

## Assignment

1. Consider a disease known as diabetes mellitus, which is characterized by an increase in the blood sugar level. Infectious agents may contribute to the development of the disease in early childhood, but are not the main cause of the disease. Can it be classified as communicable? Explain your reasons

Let first explain what is meant by the diabetes mellitus, communicable and non-communicable diseases.

- a) Diabetes mellitus is a disease that prevents body from properly using the energy from the food you eat. Diabetes occurs in one of the following situations:
  - The pancreas (an organ behind your stomach) produces little insulin or no insulin at all. Insulin is a naturally occurring hormone, produced by the beta cells of the pancreas, which helps the body use sugar for energy.

-Or

- The pancreas makes insulin, but the insulin made does not work as it should. This condition is called insulin resistance. Type 2 diabetes which develops when the body becomes resistant to insulin or when the pancreas is unable to produce enough insulin. Exactly why this happens is unknown, although genetics and environmental factors, such as being overweight and inactive, seem to be contributing factors.

The following risk factors may increase the chance of getting diabetes:

Family history of diabetes;

Being overweight;

Physical stress (such as surgery or illness);

Use of certain medications, including steroids;

Injury to the pancreas (such as infection, tumor, surgery or accident);

- Autoimmune disease ;
- High blood pressure ;
- Abnormal blood cholesterol or triglyceride levels;
- Age (risk increases with age);

- Smoking ;
- History of gestational diabetes.

The symptoms of diabetes include:

- Increased thirst
- Increased hunger (especially after eating)
- Dry mouth
- Frequent urination
- Unexplained weight loss (even though you are eating and feel hungry)
- Weak, tired feeling
- Blurred vision
- Numbness or tingling in the hands or feet
- Slow-healing sores or cuts
- Dry and itchy skin
- Frequent yeast infections or urinary tract infections

Common early symptoms of low blood sugar include the following:

- Feeling weak
- Feeling dizzy
- Feeling hungry
- Trembling and feeling shaky
- Sweating
- Pounding heart
- Pale skin
- Feeling frightened or anxious

Late symptoms of low blood sugar include:

- Feeling confused
- Headache
- Feeling cranky
- Poor coordination
- Bad dreams or nightmares
- Being unable keep your mind on one subject
- Numbness in your mouth and tongue
- Passing out

- b) Communicable diseases or infectious diseases are the diseases which pass from one individual to another individual. They are generally caused by some bacteria, viruses or any other pathogens. For example, malaria, AIDS etc. It is an infectious disease transmissible by direct contact with an affected individual or the individual's discharges or by indirect means (as by a vector), compare contagious disease. They are caused by microorganisms such as bacteria, viruses, parasites and fungi that can be spread, directly

or indirectly, from one person to another. Some are transmitted through bites from insects while others are caused by ingesting contaminated food or water.

- c) Non-communicable diseases are the diseases which do not spread from one person to another person. A non-communicable disease (NCD) is a disease that is not transmissible directly from one person to another. NCDs include Parkinson's disease, autoimmune diseases, strokes, most heart diseases, most cancers, diabetes, chronic kidney disease, osteoarthritis, osteoporosis, Alzheimer's disease, cataracts, and others.
- d) Diabetes is in a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction, and failure of different organs, especially the eyes, kidneys, nerves, heart, and blood vessels. Examples of non-communicable diseases include diabetes, Alzheimer's, cancer, osteoporosis, chronic lung disease, stroke, and heart disease. ... However, some chronic diseases are not non-communicable because they are infectious, such as HIV/AIDS. Diabetes is one of the four major types of non-communicable diseases (cardiovascular disease, diabetes, cancer and chronic respiratory diseases). It is a chronic condition that occurs when the body either does not produce enough insulin or cannot effectively use the insulin it does produce.

Therefore the examples of non-communicable diseases include diabetes, Alzheimer's, cancer, osteoporosis, chronic lung disease, stroke, and heart disease. ... However, some chronic diseases are not non-communicable because they are infectious, such as HIV/AIDS.

