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Manual of Community Health Nursing



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3rd Edition

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4 CHAPTER

Principles of Epidemiology and Epidemiological Methods



Learning Objectives

- Definition and aims of epidemiology, communicable and noncommunicable diseases
- Basic tools of measurement in epidemiology
- Uses of epidemiology
- Disease cycle
- Spectrum of disease
- Levels of prevention of disease
- Disease transmission—direct and indirect
- Immunizing agents, immunization and national immunization schedule
- Control of infectious diseases
- Disinfection



TERMINOLOGY

- **Incidence:** Number of people developing the disease during a defined time period per 1000 population.
- **Prevalence:** Number of people having disease at a given point of time (point prevalence) or during a defined time period (period prevalence) per 1000 population. The number consists of all cases including new and old ones.
- **Rate:** Number of occurrences of an event per unit time. It is the time fraction in which all cases contributing to numerator are also counted in denominator. Denominator is the entire population at risk. Rates are generally expressed as per 1000.
- **Case:** A person identified as having a particular disease, behavior or condition. Cases may be divided into possible, probable and definite depending on how well a set of specific criteria is satisfied.
- **Carrier:** Presence of a specific infectious agent in the absence of clinical disease. A carrier serves as potential source for further transmission of disease in the community. Temporary carrier state lasts for less than six months. Chronic carrier state may last lifelong.
- **Contact:** Exposure to a source of an infection. Transmission due to direct contact may occur when skin or mucous membranes touch, as in body contact, kissing and sexual intercourse. Disease transmitted by contact is also known as contagious disease.
- **Reservoir:** Reservoir of infection means the natural habit of an infectious agent where the infectious agent may survive or multiply. It may be human, animal or inanimate environment, such as soil.
- **Pathogen:** A microorganism capable of causing disease is a pathogen; those that do not cause disease and are part of the normal flora are known as nonpathogens. Opportunistic pathogens are microbes, which are capable of causing disease only when the host resistance is compromised.
- **Epidemic:** Occurrence of a disease in a community area, clearly in excess of what is expected. This is also referred to as an outbreak. A worldwide epidemic is known as pandemic.
- **Eradication:** Extermination of an infectious agent resulting in cessation of transmission of infection altogether from given area.

INTRODUCTION

Epidemiology is the study of the distribution and determinants of disease frequency in human populations. Interest in frequency or occurrence of disease derives largely from a basic tenet of epidemiology, namely that disease does not develop at random. In essence, all persons are not equally likely to develop a particular disease. The level of risk for different individuals typically is a function of their personal characteristics and environment. The epidemiologist's

JAYPEE BROTHERS

perspective of the relationship between exposure to risk factors and the development of disease in human populations may appear rather crude in comparison to exacting research performed at the molecular level. Indeed, epidemiology is not particularly useful for characterizing the precise biologic mechanisms of disease development.

HISTORY OF EPIDEMIOLOGY AND POPULATION HEALTH

- **1849–54:** John Snow formed and tested the hypothesis on the origin of cholera in London—one of the first studies in analytic epidemiology
- **1910:** Flu pandemic
- **1920:** Goldberger published a descriptive field study showing the dietary origin of pellagra
- **1940s:** Fluoride supplements added to public water supplies in randomized community trials
- **1949:** Initiation of the Framingham study of risk factors for cardiovascular disease
- **1950:** Epidemiological studies link cigarette smoking and lung cancer, demonstrating the power of case-control study design
- **1954:** Field trial of the Salk polio vaccine—the largest formal human experiment
- **1959:** Mantel and Haenszel develop a statistical procedure for stratified analysis of case-control studies
- **1960:** McMahon published the first epidemiologic text with a systematic focus on study design
- **1964:** US Surgeon General's report on smoking and health establish criteria for evaluation of causality
- **1970:** Large community-based trials implemented, such as North Karelia and Stanford Three Communities; worldwide eradication of smallpox
- **1980:** Chronic disease, injury and occupational epidemiology; HIV epidemic
- **1990:** Behavioral risk factor epidemiology; prevention of adverse health outcomes through policies and regulations; national programs in breast and cervical cancer prevention; tobacco epidemiology; emerging infectious diseases; criticism of epidemiology for being inconsequential ('small' risk ratios); standardization of surveillance methods; bovine spongiform encephalopathy (BSE), also known as mad cow disease in England and Europe; variant Creutzfeldt-Jacob disease (vCJD); aging of USA; disaster epidemiology.
- **2000:** Genetic and molecular epidemiology; health disparities; racialism; HIPAA in the USA; West Nile virus-bioterrorism; anthrax and smallpox threat and vaccinations
- **2003:** SARS, quarantines and public health law; and worldwide epidemiology; BSE in Canada—SARS recurrence; BSE in the USA; the flu epidemic
- **2009:** H1N1 pandemic

CONCEPT OF EPIDEMIOLOGY (FIG. 4.1)

Epidemiology is a compound of three Greek words 'epi' meaning upon, 'demos' meaning people, and 'logos,' meaning science. Thus on etymological basis, epidemiology is a science that deals with mass phenomena. This "definition" though not precise, is sufficiently broad-based to suit the expanding scope of epidemiology.

- Epidemiologists are concerned not only with death, illness, and disability, but also with more positive health status and, most importantly, with the means to improve health.
- The term "disease" encompasses all unfavorable health changes, including injuries and mental health.
- In simple terms, epidemiology is the study of how the disease is distributed in populations and the factors that influence or determine this distribution.
- Epidemiology is the study of the distribution and determinants of diseases within human populations. Research in this field is based primarily upon observing people directly in their natural environments.
- Epidemiology can be used for descriptive purposes, such as surveillance of the occurrence (incidence) of a particular illness.

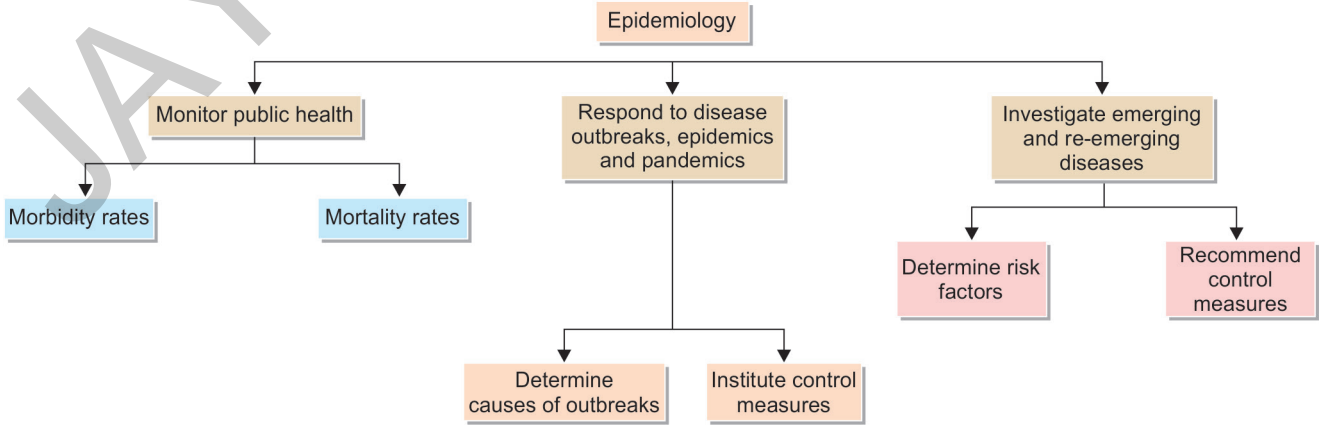


Fig. 4.1: Concept of epidemiology.

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- Epidemiology can be used for analytic purposes, such as studying risk factors for disease development.
- Epidemiologic methods can be used to assess the performance of diagnostic tests.
- Epidemiology can be used to study the progression or natural history of a disease.
- Epidemiologic methods can be used to study prognostic factors, which are determinants of the progression of a disease.
- Epidemiology can be used to evaluate treatments for a disease.

