

PRINCIPLES OF EPIDEMIOLOGY

ABSTRACT

Epidemiology is the study of the distribution, patterns, and determinants of health-related events and diseases in populations. It plays a crucial role in public health by identifying risk factors, causes, and methods of disease prevention and control. The principles of epidemiology focus on understanding and controlling disease patterns within populations. One key principle is disease distribution, which examines how health conditions vary by person, place, and time. Epidemiological study designs, including observational and experimental studies, help researchers investigate health trends and evaluate interventions. Another important principle is causation and association, which determines whether a risk factor directly leads to a disease. Lastly, disease prevention and control focus on strategies such as vaccination, sanitation, and public health policies to reduce the spread of illnesses and improve overall community health. This chapter will discuss regarding the different principles of epidemiology to guide public health professionals in making evidence-based decisions to enhance population well-being.

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I. INTRODUCTION

Epidemiology is the study of frequency, distribution, and determinants of the health-related states or events. It is a basic science of preventive and social medicine. The epidemiology is derived from Greek word of “Epidemic”.

Epi means upon or among

Demos means people

Logy means study

Epidemiology means the study of people or science upon people. The concept of epidemiology is to find the frequency of basic measures to facilitate the comparison, to the distribution of disease in patterns by time, place and person and to identify the determinants of underlying causes or risk factors.

II. PRINCIPLES OF EPIDEMIOLOGY

The principles of epidemiology are based on the components of disease in epidemiology. Epidemiology is a fundamental principle of public health. Disease prevention and health surveillance among people were controlled in the trials of recovery of people from the total population. The following headings describe knowledge of the principles of epidemiology

PRINCIPLES OF EPIDEMIOLOGY

- Principle of disease frequency
- Principle of disease distribution
- Principle of health determinants
 - Principle of disease pattern
- Principle of screening individual risk
- Principle of outbreak investigation
 - Principle of community diagnosis
 - Principle of disease surveillance
- Principle of natural history of disease
- Principle of disease prevention and control
 - Principle of population changes
 - Principle of policy development
- Principle of research and innovation
 - Principle of ethics in public health
 - Principle of planning and evaluation

- 1. Principle of Disease Frequency:** Disease frequency is one of the principles of epidemiology. Disease frequency is measured by how the disease occurs in a population. In these measures of frequency of disease, prevalence and incidence rate is important. These are described the distribution of health issue, establishing the casual relationship between the exposure and disease and evaluate the impact of preventive measures.

For Example: In 2024, the incidence rate of diabetes in a population of 1 million was reported at 12 cases per 100,000 individuals, indicating 120 new cases that year. In contrast, the prevalence rate of diabetes stood at 350 per 100,000, reflecting a total of 3,500 existing cases in the population.

- 2. Principle of Disease Distribution:** Disease distribution is a part of epidemiology in which to identify the potential risk of factors and epidemic characters by time, place and person. In epidemiology, how the disease is resulting in interaction of two external agents, susceptible host and environment.

For Example: In geographic distribution, Metropolitan areas in Asia and Africa are rapidly expanding and also in ethnicity, rising multiculturalism in urban areas, with significant increases in immigrant populations contributing to ethnic diversity in cities

- 3. Principle of Health Determinants:** The determinants of health are to determine the individual's health in a population with the aspects of biological, psychological, social, economic and environmental factors to improve population health, to take action on determinants and to reduce health inequities.

For Example: Emergence of new variants of diseases, such as COVID -19, impacting public health strategies and resource allocation.

- 4. Principle of Disease Pattern:** Disease pattern is main principle of epidemiology. This is models that measure the sickness and death in a population at given time. The common disease patterns are sporadic, endemic, epidemic and pandemic. The disease pattern is measured the distribution of disease in on extra time.

For Example: In 2020, the pandemic condition of COVID, its spreading all over the world. The pattern of COVID is where the number of cases increased above what expected in given area.

- 5. Principle of Screening Individual Risk:** Screening individual risk is process of identifying the individual those who may at risk in a given population. The aim of screening is to detect the disease in early, to find possible risk, to resolve the solution. This principle of screening individual risk is important to detect the disease and also reduce the risk of disease.

For Example: Screening test of pap smear helps to detecting the cervical cancer and may be detect those who getting risk under cervical cancer.

- 6. Principle of Outbreak Investigation:** The principle of outbreak investigation helps to quick solution of community people in a population. This outbreak investigation measures the disease causation, high risk detection and evaluative outcome. It was implementing the as soon as for knowing the source and mode of transmission.

For Example: Epidemiologist investigating the outbreak of diarrhoea on a cruise ship. They can collect the sample of stool to individuals those who affected by diarrhoea. After investigating identify the microorganism and others also positive to stool test. This outbreak break investigation helps to prevent future outbreaks.

