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الشيت المباع لا يرد ولا يستبدل فارجوا التأكد من طلبك قبل المجئ لكي لا تحرج نفسك وتحرجني معاك

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HEALTH

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Definition: The World Health Organization (WHO) has defined health as "A state of complete physical, mental and social well-being, not merely the absence of disease or infirmity". Thus basic criteria of health are physical fitness, sound mental health, personality and psychological behavior and social well-being, with satisfactory economic and living conditions.

Determinants of Health

Health is the outcome of many favorable interacting factors which can be classified into prenatal (before birth), natal (at birth) and postnatal (after birth) factors.

I. Before birth:

a. Genetic factor related to number and structure of genes, (chromosomes of ovum and sperm)

b. Intrauterine factors (fetus must be provided with requirements of normal growth and development and avoiding exposure of the fetus to adverse conditions, which may otherwise cause unfavorable outcome of pregnancy, therefore, the objectives of prenatal care are normal labor and fulfilling requirements of fetal health.

II. At birth:

Natal care to prevent or minimize the risk of difficult and complicated labor which would otherwise expose the new born to birth injuries and other hazards.

3. After birth:

Fulfilling requirements of health promotion and prevention of health hazards by adequate nutrition, sanitary environment (including housing), socioeconomic welfare and healthful lifestyle.

Medical care for early case-finding and management of morbidity is also required to avoid complications.

Morbidity

Morbidity means impaired health, which comprises diseases, injuries, accidents and disability. Outcome of morbidity may clear up, or may cause handicapping and disability, or fatality.

Mortality

Mortality rate is the number of deaths in a unit of population within a prescribed time.

Ecology of disease

Ecology is a triad of interacting factors related to host, agent and environment, which determine:

- Exposure of man to the risk of morbidity
- Characteristic features and pattern of disease
- Endemicity (persistence and perpetuation) of disease in the involved community

1. Host:

Host factors are age, sex, race, occupation, education and culture, lifestyle and health status

Age: Susceptibility to disease may vary with age and show age-specific morbidity pattern.

Sex: Some pathological processes and diseases show varied sex susceptibility and incidence

Race: Some diseases may show racial susceptibility or resistance that may be explained by:

- Exposure of a particular race to a certain disease along successive generations over a long period of time e.g. Pulmonary tuberculosis
- Characteristic socioeconomic and living circumstances predisposing a particular race to morbidity rather than true racial factor.

Occupation: Workers may be exposed to occupational disease and work accidents through work or occupational activity.

Education, culture and traditional beliefs may also influence health in different ways:

- Contribute to health promotion and prevention of disease
- Predispose to morbidity

Lifestyle: Proper lifestyle favors health promotion, while faulty lifestyle provides risk factors of morbidity e.g. little exercise and physical activity, cigarette smoking, alcohol consumption, drug dependence, drug abuse, worry and tension.

Health status: A healthy individual is more resistant to morbidity, while impaired health is associated with lowered body resistance and more susceptibility to (and severity of) disease.

2. Agent:

The agent is the direct cause (causative or causal agent) of disease and which may be exogenous or endogenous.

a. Exogenous agents arise from pollution of the environment (physical, chemical and biological) and invade the body through inhalation, ingestion, percutaneous route and vectors of disease.

b. Endogenous agents: varied endogenous factors give rise to morbidity through causing dysfunction of body organs, psychological and mental disorders and psychosomatic disease.

c. Etiology of disease

Etiology of a particular disease or pathological process may be:

- Single agent: e.g. Schistosomiasis, Cholera and Pellagra
- More than two agents: two or multiple agents e.g. Diarrheal disease, Pneumonia, Puerperal sepsis, Jaundice, Conjunctivitis and Meningitis, which are clinical syndromes of varied etiology rather than specific diseases
- Interacting agents: each agent predisposes to development of other e.g. malnutrition and infection (Diarrheal disease)
- Idiopathic agents: agents of disease are not precisely known e.g. Malignant disease and Hypertensive disease of pregnancy.

Risk factors

They are not direct causal agents of disease, but increase susceptibility of at-risk individuals or groups to, and therefore show significantly more incidence of, disease. They are valuable to determine for diseases of idiopathic etiology and pathological processes and changes behind pathogenesis of certain diseases (e.g. Cardiovascular disease). How they develop may not be fully determined, but underlying risk factors can be.

3. Environment

The environment is the medium (milieu) where man lives or the external surrounding which may influence health.

Components: housing, ventilation, climate, air sanitation, water supply, disposal of wastes (refuse and sewage), insect-vectors and rodents if found, and community food supply.

Public Health

Public health is referred to as population medicine, preventive medicine or community medicine. All of them deal with the study of collective health problems of the community for the promotion of health and prevention of disease.