Then the diabetes can be classified as a non-communicable disease because it cannot be spread from one person to another. It is a disease that takes many years to develop. Diabetes is a defect in the way that our bodies process sugar, impairing the removal of sugar from the bloodstream.

## **2. How would you classify pulmonary tuberculosis using the epidemiologic method?**

**What is the main importance of such classification?**

- a) Tuberculosis (TB) is caused by a type of bacterium called *Mycobacterium tuberculosis*. It is spread when a person with active TB disease in their lungs coughs or sneezes and someone else inhales the expelled droplets, which contain TB bacteria. It may be regarded in two categories: active disease or latent infection. The most common form of active TB is lung disease, but it may invade other organs, so-called "extra pulmonary

TB." Tuberculosis remains one of the deadliest diseases in the world. The World Health Organization (WHO) estimates that each year more than 8 million new cases of tuberculosis occur and approximately 3 million persons die from the disease. Ninety-five percent of tuberculosis cases occur in developing countries, where few resources are available to ensure proper treatment and where human immunodeficiency virus (HIV) infection may be common. It is estimated that between 19 and 43% of the world's population is infected with *Mycobacterium tuberculosis*, the bacterium that causes tuberculosis infection and disease.

For example, In the United States, an estimated 15 million people are infected with tuberculosis. Although the tuberculosis case rate in the United States has declined during the past few years, there remains a huge reservoir of individuals who are infected with M. tuberculosis. Without application of effective treatment for latent infection, new cases of tuberculosis can be expected to develop from within this group.

Tuberculosis is a social disease with medical implications. It has always occurred disproportionately among disadvantaged populations such as the homeless, malnourished, and overcrowded. Within the past decade it also has become clear that the spread of HIV infection and the immigration of persons from areas of high incidence have resulted in increased numbers of tuberculosis cases.

- b) Epidemiology is the study of how often diseases occur in different groups of people and why. Epidemiological information is used to plan and evaluate strategies to prevent illness and as a guide to the management of patients in whom disease has already developed. Epidemiology identifies the distribution of diseases, factors underlying their source and cause, and methods for their control; this requires an understanding of how political, social and scientific factors intersect to exacerbate disease risk, which makes epidemiology a unique science.

It will be argued that when the individual is the unit of analysis and the disease outcome under study is dichotomous, then epidemiological study designs can best be classified according to two criteria: (i) the type of outcome under study (incidence or prevalence) and (ii) whether there is sampling on the basis of the outcome. This classification system has previously been proposed by Greenland and Morgenstern (1988)<sup>1</sup> and Morgenstern and Thomas (1993), all of whom followed previous authors in rejecting directionality (i.e. prospective/retrospective or from exposure to outcome vs from outcome to exposure) as a key feature for distinguishing study designs.

Once this two-dimensional classification system has been adopted, then there are only four basic study designs: (i) incidence studies; (ii) incidence case-control studies; (iii) prevalence studies; and (iv) prevalence case-control studies.

However, epidemiologists tend to use synonyms for: case definition, person, place, time, and causes/risk factors/modes of transmission. Descriptive epidemiology covers time,

place, and person. Compiling and analyzing data by time, place, and person is desirable for several reasons.

In other words, the word epidemiology has its roots in the study of what befalls a population. Epidemiology is the study of the distribution and determinants of health-related states or events in specified populations, and the application of this study to the control of health problems.

- c) The “Diagnostic Standards and Classification of Tuberculosis in Adults and Children” is a joint statement prepared by the American Thoracic Society and the Centers for Disease Control and endorsed by the Infectious Disease Society of America. The Diagnostic Standards are intended to provide a framework for and understanding of the diagnostic approaches to tuberculosis infection/disease and to present a classification scheme that facilitates management of all persons to whom diagnostic tests have been applied. To provide a classification scheme for tuberculosis that is based on pathogenesis.