- 7. Principle of Community Diagnosis:** Community diagnosis is important principle of epidemiology. The community diagnosis in epidemiology is to identify the health problem with non-health factors affecting a community's quality of life. This principle is finding the environmental factors, socio economic factors and mental health factors

For Example: Investigators that diagnosed to have tuberculosis on quality-of-life pattern those affected by this problem. 90% of tuberculosis patients had poor quality of life and recommending the study to improve the good quality of life pattern among tuberculosis patients.

- 8. Principle of Disease Surveillance:** The principle of Disease surveillance is one of the tools to collecting the data on diseases from health care team in hospitals. It depends on the objective and actions required to reach the surveillance of disease.

For Example: Surveillance system for acute infectious disease need to provide the rapid early warning information.

- 9. Principle of Natural History of Disease:** Natural history of disease is an important part of descriptive epidemiology to prevent and control disease. How the disease is progressing in an individual without treatment, what

about the nature of disease like that considering the information about the natural history of disease in a population of epidemiology

For Example: If untreated infection with HIV causes a spectrum of clinical problems begins at time of primary HIV and ending of AIDS and usually death.

10.Principle of Disease Prevention and Control: Disease prevention and control is implemented to practice of standard safety measures, early diagnosis, and risk identification, measures used to prevent primary, secondary and tertiary prevention in epidemiology. The health care providers were giving the implementation of measures of control and prevention of disease.

For Example: Regular hand washing, appropriate use of face mask, routine vaccinations were controlling the infectious disease in community

11.Principle of Population Changes: Population change is basic principle of epidemiology. Population change is the difference in number of people in selected or given area a specific period of time. Epidemiological transition is the theory of population change. Its helps to find the factors that influenced in birth rate, migration and death rate.

For Example: Due to pandemic reason, community people were migrated to one place to another place. It was affecting the population in particular community. By the changes of birth and death rate were affecting the population in community

12.Principle of Policy Development: Epidemiology is a key role in policy development. Policy development provides the evidence of creating and implementing the health policy and regulation of policy. This provides the information regarding epidemiology and contributed the policy which can implement on evidence-based practice approach.

For Example: Infection control policy provides the information regarding control of infectious disease to all health care providers.

13.Principle of Research and Innovation: Research and innovation is also important principle in epidemiology. Its advanced technology in epidemiology to understanding disease, maintaining communication, interdisciplinary collaboration, and also digital epidemiology. It helps to use large quantities of sample to gaining information as innovatively with

creative thinking. This generates the collecting the data, using research methods and analysing data.

For Example: In 2024, the application of epidemiological principles was evident in the response to a new influenza outbreak that enhanced surveillance systems were implemented to monitor influenza cases in real time, allowing for quick identification of emerging trends and facilitating timely public health responses.

14.Principle of Ethics in Public Health: Ethics in public health refers to maintaining the trust in public and rights of community people. It can help to planning and implementing the public health awareness with public legislation and laws. Conflict of interest, confidentiality, bias, falsification and ethical obligation were common ethical issues in epidemiology.

For Example: Untrusted public awareness, wrong informed consent, lack of confidentiality in public health, lack of public support, illegal activities in public sector

15.Principle of Planning and Evaluation: Planning is an initial part in epidemiology and Evaluation is ending part in epidemiology. Combined planning and evaluation are used to implementing health care services. When the information is used effectively and efficiently, can apply preventive and control measures. This same principle can use for this re planning and re-evaluation for further effective public health services in epidemiology.

For Example: Vaccination is the best example of the planning and evaluation principle in epidemiology. Once we have planned to take vaccination, after taking vaccination free from illness and infectious disease.

III. CONCLUSION

In concluding the principles of epidemiology, the main principle is essential for disease frequency, pattern, distribution, and determinants of health and disease. This is evaluating the health promotion campaigns, the risk to identifying the problem, collecting data, and analyzing the findings in public health fields.

REFERENCES

- [1] Last JM, editor. Dictionary of epidemiology. 4th ed. New York: Oxford University Press; 2001. p. 61.
- [2] Cates W. Epidemiology: Applying principles to clinical practice. Contemp Ob/Gyn1982; 20:147–61.

- [3] Greenwood M. Epidemics and crowd-diseases: an introduction to the study of epidemiology, Oxford University Press; 1935.
- [4] Thacker SB. Historical development. In: Teutsch SM, Churchill RE, editors. Principles and practice of public health surveillance, 2nd ed. New York: Oxford University Press; 2002. p. 1–16.
- [5] Snow J. Snow on cholera. London: Humphrey Milford: Oxford University Press; 1936.
- [6] Doll R, Hill AB. Smoking and carcinoma of the lung. Brit Med J.1950; 2:739–48.
- [7] Kannel WB. The Framingham Study: its 50-year legacy and future promise. J AtherosclerThromb2000; 6:60-6.
- [8] Fenner F, Henderson DA, Arita I, Jezek Z, Ladnyi ID. Smallpox and its eradication. Geneva: World Health Organization; 1988.