DEFINITIONS

Epidemiology has no single definition to which all epidemiologists subscribe; three components are common to most of them. First, studies of disease frequency; second, studies of the distribution and third, studies of the determinants.

- Epidemiology is a branch of medical science which treats of epidemics—Park, 1873.
- Epidemiology is the branch of science which deals with the mass phenomena of infectious diseases—Frost, 1927.
- Epidemiology is the study of the disease, any disease as a mass phenomenon—Greenwood, 1934.
- Epidemiology is the study of the distribution and determinants of disease frequency in man—McMahon, 1960.
- Epidemiology is defined as the study of the distribution and determinants of health-related states of events in specified populations and the application of this study to the control of health problems—John M Last, 1988.
- Epidemiology is the study of various factors and conditions that determine the occurrence and distribution of health, disease, defect, disability and death among groups of individuals—Clark, 1965.
- Epidemiology is the study of the distribution of a disease or a physiological condition in human population and of the factors that influence this distribution—Lilienfeld, 1980.

AIMS OF EPIDEMIOLOGY

According to the International Epidemiological Association, Epidemiology has three main aims:

1. To describe the distribution and size of disease problems in human populations.
2. To identify etiological factors in the pathogenesis of disease.
3. To provide the data essential to the planning, implementation, and evaluation of services for the prevention, control and treatment of disease and to the setting up of priorities among these services. The ultimate aim of epidemiology is to lead to effective action to eliminate or reduce the health problems or its consequences and to prevent its occurrence in future.

In brief, epidemiology is said to be concerned with all health and illness in population groups and with the factors including health services that affect them. The aims of epidemiology include knowledge of distribution of disease in order to elucidate causal mechanisms, explain local disease occurrence, describe the natural history of a disease, and provide guidance in the administration of health services. The following are human characteristics that are of concern to epidemiologists:

- Biological characteristics, such as biochemical level of blood, including antibodies and enzymes; cellular constituents of the blood; and measurement of physiological functions of different organ systems of the body.
- Demographic characteristics, such as age, sex, race, and ethnic group.
- Social and socioeconomic characteristics, such as status, education, occupation and nativity.
- Personal living habits, such as tobacco use, diet and exercises.

Factors other than personal characteristics useful in epidemiology for administrative purposes for the study of the etiology of disease include place or geography of the existence of an illness and its time or secularity. The interaction between person, place and time are also important in studying the causes of disease.

FUNCTIONS/USES OF EPIDEMIOLOGY

- To find causation of the disease
- To describe natural history
- Description of health status of populations
- Evaluation of intervention
- Community diagnosis
- Planning and evaluation
- Syndrome identification

OBJECTIVES OF EPIDEMIOLOGY

- To identify the etiology, or cause, of a disease and its relevant risk factors (i.e., factors that increase a person's risk for a disease)
- To intervene to reduce morbidity and mortality from the disease.
- To develop a rational basis for prevention programs based on identified etiologic or causal factors.
- To work on to reduce or eliminate exposure to those factors.
- To develop appropriate vaccines and treatments, that can prevent the transmission of the disease to others?
- To determine the extent of disease found in the community
- To help plan health services and facilities for effective healthcare facilities.
- To study the natural history and prognosis of the disease
- To define the baseline natural history of a disease in quantitative terms so that as we develop new modes of intervention, either through treatments or through new ways of preventing complications.

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- To help compare the results of using new modalities with the baseline data to determine whether new approaches have truly been effective.
- To evaluate both existing and newly developed preventive and therapeutic measures and modes of healthcare delivery.
- To help provide the foundation for developing public policy relating to environmental problems, genetic issues, and other social and behavioral considerations regarding disease prevention and health promotion.

COMPONENTS OF EPIDEMIOLOGY

- **Population:** The main focus of epidemiology is on the effect of disease on the population rather than individuals. For example, malaria affects many people in Ethiopia but lung cancer is rare. If an individual develops lung cancer, it is more likely that he/she will die. Even though lung cancer is more killer, epidemiology gives more emphasis to malaria since it affects many people.
- **Frequency:** This shows that epidemiology is mainly a quantitative science. Epidemiology is concerned with the frequency (occurrence) of diseases and other health related conditions. Frequency of diseases is measured by morbidity and mortality rates.
- **Health-related conditions:** Epidemiology is concerned not only with disease but also with other health-related conditions because everything around us and what we do also affects our health. Health-related conditions are conditions which directly or indirectly affect or influence health. These may be injuries, births, health related behaviors like smoking, unemployment, poverty, etc.
- **Distribution:** It refers to the geographical distribution of diseases, the distribution in time, and distribution by type of persons affected.
- **Determinants:** Determinants are factors which determine whether or not a person will get a disease.
- **Application of the studies to the promotion of health and to the prevention and control of health problems:** This means the whole aim in studying the frequency, distribution, and determinants of disease is to identify effective disease prevention and control strategies.

TYPES OF EPIDEMIOLOGY

- **Descriptive epidemiology:** Examining the distribution of disease in a population, and observing the basic features of its distribution.
- **Analytic epidemiology:** Investigating a hypothesis about the cause of disease by studying how exposures relate to disease.
- **Experimental epidemiology:** It deals with experimental confirmation of the cause-effect associations upheld by observational studies of analytical epidemiology.
- **Applied epidemiology:** It deals with the use and application of information collected through descriptive, observation and experimental studies.
- **Constructive epidemiology:** It deals with the application of epidemiological methodology in the investigation of epidemics and their management during epidemic and interepidemic phases.

BASIC TOOLS OF MEASUREMENT IN EPIDEMIOLOGY

Incidence

It is number of *NEW* cases occurring in a defined population during a specified period of time.

Formula of incidence: (No. of NEW cases in a defined population during a specified time period)/(Population at risk during the same time period) × 1000

Prevalence

It refers to ALL the cases (old and new) present in a population at a given period of time.

Formula of prevalence: (No. of All cases in a defined population during a specified time period)/(Mid-interval population at risk) × 1000

Uses of 'Incidence'

Incidence can be used:

- As the indicator of health services as it usually responds earlier than prevalence
- In research for 'risk factors' or cause
- For checking the efficacy of therapeutic of preventive measures, e.g., comparing the incidence of disease among the vaccinated and the unvaccinated.

Uses of 'Prevalence'

Prevalence can be used for:

- Measuring the disease burden in the community
- For prioritizing the health problems of the population, e.g., the amounts of TB, leprosy, etc. Indian have made the government give them a higher priority
- It is needed for planning health services, e.g., number of beds needed for the particular disease, amount of medicines needed in the store.

Measurements of Mortality

- Crude death rate (CDR)
- Specific death rates
- Case fatality ratio (CFR)
- Proportional mortality rate (PMR)
- Survival rates
- Standardized death rate (SDR)
- Standardized mortality ratio (SMR)

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Formulas for the Above Death Rates

Crude death rate: Number of deaths from any cause, per 1000 population in one year, in a defined population (No. of deaths in one year in a specified area)/(Mid-year population of the specified area during the same year) × 1000

Specific Death Rates

- **Cause specific death rate**, e.g., tuberculosis death rate (No. of deaths due to the cause in one calendar year in a specified area)/(Mid-year population of the specified area during the same calendar year) × 1000
- **Age specific death rate**, e.g., death rate in the reproductive age group (No. of deaths in the age group 15–44 years, in one year in a specified area)/(Mid-year population of the 15–44 years old, during the same year)) × 1000
- **Death rate for a month, e.g., in January** (No. of deaths in January × 12)/(Mid-year population) × 1000
- **Weekly death rate** (No. of deaths in the given week × 52)/(Mid-year population) × 1000
- **Proportional mortality ratio:** [No. of deaths due to the cause (or in a particular group)]/(total no. of deaths during the same year in the same population) × 1000
- **Case fatality ratio (CFR):** (No. of deaths due to the particular disease in one year in a specified area)/(No. of cases diagnosed with the disease in the same year and area) × 1000

