



Micro-organisms: Harmful Microbes

Close examination of various illnesses illustrates to students how and where harmful microbes cause disease. Students test their knowledge of disease-causing microbes by researching various illnesses and how they can impact the community.

Curriculum Links

Science

- Working scientifically
- Scientific attitudes
- Experimental skills and investigations

Biology

- Communicable diseases
- Structure and function of living organisms
- Cells and organisation
- Nutrition and digestion

PSHE/RSHE

- Health and prevention

English

- Reading
- Writing

Art & design

- Graphic communication

Learning Outcomes

All students will:

- Understand that sometimes microbes can make us ill and cause infection.
- Understand how harmful microbes (pathogens) can pass from person to person.
- Understand that different infections can have different associated symptoms.
- Understand how global travel has influenced the spread of disease.

Most students will:

- Understand how infectious diseases impact the local community.

Key Words

Bacteria, COVID-19, Epidemic, Fungi, Infection, Pandemic, Pathogens, Toxin, Virus

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e-bug.eu/eng/KS4/lesson/Harmful-Microbes

Fascinating Fact

Lower respiratory infections remain the world's most deadly communicable disease, ranked as the 4th leading cause of death. In 2019 it claimed 2.6 million lives.

Resources Required

Main activity: Harmful Microbes and their Diseases
Per class/group

- Copy of SH1, SH2, SH3, SW1
- Differentiated versions adaptable for students of different abilities SH4, SH5, SW2
- Copy of TS1, TS2

Main Activity 2: Harmful Microbes Fill in the Blanks
Per group

- Devices with internet access or biology textbooks
- Copy of SW3
- Copy of TS3

Outbreak Activity 1 and 2

- Groups of 4 or 5 students

Advance Preparation

1. Cut out the disease cards in SH1 - SH3, one set per group. Laminate these or stick onto stiff card for future use.
(Differentiated version: SH4-SH5)
2. Copy SW1 for each group.
(Differentiated version: SW2)

Supporting Materials

TS1 - Disease Match Answer sheet

1. Infectious Microbes		3. Transmission	
Infectious Microbe	Disease	Transmission	Disease
Bacteria	Scarlet fever, Staphylococcus aureus, Streptococcus	Sexual contact	Chlamydia, HIV, Syphilis
Virus	HIV, Chikungunya, Flu, Measles, Mumps, Rubella, Zika	Blood	Bacterial meningitis, HIV
Fungi	Trichinosis	Touch	Flu, Measles, Chikungunya, Bacterial meningitis
		Inhalation	Flu, Measles, Chikungunya, Bacterial meningitis
		Mouth to mouth	Flu, Measles, Chikungunya, Bacterial meningitis
2. Symptoms		4. Prevention of Infection	
Symptoms	Disease	Prevention	Disease
		Wash hands	Flu, Measles, Chikungunya, Bacterial meningitis

TS1 Harmful Microbes and Their Diseases Answer Sheet

SW1 - Disease Match Worksheet

1. Infectious Microbes		3. Transmission	
Infectious Microbe	Disease	Transmission	Disease
Bacteria		Sexual contact	
Virus		Blood	
Fungi		Touch	
		Inhalation	
		Mouth to mouth	
2. Symptoms		4. Prevention of Infection	
Symptoms	Disease	Prevention	Disease
		Wash hands	

SW1 Disease Match Worksheet

TS2 - Disease Match Differentiated Answer sheet

1. Infectious Microbes		4. Prevention of Infection	
Infectious Microbe	Disease	Prevention	Disease
Bacteria	Chlamydia, HIV, Syphilis	Wash hands	Flu, Measles, Chikungunya
Virus	Chikungunya, Flu, Measles	Cover coughs and sneezes	Flu, Measles, Chikungunya
Fungi	Trichinosis	Use a condom	Chlamydia, HIV, Syphilis
		Unnecessary antibiotic use	Trichinosis
		Vaccination	Chikungunya, Measles, Flu
2. Symptoms			
Symptoms	Disease		
Asymptomatic	Chlamydia		

TS2 Harmful Microbes and Their Diseases Differentiated Answer sheet

SW2 - Differentiated Disease Match

1. Infectious Microbes		4. Prevention of Infection	
Infectious Microbe	Disease	Prevention	Disease
Bacteria	Chlamydia	Wash hands	
Virus		Cover coughs and sneezes	
Fungi		Use a condom	
		Avoid unnecessary antibiotic use	
		Vaccination	
2. Symptoms			
Symptoms	Disease		
Asymptomatic			
Fever			

SW2 Differentiated Disease Match

Harmful Microbes Fill in the Blanks

Disease	Pathogen	Transmission	Symptoms	Prevention	Treatment	Prognosis
Measles	Measles virus	Respiratory droplets	Highly contagious, fever, cough, runny nose, red eyes, rash	Vaccination (MMR)	Supportive care, antipyretics	Most people recover within a few weeks
Scarlet fever	Streptococcus pyogenes	Respiratory droplets, contact	High fever, sore throat, red skin rash	Antibiotics	Antibiotics	Most people recover within a few weeks
Chikungunya	Chikungunya virus	Mosquitoes	Joint pain, fever, rash	Antibiotics	Antibiotics	Most people recover within a few weeks

