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Qn1. 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 main cause of the disease. Can it be classified as communicable? Explain your reasons

Diabetes mellitus (**American Diabetes Association, 11.5.2018**) is a disease that prevents your body from properly using the energy from the food you eat. It occurs in one of the following situations.

To better understand diabetes, it helps to know more about how the body uses food for energy (a process called metabolism). Your body is made up of millions of cells, to make energy the, the cells need food in a very simple form. When you eat or drink, much of your food is broken down into a simple sugar called glucose. Glucose provides the energy your body needs for daily activities.

Therefore to verify if diabetes mellitus is a communicable disease, we should first know what are the communicable diseases and their causes?

A communicable disease is one that is spread from one person to another through a variety of ways that include: contact with blood and bodily fluids; breathing in an airborne virus; or by being bitten by an insect. Communicable diseases may be classified according to the causative agent, the clinical illness caused, or the means of transmission. Often all three characteristics are used (e.g., food-borne Salmonella gastroenteritis). Causative agents include bacteria, viruses, and parasites. Examples of bacterial diseases include pneumococcal pneumonia and gonorrhea. Viral diseases include influenza, measles, and ebola. Parasitic diseases include malaria and schistosomiasis. Other communicable diseases may be caused by other types of microorganisms such as fungi (e.g., histoplasmosis). They are caused by infectious agents that can be transmitted to other people from an infected person, animal or a source in the environment.

The organisms that cause communicable diseases are called infectious agents, and their transmission to new uninfected people is what causes communicable diseases,

However, diseases such as heart disease like cancer and diabetes mellitus, which are not caused by infectious agents and are not transmitted between people, are called non-communicable diseases. A disease can be communicable if it is transmitted from person to person like Tuberculosis which is caused by an organism called Mycobacterium tuberculosis. And it is caused by infectious agent and it develops as a result of transmission of the infectious agent.

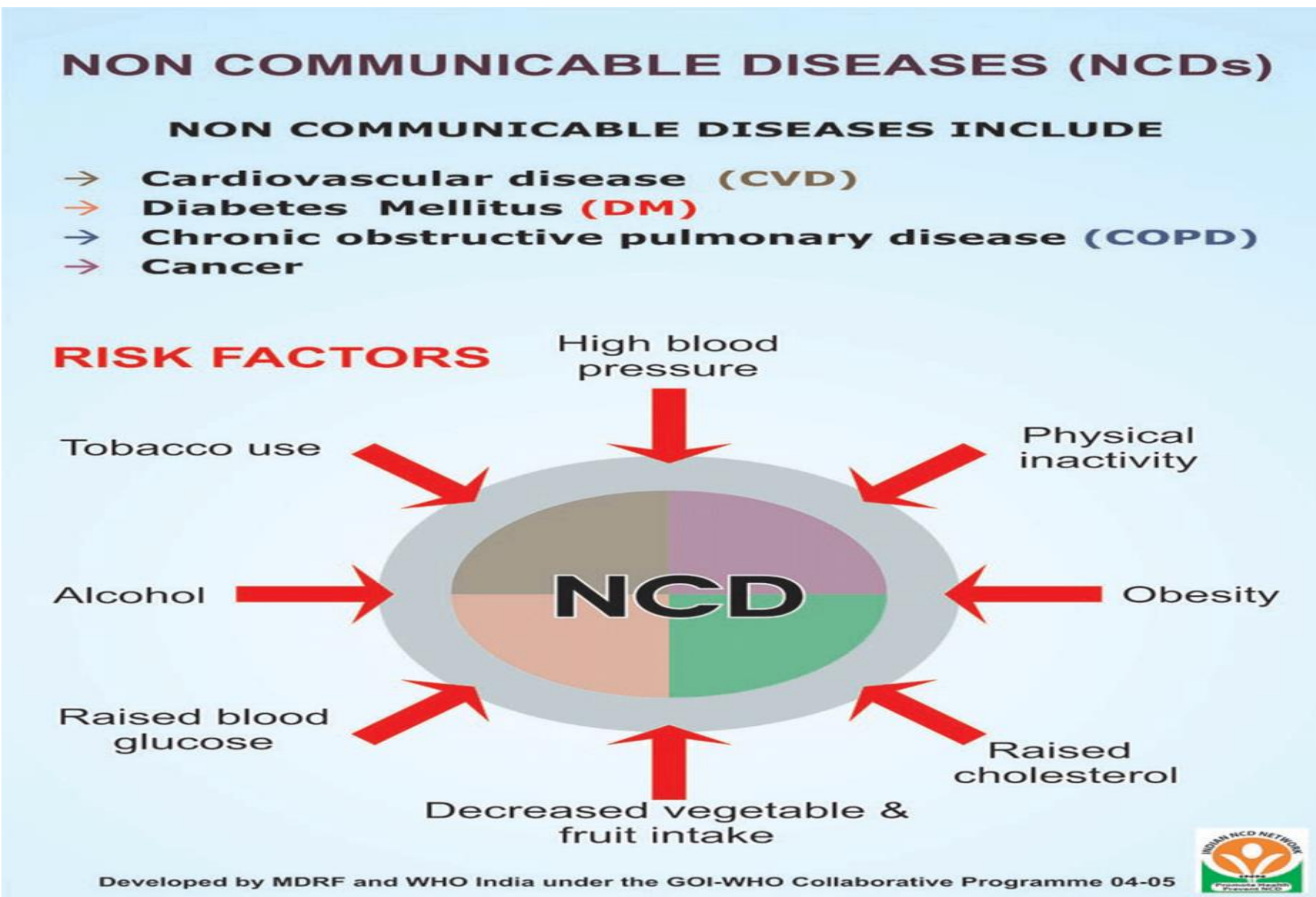
Communicable diseases are classified into two as follow