PRINCIPLES OF EPIDEMIOLOGY

- Epidemiology is the study of occurrence distribution and causes of disease of mankind. It is mainly concerned with the preventive and social science, an important aspect of community medicine. Epidemiology focuses on population or community to measure the distribution and determinants of disease for the purpose of preventing disease and promoting health.
- Epidemiology approach offers the community health nurses a theoretical basis or framework implementing and evaluating health care at community level.
- Primary purpose epidemiology is disease prevention and early intervention for the maintenance and promotion of health by which the ultimate aim that is the well-being of the society can be achieved.
- Epidemiological difference between infectious and non-infectious diseases mainly depends on the element of time. In comparison to infectious disease, noninfectious diseases have long incubation period and a lower frequency of occurrence.
- Epidemiological process **(Fig. 4.2)** in which the epidemiological investigation takes place in six steps:
  1. Establishing the occurrence of a problem
  2. Verifying the diagnosis
  3. Collecting related data

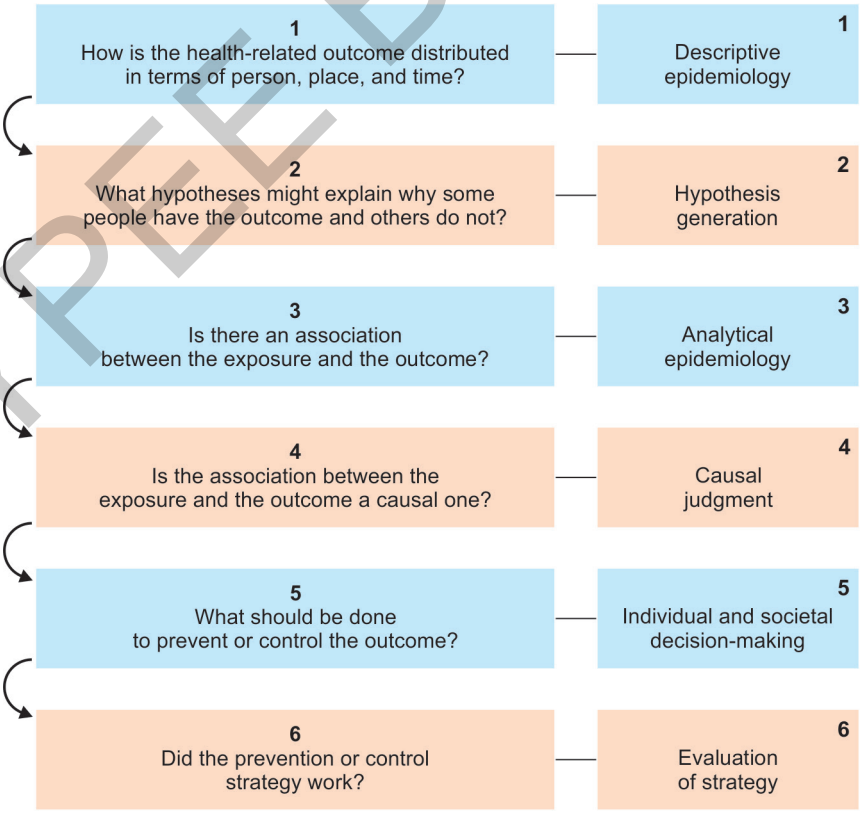


Fig. 4.2: Epidemiological process.

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4. Describing the occurrence in terms of person, place and time
5. Formulating a hypothesis
6. Testing the hypothesis

- Epidemiological study methods can be classified in different ways and there is no strict limitation about any classification.
- Epidemiological measurements are so many criteria or standards are set also used for these measurements. The main measurements have concern with mortality and morbidity.

SCOPE OF EPIDEMIOLOGY

- Epidemiology has very wide scope, wider than what is normally conceived. Besides communicable and noncommunicable diseases, the field of epidemiology covers all other health related states and events, such as alcoholism, drug abuse, accidents, divorces, migrations, etc.
- Epidemiology studies the distribution of health-related states and events. The distribution is viewed in three epidemiological dimensions of time, place and person.
- Epidemiology studies the determinants of health-related states and event. These determinants are identified by observing the distribution pattern of diseases and verifying cause-effect relationships.
- Epidemiology finds application in the control of health problems. Having identified the determinants and their cause-effect relationships, epidemiological principles guide the formulation of appropriate interventional strategies for the prevention and control of health problems.

DICHOTOMIES IN EPIDEMIOLOGICAL STUDIES

When designing epidemiologic studies, choices must be made about the role of the investigator, the purpose of the study, the hypothesis regarding exposure, and the unit of analysis. Here are some examples:

Role of Investigator

- **Observational:** The investigator does not manipulate the exposure of participants to risk factors. Most epidemiological studies are observational.
- **Experimental:** According to the study design, the investigator manipulates the exposure of participants to some factor. Clinical trials and intervention studies are examples of such experiments. If the study participants themselves act to change their exposure to an influence, a *natural experiment* may occur. For example, a study of persons who have migrated from one environment to another could constitute a natural experiment.

Purposes of the Study

- **Descriptive:** Describes the distribution of disease by time, place, person; used to generate hypotheses of disease causation or for health planning
- **Analytic:** Measures and tests the association between a hypothesized risk factor and a disease.

Hypothesized Effect of Exposure

- **Harmful:** Exposure increases risk or presence of disease
- **Beneficial:** Exposure reduces risk or presence of disease.

Unit of Analysis

- **Individual:** The individual (e.g., person, animal) is the unit of analysis; potential to ignore the impact of the community or group effect on individual risk
- **Community:** The community (e.g., county, hospital) is the unit of analysis. There is potential for ecological fallacy in such studies. Lacking individual data, assuming that individuals perform similarly to the average of the group may not be true.

EPIDEMIOLOGY IN COMMUNITY NURSING

Epidemiology and nursing are important for the attainment of optimal health of the individuals, families and communities. But the approach may be different to achieve this goal. Nursing is as old as mankind. Epidemiology is also an older concept that is found in the health field since third century BC.

Epidemiology aims at describing the occurrence of disease, risk identification and providing data for prevention and control. Community health nursing has the greater concern with the occurrence of disease, health problems and risk factor prevalent in the community. Both epidemiology and nursing needs community participation.

The recent nursing is more inclined to community's healthcare setting, as it is necessary to raise the health status of the individual and the nation. Thus, both epidemiology and nursing are utmost essential in the field of health science. Nursing and epidemiology are closely related, mutually helpful, and inseparable and have coexistence. Epidemiology describes the future trends of disease and recommends the specific control measures, which are based upon the epidemiological studies. Nursing researches also provide the clues and steps for prevention of the diseases. Community health nurse is a key person in the health information system as well as in health management.

USES OF EPIDEMIOLOGY

Epidemiology process is bound to continue in future adding new challenges to the practice of public health. In these circumstances, epidemiology is designed to play an increasingly important role in defining the magnitude of the problems, forecasting their long-term consequences and deriving appropriate strategies for their promotion and control. Presently the use of epidemiology is mainly confined to following areas:

- **Disease antecedents:** Epidemiology has always stressed the importance of exploring the natural history of disease,

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entirely, with special stress on the identification of disease antecedents rather than disease consequents.

- **Disease correlates:** Epidemiology has revolutionized the concept of etiology and etiogenesis. Epidemiological studies identified a variety of disease correlates not all of which are casually associated diseases and some of which behave as risk factors. The risk factors increase the probability of contracting a particular disease.
- **Disease behavior:** Epidemiological surveillance is applied to disease of international significance. Disease behavior is studied by a process of epidemiological surveillance whereby diseases are kept under constant observation; firstly, to identify their normal distribution patterns and normal temporal fluctuations, and secondly, to detect any deviation in their expected behavior patterns.
- **Disease causation:** Epidemiological studies not only establish cause-effect association of many non-communicable diseases, but also estimate the strength of associations in terms of relative and absolute risks. The most notable example are the cause-effect associations established by epidemiological studies between smoking and lung cancer, and smoking and coronary heart diseases, etc.
- **Strategy formulation:** Epidemiology plays an important role in strategy formulation for disease control programs and improves program efficiency and effectiveness. Control and eradication of disease is much more complex than their prevention or treatment. A sound control strategy is one that is epidemiologically relevant and operationally feasible.
- **Program evaluation:** Program performance is evaluated by measuring achievements in various operational areas of the program. Evaluation of public health program is both managerial and an epidemiological process.