Definitions of tuberculosis disease and latent infection have been selected that (i) aid in an accurate diagnosis; (ii) coincide with the appropriate response of the health care team, whether it be no response, treatment of latent infection, or treatment of disease; (iii) provide the most useful information that correlates with the prognosis; (iv) provide the necessary information for appropriate public health action; and (v) provide a uniform, functional, and practical means of reporting. Because tuberculosis, even after it has been treated adequately, remains a pertinent and lifelong part of a person's medical history, previous as well as current disease is included in the classification. This classification is based on the broad host–parasite relationships as described by exposure history, infection, and disease. It is intended mainly as an operational framework for public health programs. The HIV status of an individual should be known, since HIV infection may change the approach to diagnosis and therapy for tuberculosis.

- No tuberculosis exposure not infected. Persons in this class have no history of exposure and a negative reaction to the tuberculin skin test (if tested).

- Tuberculosis exposure, no evidence of infection. Persons in class 1 do have a history of exposure but have a negative reaction to the tuberculin skin test. Action taken for persons in this class depends mainly on the degree and recency of exposure to *M. tuberculosis*, as well as the immune status of the exposed person. If there has been significant exposure within 3 months, a follow-up skin test should be performed 10 weeks after the last exposure and in the interim, treatment of latent tuberculosis infection should be considered, especially for children less than 15 years of age and persons with HIV infection.

- Latent tuberculosis infection, no disease. Persons in class 2 have a positive reaction to the tuberculin skin test (indicate mm in duration), negative bacteriologic studies (if done), and no clinical, bacteriologic, or radiographic evidence of active tuberculosis. Treatment of latent tuberculosis infection may be indicated for some persons in this group.

Tuberculosis, clinically active. Class 3 includes all patients with clinically active tuberculosis whose diagnostic procedures are complete. If the diagnosis is still pending, the person should be

classified as a tuberculosis suspect (Class 5). To fit into Class 3, a person must have clinical, bacteriological, and/or radiographic evidence of current tuberculosis. This is established most definitively by isolation of *M. tuberculosis*. A person who had past tuberculosis and who also currently has clinically active disease belongs in Class 3. A person remains in Class 3 until treatment for the current episode of disease is completed. This group is further defined by the following features.

**3. Describe four or more bacterial vaccine-preventable diseases that have the same modes of transmission.**

- a) A vaccine-preventable disease is an infectious disease for which an effective preventive vaccine exists. If a person acquires a vaccine-preventable disease and dies from it, the death is considered a vaccine-preventable death. Vaccination increases the level of immunity in the body to the infectious agents that were used to make the harmless vaccine. Tuberculosis, diphtheria, pertussis, tetanus, meningococcal meningitis and streptococcal pneumonia are the commonest and the most important bacterial vaccine-preventable diseases. The most common and serious vaccine-preventable diseases tracked by the World Health Organization (WHO) are: diphtheria, *Haemophilus influenzae* serotype b infection, hepatitis B, measles, meningitis, mumps, pertussis, poliomyelitis, rubella, tetanus, tuberculosis, and yellow fever. The most common and serious vaccine-preventable diseases tracked by the World Health Organization (WHO) are: diphtheria, *Haemophilus influenzae* serotype b infection, hepatitis B, measles, meningitis, mumps, pertussis, poliomyelitis, rubella, tetanus, tuberculosis, and yellow fever. The WHO reports licensed vaccines being available to prevent, or contribute to the prevention and control of 25 vaccine-preventable infections.

Vaccine-preventable deaths are usually caused by a failure to obtain the vaccine in a timely manner. This may be due to financial constraints or to lack of access to the vaccine. A vaccine

that is generally recommended may be medically inappropriate for a small number of people due to severe allergies or a damaged immune system. In addition, a vaccine against a given disease may not be recommended for general use in a given country, or may be recommended only to certain populations, such as young children or older adults. Every country makes its own immunization recommendations, based on the diseases that are common in its area and its healthcare priorities. If a vaccine-preventable disease is uncommon in a country, then residents of that country are unlikely to receive a vaccine against it. For example, residents of Canada and the United States do not routinely receive vaccines against yellow fever, which leaves them vulnerable to infection if travelling to areas where risk of yellow fever is highest (endemic or transitional regions).

**i) There are 4 main types of vaccines:**

- Live-attenuated vaccines.
- Inactivated vaccines.
- Subunit, recombinant, polysaccharide, and conjugate vaccines.
- Toxoid vaccines.

