

# Human Health

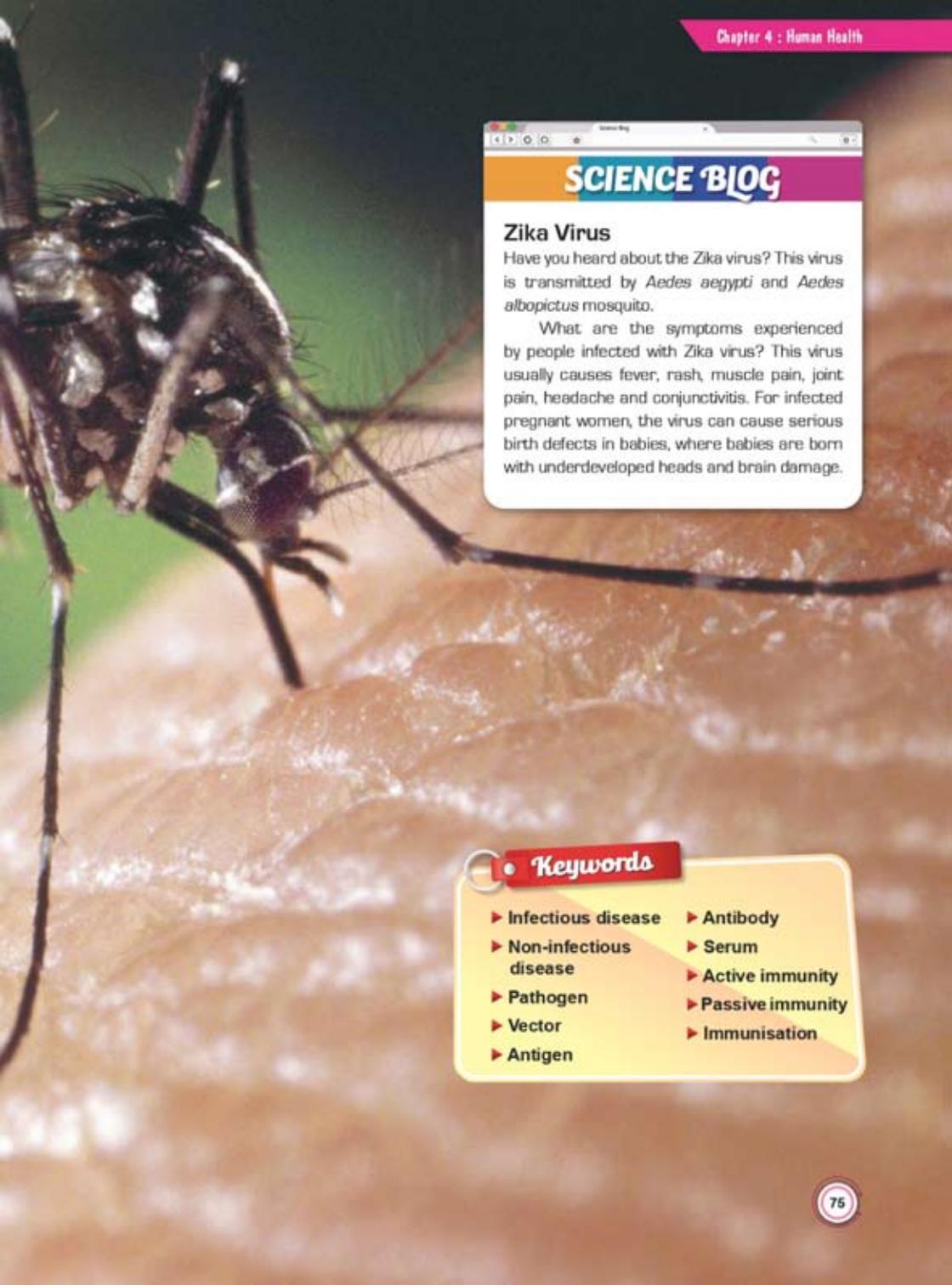
What are the differences between infectious and non-infectious diseases?

How do infectious diseases spread?

How are the microorganisms that enter the body killed?

### Let's understand:

- Infectious and non-infectious diseases
- Body defence



## SCIENCE BLOG

### Zika Virus

Have you heard about the Zika virus? This virus is transmitted by *Aedes aegypti* and *Aedes albopictus* mosquito.

What are the symptoms experienced by people infected with Zika virus? This virus usually causes fever, rash, muscle pain, joint pain, headache and conjunctivitis. For infected pregnant women, the virus can cause serious birth defects in babies, where babies are born with underdeveloped heads and brain damage.