The classic topics in public health is epidemiology, but it now includes a combination of scientific disciplines (e.g. biostatics, laboratory sciences, social medicine, demography), planning and management (as family planning, welfare of population and education of members of the health team), interventions and surveillance that are directed to the maintenance and improvement of the health of the people

Preventive medicine, when first developed was based on etiology and immunization for prevention of communicable diseases, and since preventive medicine has, increasingly, intended to be applied to the organized health activities of the community, the term preventive medicine is regarded as synonymous with public health, which includes:

1. **Health promotion:** The topmost level of health objectives, which fulfils requirements of physical, mental and social health (positive health).
2. **Prevention of Health hazards:** There are three forms of prevention:
   - Primary prevention: preventing the occurrence of health hazards to which man may be exposed.
   - Secondary prevention: applied to cases that have got an attack of disease, to prevent recurrence e.g. Rheumatic fever and Diarrheal disease.
   - Tertiary prevention: rehabilitation of the handicapped, to prevent or minimize disability.

The common community health hazards of developing countries are the endemic communicable (infectious and parasitic) and nutritional deficiency diseases.

3. **Control of Health hazards:** Case-finding is the basis of control of occurring hazards, by health appraisal, the earlier the better.

Health appraisal: Its value includes evaluation (assessment) and check-up of health status, and so any existing morbidity can be detected and its methods involve clinical or curative service,

screening tests, comprehensive medical examination, and survey studies.

4. **Rehabilitation:** If handicapping occurs, rehabilitation is needed for individuals having physical and/or mental disability interfering with normal lifestyle and activities. Handicapping may be congenital or acquired.

Topics of Public health

1. **Environmental health:** General consideration of the different components of the environment, with particular emphasis of sanitary requirements, and the impact of unsanitary environment on health, and sources and health hazards of environmental pollution.

2. **Epidemiology, prevention and control of diseases:**

   a. Communicable diseases:

   Infectious and parasitic diseases: General principles of epidemiology, prevention and control of individual infectious or parasitic diseases.

   b. Non-communicable diseases:

   Study of the epidemiology, characteristic picture, risk factors, prevention and control of certain non-communicable diseases and health problems.

3. **Public health administration:** General principles of health administration, planning, implementation and evaluation of health programs, primary health care and applied study of health services of certain groups.

4. **Nutrition:** Principles of nutrition, nutrients, adequate diet, malnutrition, and assessment of nutritional status.

5. Medical statistics:

- Statistical methods
- Biostatistics (vital statistics)
- Demography: Population studies, overpopulation problems, and family planning program.

6. Health education.

b) Epidemiological studies

I. Descriptive studies:

Observing the distribution of a disease in a community. It depends on collecting data from:

1. Survey study
2. Registered data from health authorities which should include:
   - Number of cases studied
   - Segment of people affected
   - Location and time
   - Age, sex, socioeconomic level, job and marital status.

II. Analytical study:

To show the relation between certain disease and a predisposing factor e.g. cancer and occupational diseases. It may be:

1. Retrospective (in the past) case control study
   - Case group suffering from certain disease
   - Control group: comparable group except not suffering from the same disease. Study life style, diet, and work etc

2. Prospective (followed in future) control study:

- Study group: individuals exposed to a risky factor e.g smoking
- Control group: (comparable group) but not exposed to the same risk.

III. Experimental studies:

Also two groups (study and control) to shoe the effect of a new drug or vaccine.

Results of the studies are expressed as:

Prevalence rate of a disease is the number of infected persons of cases which are present within the population at a particular point of time (indicate severity of a disease = how seriously and how long the disease is affecting a population).

$$\text{Incidence rate of a disease} = \frac{\text{Number of new cases in a stated period} \times 100}{\text{Population at risk}}$$

(reliable indicator of the spread of a disease)

Vital statistics are the best measures of public health, it includes:

1. Demographic statistics: Population, registration of marriages, and fertility
2. Morbidity statistics: Abstracts of hospital records for illness and injuries and certificates of the capacity for work.
3. Mortality statistics: records for number and causes of deaths.

General epidemiology of communicable diseases

Infectious diseases:

Infection means invasion of the body by a pathogenic organism (or parasite).

When an individual is infected, infection either remains unapparent (non-manifested) and passes unnoticed, or causes disease (shows manifestations) according to agent and host factors.

1. **Agent (causative organism) factors:**
   - Number of invading organisms (dose of infection)
   - Virulence of the organism, which depends on agent and environmental factors.

2. **Host (man) factors:**

They are related to body resistance – general defense mechanism, including natural barriers of infection, and specific immunity.

Factors predisposing to infection:

1. Basic factors:
   - Unsanitary environment. Provides vehicles (polluted air, water, food and soil), vectors (insects), and animal reservoirs (e.g. rodents, cattle) of infection
   - Unclean habits and faulty health behavior of the public

2. Contributing factors

- Occupational infection: Exposure of some occupational groups to the risk of infection through work activities e.g. medical personnel and farm workers
- Lack of preventive services of primary health care.