**ii) The Diseases Vaccines Prevent**

- Diphtheria.
- Haemophilus influenzae type b (Hib)
- Hepatitis A.
- Hepatitis B.
- Influenza (flu)
- Measles.
- Mumps.
- Pertussis (Whooping cough)
- Airborne transmission. Some infectious agents can travel long distances and remain suspended in the air for an extended period of time. ...
- Contaminated objects. ...
- Food and drinking water. ...
- Animal-to-person contact. ...
- Animal reservoirs. ...
- Insect bites (vector-borne disease) ...
- Environmental reservoirs.

**iii) Modes of Transmission of Infectious Diseases**

➤ **Direct contact**

An easy way to catch most infectious diseases is by coming in contact with a person or animal that has the infection. Three ways infectious diseases can be spread through direct contact are:

- **Person to person.** A common way for infectious diseases to spread is through the direct transfer of bacteria, viruses or other germs from one person to another. This can occur when an individual with the bacterium or virus touches, kisses, or coughs or sneezes on someone who isn't infected.

These germs can also spread through the exchange of body fluids from sexual contact. The person who passes the germ may have no symptoms of the disease, but may simply be a carrier.

- **Animal to person.** Being bitten or scratched by an infected animal , even a pet , can make you sick and, in extreme circumstances, can be fatal. Handling animal waste can be hazardous, too. For example, you can acquire a toxoplasmosis infection by scooping your cat's litter box.
- **Mother to unborn child.** A pregnant woman may pass germs that cause infectious diseases to her unborn baby. Some germs can pass through the placenta. Germs in the vagina can be transmitted to the baby during birth.

- **Indirect contact**

Disease-causing organisms also can be passed by indirect contact. Many germs can linger on an inanimate object, such as a tabletop, doorknob or faucet handle. When you touch a doorknob handled by someone ill with the flu or a cold, for example, you can pick up the germs he or she left behind. If you then touch your eyes, mouth or nose before washing your hands, you may become infected.

- **Insect bites**

Some germs rely on insect carriers such as mosquitoes, fleas, lice or ticks to move from host to host. These carriers are known as vectors. Mosquitoes can carry the malaria parasite or West Nile virus, and deer ticks may carry the bacterium that causes Lyme disease.

- **Food Contamination**

Another way disease-causing germs can infect you is through contaminated food and water. This mechanism of transmission allows germs to be spread to many people through a single source. *E. coli*, for example, is a bacterium present in or on certain foods — such as undercooked hamburger or unpasteurized fruit juice.

- **Transmission**

Regardless of the reservoir, transmission must occur for an infection to spread. First, transmission from the reservoir to the individual must occur. Then, the individual must transmit the infectious agent to other susceptible individuals, either directly or indirectly. Pathogenic microorganisms employ diverse transmission mechanisms.

- **Contact Transmission**

Contact transmission includes direct contact or indirect contact. Person-to-person transmission is a form of direct contact transmission. Here the agent is transmitted by physical contact between two individuals (Figure 1) through actions such as touching, kissing, sexual intercourse, or droplet sprays. Direct contact can be categorized as vertical, horizontal, or droplet transmission. Vertical direct contact transmission occurs when pathogens are transmitted from mother to child during pregnancy, birth, or breastfeeding. Other kinds of direct contact transmission are called horizontal direct contact transmission. Often, contact between mucous membranes is required for entry of the pathogen into the new host, although skin-to-skin contact can lead to mucous membrane contact if the new host subsequently touches a mucous membrane. Contact



transmission may also be site-specific; for example, some diseases can be transmitted by sexual contact but not by other forms of contact.

When an individual coughs or sneezes, small droplets of mucus that may contain pathogens are ejected. This leads to direct droplet transmission, which refers to droplet transmission of a pathogen to a new host over distances of one meter or less. A wide variety of diseases are transmitted by droplets, including influenza and many forms of pneumonia. Transmission over distances greater than one meter is called airborne transmission.