ADVANTAGES OF EPIDEMIOLOGY

- Epidemiology provides framework within which basic science and behavioral science can be used for community nursing practice.
- Epidemiology provides an interdisciplinary language to promote interprofessional communication and trust.
- Public health principle of family is the unit of society. Prevention and control of disease and health promotion are activated and quantifies through epidemiological approach.
- The epidemiologic model promotes understanding the relationship between the environment and agents that expose susceptible populations at risk of impediments to health.
- The epidemiology helps to plan effective need-based healthcare services on the basis of epidemiological information regarding frequencies and distribution of disease and disabilities, their associated factors and causes.
- The epidemiology helps to determine the effectiveness of healthcare services planned and implemented on the basis of predetermined criteria regarding its relevance, effectiveness, efficiency and impact on community health. This can helps to plan better services in future.
- Nursing process is extended through application of epidemiological methods to describe community needs and evaluate nursing services.
- An epidemiological perspective provides a method of extending the relationship of family problems to community welfare.
- The epidemiology helps to identify syndrome by describing the distribution and association of clinical phenomena in the population.
- The epidemiology helps to determine the usefulness and effectiveness of new innovative techniques, measures and programs.

Studies	*Advantages*	*Disadvantages*
Qualitative research	Generates hypotheses and initial exploration of issues in participants' own language without bias of investigator	Cannot test study hypotheses Can explore only what is presented or stated Has potential for bias
Cross-sectional surveys	Are fairly quick and easy to perform Are useful for hypothesis generation	Do not offer evidence of a temporal relationship between risk factors and disease Are subject to late-look bias Are not good for hypothesis testing
Ecological studies	Are fairly quick and easy to perform Are useful for hypothesis generation	Do not allow for causal conclusions to be drawn because the data are not associated with individual persons Are subject to ecological fallacy Are not good for hypothesis testing
Cohort studies	Can be performed retrospectively or prospectively Can be used to obtain a true (absolute) measure of risk Can study many disease outcomes and are good for studying rare risk factors	Are time-consuming and costly (especially prospective studies) Can study only the risk factors measured at the beginning Can be used only for common diseases May have losses to follow-up
Case-control studies	Are fairly quick and easy to perform Can study many risk factors Are good for studying rare diseases	Can obtain only a relative measure of risk Are subject to recall bias Selection of controls may be difficult Temporal relationships may be unclear Can study only one disease outcome at a time

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Studies	*Advantages*	*Disadvantages*
Randomized controlled trials	Are the "gold standard" for evaluating treatment interventions (clinical trials) or preventive interventions (field trials) Allow investigator to have extensive control over research process	Are time-consuming and usually costly Can study only interventions or exposures that are controlled by investigator May have problems related to therapy changes and dropouts May be limited in generalizability Are often unethical to perform at all
Systematic reviews and meta-analysis	Decrease subjective element of literature review Increase statistical power Allow exploration of subgroups Provide quantitative estimates of effect	Mixing poor quality studies together in a review or meta-analysis does not improve the underlying quality of studies
Cost-effectiveness analysis	Clinically important	Difficult to identify costs and payments in many healthcare systems

EPIDEMIOLOGICAL APPROACHES

The epidemiological approach to problems of health and disease is based on two major foundations:

1. Asking questions
2. **Making comparisons:** The community health nurse or any health worker need to bear in mind always to use what is known as epidemiological approach in the control of communicable diseases, which includes finding out the source of infection. For this, community health nurse needs to have a guide in the following manner of questioning:
   - When did the disease occur?
   - Where did the disease occur?
   - Who were the people affected?
   - Why should it appear?
   - What should be done to prevent the spread?

Asking questions and making observations: Epidemiological studies are done to know the incidence and prevalence of disease in the various subgroups of population by time, place and person.

Epidemiologist asks variety of questions and makes observation related to nature and extend (magnitude) of the problem, geographical distribution (where?) time trends (when?) and personal characteristics of people who get the disease (who?). Answer to these questions would help in finding clues to the determinants of disease, which are further evaluated.

Making comparisons: The basic approach in epidemiology is to make comparisons and draw inferences. This may be comparison of two or more groups—one group having the disease (or exposed to risk factor) and the other groups not having the disease (or not exposed to risk factors), or comparison between individuals. Making comparison is another approach which is very important in epidemiological studies, especially analytical and experimental studies to test etiological hypothesis of various disease and evaluate the effectiveness of preventive and therapeutic measures. The similar group for comparison can be obtained either by random selection method or by matching selected characteristics, which might affect the results and interpretation.

Epidemiological Methods

Epidemiological methods are applied to know the disease etiology. Various epidemiological studies can be conducted to find out the occurrence of disease in people or persons, which may be involved in process of spreading the disease. Epidemiological study methods can be classified in different ways and there are no strict limitations about any complements.

Descriptive Method

This method of epidemiological study is concern with the study of frequency and distribution of disease and health related events in population I terms of person, place and time. Descriptive method is the first phase of an epidemiological investigation. It concerned with observing the distribution of disease or health-related characteristics with which the disease in question seems to be associated.

Descriptive epidemiology deals with the distribution of health-related states and events by time, place and person. Distribution of cases by time of their appearance gives the time trend of disease.

The time trends commonly observed are epidemic, seasonal, cyclical and secular.

Objectives of Descriptive Method

- To provide a database for planning, providing and evaluating health services.
- To evaluate the trends in health sector and provide a basis for comparisons among groups.
- To identify problems for further analysis.

Data Collection in Descriptive Method

- Personal characteristics, such as age, sex, race, marital status, occupation, education, income, social class, dietary pattern, habits, etc.
- Place distribution of cases, i.e., areas of high concentration, low concentration and spotting cases in the map
- Time distribution trends, such as year, season, month, week, day and hour of onset of the disease.

Analytical Method

Analytical studies are more specific in focus, test hypothesis and attempt to determine casual factors of disease.

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Analytical method is contrast to descriptive studies that look at entire population, in analytical studies the subject of interest is the individuals within the population.

Analytical method is carried out to test the hypothesis. These hypotheses are formulated on the information gathered from the descriptive method.

Approaches of Analytical Method

Case control study: It is often called retrospective study which is the common and first approach to test casual hypothesis. A case control study is a longitudinal, observational enquiry undertaken to verify the existence as well as the strength of cause-effect associations in disease phenomena.

Case control studies are used for:

- Estimating the risk of exposure to various factors associated with disease phenomena.
- Identify the modifiable causal factors that can be arrested in the interest of public health.
- Evolving risk intervention strategies for prevention and control of public health problems.

Cohort study: Cohort study is another type of analytical study, which is usually undertaken to obtain additional evidence to refuse or support the existence of an association between suspected cause and disease. Cohort study is known by variety of names—prospective study, longitudinal study, incidence study and forward-looking study.

Cohort study is useful for:

- Estimating directly the risk of exposure to various factors associated with disease phenomena.
- Exploring the natural history of disease in entirely and identifying additional pathological events to complete the natural history.
- Identifying appropriate outcome events in the natural history of diseases for appropriate intervention for disability limitation.
- Identifying modifiable causal factors for evolving appropriate risk intervention strategies.

Experimental Method

It involves some action intervention or manipulation, such as deliberate application or withdrawal of the suspected cause or changing one variable the causative chain in the experimental group while making no change in the control group observing and comparing the outcome of the experiment in both the groups.

An experimental method is a longitudinal interventional process of trial or verification, undertaken to confirm cause-effect relationship of disease phenomena or to evaluate the efficiency of various preventive or curative procedures or programs applicable in hospital or community settings.