N.B. The difference between infection and disease lies in the fact that infection is the invasion of the body by a pathogenic organism and may, or may not be followed by disease

Epidemiological cycle (infectious process)

In endemic areas infection is maintained by the infectious process, which is a perpetual cycle having three links - reservoirs of infection, modes of transmission, and exposed host who gets infected to become a reservoir of infection and so on. If any link is missing, infection will no more exist.

Reservoirs of infection

The reservoir is man (mostly) or animal (occasionally) infected with a pathogenic organism, and can thus spread infection. The human reservoir may be a case (patient) or carrier.

- **Case** or patient who shows manifestations of disease, and is infectious.
- **Carrier** which is an infected person who harbors a pathogenic organism in his body, and can spread infection, but shows no signs and symptoms of disease. Some, not all, infectious diseases have carriers.

Types of Carriers:

1. **Incubatory carrier**

The case is infectious during the last days of the incubation period, where the organism is found in his discharges. Infectivity is longer in viral hepatitis, and very long in AIDS.

2. **Convalescent carrier**

In some infectious diseases, a certain percent only (not all) of recovered cases continues (weeks, months, years, or lifelong to be infectious). The convalescent carrier is thus clinically cured, but not bacteriologically free.

3. **Contact carrier**

Contacts of a case (or carrier) may get infected, but eliminate infection in around two weeks, without getting diseased. Meanwhile, they are carriers and can spread infection.

4. **Healthy carrier**

Inhabitants of endemic areas may get infected from the polluted environment (e.g. water supply). Infection persists for around two weeks, but healthy carriers of HBV are infective for years.

The case is infective (contributing to the spread of infections) along the following stages:

1. Incubatory carrier before onset of disease
2. During the course of disease
3. Convalescent carrier, for varied period of time
4. Indirectly through infecting contacts who may become contact carriers.

Classification of carriers: The four types of carriers can be classified into groups (not types) according to certain characteristics:

1- **Carriers by period of infectivity:**

- Transient carriers for few days (Incubatory carriers usually).
- Temporary carriers for few weeks or months. Contact and healthy carriers (for two weeks), and the majority of convalescent carriers, and some incubatory.
- Chronic or permanent carriers. Very small percent of convalescent carriers (years or lifelong). In enteric Typhoid and Paratyphoid, for example, about 10% of convalescents may become carriers, 8% temporary and 2% chronic (years or lifelong). Incubatory carriers of AIDS are infective for months to years.

2- **Carriers by portal of exit:**

Respiratory, urinary and fecal carriers

- Respiratory carriers: Organisms in the upper respiratory tract (throat, nose and nasopharynx) find exit in respiratory discharges through the mouth and nose. Respiratory carriers can also be divided into throat, nasal and nasopharyngeal carriers.
- Urinary carriers: Typhoid and Paratyphoid bacilli in the urinary tract find exit in urine.

- **Fecal carriers**: Organisms in the gall bladder, small intestine and colon find exit in feces.

Carriers by flow of organisms:

Some carriers, especially of Enterica, may not always give positive culture of stools and urine, but alternative negative results may be given. They are described as "intermittent carriers". Thus to show that the carrier became free, more than one negative culture (usually three) are needed.

- Sexual and blood carriers

Foci of infection

Some parts of the body may be inhabited by varied organisms, giving forms of infection foci.

- Foci of carrier state
- Foci of commensal organisms

Commensals:

They are normal inhabitants of some parts of the body, especially the upper respiratory tract, intestine, skin and vagina. Though nonpathogenic under normal conditions, they are potentially pathogenic (become pathogenic) under certain adverse circumstances:

- Lowered body resistance
- Injury of tissues, by trauma, accidents or surgery
- Negligence of personal cleanliness, specially oral hygiene

- When the organism leaves its normal habitat to other parts of the body.

Important foci of infection

1. Upper respiratory tract
   a. Respiratory carriers
      - Throat: Hemolytic streptococci, Staphylococcus aureus, Polioviruses and Diphtheria bacilli
      - Nose: Staphylococcus aureus and Diphtheria bacilli
   b. Commensals of nasopharynx
      - Streptococcus viridans, Pneumococcus and Meningococcus.
2. Gastrointestinal tract:
   a. Fecal carriers:
      - Small intestine: Salmonellae, Polio viruses, Cholera vibrio and Hepatitis A virus
      - Colon: Shigellae
      - Gall bladder: Typhoid and Paratyphoid bacilli
   b. Intestinal commensals:
      - Intestinal flora of the large intestine (colon), mainly Escherichia coli, Streptococcus faecalis and Lactobacilli.
3. Urinary tract:
   - Carriers of Typhoid and Paratyphoid

4 Vagina

- Two commensals may be found, anaerobic Streptococci and Lactobacilli

5 Mouth

- Lactobacilli are natural inhabitants.