### Keywords

- ▶ Infectious disease
- ▶ Non-infectious disease
- ▶ Pathogen
- ▶ Vector
- ▶ Antigen
- ▶ Antibody
- ▶ Serum
- ▶ Active immunity
- ▶ Passive immunity
- ▶ Immunisation

A disease is an abnormal condition of body or mind that causes discomfort, difficulty to function or stress to an individual. Diseases can be classified into two, namely **infectious diseases** and **non-infectious diseases**. What are the differences between these two types of diseases?

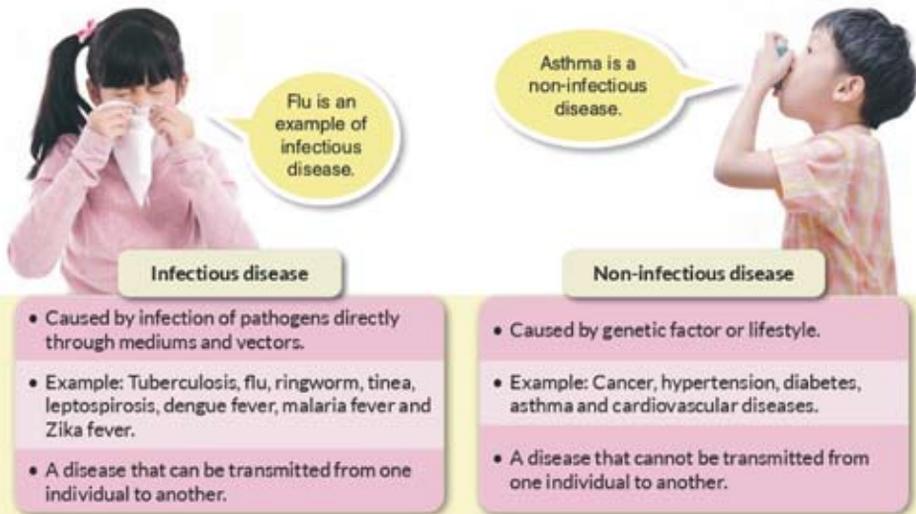


Figure 4.1 Differences between infectious and non-infectious diseases

## How are Infectious Diseases Spread?

Infectious diseases are spread by **pathogens**, the organisms that cause diseases. All virus, some bacteria, protozoa, fungi and worms are pathogens.



Infectious diseases are spread by pathogens transmitted from an infected person (host) to another person through vectors and mediums such as water, air and contact. The host is a victim who is weak and easily infected. After getting infected, the host will show certain symptoms of the disease.

### Airborne diseases

There are two ways airborne diseases are transmitted, through **droplet transmission** and **dust transmission**.



Not all microorganisms are pathogens that are harmful to health. There are some bacteria acting on food residue in the large intestine to produce vitamin K and vitamin B12 which are absorbed by the body.

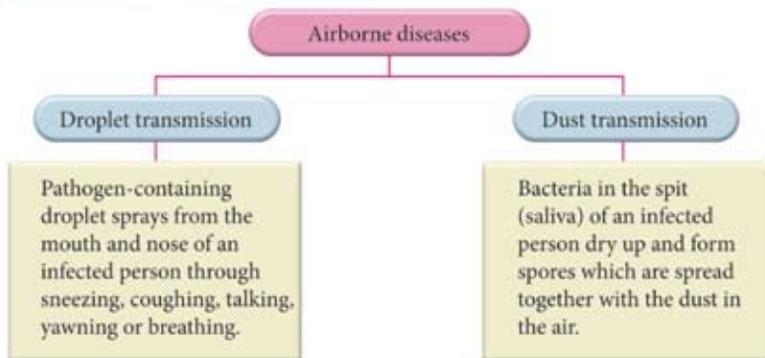


Figure 4.2 Ways of transmission of airborne diseases

Airborne diseases can be prevented by practising the following ways:

- ✓ cover the mouth and nose when sneezing, coughing or yawning
- ✓ do not spit everywhere
- ✓ avoid being in a crowded place
- ✓ ensure the living place gets enough light as ultraviolet rays can kill certain microorganisms in the air

### Brain Teaser

Why does influenza spread more rapidly during cold weather?

Example of diseases that can be spread through air are tuberculosis, flu, Severe Acute Respiratory Syndrome (SARS), Influenza A (H1N1) and chicken pox.



H1N1  
[www.who.int](http://www.who.int)

Info

## Waterborne diseases

Infection through water usually happens in areas with inadequate water supply and poor sanitation. For instance, when someone uses a toilet built over a river, faecal pathogens enter the river and pollute the river. A person can be infected by pathogens when he drinks the contaminated water.

Other than inadequate water supply and poor sanitation, floods can also spread infectious diseases.