a- Clinical classification which is based on the main clinical manifestations (symptoms and signs) of the disease. This way of classification is important in helping you to treat the symptoms and signs that are common to (shared by) individuals who suffer from different diseases. E.g. Diarrhoeal diseases. Another clinical classification refers to diseases characterized as febrile illnesses, because they all have the main symptom of fevers. E.g. Malaria.

b- Epidemiologic classification is based on the main mode of transmission of the disease. This classification is based on the main mode of transmission of the infectious agents. E.g Cholera and typhoid fever are two different diseases which can be transmitted by drinking contaminated water, therefore, they are classified as waterborne diseases. Based on the mode of transmission of the infectious agent, epidemiologic classification of communicable can be as follow

- Waterborne diseases; transmitted by ingestion of contaminated water
- Foodborne diseases; transmitted by ingestion of contaminated food
- Airborne diseases; transmitted through the air
- Vector-borne diseases; transmitted by vectors, such as mosquitoes and flies

Non communicable diseases (NCDs)



Qn2. How would you classify pulmonary tuberculosis using the epidemiologic method? What is the main importance of such classification?

Pulmonary tuberculosis is classically divided into primary and post-primary (reactivation). Although it is the most common pulmonary form in children, it has also been increasingly observed in adult patients.

Primary tuberculosis:

Primary disease is currently found in 25-35% of all adult cases of tuberculosis. It occurs when an uninfected patient inhales an infectious droplet and produces infection in the terminal airway. Symptoms and signs include those associated with the specific disease site, as well as non-specific constitutional symptoms. The classic clinical features of pulmonary tuberculosis include fever, weight loss, night sweats, chronic cough, sputum production, haemoptysis and appetite loss. The risk of active disease increases after infection with HIV, and the manifestations of pulmonary tuberculosis in these patients are similar to those in HIV-negative patients.

Post-primary tuberculosis:

This form usually results from reactivation of a previously dormant primary infection in 90% of cases. In a few cases, it may result from the continuation of primary disease. Reactivation of mycobacterial disease is almost exclusively seen in young patients. Post-primary lasions have a slow, progressive course, and result in high morbidity if not adequately treated. The radiological features might be classified as parenchymal disease with cavitation, airway involvement and pleural extension. The symptoms and signs depend on the location and type of disease.

Every epidemiological method has its drawbacks. Most vulnerability analyses fail to take into account all the factors that contribute to the structure of the human environment, particularly the knowledge, attitudes, and behaviors of the population at risk. Rapid needs assessments continue to suffer from a lack of common indicators that can be linked in standard formats and commonly shared among response agencies.