Examples of potential pathogens of commensals:

Anaerobic Streptococci of vagina may cause Puerperal sepsis

Streptococcus viridans of the nasopharynx may invade blood to reach diseased heart valves

Disease	Incubatory	Convalescent		Contact	Healthy
		Temporary	Chronic		
Diphtheria	±	+	−	+	−
Mumps	+	−	−	−	−
Rubella	+	−	−	−	−
Strept. pharyngitis	±	±	−	−	−
Enterica	+	+	+	+	+
Poliomyelitis	+	+	−	+	+
A and C Hepatitis	+	−	−	−	−
B Hepatitis	±	±	±	±	years
Salmonellusis	−	+	+	−	−
Shigellosis	−	+	+	+	+
Cholera	+	+	+	+	+
AIDS	Latent infection				

Period of infectivity:

"Period of infectiousness" or "Period of communicability" for how long cases and carriers remain infective.

1. Infectivity of cases:

- Untreated cases: Usually infective through the clinical course of disease, which varies according to nature of disease.
  - Some days only: In acute self-limited disease, as Influenza, Common cold, Measles, Varicella, Poliomyelitis, Streptococcal pharyngitis and Purulent conjunctivitis.
  - Some weeks, or few months: Enterica, Pertussis, Trachoma and all forms of viral Hepatitis.
  - Long period of infectivity in chronic diseases as Leprosy, Syphilis, AIDS and Tuberculosis.
- Treated cases: Specific chemotherapy eliminates infection within short time, mat be one or more days (e.g. Streptococcal pharyngitis, Meningococcal meningitis, Diphtheria and Syphilis), or some weeks (e.g. Pulmonary tuberculosis), but it may not be effective to eliminate infection in Enterica.

2. Infectivity of carriers:

Varies days, weeks, months or years, according to:

- Type of carriers: Few days for most incubatory, around two weeks for contact and healthy, and weeks, months or years for convalescent.

- Nature of disease: Infectivity of convalescent carrier varies. It may be few weeks only in Poliomyelitis and Classical cholera, weeks or months and rarely more in Diphtheria, or years in Enterica and El-Tor cholera and healthy carriers of B Hepatitis.
- Presence of pathological focus in the body which favors persistence of infection and carrier state e.g.:
  - Chronic cholecystitis and urinary lesion for Enteric microorganisms.
  - Chronic tonsillitis in Streptococcal pharyngitis and Diphtheria.

Whether specific antimicrobials are available, and given or not, they help elimination of some (not all) infections e.g. Meningococci, Diphtheria bacilli and Cholera vibrios, but they are not effective for Enterica and not available for viral infections.

Exit of infection:

1. Organisms in respiratory passages find exit with respiratory discharges (droplets, sputum, mucous secretion) and saliva through the nose and mouth, with forced expiratory acts (sneezing, coughing, shouting, loud speaking).
2. Organisms in gastrointestinal tract (small intestine and colon) and gall bladder find exit in feces. Cholera vibrios may also find exit in vomitus of the case.
3. Typhoid and Paratyphoid bacilli in urinary tract of cases and carriers find exit in urine (Brucellae may also pass in urine of cases, but there is no man-to-man infection, i.e. man is not reservoir of Brucellosis which is only zoonotic).

4. Organisms in skin and mucous membrane lesions find exit with:
   - Skin discharges of pyogenic and mycotic lesions
   - Skin eruption of Varicella, Herpes zoster, and Variola
   - Eye discharge of infective Conjunctivitis
   - Urethral and cervical discharge of Gonorrhoea
   - Syphilitic lesions of mouth and genitalia

5. Organisms in blood find exit through:
   - Biting arthropod-vectors of disease, e g Borreliae and Rickettsiae in blood of relapsing fever and epidemic Typhus cases are released by the louse
   - Blood transfusion and blood-contaminated syringes and needles transmit organisms of virus Hepatitis, AIDS and Syphilis
   - Maternal-fetal circulation, causing congenital infection.

Animal Reservoirs

Diseases of animals are not transmissible to man who has 'species immunity' against animal infections. However, certain infectious agents of few animals are pathogenic to man causing "zoonosis".

Definition of zoonosis: A disease which primarily infects animals, and can also infect man by different means of transmission.

Causative agents of Zoonosis

Viral	Protozoal
Rabies	Amoebiasis
Jungle yellow fever	Balantidiasis
Encephalitis	Leishmaniasis
Rift valley fever	Toxoplasmosis
Foot and mouth disease	Trypanosomiasis
Lymphocytic choriomeningitis	
Rickettsial	**Bacterial**
Q fever (Coxiella)	Tick-borne relapsing
Murine typhus	Psittacosis
Others	Rat-bite fever
Fungal	Brucellosis
Dermatophytoses	Salmonellosis
	Plague
	Anthrax
	Leptospirosis
	Tularaemia
	Tuberculosis (Bovine)