**Photograph 4.1** Flood

Among the diseases that are transmitted through water include cholera, typhoid and amoebic dysentery. Infection of diseases through water can be prevented by the following ways:



✓ add chlorine into swimming pools and water supply systems



✓ build toilets with good sanitation



✓ boil drinking water properly



✓ wash hands with soap after using the toilet

**Photograph 4.2** Steps to prevent waterborne diseases

### Infection of diseases through contact

Two examples of diseases that can be transmitted through contact are **ringworm** and **tinea**. Both are caused by **fungi**. Accidentally touching the infected skin or wearing the clothes of an infected person will cause infections to occur.

Diseases like **syphilis** and **gonorrhoea** can spread through sexual intercourse. Pathogens of these diseases are present in body fluids such as semen and vaginal fluid.

The HIV virus that causes AIDS can also be transmitted through sexual intercourse, blood as well as exposure to syringe-sharing among patients and among drug addicts.



Tinea



Ringworm

Photograph 4.3 Diseases transmitted through contact

### Infection of diseases through vectors

Some pathogens are transmitted from one host to another new host through animals. Animals that transmit these pathogens are called **vectors**.

### Brain Teaser

Construct a bridge map for vectors and their pathogens.

Table 4.1 Vector and pathogen

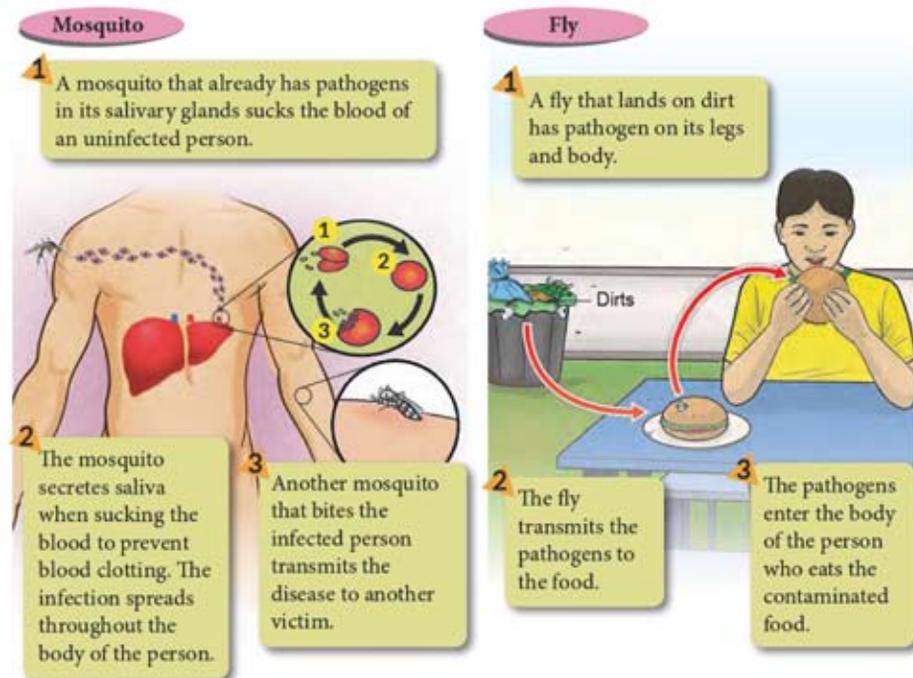
Vector	Pathogen	Vector	Pathogen
1  Cockroach	 Salmonella typhi	4  Aedes mosquito	 Zika virus
2  Fly	 Salmonella typhi	5  Anopheles mosquito	 Plasmodium malariae
3  Aedes mosquito	 Dengue virus	6  Rat	 Leptospira sp. bacteria

**Table 4.2** Several types of diseases, symptoms, pathogens, vectors and ways of infection

Disease	Symptoms	Pathogen	Vectors	Way of infection
Malaria	shivering, fever and sweating	<i>Plasmodium malariae</i>	female Anopheles mosquito	mosquito bite
Cholera	diarrhea and vomiting	<i>Vibrio cholerae</i> bacteria	fly	contaminated food and water
Dengue	joint pain, fever, headache and watery eyes	virus	Aedes mosquito	mosquito bite
Zika	fever, rashes, joint pain and conjunctivitis	virus	Aedes mosquito	mosquito bite
Typhoid	fever, intestinal bleeding and red rashes	<i>Salmonella typhi</i> bacteria	cockroach, fly	contaminated food and water
Leptospirosis	fever, headache and muscle pain	<i>Leptospira</i> sp. bacteria	rat	contaminated soil, food and water

## How Do Vectors Spread Diseases?

Mosquitoes and flies are the two vectors that spread numerous infectious diseases. Let us see how these vectors spread diseases.