Indirect contact transmission involves inanimate objects called fomites that become contaminated by pathogens from an infected individual or reservoir (Figure 2). For example, an individual with the common cold may sneeze, causing droplets to land on a fomite such as a tablecloth or carpet, or the individual may wipe her nose and then transfer mucus to a fomite such as a doorknob or towel. Transmission occurs indirectly when a new susceptible host later touches the fomite and transfers the contaminated material to a susceptible portal of entry. Fomites can also include objects used in clinical settings that are not properly sterilized, such as syringes, needles, catheters, and surgical equipment. Pathogens transmitted indirectly via such fomites are a major cause of healthcare-associated infections (see Controlling Microbial Growth).

Reservoirs of human disease can include the human and animal populations, soil, water, and inanimate objects or materials.

Vector transmission occurs when a living organism carries an infectious agent on its body (mechanical) or as an infection host itself (biological), to a new host.

Vehicle transmission occurs when a substance, such as soil, water, or air, carries an infectious agent to a new host.

Healthcare-associated infections (HAI), or nosocomial infections, are acquired in a clinical setting. Transmission is facilitated by medical interventions and the high concentration of susceptible, immunocompromised individuals in clinical settings.

In medicine, public health, and biology, transmission is the passing of a pathogen causing communicable disease from an infected host individual or group to a particular individual or group, regardless of whether the other individual was previously infected.

The term strictly refers to the transmission of microorganisms directly from one individual to another by one or more of the following means:

- Droplet contact – coughing or sneezing on another individual
- direct physical contact – touching an infected individual, including sexual contact
- indirect physical contact; usually by touching a contaminated surface, including soil (fomite)
- airborne transmission , if the microorganism can remain in the air for long periods

- Fecal-oral transmission, usually from unwashed hands, contaminated food or water sources due to lack of sanitation and hygiene, an important transmission route in pediatrics, veterinary medicine and developing countries.

Transmission can also be indirect, via another organism, either a vector (e.g. a mosquito or fly) or an intermediate host (e.g. tapeworm in pigs can be transmitted to humans who ingest improperly cooked pork). Indirect transmission could involve zoonoses or, more typically, larger pathogens like macro parasites with more complex life cycles. Transmissions can be autochthonous (i.e. between two individuals in the same place) or may involve travel of the microorganism or the affected hosts.

Examples of microorganisms that are spread by droplet transmission are: influenza, colds, respiratory syncytial virus (RSV) and some organisms causing pneumonia.

#### **4. What are the causes and methods for preventing bacterial meningitis?**

Vaccines are the most effective way to protect against certain types of bacterial meningitis. One can also help protect himself and others from bacterial meningitis by maintaining healthy habits:

- Don't smoke and avoid cigarette smoke.
- Get plenty of rest.
- Avoid close contact with people who are sick.

These steps can help also prevent meningitis:

- i) Wash hands. Careful hand-washing helps prevent the spread of germs;
- ii) Practice good hygiene. Don't share drinks, foods, and straws, eating utensils, lip balms or toothbrushes with anyone else;
- iii) Stay healthy ;
- iv) Cover mouth ;
- v) If pregnant, take care with food.

Bacterial meningitis occurs when these bacteria get in the bloodstream and travel to your brain and spinal cord to start an infection. Most bacteria that cause this form of infection are spread through close personal contact, such as: coughing and sneezing.

Healthy immune system can help prevent an infection from the viruses and bacteria that cause meningitis. Keep your immune system at its fighting best by eating healthy including fresh fruits

and vegetables, whole grains, and lean proteins and by getting regular exercise. Also, be sure to get the sleep you need.

There are actually five types of meningitis, bacterial, viral, parasitic, fungal, and non-infectious, each classified by the cause of the disease. Early diagnosis and treatment will prevent brain damage and death. Bacterial meningitis is treated with intravenous antibiotics. There's no specific antibiotic for bacterial meningitis. Viral meningitis may resolve on its own, but some causes of viral meningitis will be treated with intravenous antiviral medications.

Bacterial meningitis is caused by several different types of bacteria, including:

- *Streptococcus pneumoniae*, also called pneumococcus;
- *Neisseria meningitidis*, also called meningococcus;
- *Haemophilus influenzae*, also called Hib;
- *Listeria monocytogenes*;
- group B strep;
- *E. coli*.