Important Reservoirs of Zoonosis

Cattle	Rodents
Bovine tuberculosis	a) Rats and mice
Brucellosis	Plague
Salmonellosis	Murine typhus
Foot and mouth disease	Salmonellosis
Anthrax	Weil's disease
Q fever	Rat-bite fever
Dermatophytosis	Some rickettsial diseases
(Imported: Rift valley fever)	Lymphocytic choriomeningitis
Poultry	Dermatophytosis
Salmonellosis	Rabies (rare)
Tuberculosis	
Histoplasmosis	b) Wild Rodents
Other birds	Tick-borne relapsing
Psittacosis	Scrub typhus
Encephalitis	Spotted fever
Dogs	**Horses**
Rabies	Tetanus
Leptospirosis	Dermatophytosis
Dermatophytosis	
Rickettsial disease	
Cats	**Monkeys**
Rabies	Jungle yellow fever
Dermatophytosis	Lymphocytic choriomeningitis

Modes of transmission

Organisms finding exit from the body of reservoirs of infection reach the new host by different means (modes, methods, and ways) of transmission (propagation, spread, dissemination).

Modes of transmission are four basic and two occasional

Basic modes of transmission:

- Droplet infection (respiratory infection)
- Ingestion infection (food-borne infection)
- Arthropod-borne infection (insect-borne infection, vector-borne infection)
- Contact infection (including percutaneous infection).

Occasional means of transmission:

- Injection infection (a form of contact infection)
- Congenital infection including transplacental infection

Single and multiple means of transmission

Some infectious diseases spread by one means only, e.g.

- Meningococcal meningitis: Droplet infection
- Cholera, Enterica and Infective diarrheal disease: Ingestion infection
- Relapsing fever, Yellow fever and Rift valley fever: Arthropod-borne infection
- Tetanus, Gas gangrene and Rabies: Contact infection

Some infectious diseases spread by more than one means which may either be equally important, or one means get the upper hand, e.g.

- Poliomyelitis: Respiratory and ingestion infection, the first is the main means in developed countries, and the second in developing countries.
- Tuberculosis: Respiratory infection causing pulmonary disease in the majority of cases, and ingestion infection causing extrapulmonary disease
- Bruceilosis: Ingestion infection (mainly), and inhalation and contact infection (occasionally)
- Virus B Hepatitis: Injection infection (mainly), contact venereal infection (occasionally) and oral infection (very rarely).

Entry of Infection

Pathogenic organisms invade the exposed host through the following portals of entry:

- Respiratory tract, in respiratory (droplet) infection
- Gastrointestinal tract, in ingestion infection
- Percutaneous route in arthropod-borne infection, by biting insects, wound infection, and injection infection
- Skin and mucous membranes in other contact infections
- Congenital infection.

I. Droplet infection (Respiratory infection)

Modes of transmission:

The organisms in respiratory discharges of the reservoir reach the new host by:

- Direct droplet infection (the most important)
- Indirect infection: By airborne infection, contaminated objects, and may be milk.

1. Direct droplet infection:

Both reservoir of infection and the new host are found together within the same place. The host gets infected through inhalation of droplet spray of the reservoir.

2. Indirect droplet infection:

Reservoirs and new hosts do not come together but infection is transmitted by:

a. Airborne infection

Air is the vehicle that carries the organisms in droplet nucle and dust, inhalation of which causes infection.

- Droplet nuclei: The minute residues of fine droplets after evaporation of water. They remain suspended in air for hours and may be carried by air currents to nearby places.
- Dust: Big droplets and respiratory discharges may fall on the floor or any surface and get dried; included organisms may rise again in air with dust when disturbed by wind, and on sweeping, shaking or beating of floors, furniture, bedding, carpets and other contaminated surfaces.

b. Contaminated objects: Articles and fomites may be contaminated with respiratory discharges, and transmit infection when used in common with the others.

c. Milk: Though milk is food, yet it may be contaminated with two (respiratory organisms) which may cause respiratory mucosa (not ingestion).

- Hemolytic Streptococci causing Pharyngitis (or Scarlet fever)
- Diphtheria bacilli, causing Diphtheria

Portal of entry

Organisms of droplet infection invade the respiratory tract at any point from the nasal mucosa down to the alveoli. Invasion is followed by local involvement of the respiratory tract or and systemic manifestations.

Diseases of Respiratory Infection:

1. Human Reservoir: Streptococcal pharyngitis, Influenza, Common cold, Measles, Pertussis, Varicella, Mumps, Rubella, Poliomyelitis, Diphtheria, lower respiratory tract infections (Pulmonary tuberculosis, Bronchitis, Pneumonia, Bronchopneunomia, and other lung infections), Meningococcal meningitis (Variola which is eradicated) and others.
2. Animal Reservoir: Pulmonary tuberculosis, by Bovine bacillus.

II. Ingestion infection (Food-borne infection)

Reservoirs of infection may be man or animal

Human Reservoirs: Organsims find exit in stools (all infections), urine (Typhoid and Paratyphoid only), and vomitus (Cholera).

Modes of transmission:

- Ingestion of contaminated food, water (and ice), milk (and milk products) and other potable fluids
- Hand-to-mouth infection: Infection is introduced by contaminated hand. Though hand-to-mouth infection is not food-borne, yet it is considered a mode of food-borne (ingestion) infection.