**Figure 4.3** Ways mosquitoes and flies spread diseases

## The Mechanism to Prevent the Spread of Infectious Diseases

How can infectious diseases be prevented from spreading? Prevention of infectious diseases involves three stages as shown in Table 4.3.

**Table 4.3** Three stages of prevention of infectious diseases

Primary stage	Secondary stage	Tertiary stage
<ul style="list-style-type: none"> <li>• Improving health               <ul style="list-style-type: none"> <li>→ Improving personal and family hygiene, cleanliness of living places and sanitation systems</li> </ul> </li> <li>• Strengthening the body's defence system               <ul style="list-style-type: none"> <li>→ Getting vaccines and immunisation for babies, children, pregnant women, food premises operators, hajj pilgrims and travellers.</li> </ul> </li> <li>• Frequent health check-ups</li> <li>• Maintaining a healthy lifestyle               <ul style="list-style-type: none"> <li>→ Inhaling clean air</li> <li>→ Eating a balanced diet</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Determining transmission of infections through active and passive case detection               <ul style="list-style-type: none"> <li>→ Giving early treatment to patients</li> <li>→ Separating patients from others</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Controlling vector populations               <ul style="list-style-type: none"> <li>→ Destroying vector breeding and hiding places</li> <li>→ Fogging to kill vectors</li> <li>→ Enforcing laws by issuing compounds to owner of dirty food premises</li> </ul> </li> <li>• Protecting hosts               <ul style="list-style-type: none"> <li>→ Using mosquito nets or mosquito coils</li> <li>→ Wearing thick clothes</li> </ul> </li> </ul>



### Activity 4.1

**Aim:** To carry out a case study on diseases in Malaysia.

#### Instruction

1. Work in groups.
2. Visit the website <http://www.moh.gov.my>.
3. Gather information on the statistics of infectious diseases from the website.
4. Discuss the following matters:
  - (a) most common diseases in Malaysia
  - (b) types of diseases transmitted, the causes and preventions
  - (c) prediction of diseases progression based on the statistical graphs from Ministry of Health
  - (d) suggestions to solve this problem
5. Present the outcomes using a multimedia presentation.



Ministry of Health  
Malaysia  
<http://www.moh.gov.my>

### Formative Practice 4.1

1. What is meant by pathogen and vector?
2. Give one example of disease caused by
  - (a) bacteria
  - (b) virus
  - (c) fungi
3. Give two examples of infectious diseases and two examples of non-infectious diseases.
4. State three ways infectious diseases are spread.

## 4.2 Body Defence

Pathogens enter the body through the respiratory system, digestive system, excretory system and skin. Pathogens need to be destroyed by the body. Do you know that our body has a strategy to defend itself against infections?