Bacteria that cause meningitis can live in a body and the environment around. In many cases they are harmless. Bacterial meningitis occurs when these bacteria get in a body bloodstream and travel to your brain and spinal cord to start an infection.

Most bacteria that cause this form of infection are spread through close personal contact, such as:

- coughing
- sneezing
- kissing

An infected person's throat secretions, like saliva, contain bacteria. When that person coughs or sneezes the bacteria travel through the air. But most of the germs that can lead to bacterial meningitis aren't contagious. In fact, the bacteria that cause meningitis are less contagious than viruses that cause the cold or flu.

Not all bacteria that cause meningitis are spread from one person to another. One can also develop bacterial meningitis after eating certain foods containing the *Listeria* bacterium, such as:

- soft cheeses
- hot dogs
- sandwich meats

Problems due to Listeria are more common in:

- pregnant women
- the elderly
- babies

Meningitis-causing bacteria are more likely to attack the membranes of a brain after a trauma such as:

- a head fracture
- surgery
- a sinus infection

These conditions lower your immunity and disrupt your body's natural barriers, leaving your body open to infection of any kind, including bacterial meningitis.

Additionally, babies and people with weak immune systems are more likely to develop bacterial meningitis. It's important to note that the cause of an infection can be hard to pinpoint.

#### **a) Prevention**

Some types of bacterial meningitis can be prevented through immunizations. There are vaccines that protect against pneumococcus, meningococcus, and Hib, all of which cause meningitis. Vaccinations are key to the prevention of meningitis. See your doctor to make sure your vaccinations, and those of your children, are up-to-date.

Bacterial meningitis can lead to severe health complications, such as stroke and brain damage. It can even be fatal. Complications of the disease are often permanent. Other serious possible complications include:

- ✓ Memory problems;
- ✓ Hearing loss;
- ✓ Paralysis;
- ✓ Kidney failure;
- ✓ Body-wide infection and shock, called septicemia;
- ✓ Movement problems, such as difficulty walking;
- ✓ Learning disabilities;
- ✓ Headaches;
- ✓ Seizures.

**5. Explain two characteristics that illustrate how the Anopheles larvae are different from other mosquito larvae. Using illustration is advised**

The body of the adult Anopheles mosquito is dark brown to black in color and has three sections which are the head, thorax and abdomen. When resting, the stomach area of the anopheles mosquito species points upward, rather than being even with the surrounding surface like most mosquitoes. Aedes and Culex are very similar, however. But looking at the siphon it will be noticed that the ones from Culex are longer and have a lighter color; their body is also "hairy" compared to Aedes. ... Anopheles mosquitoes have a ~45 degree angle, while Culex stays parallel to the surface. Their coloring ranges from greyish-brown to black with white, green or blue markings. They have scales along the veins of their wings and long beak-like, sharp sucking mouth parts called a proboscis. These two features distinguish mosquitoes from other flies. Mosquitoes also have feathery or hairy antennae. Aedes aegypti and Aedes albopictus look similar, with black and white stripes on their bodies and legs. However, we can differentiate them by their scale patterns. Aedes aegypti has two white lyre-shaped bands on its thorax (back), whereas Aedes albopictus has a white central band on its thorax.

Eggs of culex are vertically laid in clusters on the surface of the water whereas of anopheles are laid singly and horizontally on the surface of the water. Larva of culex mosquito is bottom feeder whereas of anopheles mosquito is surface feeder.

After mosquito eggs hatch in water, they become mosquito larvae. Learn more about these small pests. All mosquitoes undergo metamorphosis, passing through four distinct stages during their lives: egg, larva, pupa and adult. Larvae, within a week, the eggs hatch in water, becoming mosquito larvae called "wigglers."

Culex and Anopheles are yellow-ish, but one can identify them by observing their resting position. Anopheles mosquitoes have a ~45 degree angle, while Culex stays parallel to the surface. Microscopically, look for antenna morphology. To identify instars, just look at the size and the color of the larvae.