The organisms finding exit from cases and carriers reach food by handling (food handlers), vectors (houseflies and may be cockroaches), polluted water, and excreta-contaminated dust. Fertilization of vegetables by fresh human manure is a potential risk.

Portal of entry:

Ingestion infection finds entry through the mouth.

Predisposing factors:

Unsanitary environment, and unclean habits of handlers and the public.

Food-borne diseases:

Man is the reservoir of Enterica, Salmonellosis, Shigellosis, Poliomyelitis, Infective diarrheal disease, Cholera, Food poisoning,

Virus A Hepatitis, and Extrapulmonary tuberculosis by human bacillus

Other modes of transmission

Injection infection may cause

a Infections in blood: Virus Hepatitis (specially B and C), Cytomegalovirus disease, Syphilis and AIDS, and Malaria through

- Injections by any route, specially the intravenous using blood-contaminated syringes and needles,
- Blood transfusion without safety precautions

b Pyogenic infection, usually Staphylococcal, by contaminated syringes and needles

III. Congenital infection

It is infection transmitted from the pregnant mother to the embryo (before formation of placenta), and sometimes to the fetus (after formation of placenta) i.e. transplacental (e.g. Syphilis).

Viral congenital infections: Rubella, Cytomegalovirus, HBV, HIV and potentially Mumps, Varicella and other viruses

Hazards of congenital infection

It is etiological factor of unfavorable outcome of pregnancy. lethal (abortion, stillbirth, or neonatal mortality), or sublethal (congenital anomalies and handicapping, and congenital disease as Syphilis and Rubella syndrome).

Exposed host

The host is the third link of the infectious cycle. When he gets infected, infection either passes unnoticed or is followed by disease according to agent (number and virulence of organisms) and host (body resistance and immunity) factors.

Body resistance and immunity are determined by nonspecific and specific factors.

- Nonspecific factors: Inherited or inborn factors which form the defense mechanism of the body against infection, in general.
- Specific factors: immunity (specific resistance to infection) produced by specific immune response of the body.

Defense mechanism

It is made up of two components: natural barriers of infection and inner body defenses.

1. Natural Barriers of Infection: Healthy skin and mucous membranes form the first line of defense to prevent the introduction of infection. Skin is a natural barrier of infection through intact surface, and bactericidal effect of sweat and sebaceous secretion.

a. Respiratory tract:

- Hair at anterior nares catches dust in air
- Cilia of epithelial lining
- Mucous coating of respiratory passages
- Sneezing and coughing help elimination of infection, but with precautions to prevent spread of infection to the others.

(e) Role of pulmonary macrophages

b. Gastrointestinal tract

1. Saliva and bacterial flora of mouth inhibit infection
2. Gastric acidity is bactericidal
3. Intestinal flora of colon overgrow pathogens

c. Vagina of adult

- Acidity, by lactobacilli inhibits pathogens
- Stratified epithelial lining is a bacterial barrier

d. The eyes

- Healthy intact membranes are barriers of infection
- Tears: Washing effect and lysozyme
- Blinking reflex helps protection of eye.

2. Inner body defenses: They deal with the organisms which have passed the natural barriers of infection.

- **Plasma:** has diluting and bactericidal effect.
- **Phagocytosis:** by polymorphonuclear leucocytes of blood and macrophages of the reticuloendothelial system.

Specific immunity

Experiences resulting from previous infection of the host can lead to the development of immunity. Specific immunity may be cellular (conferred by T-lymphocytes sensitization) or humoral (from the response from the B-lymphocytes). Immunity is either passive or acquired.

i. **Passive immunity**: Passive (or humoral) immunity is the transfer of antibodies from mother to her child through the placenta. Passive immunity is short-lived. For example infants are protected against Measles during the first 6 months of life. Passive immunity can also be introduced, such as rabies immune serum.

ii. **Acquired immunity**: Acquired immunity follows an infection or vaccination. This will induce the body to develop an immune response in a number of diseases.

The susceptibility of the host to infection is affected by many factors, the most important ones include age, sex, nutrition, pregnancy, trauma and fatigue as well as the environmental conditions e.g. climate and seasonality.

Herd immunity

Herd immunity is a concept used to explain the resistance of a group to invasion and spread of an infectious agent, due to immunity of a high proportion (%) of the members of the group. Thus, herd immunity is the level of immunity in the community as a whole. When herd immunity is low, introduction of the infection is likely to lead to severe epidemics.

If the percent (%) of immune individuals is sufficiently high, then the whole population will be protected. The fraction of the resistant individuals necessary to prevent an epidemic is higher for a highly virulent agent or one with a long period of infectivity and vice versa. One of the consequences of herd immunity is that the decreased incidence of the disease leads to a reduction in motivation of many individuals to become immunized. This means that the % of

immunized individuals decrease with time (i.e the likelihood of disease increases, this is called the cycles of the disease.

