University College Hospital , CHO,300l
Epidemiology – Test Questions

1. Define epidemiology and explain its main objectives.

Epidemiology is the study of how diseases and health-related conditions are distributed in populations, and the factors that influence or determine this distribution. It helps identify the causes of health problems and provides the foundation for preventive and control measures.

The main objectives of epidemiology are to:

Describe the occurrence of diseases in terms of time, place, and person.

Identify the causes and risk factors of diseases.

Predict future trends of diseases in a population.

Control and prevent health problems by applying findings to public health policies and interventions.

In short, epidemiology aims to understand why diseases occur, who is at risk, and how they can be prevented.

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

Descriptive epidemiology focuses on describing the occurrence of disease in terms of person, place, and time. It answers questions like who is affected, where the problem occurs, and when it happens. For example, studying the pattern of malaria cases in a particular region over a 10-year period is descriptive epidemiology.

Analytical epidemiology, on the other hand, goes a step further by exploring the why and how of disease occurrence. It examines the relationship between exposure and outcome, often using comparison groups. For instance, investigating whether people who sleep under mosquito nets have lower rates of malaria than those who don’t is an example of analytical epidemiology.

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

The epidemiologic triangle is a model used to understand the interaction between three key elements that influence disease occurrence: the agent, the host, and the environment.

The agent is the microorganism or pathogen that causes the disease, such as bacteria, viruses, or parasites.

The host is the organism (usually a human or animal) that can become infected. Factors like age, immunity, nutrition, and behavior affect a host's susceptibility.

The environment includes all external conditions that influence the agent and the opportunity for exposure, such as climate, sanitation, living conditions, and vector presence.

These three components constantly interact. For example, in malaria: the agent is the Plasmodium parasite, the host is the human, and the environment includes stagnant water and the presence of mosquitoes. A change in any one of these factors, like improved sanitation or mosquito control, can disrupt disease transmission.

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

In epidemiology, determinants are factors or conditions that influence the occurrence, distribution, or severity of a disease. They help explain why some people get sick while others do not. Determinants can be biological, environmental, social, or behavioral.

Biological determinants: Examples include genetic makeup and immune status. For instance, people with weak immune systems are more susceptible to infections, while genetic factors can influence diseases like sickle-cell anemia.

Environmental determinants: These include factors such as air quality, water sanitation, and housing conditions. Poor sanitation, for example, increases the risk of diseases like cholera, while overcrowded housing can facilitate the spread of tuberculosis.

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

Public health uses a three-level prevention model to reduce the burden of disease:

Primary prevention aims to prevent the onset of disease before it occurs. It involves health promotion and specific protection measures.
Example: Vaccination against measles prevents infection before exposure.

Secondary prevention focuses on early detection and prompt treatment to stop disease progression.
Example: Regular blood pressure checks to detect hypertension early and manage it before complications develop.

Tertiary prevention aims to reduce complications and improve quality of life among people with established disease.
Example: Rehabilitation programs for stroke survivors to help them regain mobility and function.

6. How did John Snow contribute to the development of modern epidemiology? Describe the method he used during the cholera outbreak.

John Snow is often regarded as the father of modern epidemiology because of his groundbreaking work during the 1854 cholera outbreak in London. At a time when most people believed diseases spread through “bad air” or miasma, Snow suspected that cholera was transmitted through contaminated water.

He conducted a detailed investigation by mapping cholera cases around the Soho district and noticed a strong concentration of cases near the Broad Street water pump. To test his hypothesis, he persuaded local authorities to remove the pump handle , and shortly after, the number of new cases dropped significantly.

Snow’s approach,careful observation, mapping, data analysis, and drawing conclusions based on evidence ,marked one of the earliest examples of using systematic, data-driven methods to understand and control disease. His work laid the foundation for epidemiological research and public health interventions.

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

Incidence refers to the number of new cases of a disease that develop in a specific population over a certain period of time. It helps measure the risk of developing the disease.

Prevalence, on the other hand, represents the total number of existing cases (both new and old) in a population at a given time. It reflects how widespread the disease is.

When studying a long-term condition like diabetes, understanding both measures is crucial. Incidence tells us how many new people are being diagnosed, indicating whether risk factors or prevention efforts are changing. Prevalence shows the overall disease burden on the community, helping plan healthcare services, medication supplies, and long-term management programs.

In short, incidence tracks the rate of occurrence, while prevalence reflects the extent of the problem.

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

Common epidemiological study designs include descriptive studies (such as case reports and cross-sectional studies) and analytical studies (which include cohort and case-control studies). There are also experimental studies, such as clinical trials.

A cohort study follows a group of people over time to see who develops the disease, based on their exposure to a particular factor. It starts with disease-free individuals and compares outcomes between those exposed and those not exposed. For example, tracking smokers and non-smokers over several years to observe who develops lung cancer.

A case-control study, on the other hand, starts with people who already have the disease (cases) and compares them to people without the disease (controls) to see what exposures they had in the past.

The main difference lies in direction and timing:

Cohort studies move forward in time from exposure to outcome.

Case-control studies look backward in time from outcome to exposure.

Cohort studies are ideal for studying rare exposures, while case-control studies are more efficient for studying rare diseases.

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

Relative Risk (RR) is the ratio of the probability of developing a disease in the exposed group compared to the unexposed group. It shows how much more (or less) likely disease occurrence is among those exposed to a particular risk factor. RR is commonly used in cohort studies, where the incidence of disease can be directly measured.

Odds Ratio (OR) compares the odds of exposure among cases to the odds of exposure among controls. It's used mainly in case-control studies, where we cannot directly measure incidence.

In simple terms:

RR = risk in exposed ÷ risk in unexposed.

OR = odds of exposure in cases ÷ odds of exposure in controls.

When a disease is rare, the odds ratio closely approximates the relative risk. Both measures help researchers quantify the strength of an association between exposure and disease.

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

Epidemiological surveillance is the continuous, systematic collection, analysis, interpretation, and dissemination of health data. Its main purpose is to detect changes in disease patterns, guide prevention strategies, and evaluate public health interventions.

During an emerging epidemic, surveillance plays a vital role by:

Detecting outbreaks early, allowing rapid response before the disease spreads widely.

Tracking the spread of infection across regions to identify high-risk areas.

Providing data that guide resource allocation, such as vaccines, medical supplies, and healthcare workers.

Evaluating interventions, such as the effectiveness of quarantine measures or vaccination campaigns.

For example, during the COVID-19 pandemic, real-time surveillance systems helped monitor new cases, detect variants, and shape policies on testing and vaccination. Without effective surveillance, epidemics can escalate quickly, making control far more difficult.