Mortality rates may be inappropriately underestimated or overestimated if population estimates are not accurate or if mortality events are clustered in time and place. Respondents may readily introduce selection biases in nonrandomized quantitative or qualitative surveys. Depending on perceived incentives or disincentives, respondents may exaggerate the needs of the community (if the interviewer has access to outside resources) or minimize the needs of the community (if the interviewer is seen as an outsider and garners mistrust). Since all epidemiological methods have benefits and pitfalls, it is imperative that they are used correctly, with thoughtful consideration to the population`s needs, the space and time context, and the potential biases that may be introduced.

The epidemiological method relies on population-wide statistics about the prevalence and incidence of injuries. These analyses are often specific to certain characteristics such as type and cause (e.g., burns, drowning, firearm wounds, or motor vehicle occupant), demographic variables (e.g., age, sex, socioeconomic class of the injured victim), and injury circumstances (e.g., where the injury occurred: street, house, school; how it occurred: fall, car collision, fire). These epidemiological analyses can convey some aspects of injury development in order to suggest where attention is needed to prevent or control injuries *(* **(Baker et al, 1992), (Robertson, 1998)**.

Epidemiology studies have established that motor vehicles contribute to the most injuries of any cause, indicating that speed, road conditions, passengers seatbelt use, driver`s alcohol consumption, for example, are related to these injuries and deaths. Different types of injuries vary in predominance at various ages. For children, a developmental relationship of behavior, ability, and environment has been noted: toddlers are injured in falls and ingestion of poisons; school children are hit by cars as pedestrians; adolescents are injured in car collusions as drivers of passengers, in sports activities, and by firearms. The elderly are injured at falls.

Qn3. Describes four or more bacterial vaccine-preventable diseases that have the same modes of transmission

Vaccines are medical products prepared from whole or parts of bacteria, viruses, or the toxins (poisonous substances) that some bacteria produce. The contents of the vaccine have first been treated, weakened or killed to make them safe. If a vaccine is injected into a person, or given orally by drops into the mouth, it should not cause the disease it is meant to prevent, even though it contains material from the infectious agent. Vaccines are given to susceptible persons, particularly children, so that they can develop immunity against the infectious agent

Immunity refers to the ability of an individual to resist a communicable disease. When a dead or weakened micro-organism is given in the form of a vaccine, this process is called **vaccination** or **immunization**. The vaccine circulates in the body and stimulates white blood cells called **lymphocytes** to begin producing special defensive proteins known as **antibodies**.

Antibodies are also normally produced whenever a person is infected with active bacteria or viruses transmitted from a reservoir in the community. Antibodies and white blood cells are very important natural defenses against the spread of infection in our bodies, because they can destroy infectious agents before the disease develops. What vaccination does is to stimulate this normal response, by introducing a weakened or killed form of infection, which the white blood cells and antibodies attack.

This defensive response against the harmless vaccine increases the person’s level of immunity against the active infectious agents, if the same type that was in the vaccine gets into the body. The protective effect of vaccination lasts for months or years afterwards, and if several vaccinations are given with the same vaccine, the person may be protected from that infection for their lifetime

Vaccine-preventable diseases are important causes of death in children. The causes, infectious agents, modes of transmission and symptoms of the most important bacterial vaccine-preventable diseases are summarized in the below table

Disease	Bacterial cause *(scientific name)*	Mode of transmission	Symptoms
Tuberculosis	*Mycobacterium tuberculosis*	Respiratory by coughing or sneezing	Chronic cough, weight loss, fever, decreased appetite
Diphtheria	*Corynebacterium diphtheriae* and its toxin	Respiratory by coughing or sneezing	Sore throat, loss of appetite, and slight fever
Pertussis	*Bordetella pertussis*	Respiratory by coughing or sneezing	Runny nose, watery eyes, sneezing, fever, and continuous cough, followed by vomiting
Meningitis (infection of the brain or spinal cord)	*Neisseria meningitidis*	Respiratory by coughing or sneezing	Fever, headache, neck stiffness, coma
Pneumonia (infection of the lungs)	*Streptococcus pneumoniae*	Respiratory by coughing or sneezing	Cough, fast breathing/difficult breathing
Haemophilus influenzae	Respiratory by coughing or sneezing	Cough, fast breathing/difficult breathing.	Treatment by antibiotics; Hib is part of the pentavalent vaccine

Qn4.what are the causes and method for preventing bacterial meningitis?