The concept of propagated epidemics and herd immunity can explain why certain diseases occur in cycles e.g. measles. Before the measles vaccine, measles occurred in high % of school children at school entry time (transmission by respiratory routes in crowded classes). These children develop immunity but with new academic year new batch of children enter school and get exposed to infection, this leads to a new epidemic... and so on.

Diseases in populations

When studying the frequency of diseases in populations, epidemiologists must consider the geographic areas affected and the degree of harm the disease cause in the population. On the basis of their findings they classify diseases as endemic, epidemic, pandemic or sporadic.

Endemic:

Habitual presence of a disease in a particular geographical area but both the number of reported cases and the severity of the disease remains too low to constitute a public health problem e.g. Bilharzias in Egypt.

Epidemic:

When a disease suddenly has a higher-than-normal incidence in a population i.e. the number of cases exceeds that expected, then the

mortality and/or morbidity rates become high enough to pose a public health problem.

Pandemic:

An epidemic occurring over a wide geographical area i.e. more than one nation.

Sporadic:

Infrequent and scattered cases of a disease in a community that pose no great threat to the whole population.

The nature of epidemics

Two major types of epidemics can be distinguished namely common source epidemics and propagative (person-to-person) epidemics.

a. Common source epidemics: Result of infection (or intoxication) of large number of people from a contaminated source as food or water.

b. Propagative (person-to-person) epidemics: Cases continue to be reported over a period of time equivalent to several incubation periods of the disease.

Public health measures for control of epidemics

Control of communicable diseases could be achieved by interruption of the infection cycle by one of the following methods:

- Eliminate the reservoir of the infection
- Interrupt the way of transmission
- Protect the susceptible host

1. **Controls directed against the reservoir:**

i. If animal:

Disease can be prevented if the disease is eliminated form the infected animal population. This could be achieved by immunization or by slaughter of infected animals (effective but expensive). The authorities should compensate the farmers. If the animal is wild it is more difficult to control. If domestic animal e.g. Rabies, immunization and strict laws and quarantine are essential.

ii. If human:

Where the reservoir is in man, the objective would be to find and treat all infected persons, both patients and carriers, thereby eliminating sources of infection. For some infections, segregation of infected persons through isolation or quarantine may be necessary. It may be noted that control is much more difficult when the reservoir is a carrier.

Isolation of patients

Isolation is indicated in the control of acute epidemic diseases or for chronic infections such as Lepromatous leprosy. Isolation of patients is indicated for infections which have the following features:

1. High morbidity or high mortality
2. High infectivity
3. No significant extra-human reservoir
4. No significant number of carriers
5. Infectious cases easily recognizable.

Quarantine:

This refers to the limitation of movement of persons who have been exposed to infection. The restriction continues for a period of time equal to the longest duration of the incubation period of the disease (i.e. the longest period of communicability of the given disease). By international agreements six diseases are considered quarantinable. Small pox, Cholera, Plague, Yellow fever, Typhus fever and Relapsing fever.

2. Control directed against transmission of pathogens:

If the microorganism is transmitted via food or water, then public health authorities should prevent contamination of these vehicles or destroy the pathogen in the vehicle. Pasteurization of milk reduced bovine T.B. For air-borne infections in some countries many individuals wear face masks when they have upper respiratory tract infections.

3. Immunization:

Immunization is the main method for control of infectious diseases. Immunization leads to elimination of some diseases such as Small pox, Diphtheria, and Whooping cough. If the person receives low titre of the vaccine or if the immunity gradually disappeared they might get childhood diseases when they are adults. Some of these diseases are more serious for adults e.g. Measles and Poliomyelitis, and also Rubella for pregnant women.

Some of the vaccines available for infectious diseases in human

Disease	Type of vaccine
1. Bacterial diseases	
Diphtheria	Toxoid
Tetanus	Toxoid
Pertussis	Killed bacteria (Bordetella pertussis)
Typhoid fever	Killed bacteria (Salmonella typhi)
Paratyphoid fever	Killed bacteria (Salmonella paratyphi)
Cholera	Killed cells or cell extract (Vibrio cholera)
Plague	Killed cells or cell extract (Yersinia pestis)
Tuberculosis	Attenuated strain of Mycobacterium tuberculosis
Meningitis	Purified polysaccharide from Neisseria meningitidis
Bacterial pneumonia	Purified polysaccharide from Streptococcus pneumoniae
Typhus fever	Killed bacteria (Richettsia prowazeckii)
2. Viral diseases	
Small pox	Attenuated strain (Vaccinia)
Yellow fever	Attenuated strain
Measles	Attenuated strain
Mumps	Attenuated strain
Rubella	Attenuated strain
Polio	Attenuated strain (Sabin) or inactivated virus (Salk)
Influenza	Attenuated strain
Rabies	Attenuated strain

