

Certificate in Public Health Innovations

## Epidemiology and Biostatistics

Epidemiology is a crucial field in public health that involves studying the distribution and determinants of health-related states or events in specific populations, as well as the application of this study to control health problems. By understanding the patterns of disease and health outcomes in populations, epidemiologists can develop strategies to prevent and control diseases, improve health outcomes, and promote public health.

Epidemiology relies heavily on various key terms and vocabulary to describe the characteristics of disease occurrence, risk factors, study designs, and statistical methods. Understanding these terms is essential for interpreting epidemiological studies, conducting research, and making evidence-based decisions in public health practice. Below are some key terms and vocabulary commonly used in epidemiology:

### 1. Disease Occurrence:

- Incidence: The number of new cases of a disease that develop in a defined population over a specified period.
- Prevalence: The proportion of individuals in a population who have a specific disease at a given point in time.
- Morbidity: The presence of illness or disease in a population.
- Mortality: The number of deaths in a population due to a specific cause.

### 2. Measures of Association:

- Relative Risk (RR): The ratio of the risk of an outcome in an exposed group to the risk in an unexposed group.
- Odds Ratio (OR): The ratio of the odds of exposure in cases to the odds of exposure in controls.
- Attributable Risk: The difference in risk between exposed and unexposed groups.

### 3. Study Designs:

- Cohort Study: A study that follows a group of individuals over time to evaluate the association between exposures and outcomes.
- Case-Control Study: A study that compares individuals with a specific outcome (cases) to those without the outcome (controls) to assess exposure history.
- Cross-Sectional Study: A study that examines the relationship between exposures and outcomes at a single point in time.

### 4. Bias and Confounding:

- Bias: Systematic error in the design, conduct, or analysis of a study that results in distorted findings.
- Confounding: A distortion of the true effect of an exposure on an outcome due to the presence of a

third variable associated with both.

#### 5. Statistical Methods:

- Hypothesis Testing: Statistical method to determine whether an observed difference between groups is significant or occurred by chance.
- Regression Analysis: Statistical technique to determine the relationship between one or more independent variables and a dependent variable.

#### 6. Outbreak Investigation:

- Cluster: An aggregation of cases of a disease in a specific time and place.
- Index Case: The first case of a disease in an outbreak that comes to the attention of health authorities.
- Contact Tracing: Identifying and monitoring individuals who have been exposed to a case of a communicable disease.

#### 7. Public Health Interventions:

- Primary Prevention: Interventions aimed at preventing the occurrence of disease before it occurs.
- Secondary Prevention: Interventions aimed at early detection and treatment of disease to prevent progression.
- Tertiary Prevention: Interventions aimed at reducing the impact of established disease on individuals and communities.

#### 8. Surveillance Systems:

- Passive Surveillance: The routine reporting of notifiable diseases by healthcare providers to public health authorities.
- Active Surveillance: The systematic collection of data through regular outreach to healthcare providers and facilities.

#### 9. Risk Factors:

- Modifiable Risk Factor: A risk factor that can be altered through intervention or behavior change.
- Non-Modifiable Risk Factor: A risk factor that cannot be changed, such as age or genetic predisposition.

#### 10. Vaccine Efficacy and Effectiveness:

- Vaccine Efficacy: The reduction in disease incidence in a vaccinated group compared to an unvaccinated group under controlled conditions.
- Vaccine Effectiveness: The reduction in disease incidence in a vaccinated group compared to an unvaccinated group under real-world conditions.

#### 11. Relative vs. Absolute Risk:

- Relative Risk Reduction: The proportional reduction in risk associated with an intervention compared to a control group.
- Absolute Risk Reduction: The actual difference in risk between an intervention group and a control group.

12. Disease Transmission:

- Direct Transmission: Transmission of a pathogen from an infected individual to a susceptible individual through direct contact.
- Indirect Transmission: Transmission of a pathogen through a contaminated intermediary, such as food, water, or fomites.

13. Herd Immunity:

- Herd Immunity: The indirect protection from infectious diseases that occurs when a significant proportion of a population is immune to the pathogen.

14. Risk Communication:

- Risk Communication: The exchange of information about health risks between public health officials, healthcare providers, and the public.

15. Outcomes Research:

- Outcomes Research: Research that assesses the impact of healthcare interventions on patient outcomes, quality of life, and healthcare costs.

16. Data Analysis:

- Descriptive Statistics: Statistical methods used to summarize and describe the characteristics of a dataset.
- Inferential Statistics: Statistical methods used to make predictions or inferences about a population based on a sample.

17. Precision and Accuracy:

- Precision: The degree of reproducibility or consistency in measurements.
- Accuracy: The degree of closeness of a measurement to the true value.