Meningococcal meningitis is an infection of the brain and spinal cord by the bacterium *Neisseria meningitidis* (also known as the meningococcus bacterium). The disease is caused by several groups of meningococcus bacteria, which are given distinguishing codes such as type A, B, C, Y and W135.

In populations over 30,000 people, a meningitis epidemic is defined as 15 cases per 100,000 inhabitants per week; or in smaller populations, five cases in one week or an increase in the number compared to the same period in previous years.

The disease occurs globally, but in sub-Saharan Africa, meningitis epidemics occur every two to three years. An **epidemic** is a sudden and significant increase in the number of cases of a communicable disease, which may go on rising for weeks, months or years. Meningitis epidemics are common in many countries of Sub-Saharan Africa, including Ethiopia. In Ethiopia, these epidemics are usually caused by group A and C type meningococcus bacteria, and are more common in western Ethiopia. The disease is most common in young children, but it also can affect young adults living in crowded conditions, in institutions, schools and refugee camps.

Mode of transmission and clinical symptoms

Meningococcal meningitis is transmitted to a healthy person by airborne droplets from the nose and throat of infected people when they sneeze or cough. The disease is marked by the sudden onset of intense headache, fever, nausea, vomiting, sensitivity to light and stiffness of the neck. Other signs include lethargy (extreme lack of energy), coma (loss of consciousness), and convulsions (uncontrollable shaking, seizures).

General and more specific signs of meningitis in infants

General signs of meningitis:

- Drowsy, lethargic or unconscious
- Reduced feeding
- Irritable
- High pitched cry.

More specific signs of meningitis:

- Convulsion (fits)
- Bulging fontanelle in infants.

A child with typical signs of meningitis such as neck stiffness, bulging fontanelle and convulsion, should be immediately referred to the nearest hospital or health centre.

During examination of a baby with meningitis, you will notice stiffness of the neck, or bulging of the **fontanelle** – the soft spot on top of the head of infants. The fontanelle bulges because the infection causes fluid to build up around the brain, raising the pressure inside the skull. A bulging fontanelle due to meningitis is observed in infants since the bones of the skull are not yet fused together. **(*Source: WHO, 2005, Pocket Book of Hospital Care for Children, p.50)***

Children may also show rigid posture due to irritation of the covering part of the brain or spinal cord. To check the presence of neck stiffness, ask the parents to lay the child in his/her back in the bed and try to flex the neck of the child

If meningitis is not treated, mortality is 50% in children. This means that half of all cases end in death. However, with early treatment, mortality is reduced to between 5 to 10%. But about 10 to 15% of those surviving meningococcal meningitis will suffer from serious complications afterwards, including mental disorders, deafness and seizures.

Diagnosis and treatment of meningitis

Meningitis is diagnosed by physical examination of the person, and by laboratory testing of the fluid from their spinal cord, where the meningococcal bacteria can be found. In the hospital or health centre, the meningitis is treated using antibiotics given intravenously (IV), that is, liquid antibiotics given directly into the bloodstream through a vein.

Prevention and control of meningococcal meningitis

Next we describe how to prevent meningococcal meningitis from spreading in a community. The most important preventive and control methods are as follow;

Strategies to prevent and control meningitis

- *Early identification* and *prompt treatment* of cases in the health facility and in the community.
- *Education* of people in the community on the symptoms of meningitis, the mode of transmission and the treatment of the disease.
- *Reporting* any cases of meningitis to the District Health Office; and avoiding close contact with the sick persons. Your health education messages should tell everyone about this.
- *Vaccination* against meningococcus bacteria of types A, C, Y and W135, as described in the *Immunization* Module.

A mass immunization campaign that reaches at least 80% of the entire population with meningococcus vaccines can prevent an epidemic. However, these vaccines are not effective in young children and infants, and they only provide protection for a limited time, especially in children younger than two years old. A single case of meningitis could be a warning sign for the start of an epidemic. As a community Health Extension Practitioner, you will need to educate your community about the symptoms of meningitis and how it is transmitted. All cases should be reported to the District Health Office.