Some recommended immunization procedures for infants and children

Age	Immunization	Comments
During the first year of life	•BCG	Given during the first month
	•Diphtheria, Pertussis, Tetanus (DPT)	Given at 2, 4 and 6 months
	•Oral polio	Given at 2, 4 and 6 months
	•Hemophilus influenza type B vaccine (Hib)	Given at 2, 4, 6 and 12 months
	•Hepatitis B surface antigen (HBs Ag)	Given at 1, 2 and 6 months
During the second year	•Mumps, Measles, Rubella (MMR)	Given at 15 months
	•DPT booster	Given at 18 months
	•OP booster	Given at 18 months
	•Hib	Given at 18 months
At 4 – 6 years	•DPT booster	Given at 3 years on entering nursery school
	•OP booster	
At 14-16 years	•Adult-type Tetanus and Diphtheria booster	Pertussis omitted

Vaccination of travelers:

Travelers to certain countries need to be vaccinated against the infectious diseases endemic to that area. Many countries require immunization certificates for Cholera and Yellow fever, but many other immunizations are only recommended for people who are expected to be at risk. Travelers are advised to take reasonable precautions such as avoiding insect or animal bites, only drinking

water which has been properly treated, and undergoing chemotherapeutic programs after exposure.

Global health considerations

Causes of death in developed and developing countries are different. In developing countries, infectious diseases are still major causes of death (account for 30-50% of deaths), whereas in developed countries infectious diseases account for (4-8% of deaths). On the other hand, deaths due to circulatory disorders account for over 50% in developed countries, whereas it accounts for about 14-24% of deaths in developing countries.

Nosocomial diseases (hospital acquired infection)

They are derived form patients, working staff or environment. The agents frequently involved in hospital infection are:

1. Bacteria:

E.coli, hemolytic Streptococci of gpA, Staphylococcus aureus and Pseudomonas aeruginosa.

2. Virus:

Hepatitis B, Herpes simplex and Influenza or other respiratory viruses.

Identification of nosocomial infections (determination of the source of infection)

1. Isolation of the causative agent
2. Microscopic, cultural and biochemical identification

3. Typing of the causative agent

- Antibiogram (antibiotic resistance pattern)
- Serotyping
- Phage typing
- Plasmid profile
- Restriction endonuclease analysis.

Prevention and control of nosocomial diseases

1. Isolation of infectious cases including hospital staff
2. Disinfection of articles
   - Concurrent disinfection: Immediate disinfection of all contaminated materials during the course of illness.
   - Terminal disinfection: Disinfection after recovery of the patient or death
3. Sanitation
   - Vacuum cleaning of air and adequate ventilation
   - Washing hands with disinfectants
   - Wearing sterile coats and gloves.

Food-borne and water-borne diseases

Inadequate cooking or improper storage of food, as well as poor sanitary conditions in food preparation can cause comfortable and even serious diseases due to presence of microorganisms. There are two major categories of food-borne diseases caused by microorganisms:

1. Food poisoning

2. Food-borne infections

Food poisoning occur when a microorganism produces a toxin in a food and when people consume the food, the ingested toxin causes damage to the body.

Food-borne infections occur when the pathogen is ingested and grows within the body. Food-borne infections are usually diseases of the intestinal tract, although other areas of the body may be affected. Water-borne infections occur when an infectious microorganism is acquired through consumption of water contaminated by fecal matter containing pathogens from humans or animals. When these pathogens contaminate a municipal water supply or other source of drinking water used by many people, outbreaks of intestinal disease tend to be of epidemic type (common source).

Bacteria, viruses, protozoa and helminthes have been implicated in food-borne and water-borne diseases. While many of these diseases are gastrointestinal in nature, some may affect other parts of the body, such as the muscles, nervous system, or organs such as the heart. The distinction between food-borne and water-borne infections often is not sharply defined. This is because some pathogens (e.g. Typhoid) can be transmitted by either food or water.

Gastroenteritis and Diarrhea

Many pathogenic microorganisms transmitted by food and water can cause Gastroenteritis. One of the most common symptoms of

Gastroenteritis is diarrhea that is characterized by increase water content in the feces. Diarrhea is ultimately the result of either:

1. A decreased absorption of fluids from the intestinal tract
2. An increased secretion of fluids from the patient's blood into the intestinal tract

If the diarrhea is severe, it leads to dehydration of the body, increased acidity of the blood and hemo-concentration (I.V administration of fluids may be then necessary).

Food poisoning

Food poisoning occurs when people consume food contaminated with a toxin made by a microorganism. The most common food poisoning is staphylococcal food poisoning but the most deadly food poisoning is Botulism.

Staphylococcal food poisoning

It is caused by S. aureus. Staphylococcus can grow well under aerobic and anaerobic conditions but they generally do not compete well with other microorganisms present in food. However, if other microorganisms are killed during cooking, Staphylococci that subsequently contaminate the cooked food may grow well. One microgram (µg) of S. aureus enterotoxin is enough to cause food poisoning.

Only the strains of S. aureus that produce enterotoxin are the ones that can cause food poisoning. Food contamination with S. aureus occurs most commonly from human carriers (nasal secretions), and hands contaminated from wound infections may be also a cause. If