Experimental studies are used for:

- Confirming cause effect associations or judging the validity of hypotheses established by observational studies.
- Evaluating various treatment modalities and interventional procedures applicable in hospital situations.
- Evaluating the feasibility, efficacy and relevance of various preventive programs of public health significance.
- Evaluating the feasibility, efficacy and relevance of various risks, intervention approaches of public health importance.

PREVENTIVE EPIDEMIOLOGY

- **Health surveys** are investigation to identify frequency, distribution and the determinants of health-related events or states in the community. Health survey helps in knowing the community and making diagnosis. The health survey can be collected by using questioning, health examination and laboratory investigation, record review and observation.
- **Screening** is testing for infection or disease in population or in individuals who are not seeking healthcare for example serological testing for AIDS virus in blood donors. The screening is used in case detection, control of disease research purposes and provide opportunities for creating public awareness and for educating health professionals.
- **Surveillance:** It means close vigilance on occurrence and distribution of diseases and health-related problems, population dynamics, community behavior and environmental processes, resulting in increased risk of ill health in the community. It involves identification of missed and suspected cases and contacts, their confirmation by laboratory investigations, identifying source of infection and channel of transmission.
- **Monitoring** helps in keeping a continuous tract of health related states or events and accordingly plan replan and take correct measures. Epidemiologically, monitoring is specific and essential part of surveillance.

IMPORTANCE OF EPIDEMIOLOGY

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- **Program evaluation:** Program performance is evaluated by measuring achievements in various operational areas of the program. Evaluation of public health program is both managerial and epidemiological process.

DISEASE CYCLE

This cycle includes phases of growth, consolidation, change of structure, multiplication/reproduction, spread, and infection of a new host. The combination of these phases is called the development of the pathogen. The transmission of pathogens from current to future host follows a repeating cycle. This cycle can be simple, with a direct transmission from current to future host, or complex, where transmission occurs through (multiple) intermediate hosts or vectors. This cycle is called the transmission cycle of disease, or transmission cycle. The transmission cycle has different elements:

- **Pathogen:** The organism causing the infection
- **Host:** The infected person or animal 'carrying' the pathogen
- **Exit:** The method of the pathogen uses to leave the body of the host
- **Transmission:** How the pathogen is transferred from host to susceptible person or animal, which can include developmental stages in the environment, in intermediate hosts, or in vectors
- **Environment:** The environment in which transmission of the pathogen takes place
- **Entry:** The method the pathogen uses to enter the body of the susceptible person or animal. The susceptible person or animal. The potential future host who is receptive to the pathogen.

MODES OF DISEASE TRANSMISSION

Communicable disease may be transmitted from the reservoir or source of infection to a susceptible individual in many different ways, depending upon the infectious agent, portal entry and the local ecological conditions.

- **Direct contact:** Infection may be transmitted by direct contact from skin to skin, mucosa to mucosa or mucosa to skin of the same or another person. For example, during touching, kissing, sexual intercourse (STD, AIDS, leprosy, skin infections) and scratching through fingers.
- **Droplet infection:** Droplet infection occurs due to contact transmission by infections agents contained in most respiratory secretions. The microorganisms from nasopharyngeal secretions during coughing, sneezing, speaking and spitting into the surrounding atmosphere (e.g., respiratory infections, TB, meningitis, etc.).
- **Contact with soil:** Infectious agent (microorganisms) present in soil can cause disease, when the host comes into contact with soil (e.g., hookworm, tetanus, etc.)
- **Inoculation into skin or mucosa:** The disease agent may be inoculated directly into the skin or mucosa. Transmission of infection occurs by direct inoculation into skin with syringe, needles or animal bite, e.g., rabies virus infection after dog.
- **Transplacental (vertical):** Transmission of infectious agent can occur transplacentally.

SPECTRUM OF DISEASE

Natural history of disease refers to the progression of a disease process in an individual overtime, in the absence of treatment. For example, untreated infection with HIV causes a spectrum of clinical problems beginning at the time of seroconversion (primary HIV) and terminating with AIDS and usually death. It is now recognized that it may take 10 years or more for AIDS to develop after seroconversion. Many, if not most, diseases have a characteristic natural history, although the timeframe and specific manifestations of disease may vary from individual to individual and are influenced by preventive and therapeutic measures.

The onset of symptoms marks the transition from subclinical to clinical disease. Most diagnoses are made during the stage of clinical disease. In some people, however, the disease process may never progress to clinically apparent illness. In others, the disease process may result in illness that ranges from mild to severe or fatal. This range is called the spectrum of disease. Ultimately, the disease process ends either in recovery, disability or death **(Fig. 4.3)**.

DISEASE CAUSATION

A number of models of disease causation have been proposed. Among the simplest of these is the epidemiologic

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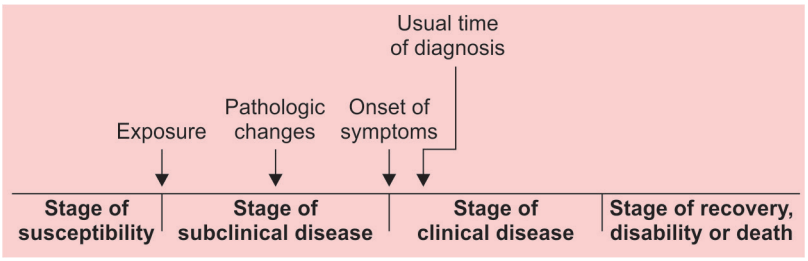


Fig. 4.3: Epidemiological triad.

triad or triangle, the traditional model for infectious disease. The triad consists of an external agent, a susceptible host, and an environment that brings the host and agent together. In this model, disease results from the interaction between the agent and the susceptible host in an environment that supports transmission of the agent from a source to that host.

Cause of Disease

It is an event, condition, characteristic or a combination of these factors which plays an important role in producing the disease. The causes of disease can be classified into two:

1. **Primary causes:** These are the factors which are necessary for a disease to occur, in whose absence the disease will not occur. The term "etiologic agent" can be used instead of primary cause for Infectious causes of diseases. For example "*Mycobacterium tuberculosis*" is the primary cause (etiologic agent) of pulmonary tuberculosis.
2. **Risk factors (contributing, predisposing, or aggravating factors):** These are not the necessary causes of disease but they are important for a disease to occur. A factor associated with an increased occurrence of a disease is risk factor for the exposed group; and a factor associated with a decreased occurrence of a disease is a risk factor for the nonexposed group. Risk factors could be related to the agent, the host and the environment.

EPIDEMIOLOGICAL TRIAD (FIG. 4.4)

The etiology of a disease is the sum total of all the factors (primary causes and risk factors) which contribute to the occurrence of the disease. It is the interaction of the agent, the host, and the environment which determines whether or not a disease develops, and this can be illustrated using the epidemiologic triangle. The epidemiology demands a broader concept of disease causation that synthesized the basic factors of agent, host and environment. An individual's health is never static and is always in a dynamic equilibrium with his environment. The condition of health is seen as the resultant of various ecologic interactions which determines the health status of the human body.

- **Agent factors:** Disease causing agent are in the environment may be classified into the following categories. Inanimate group of agents are mainly responsible for non-communicable diseases, such as physical agents, chemical agents, nutritional agents.
  - *Physical agents*—heat, light, radiation, etc.
  - *Chemical agents*—acids, alkalies, metals, etc.
  - *Nutritional agents*—lack or excess nutritional factors.
  - *Biological agents*— the disease caused are always transmissible from one individual to another individual. Therefore, they are called communicable diseases. Some of the communicable diseases are transferable only through another medium like insects, where the agents undergo certain changes in their life cycle.
- **Environmental factors:** Environment is the aggregate of all external conditions and influence factors affecting the life and development of an organism. It is classified as below:
  - *Physical environment*—all those inanimate objects like air, water, food, etc.
  - *Biological environment*—all those animate objects like animals, insects and other humans.
  - *Socioeconomic environment*—social and economic factors like housing, social group, education, etc.