Qn5. Explain two characteristics that illustrate how the anopheles larvae are different from other mosquito larvae; Using illustration is advisable.

Human malaria (Plasmodium parasite) is transmitted from an infected person to another person by Anopheles mosquitoes, The parasite spreads by infecting two types of hosts: humans and female Anopheles mosquitoes. The mosquitoes then act as the vector for the parasite. Malaria is a human parasite that is transmitted only between people; malaria is not transmitted from animals to humans, or from humans to animals.

Life cycle of the mosquito vector

Now you will learn about the life cycle of the vector of the malaria parasite, the mosquito. Mosquitoes have four different stages in their life cycle: The first three stages are immature and are found in water collections. The adult is a flying insect. The time taken for the different stages to develop depends on temperature and nutritional factors in their environment. Development takes a shorter time at higher temperatures.

Eggs

A female Anopheles mosquito normally mates only once in her lifetime. It usually requires a blood meal after mating before her eggs can develop. While the blood meal is not essential for the survival of female mosquitoes, it is crucial for successful egg production and egg laying. Blood meals are generally taken every two to three days, before the next batch of eggs is laid. About 100 to 150 eggs are laid on the water surface during oviposition (egg laying). Oviposition sites vary from small hoof prints and rain pools to streams, swamps, canals, river beds, ponds, lakes and crop fields. Each species of mosquito prefers different types of habitats to lay eggs. Under the best conditions in the tropics, the average lifespan of female Anopheles mosquitoes is about three to four weeks.

Larvae

A larva hatches from the egg after one or two days and generally floats parallel under the water surface, since it needs to breathe air. It feeds by taking up food from the water. When disturbed, the larva quickly swims towards the bottom, but it soon needs to return to the surface to breathe.

There are four larval stages or instars. The small larva emerging from the egg is called the first instar. After one or two days it sheds its skin and becomes the second instar, followed by the third and fourth instars at further intervals of about two days each. The larva remains in the fourth instar stage for three or four more days before changing into a pupa. The total time spent in the larval stage is generally eight to ten days at normal tropical water temperatures. At lower temperatures, the larval stages take longer to develop.

Pupae

The pupa is the stage during which a major transformation takes place, from living in water to becoming a flying adult mosquito. The pupa is shaped like a comma. It stays under the surface and swims down when disturbed, but it does not feed. The pupal stage lasts for two to three days, after which the skin of the pupa splits. Then the adult mosquito emerges and rests temporarily on the water's surface until it is able to fly.

Adult mosquitoes

Mating takes place soon after the adult emerges from the pupa. The female usually mates only once because it receives sufficient sperm from a single mating for all subsequent egg batches. Normally the female takes her first blood meal only after mating, but sometimes the first blood meal can be taken by young virgin females. The first batch of eggs develops after one or two blood meals (depending on the species); while successive batches usually require only one blood meal. The process of blood-feeding, egg maturation and egg laying is repeated several times throughout the life of the mosquito. The length of time between two feeding cycles depends on the external temperature. In Anopheles arabiensis, for example, the cycle takes 48 hours when the average day-night temperature is 23°C.

Distinguishing Anopheles mosquitoes from other types

There are two common types of mosquitoes that lay their eggs in water: anophelines, which can be vectors of malaria, and culicines, which do not carry malaria. It is very important that you know the difference in the morphology (structure and shape) of these mosquitoes to identify the exact breeding habitats that support the development of the potential vectors Now study the differences in the body structure and resting position in water collections of the anopheline and culicine larvae, as illustrated in Figure 5.7. You don’t need magnifying or other equipment to distinguish anopheline and culicine larvae. You can tell the difference by looking at the larvae in the vector breeding waters. Your mentor will show you the difference between the two during your practical training. This will be a very important part of your task as a Health Extension Practitioner: identifying water collections that shelter anopheline larvae and taking action to eliminate such breeding grounds or kill the larvae.

There are four stages in the mosquito life cycle, and three of them — eggs, larvae and pupae — are to be found in water.

Eggs

Mosquito eggs either clump together in a ‘raft’ (Culex) or float separately (Aedes); anopheline eggs float separately and each of them has ‘floats’.