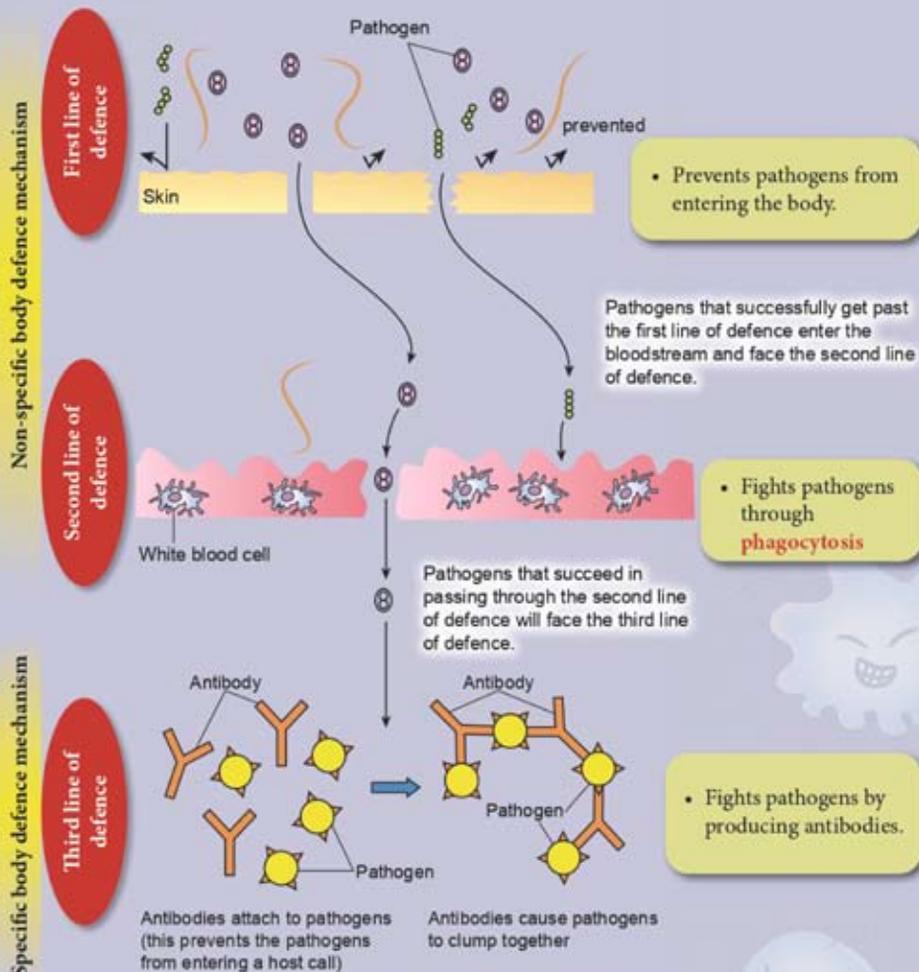


Figure 4.4 Body defence mechanism



Pathogens need to be destroyed!

### First line of defence

#### Skin

- The human **skin** is made of a tough layer and is difficult to be penetrated by microorganisms.
- Microorganisms can only get into the body if there is a wound or if the skin is injured.
- **Sweat** and **sebum** secreted by the skin contain chemicals that can kill microorganisms.

#### Mucous membrane

- **Mucous membrane** is a membrane that lines the **digestive tract** and **respiratory tract**.
- Microorganisms that enter the respiratory tract are filtered by nasal hairs and trapped by mucous lining the nasal cavity.
- Earwax, tears and vaginal secretions also function as an antiseptic that kills microorganisms.

### Second line of defence

#### Phagocytosis

- White blood cells engulf and digest the pathogens using enzymes through **phagocytosis**.

White blood cell

Phagocytosis



Pathogen

### Third line of defence

#### Body immune system

- Immunity is the ability of the body system to resist pathogens before it is infected.
- It involves the production of antibodies when pathogens enter the body.
- **Antibody** is a protein produced by white blood cells into the bloodstream in response to antigens.
- An **antigen** is a foreign substance that comes from outside the body and induces the production of antibodies. Examples of antigens are pathogens, toxin molecules and blood cells from other blood groups.

## Activity 4.2

21  
Century

**Aim:** To create a multimedia presentation on how the body defence system fights against infections and promotes healing.

### Instruction

1. Work in groups.
2. Gather information on:
  - (a) body defence system fighting against infections
  - (b) ways to promote healing from infections.
3. Present the outcomes using a multimedia presentation.

## Importance of Immunisation

**Immunisation** is an effort to stimulate the body defence against infections in babies, children and adults by injecting vaccines.

Is vaccination safe, especially for babies and children?

Yes, it's safe! Vaccines used by the Ministry of Health Malaysia have been evaluated according to international standards.



A **vaccine** contains antigens obtained from a part or the whole structure of a weakened or dead virus or bacterium. Antigens stimulate the body's immune system, forming immunity against certain infections. Therefore, a baby needs to be injected with a few types of vaccines. Table 4.4 shows a vaccination schedule in Malaysia.

Table 4.4 Vaccination schedule in Malaysia

IMMUNISATION	Age (Month)										Year		
	0	1	2	3	5	6	9	12	18	21	7	13	15
BCG	Dose 1												
Hepatitis B	Dose 1	Dose 2				Dose 3							
DTaP			Dose 1	Dose 2	Dose 3					Booster			
Hib			Dose 1	Dose 2	Dose 3					Booster			
Polio (IPV)			Dose 1	Dose 2	Dose 3					Booster			
Measles						Sabah only							
MMR							Dose 1	Dose 2					
MR											Dose 2		
DT											Booster		
HPV												Females only	
Tetanus													Booster
JE (Sarawak)							Dose 1			Dose 2			

Source: Ministry of Health Malaysia

**Notes:**

- Bacillus Calmette–Guérin (BCG) is a vaccine that gives protection against Tuberculosis.
- DTaP is the combination of Diphtheria, Tetanus and Pertussis.
- Hib is Haemophilus influenza type B.
- IPV is Inactivated Polio Vaccine that protects against Polio.
- MMR is the combination of Measles, Mumps and Rubella.
- MR is a booster dose to provide protection against Measles and Rubella.
- DT is a booster dose to protect against Diphtheria and Tetanus.
- HPV is Human Papillomavirus. This vaccine is given only for girls aged 13 years old. Dose 2 is given six months after dose 1.
- JE is vaccine against Japanese Encephalitis. This vaccine is only given in Sarawak.

