50 smokers have lung cancer (odds = 40/10 = 4),

and 10 of 50 non-smokers have lung cancer (odds = 10/40 = 0.25),

Ans: OR = \frac{4}{0.25} = 16

It is Commonly used in case-control studies, where incidence (risk) cannot be directly calculated because the total number of exposed individuals is not known.Also used in logistic regression analyses.

Differences between RR and OR:

RR measures risk directly, while OR measures odds.

RR is easier to interpret but can only be calculated when incidence data is available.

OR is often used when incidence cannot be measured, especially in case-control studies.

When the disease is rare, the OR approximates the RR.

10. Explain the role of epidemiological surveillance in managing public health. How can it help during an emerging epidemic

Ans. Epidemiological surveillance is the continuous, systematic collection, analysis, interpretation, and dissemination of health data. It helps in monitoring the occurrence and distribution of diseases and guides timely public health actions.

Role in Managing Public Health include:

1. Early Detection of Diseases:

Surveillance helps identify new cases or unusual patterns of illness early, allowing for quick intervention before diseases spread widely.

2. Monitoring Trends:

It tracks disease frequency and distribution over time to detect increases, decreases, or changes in disease patterns.

3. Evaluating Control Programs:

Data from surveillance systems are used to assess the effectiveness of vaccination, sanitation, or vector -control programs.

4. Guiding Public Health Policies:

Reliable surveillance data inform policymakers to set priorities, allocate resources, and plan preventive strategies.

5. Preventing Outbreaks:

Through continuous monitoring, surveillance can identify potential outbreaks and trigger early responses to prevent further spread.

During an Emerging Epidemic:

1. Rapid Detection and Confirmation:

Surveillance helps identify the first cases of an emerging epidemic quickly, allowing laboratory confirmation and understanding of the disease's cause.

2. Tracing the Source and Mode of Transmission:

It provides information on how the disease is spreading and who is at risk, guiding targeted control measures.

3. Guiding Response Measures:

Data from surveillance direct the implementation of quarantine, vaccination, or treatment programs to affected populations.

4. Evaluating the Impact of Interventions:

Ongoing surveillance shows whether the control measures (like lockdowns or vaccination) are effective.

5. Informing the Public and Health Authorities:

It ensures that accurate and timely information reaches decision-makers and the public to reduce panic and promote appropriate health behaviors.