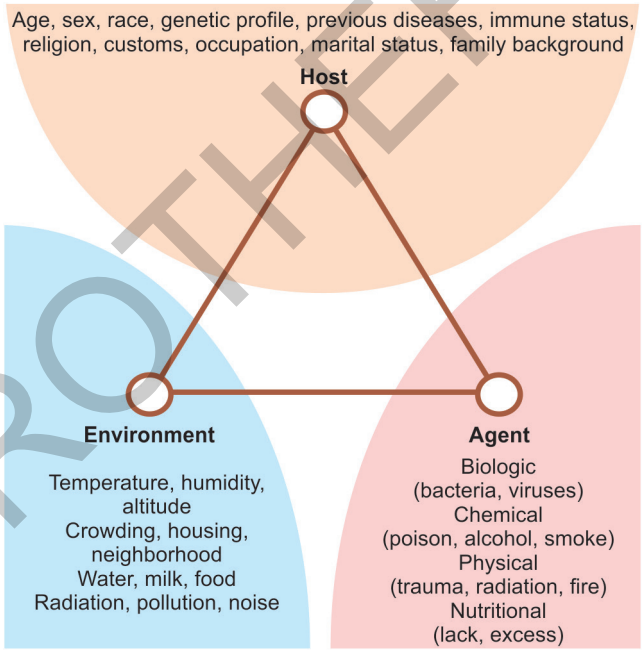


Fig. 4.4: Epidemiological triad.

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- **Host factors:** Age, sex, habits and customs, general and specific defense mechanism, genetic makeup and psychobiological characteristics of the host are some of the important factors which determine the outcome of interaction between the agents and host in a suitable environment.

NATURAL HISTORY OF DISEASES

Every disease has a period before man is involved and this is called the 'period of prepathogenesis where the interrelations, of the various agents, host and environmental factors which bring the agent and host that follow, will take place. If the host is able to withstand the stimulus the disease process will not be allowed to progress. If the agent takes the upper hand the disease progresses within the tissue and physiological changes in the body.

- During the early part of this period (early pathogenesis), the disease will not be recognized (unless special examinations like the vaginal test, i.e., PAP test in the detection of cervical cancer are available), may be missed.
- Further progression of the disease produces signs and symptoms of the disease.
- This may progress further, if not recognized and treated early, into disability, defect or death, or to a complete recovery without any disability depending on the host factors and effectiveness of treatment taken.
- Disease results from a complex interaction between man, an agent (or cause of disease) and the environment. The term natural history of disease is a key concept in epidemiology.
- Each disease has its own unique natural history, which is not necessarily the same in all individuals, so much so any general formulation of the natural history of disease is necessarily arbitrary.

Prepathogenesis Phase (Fig. 4.5)

Prepathogenesis phase is a period preliminary to the onset of disease in man. The disease agent has not yet entered man, but the factors which favor its interaction with the human host already exist in the environment. The causative factors of disease may be classified as agent, host and environment. Prepathogenesis period is not sufficient to start disease in man. There is an interaction of these factors to initiate the disease process in man.

Pathogenesis Phase

Pathogenesis phase begins with the entry of the disease agent in the susceptible human host. The further events in the pathogenesis phase are clear cut in infectious disease. The disease agent multiplies and induces tissue and pathological changes. The disease progresses through a period of incubation and later through early and late pathogenesis. The final outcome of the disease may be recovery, disability or death.

Four Stages in the Natural History of a Disease

The "natural history of disease" refers to the progression of disease process in an individual over time, in the absence of intervention. There are four stages in the natural history

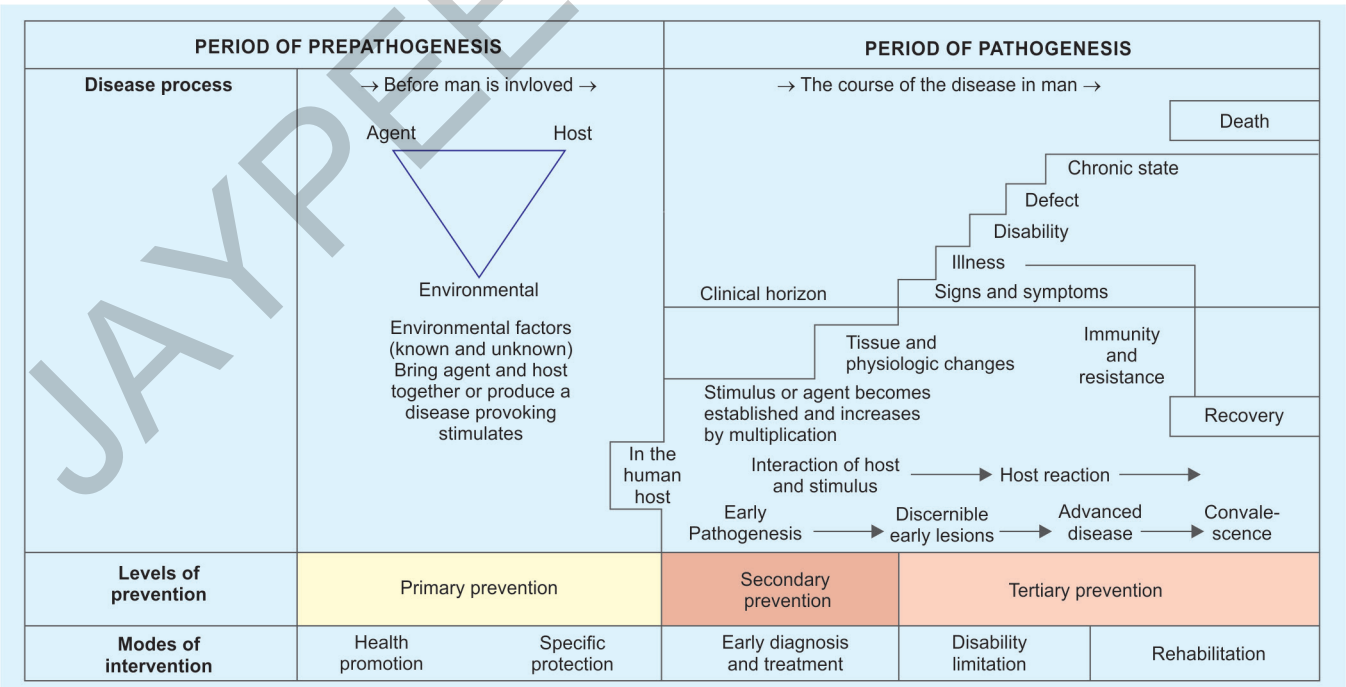


Fig. 4.5: Levels of health prevention.

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THE NATURAL HISTORY OF ANY DISEASE OF MAN				
Interrelations of agent, host, and environmental factors Production of STIMULUS		Reaction of the HOST to the STIMULUS Early pathogenesis	Discernible early lesions	Advanced disease / Convalescence
Prepathogenesis period		**Period of pathogenesis**		
Health promotion	**Specific protection**	**Early diagnosis and Prompt treatment**	**Disability limitation**	**Rehabilitation**
Health education Good standard of nutrition adjusted to developmental phases of life Attention to personality development Provision of adequate housing, recreation and agreeable working conditions Marriage counseling and sex education Genetics Periodic selective examinations	Use of specific immunizations Attention to personal hygiene Use of environmental sanitation Protection against occupational hazards Protection from accidents Use of specific nutrients Protection from carcinogens Avoidance of allergens	Case-finding measures, individual and mass Screening surveys Selective examinations **Objectives:** To cure and prevent disease processes To prevent the spread of communicable diseases To prevent complications and sequelae To shorten period of disability	Adequate treatment to arrest the disease process and to prevent further complications and sequelae Provision of facilities to limit disability and to prevent death	Provision of hospital and community facilities for retraining and education for maximum use of remaining capacities Education of the public and industry to utilize the rehabilitated As full employment as possible Selective placement Work therapy in hospitals Use of sheltered colony
Primary prevention		**Secondary prevention**		**Tertiary prevention**
Levels of application of Preventive measures				

Fig. 4.6: History of natural causes of illness.

of a disease. These are: (1) Stage of susceptibility, (2) Stage of pre-symptomatic (subclinical) disease, (3) Stage of clinical disease, and (4) Stage of disability or death **(Fig. 4.6)**.