**Passive Immunity and Active Immunity**

Immunity can be classified into two types, **passive immunity** and **active immunity**. Both immunities can be obtained **naturally** or **artificially**.

**Science Info**

Antibiotics that we consume are excreted from our body and the dose will become less. Thus, antibiotics should be taken at the prescribed dose and time so that the antibiotics are always at the optimum level.

**Passive immunity: The body gains antibody from external sources**

Natural

- Obtained when a baby receives antibody from breast milk or from the mother's blood that flows across the placenta.
- The immunity is temporary and short-lived, lasts for the first few months after the birth of the baby (Figure 4.5).

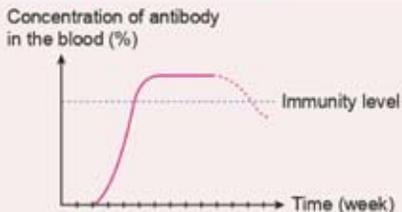


Figure 4.5 Graph of passive natural immunity

Artificial

- Obtained when an antiserum is injected into the patient's body.
- The antiserum fights against pathogens without interrupting the patient's immune system.
  - Antiserum is a clear liquid in the blood that contains antibodies to prevent diseases.
- The immunity is fast and temporary (Figure 4.6).

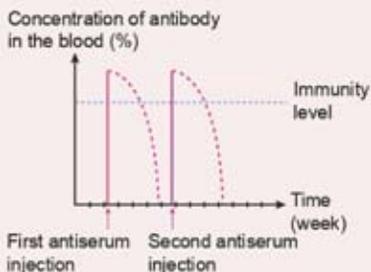


Figure 4.6 Graph of passive artificial immunity

**Active immunity: The body produces its own antibodies when stimulated by antigens**

Natural

- Occurs when a person recovers from an infection.
- The immunity lasts long after the infection (Figure 4.7).

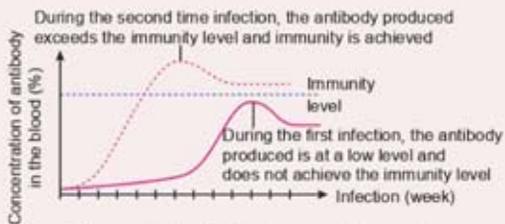


Figure 4.7 Graph of active natural immunity

Artificial

- Occurs when a vaccine that contains a dead or weakened pathogen is injected into the body, and the immune system responds by producing antibodies.
- The immunity lasts long after the infection (Figure 4.8).

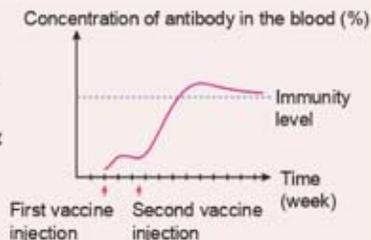


Figure 4.8 Graph of active artificial immunity

## Strong Immune System

The human body is made up of various systems including the immune system. When there is an imbalance in the body or too much toxins, the immune system becomes weak. Some of the causes that weaken the immune system and the practices that strengthen the immune system are shown in Photograph 4.4.

Causes  
that weaken  
the immune  
system



Exposure to polluted air



Exposure to pesticides

**i** Science  
Info

An allergy is the response of the body's immune system to allergen (cause of allergies) in the environment that is usually harmless for most people. Examples of allergens are mites, animal hair, dust, pollen, spores, food (seafood, milk and eggs), animal stings and some medicines.



Stress



Excessive intake of  
sugar



Getting enough sleep and  
rest



Exercising and inhaling  
fresh air

Practices  
that strengthen  
the immune  
system



Not smoking and no  
exposure to cigarette smoke



Doing periodic health  
examination

**Photograph 4.4** Causes that weaken and practices that strengthen the immune system

## Activity 4.3

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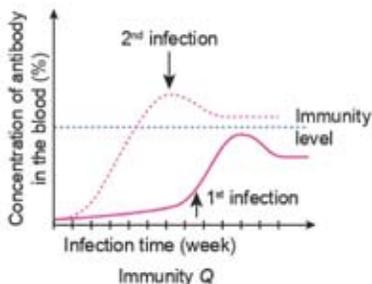
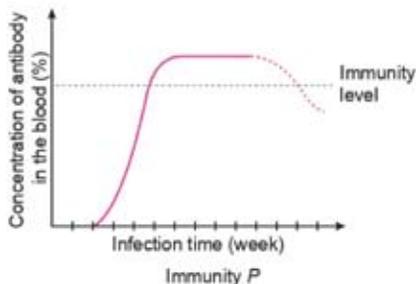
**Aim:** To gather information on the importance of immunisation and health level of individuals.