Larvae

The culicine larva has a breathing tube (siphon) which it also uses to hang down from the water surface, whereas the anopheline larva has no siphon and rests parallel to and immediately below the surface.

Pupae

Pupae of both anophelines and culicines are comma-shaped and hang just below the water surface. They swim when disturbed. The breathing trumpet of the anopheline pupa is short and has a wide opening, whereas that of the culicine pupa is long and slender with a narrow opening. However, it is difficult to distinguish anopheline from culicine pupae in the field.

Adults

With live mosquitoes, you can distinguish between adult anopheline and culicine mosquitoes by observing their resting postures. Anophelines rest at an angle between 50o and 90o to the surface, whereas culicines rest more or less parallel to the surface.

Behaviour of mosquitoes that transmit malaria

To help you work effectively to prevent malaria transmission, you need to learn about the most important behaviours of a malaria-transmitting mosquito.

Female mosquitoes can feed on animals and humans. Most species show a preference for certain animals or for humans. They are attracted by the body odours, carbon dioxide and heat emitted from the animal or person. Species of mosquitoes that prefer to feed on animals are usually not very effective in transmitting diseases from person to person. Those who prefer to take human blood are the most dangerous as they are more likely to transmit diseases between people. One of the reasons why An. arabiensis mosquitoes are better vectors of malaria than other mosquitoes is that they feed mostly on humans and very little on cattle.

Most anopheline mosquitoes bite at night. Some species bite just after sunset while others bite later, around midnight or in the early morning. Those that bite in the early evening may be more difficult to avoid than species that feed at night.

Some species prefer to feed in forests, some outside houses and others indoors. Mosquitoes that enter a house usually rest on a wall, under furniture or on clothes hanging in the house. Mosquitoes that bite outside usually rest on plants, in holes, in trees, or on the ground, or in other cool dark places.

Because digestion of the blood-meal and development of the eggs takes 2-3 days, a blood-fed mosquito looks for a safe resting place that is shaded and offers protection from drying out. Some species prefer to rest in houses or cattle sheds, while others prefer to rest outdoors, on vegetation or at other natural sites. After the mosquito takes a blood meal indoors, it usually rests inside the house, some for a short period and some for days. Mosquitoes do not usually bite while eggs are developing.

Adult females can normally live between 20 days and one month. The average survival is much shorter at 6-9 days. The average life-span of the female has direct relevance to its efficiency as a malaria vector, because it has to live long enough to transmit malaria (i.e. long enough for the parasite to complete its life cycle in the mosquito host, approximately 10 days).

On average, the flight range of adult Anopheles is between a few hundred metres and 2 kilometres. Therefore water collections very close to houses are more important sources of vectors than those located far away from houses.