18. Sensitivity and Specificity:

- Sensitivity: The proportion of true positive results among those with the disease.
- Specificity: The proportion of true negative results among those without the disease.

19. Randomized Controlled Trial (RCT):

- Randomized Controlled Trial: A study design in which participants are randomly allocated to intervention and control groups to assess the efficacy of an intervention.

20. Meta-Analysis:

- Meta-Analysis: A statistical technique that combines results from multiple studies to provide a more precise estimate of the effect of an intervention.

21. Data Quality:

- Data Quality: The reliability, validity, and completeness of data collected for research or surveillance

purposes.

22. Bias Reduction:

- Bias Reduction: Strategies employed to minimize biases in study design, data collection, and analysis to ensure the validity of study findings.

23. Causality:

- Causality: The relationship between a cause and its effect, established through rigorous study design, statistical analysis, and biological plausibility.

24. Cluster Randomized Trial:

- Cluster Randomized Trial: A type of RCT in which groups of individuals, rather than individual participants, are randomized to intervention and control groups.

25. Systematic Review:

- Systematic Review: A comprehensive review of the literature on a specific topic that follows a structured methodology to identify, appraise, and synthesize relevant studies.

26. Case Definition:

- Case Definition: The criteria used to define a case of a specific disease or condition for surveillance or research purposes.

27. Confidence Interval:

- Confidence Interval: A range of values around a point estimate that indicates the precision of the estimate and the level of confidence that the true value lies within that range.

28. Data Collection Methods:

- Surveys: Questionnaires or interviews used to collect data on exposures, outcomes, and other variables of interest.

- Medical Records: Documented information on patient diagnoses, treatments, and outcomes collected for clinical or research purposes.

29. Environmental Epidemiology:

- Environmental Epidemiology: The study of how environmental factors such as air quality, water quality, and toxic substances affect human health.

30. Health Disparities:

- Health Disparities: Differences in health outcomes or access to healthcare services between different populations based on race, ethnicity, socioeconomic status, or geographic location.

31. Multivariate Analysis:

- Multivariate Analysis: Statistical techniques that analyze the relationship between multiple independent variables and a dependent variable simultaneously.

32. Age-Standardization:

- Age-Standardization: A method used to compare disease rates between populations with different age distributions by adjusting for age as a confounding factor.

33. Stratified Analysis:

- Stratified Analysis: Analysis of data after dividing the study population into subgroups based on a specific characteristic to assess effect modification.

34. Interaction:

- Interaction: The combined effect of two or more exposures on an outcome that is greater or less than the sum of their individual effects.

35. Sensitivity Analysis:

- Sensitivity Analysis: A method used to assess the robustness of study findings by varying key assumptions or parameters in the analysis.

36. Data Visualization:

- Data Visualization: The use of charts, graphs, and other visual tools to represent data in a clear and meaningful way.

37. Life Table Analysis:

- Life Table Analysis: A method used to estimate survival rates and life expectancy based on age-specific mortality rates.

38. Time Series Analysis:

- Time Series Analysis: A statistical method used to analyze trends, patterns, and seasonality in data collected over time.

39. Public Health Informatics:

- Public Health Informatics: The application of information and communication technologies to public health practice, research, and decision-making.

40. Regression to the Mean:

- Regression to the Mean: The tendency for extreme values of a variable to move closer to the mean upon repeated measurements.

41. Selection Bias:

- Selection Bias: Bias introduced when the selection of study participants is not random or representative of the target population.

42. Power Analysis:

- Power Analysis: A statistical method used to determine the sample size needed to detect a significant effect if one truly exists.

43. Comorbidity:

- Comorbidity: The presence of two or more chronic conditions or diseases in an individual at the same time.

44. Ecological Study:

- Ecological Study: A study that examines the relationship between population-level exposures and outcomes rather than individual-level associations.

45. Case Fatality Rate:

- Case Fatality Rate: The proportion of individuals with a specific disease who die from that disease within a specified period.

46. Point Source Outbreak:

- Point Source Outbreak: An outbreak in which individuals are exposed to a common source of infection at the same time and place.

47. Retrospective Study:

- Retrospective Study: A study that looks back in time to assess the relationship between exposures and outcomes.

48. Prospective Study:

- Prospective Study: A study that follows individuals forward in time to assess the relationship between exposures and outcomes.

49. Case Series:

- Case Series: A descriptive study that reports on a series of cases with similar characteristics or outcomes.

50. Cumulative Incidence:

- Cumulative Incidence: The proportion of individuals in a population who develop a specific disease over a specified period.

These key terms and vocabulary are essential for understanding and applying epidemiological concepts in public health practice. By familiarizing yourself with these terms and their definitions, you can interpret research findings, design studies, and implement interventions to improve population health outcomes.