### Instruction

1. Work in groups.
2. Gather information on immunisation and the implications of the health level of individuals to the family, society, economy and nation.
3. Relate to the aspects of:
  - (a) recurrence of controlled diseases such as leprosy, whooping cough and tuberculosis
  - (b) increased costs of health care
  - (c) affected quality of work
  - (d) insurance coverage
  - (e) quality of life
  - (f) labour (migration)
4. Present the outcomes using a multimedia presentation.

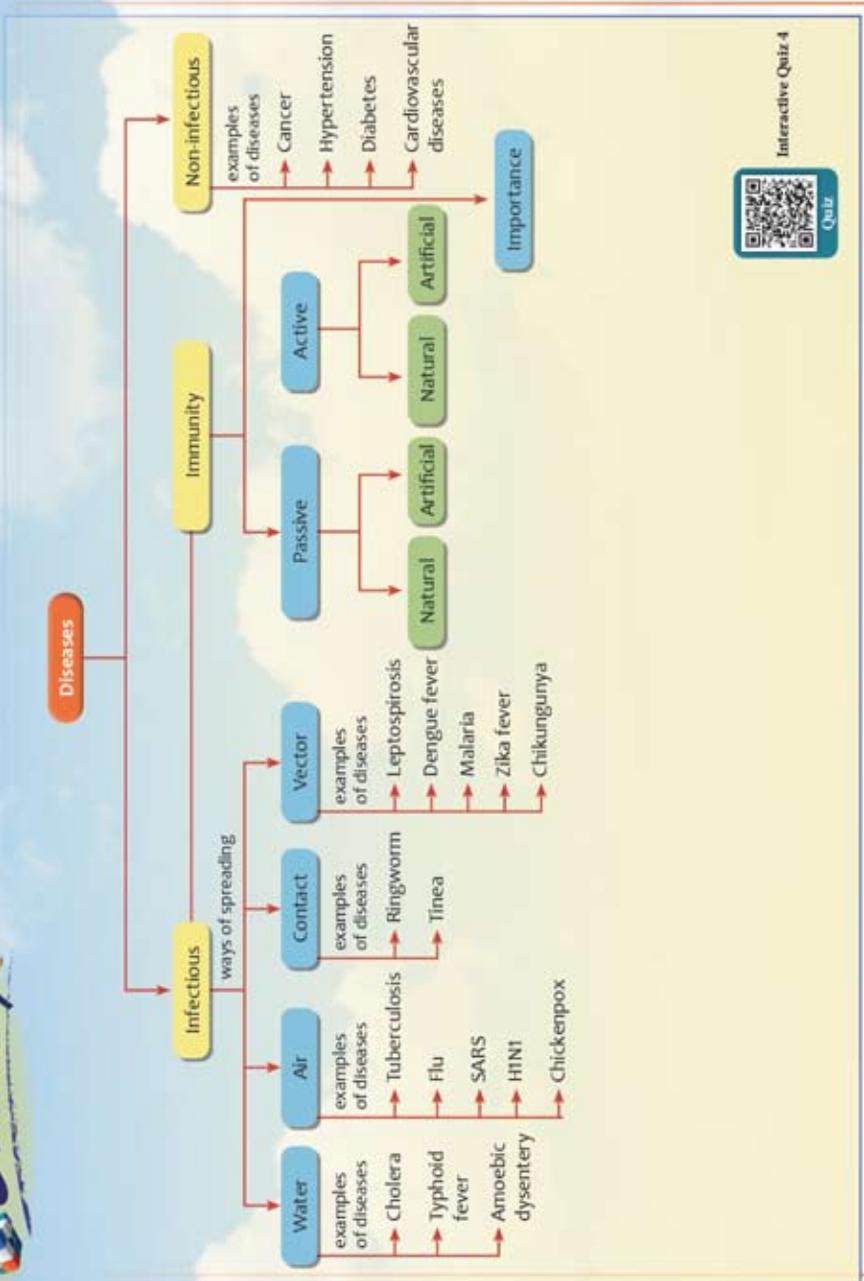
### Formative Practice 4.2

1. Name two strategies of human body defence system.
2. What is meant by antigen, antibody and immunity?
3. The graphs below show two types of immunity, P and Q.



- (a) Name immunity P and immunity Q.
  - (b) Explain the similarities and differences between immunity P and immunity Q.
  - (c) In your opinion, which immunity is better? Explain your answer.
4. Suggest two practices that weaken the immune system of a person.
  5. Explain the reason why immunisation should be given to babies and children.