1. **Stage of susceptibility:** In this stage, disease has not yet developed, but the groundwork has been laid by the presence of factors that favor its occurrence. For example, unvaccinated child is susceptible to measles.
2. **Stage of presymptomatic (subclinical) disease:** In this stage, there are no manifestations of the disease but pathologic changes (damages) have started to occur in the body. The disease can only be detected through special tests since the signs and symptoms of the disease are not present.
   Examples:
   - Detection of antibodies against HIV in an apparently healthy person.
   - Ova of intestinal parasite in the stool of apparently healthy children.

   The presymptomatic (subclinical) stage may lead to the clinical stage, or may sometimes end in recovery without development of any signs or symptoms.
3. **Clinical stage:** At this stage, the person has developed signs and symptoms of the disease. The clinical stage of different diseases differs in duration, severity and outcome. The outcomes of this stage may be recovery, disability or death.
   Examples:
   - Common cold has a short and mild clinical stage and almost everyone recovers quickly.
   - Polio has a severe clinical stage and many patients develop paralysis becoming disabled for the rest of their lives.
   - Rabies has a relatively short but severe clinical stage and almost always results in death.
   - Diabetes mellitus has a relatively longer clinical stage and eventually results in death if the patient is not properly treated.
4. **Stage of disability or death:** Some diseases run their course and then resolve completely either spontaneously or by treatment. In others, the disease may result in a residual defect, leaving the person disabled for a short or longer duration. Still, other diseases will end in death. Disability is limitation of a person's activities including his role as a parent, wage earner, etc.
   Examples:
   - Trachoma may cause blindness
   - Meningitis may result in blindness or deafness. Meningitis may also result in death.

LEVELS OF DISEASE PREVENTION

The disease process, in many instances is susceptible to interruption in order to limit its further progress or the speed of its progression. As disease involves interaction of host, agent and environment, prevention can be achieved by altering one or more of these three elements so that interaction does not take place or is interrupted in favor of the host. Effective preventive measure requires that the disease process be interrupted as early in its course as possible.

The interaction between the agent and the host can be avoided either by the elimination of the agent in the environment or by converting the human host immune to the attack of the agent.

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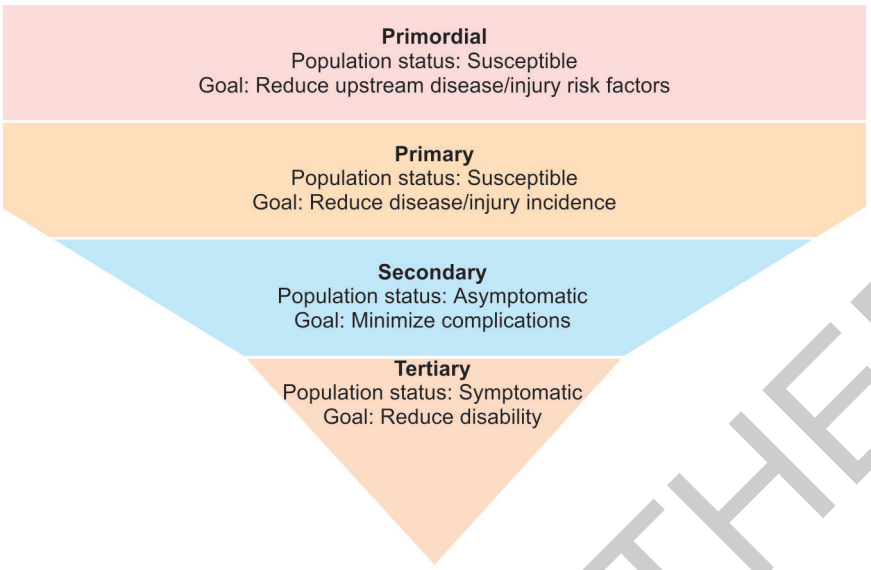


Fig. 4.7: Phase of illness prevention.

Those attempts to bring about changes in the three elements before the disease stimulus is produced are grouped under one type of prevention, namely primary prevention. When the disease stimulus has already been practiced and the disease process has crossed over to the period of pathogenesis measures taken are grouped under two types of prevention, namely secondary and tertiary prevention **(Fig. 4.7)**.

Primary Prevention

Primary prevention can be defined as an action taken prior to the onset of disease which removes the possibility that a disease will ever occur. It signifies intervention in the prepathogenesis phase of a disease or health problem or other departure from health. Primary prevention is applied at the prepathogenic period; it includes health promotion and specific protection.

- **Health promotion:** The first level of prevention is by promoting and maintaining the health of the host by nutrition, health education, good heredity and other health promotion activities.
- **Specific protection:** It may be directed towards the agent like disinfection of contaminated particles, materials water, food and other particles on the assumption that the agent has escaped into these vehicles or environment. Specific protection can also be achieved by immunizations to increase the resistance of the host so that the host will be able to withstand the onslaught of the agent. This is done by the active and passive immunizations.

Secondary Prevention

Secondary prevention can be defined as an action which halts the progress of a disease at its incipient stage and prevents complications. The specific interventions are early diagnosis, e.g., screening tests, case-finding programs) and adequate treatment. The secondary prevention is done by early diagnosis and treatment. Early diagnosis and prompt treatment comes under secondary prevention. If primary prevention fails or when suitable measures are not available (as in cancer) the disease stimulus is bound to be produced. Early detection of the disease is possible by periodic examinations of population groups who are at special risks like antenatal mothers, growing children, industrial worker, etc.

Monitoring of persons of middle age and above is one of the modern methods of early detection of cancer. In many instances, this detection of the diseases condition is possible only after the onset of the signs and symptoms. Early detection of the disease ensures prompt treatment so that the disease will not progress further.

Tertiary Prevention

When the disease process has advanced beyond its early stages, it is still possible to accomplish prevention by what might be called tertiary prevention. It signifies intervention in the late pathogenesis phase. Tertiary prevention can be defined as all measures available to reduce or limit impairment and disabilities, from good health and to promote the patient's adjustments to irremediable conditions. Tertiary prevention includes disability limitation and rehabilitation.

Disability limitation: It is necessary that the disability that is caused should be limited by active medical or surgical treatment so that there is no further deterioration of the health.

Rehabilitation: Those with permanent disability as in the case of leprosy, tuberculosis, polio, mental retardation, etc.,

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will not be able to lead an independent life unless they are rehabilitated. This level will be needed only when it has failed in the application of previous levels of prevention.

CONTROL OF INFECTIOUS DISEASES

The control of communicable disease implies mainly the prevention of disease, primary prevention or secondary prevention or combination of both. Tertiary prevention is not so significant in the disease control. The term disease eradication indicates absolute termination of the disease. It implies the cessation of infection and disease. The term disease elimination comes in middle category between the control and eradication.

Objectives of Disease Control

- To decrease mortality and morbidity
- To reduce disease occurrence
- To reduce the risk of disease transmission
- To reduce the financial burden to the population
- To decrease the duration of illness
- To prevent from possible complications.

Techniques Used for Disease Control

- **Disinfection:** Killing or destroying most infectious agents outside the body by physical, chemical or any means. Disinfection classified into concurrent and terminal disinfection. Concurrent disinfection is disposal of contaminated material or equipment as early as possible. Terminal disinfection is disposal of contaminated articles after patient gets transfer or discharge or death.
- **Antiseptic:** A chemical substance that destroys microorganisms or inhibits their growth. Antiseptics destroy microorganisms or inhibit their growth. Antiseptics are less strong and are safe enough to be used on living tissues.
- **Sterilization:** It is a process of destroying all forms of microorganisms (including spores). It is the complete destruction of all pathogenic, nonpathogenic microorganisms and viruses or elimination of all viable organisms.