Characteristics of anopheles larva

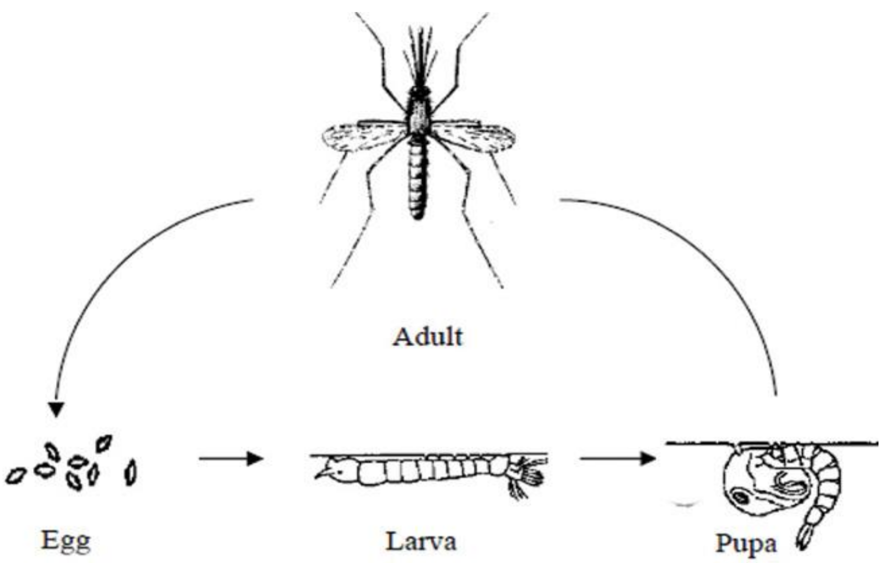


Figure 1.1 shows Life cycle of anopheles mosquito laying and growing into adult

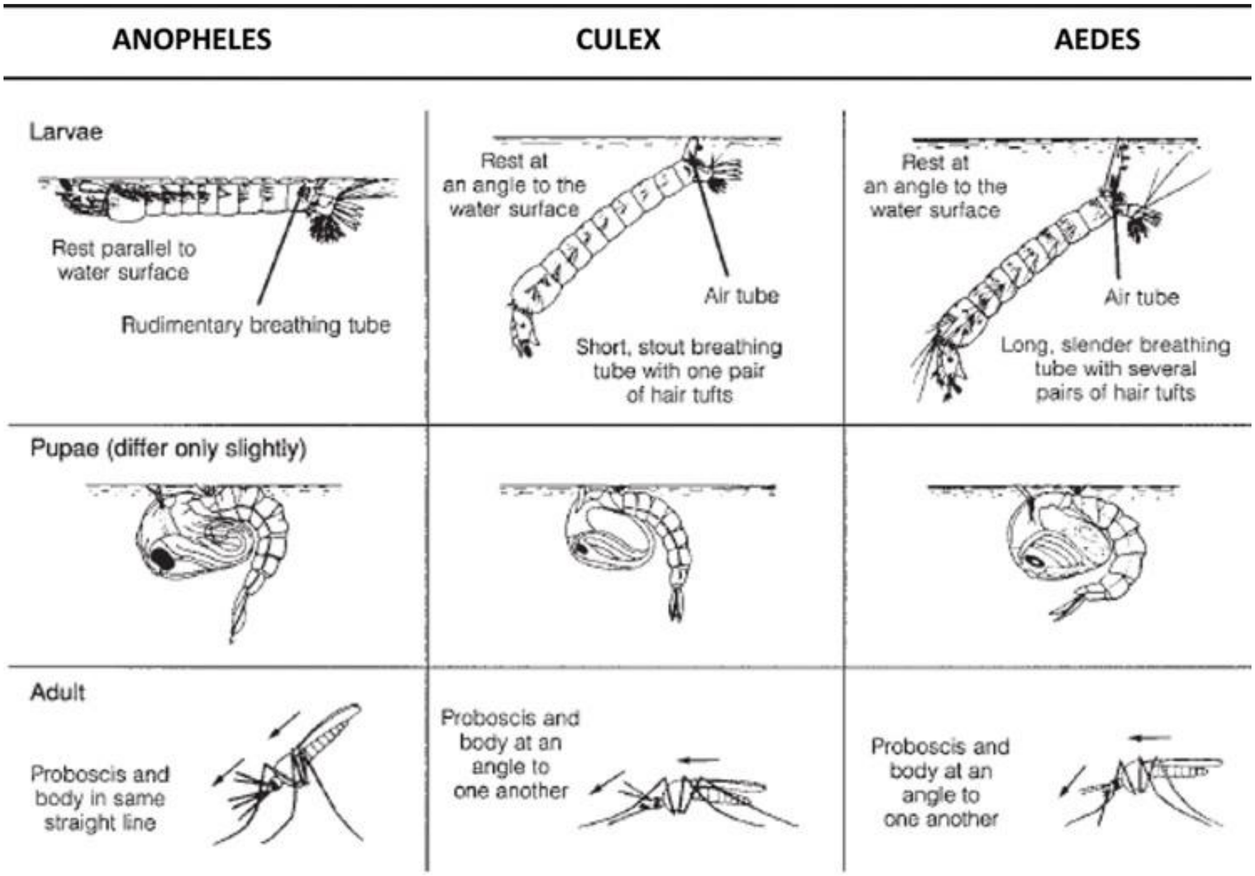


Figure 1.2 also shows the distinguishing features of anopheles mosquitoes (potential malaria vectors) and culicine and aedes mosquitoes (which does not transmitted malaria). Source (WHO 1997).

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