# Summary



Interactive Quiz 4



Quiz



## SELF-REFLECTION

After learning this chapter, you are able to:

### 4.1 Infectious and Non-infectious Diseases

- Differentiate and communicate infectious and non-infectious diseases.
- Explain how infectious diseases are spread.
- Separate the cause and spread of infectious diseases.
- Generate ideas on the mechanism to prevent the spread of infectious diseases.

### 4.2 Body Defence

- Elaborate and communicate the function of body defence system.
- Define antigens, antibodies and immunity.
- Justify the importance of immunisation.
- Differentiate passive immunity and active immunity.
- Justify good practices towards strong immune system.
- Justify and communicate the importance of immunisation and health level of individuals to the family, social, economy and nation.

## Summative Practice 4

1. The following are among the diseases recorded in Malaysia.

Diabetes  
Leptospirosis

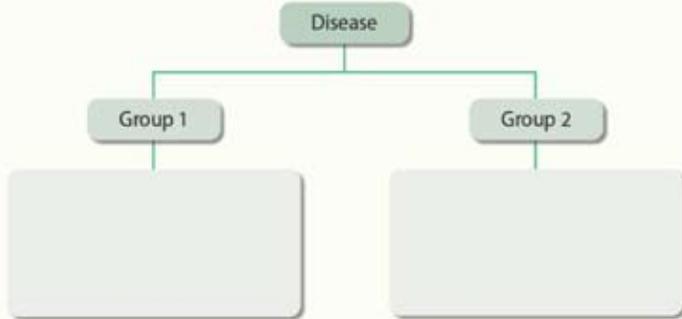
Flu  
Zika

Chickenpox  
Cholera

Hypertension  
Cancer

Heart attack  
Tinea

(a) Classify the diseases above into two groups based on their common characteristics.



- (b) State the characteristic that you used to do the classification in 1(a).
- (c) Based on the list of diseases above, state a disease caused by each of the following factors.
- Fungi
  - Leptospira bacteria
  - Influenza virus
  - Unhealthy eating habits
- (d) Which disease is included in the immunisation programme for babies and children?
2. Dengue haemorrhagic fever is a fatal infectious disease.
- Name the pathogen and vector for this disease.
  - Give one other example of disease spread through the same vector of dengue haemorrhagic fever.
  - Explain the way this disease is spread.
3. Photograph 1 shows a dustbin in a residential area. Predict the effects on the public if this situation prolongs. Give your reasons. 🧠



Photograph 1

4. Figure 1 shows the graph of concentration of antibody in the blood (%) over a period of 40 days. Based on the graph, answer the following questions.
- Explain the reaction of the body against the infection of virus A. 🧠
  - How long does it take for the body to build antibodies to reach the immunity level after an infection? 🧠
  - Give one reason why the antibody level drops after reaching the immunity level. 🧠

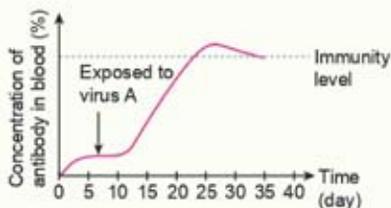


Figure 1

5. Humans are lucky to have two types of body defence mechanisms, specific defence mechanism and non-specific defence mechanism.

- Compare and contrast specific defence mechanism and non-specific defence mechanism.
- Describe the strategy of
  - specific defence mechanism
  - non-specific defence mechanism
- Complete the table below by stating the type of immunity for each case.

Case	Type of immunity
(i) Amin is not infected with chickenpox anymore as he had been infected with the disease when he was 7 years old.	
(ii) Kelvin is not infected with hepatitis B as he has obtained immunisation against the disease.	
(iii) A baby gets antibodies from breast milk.	
(iv) A patient with a hacking cough is injected with the antibody taken from an individual immune to the disease.	

6. Assume you are a scientist. You are responsible to investigate a case of an infectious disease that has been spreading in a small town. The plague has caused three fatal cases and 10 more people have shown the symptoms of infection.

- What are the precautionary steps that should be taken before you carry out the laboratory test to investigate the cause of the plague?
- List down a few questions that you may ask the infected victims to help you in the investigation.
- What are the steps that you can suggest to the residents of the town to protect those who are not infected yet?
- The hospital has decided to impose quarantine on the infected people. Justify the hospital's decision.

## HOTS Mastery 4

7. A farmer bought three hens and kept them in a chicken coop together with other 15 hens. After two days, the farmer found that the three new hens were infected with a disease. After few days, four more hens were infected with the disease. He called a veterinarian to help him. He told him about the three new hens and the change he made in the type of food for the hens a day before he found them sick.

- Suggest two inferences on the infected hens.
- If you were the veterinarian, how could you help the farmer to solve his problem? Explain the design of your test.