Host Defenses by Immunization

A person is said immune when he possess specific protective antibodies or cellular immunity as a result of previous infection or immunization or is so conditioned by such previous experience as to respond adequately to prevent infection and/or clinical illness following exposure to a specific infectious agent.

Active Immunity

Active immunity depends upon the humoral and cellular responses of the host. The immunity produced is specific for a particular disease, i.e., the individual in most cases is immune to further infection with the same organism or antigenically related organism for varying periods depending upon the particular disease.

- **Humoral immunity:** It comes from the B–cells (bone marrow derived lymphocytes) which proliferate and manufacture specific antibodies after antigen presentation by macrophages. The antibodies are localized in the immunoglobulin fraction, subpopulations able to help B-lymphocytes.
- **Cellular immunity:** It plays a fundamental role in resistance to infection. It is mediated by the T-cells, which differentiate into subpopulations able to help B-lymphocytes.
- **Combination of the above:** In addition to the B and T lymphoid cells, which are responsible for recognizing self and non-self very often, the macrophages and human K (killer) cells and their joint functions constitute the complex events of immunity.

Passive Immunization

It is a process of conferring immunity by administrating readymade antibodies of human or animal origin. The immunity offers specific protection for a limited period, lasting for a few months.

- **Normal human Ig:** It is used to prevent measles in highly susceptible individuals and to provide temporary protection (up to 12 weeks) against hepatitis A infection for travelers to endemic areas and to control institutional and household outbreaks of hepatitis infection.
- **Specific human Ig:** These preparations are made from the plasma of patients who have recently recovered from an infection or are obtained from individuals who have been immunized against a specific infection. Specific human Igs are used for chickenpox prophylaxis and for post exposure prophylaxis of hepatitis B and rabies, and tetanus prophylaxis in the wounded.
- **Antisera or antitoxins:** These are prepared from non-human sources, such as horses. Antitoxins are used against tetanus, diphtheria, botulism, gas gangrene and snake bite. Administration of antisera may occasionally give rise to serum sickness and anaphylactic shock due to abnormal sensitivity of the recipient.

DISINFECTION

Disinfecting uses chemicals (disinfectants) to kill germs on surfaces and objects. Some common disinfectants are bleach and alcohol solutions. You usually need to leave the disinfectant on the surfaces and objects for a certain period of time to kill the germs. Disinfecting does not necessarily clean dirty surfaces or remove germs.

Definition: Disinfection is defined as the treatment of surfaces/equipment using physical or chemical means such

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that the amount of microorganisms present is reduced to an acceptable level.

Methods of Disinfection

Chemical Disinfectants

- Alcohol
- Chlorine and chlorine compounds
- Formaldehyde
- Glutaraldehyde
- Hydrogen peroxide
- Iodophors
- Ortho-phthalaldehyde (OPA)
- Peracetic acid
- Peracetic acid and hydrogen peroxide
- Phenolics
- Quaternary ammonium compounds

Miscellaneous Inactivating Agents

- Other germicides
- Metals as microbicides
- Ultraviolet radiation
- Pasteurization
- Flushing- and washer-disinfectors

ROLE OF COMMUNITY HEALTH NURSE IN EPIDEMICS

Epidemiology and community health nursing are utmost essential in the field of health science. Epidemiology and nursing are closely related for the attainment of optimal health of the individuals, families and communities. Community health nurse take active role to identify and investigates the problem during outbreak of epidemics.

- Community health nurse has a greater concern with the occurrence of disease, health problems and risk factors prevalent in the community. The community health nurse works for the prevention and control of disease at various levels.
- Community health nurse participate as one of the team member especially when it is large scale investigation. For example, occurrence of any epidemic or community level general health survey or specific health survey, surveillance activities and screening, etc.
- Community health nurse take active participation in prevention and control of communicable diseases, such as notification of certain specific disease, such as measles, diphtheria, tetanus, hepatitis rabies and STD to the health authority. And also identify sources of infection and methods of spread of infection.
- Community health nurse provide health education for the community regarding preventive and control measures for epidemics. Because of this she plays a key role in the health information system in the community.
- Community health nurse takes vital role during any unusual occurrence of any disease. She investigates regarding frequency and distribution and possible determinants. Community health nurse analyses the information collected, compares it with previous findings and with rates at the national level. They are also involved in planning and implementation of prevention and control program.

Conclusion

Epidemiology studies the three components, i.e., disease frequency, distribution of disease and determinants of disease. The first component indicates that epidemiology is measurement of frequency of disease, disability or death and summarizing this information in the form of rates and ratio, i.e., prevalence rate, incidence rate, death rate, etc. The second component concerned with describing the distribution of health status in terms of age, sex, race, geography, etc., and the third involves interpretation of the distribution in terms of the possible causal factors. Hence, it is a science developed from the study of the unusual to find out an explanation for unusual happenings.

REVIEW QUESTION

Long Essays

1. Discuss the history of epidemiology and population health.
2. Define epidemiology. Explain aims, objectives, and functions of epidemiology.
3. Discuss the use of epidemiology in community health nursing.
4. Describe the epidemiological methods used in community health nursing.
5. Explain the natural history of diseases.
6. Enumerate the levels of disease prevention.
7. Role of community health nurse in epidemics.

Short Essays

1. Types of epidemiology.
2. Tools of measurement in epidemiology.
3. Components of epidemiology.
4. Principles of epidemiology.
5. Scope of epidemiology.
6. Dichotomies in epidemiological studies.
7. Epidemiological approaches.
8. Analytical method.
9. Importance of epidemiology.
10. Disease cycle.
11. Epidemiological triad.
12. Stages in the natural history of a disease.
13. Techniques used for disease control.
14. Methods of disinfection.

Short Answers

1. Carrier.

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2. Contact.
3. Reservoir.
4. Pathogen.
5. Epidemic.
6. Eradication.
7. Experimental epidemiology.
8. Disease behavior.
9. Advantages of epidemiology.
10. Case control study.
11. Cohort study.
12. Spectrum of disease.
13. Disease causation.
14. Levels of health prevention.
15. Prepathogenesis phase.
16. Tertiary prevention.
17. Disability limitation.
18. Active immunity.
19. Objectives of disease control.

Multiple Choice Questions

1. **Which of the following is not a part of continuum of natural history of the disease?**
   a. Stage of susceptibility b. Stage of preclinical
   c. Stage of prevention d. Stage of recovery
2. **Which of the following are also known as retrospective studies?**
   a. Cohort studies b. Descriptive studies
   c. Experimental studies d. Case control studies
3. **Total number of deaths reported during a given time interval from estimated mid-interval population is called:**
   a. Death rate b. Crude death rate
   c. Mortality rate d. Proportional mortality
4. **Use of statistics to analyze characteristics or changes to a population is termed as:**
   a. Population pyramid b. Vital statistics
   c. Population statistics d. Population dynamics
5. **Which of the following is not a basic measurement in epidemiology?**
   a. Rate b. Nominator
   c. Ratio d. Proportion
6. **Which of the following is usually expressed as percentage?**
   a. Rate b. Nominator
   c. Ratio d. Proportion
7. **Measurement of current status of disease is termed as:**
   a. Prevalence
   b. Incidence
   c. Cumulative incidence
   d. Mid interval population
8. **The modes of transmission of infectious diseases are as follows, *except*:**
   a. Direct b. Indirect
   c. Physiological d. Biological
9. **The number of new cases occurring in a defined population during a specified period of time is called:**
   a. Prevalence b. Incidence
   c. a and b d. Cumulative incidence
10. **Measure of the frequency of occurrence of death in a defined population during a specified interval is called:**
    a. Crude death rate b. Mortality rate
    c. Death ratio d. Mortality
11. **Public health surveillance does not consists on the following step:**
    a. Systematic collection b. Analysis
    c. Planning d. Interpretation

Answer Key

1. c	2. d	3. b	4. c	5. b
6. b	7. a	8. c	9. b	10. b
11. c				

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