TS3 Harmful Microbes Fill in The Blanks

Harmful Microbes Fill in the Blanks

Disease	Pathogen	Transmission	Symptoms	Prevention	Treatment	Prognosis
Measles	Measles virus	Respiratory droplets	Highly contagious, fever, cough, runny nose, red eyes, rash	Vaccination (MMR)	Supportive care, antipyretics	Most people recover within a few weeks
Scarlet fever	Streptococcus pyogenes	Respiratory droplets, contact	High fever, sore throat, red skin rash	Antibiotics	Antibiotics	Most people recover within a few weeks
Chikungunya	Chikungunya virus	Mosquitoes	Joint pain, fever, rash	Antibiotics	Antibiotics	Most people recover within a few weeks

Harmful Microbes Fill in the Blanks

Disease	Pathogen	Transmission	Symptoms	Prevention	Treatment	Prognosis
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Scarlet fever	Streptococcus pyogenes	Respiratory droplets, contact	High fever, sore throat, red skin rash	Antibiotics	Antibiotics	Most people recover within a few weeks
Chikungunya	Chikungunya virus	Mosquitoes	Joint pain, fever, rash	Antibiotics	Antibiotics	Most people recover within a few weeks

SW3 Harmful Microbes Fill in The Blanks

Harmful Microbes Fill in the Blanks

Disease	Pathogen	Transmission	Symptoms	Prevention	Treatment	Prognosis
Measles	Measles virus	Respiratory droplets	Highly contagious, fever, cough, runny nose, red eyes, rash	Vaccination (MMR)	Supportive care, antipyretics	Most people recover within a few weeks
Scarlet fever	Streptococcus pyogenes	Respiratory droplets, contact	High fever, sore throat, red skin rash	Antibiotics	Antibiotics	Most people recover within a few weeks
Chikungunya	Chikungunya virus	Mosquitoes	Joint pain, fever, rash	Antibiotics	Antibiotics	Most people recover within a few weeks

SH1-3 Information Sheets

Methicillin Resistant Staphylococcus aureus (MRSA)	
Infectious agent	Bacteria - Staphylococcus aureus
Symptoms	Asymptomatic in healthy individuals, skin infections, wound infections, urinary tract infections, pneumonia, bloodstream infections, bone and joint infections, sepsis
Diagnosis	Swab and culture sensitivity tests
Mortality Rate	High - if not given the correct antibiotics
Transmission	Contact with infected individuals, contact with contaminated surfaces
Prevention	Regular hand washing, use of antiseptics
Treatment	Resistant to many antibiotics, often require combination therapy, often in hospital setting
History	First reported in 1961, increasing problem globally
Measles	
Infectious agent	Virus - Paramyxovirus
Symptoms	High fever, cough, runny nose, red eyes, rash, sore throat, swollen lymph nodes
Diagnosis	Swab and culture sensitivity tests
Mortality Rate	Low - if given the correct antibiotics

SH1-3 Information Sheets

SH4-5 Differentiated Information Sheets

Measles	
Infectious agent	Virus - Paramyxovirus
Symptoms	High fever, cough, runny nose, red eyes, rash, sore throat, swollen lymph nodes
Diagnosis	Swab and culture sensitivity tests
Mortality Rate	Low - if given the correct antibiotics
Flu	
Infectious agent	Virus - Influenza
Symptoms	High fever, cough, runny nose, sore throat, muscle aches, fatigue
Diagnosis	Swab and culture sensitivity tests
Mortality Rate	Low - if given the correct antibiotics

SH4-5 Differentiated Information Sheets

Lesson Plan



≡ Introduction

1. Begin the lesson by explaining to the class that sometimes microbes can be harmful to humans and cause disease. These are known as pathogenic microbes. Once bacteria and viruses enter your body, they can reproduce rapidly. Bacteria can also divide by binary fission and produce toxins when they reproduce which are harmful to the body. Viruses act like parasites multiplying inside our cells and destroying them. Some fungi like to grow on our skin making it itchy and sore. Find out how many different words they have for microbes – germs, bugs, etc.
2. Ask the class to create a list of infections (infectious/ communicable diseases) by brainstorming any diseases they have heard of. Do they know what microbes cause the diseases? Do they know how these pathogenic (harmful) microbes are spread - modes of transmission? Ask the students what disease they think poses a threat to students in the class today? Tell them that in the early 1900s the disease of greatest threat was measles; many children who caught measles died.

There are 4 main mode of transmission for pathogenic microbes:

- a. By air including droplet transmission – many pathogens are carried and spread from one organism to another by air. When you are ill, you expel tiny droplets full of pathogens from your respiratory system when you cough, sneeze, or talk. Other people breathe in the droplets, along with the pathogens they contain, so they pick up the infection. Examples include flu (influenza), tuberculosis, and the common cold.
- b. Direct contact - spread by direct contact of an infected organism with a healthy one. Pathogens such as the viruses which cause HIV/AIDS or hepatitis enter the body through direct sexual contact, cuts, scratches, and needle punctures that give access to the blood.
- c. By consumption - eating raw, undercooked, or contaminated food, or drinking water containing sewage can spread diseases such as diarrhoeal diseases, cholera, or salmonellosis. The pathogen enters your body through your digestive system.
- e. Vector – some diseases e.g. malaria, are vector-borne, this means that some living organism can transmit infectious pathogens between humans, or from animals to humans.

Lifestyle factors often affect the spread of disease. For example, when people live in crowded conditions with no sewage system, infectious diseases can spread very rapidly.

3. Explain to the class that someone who has contracted harmful disease-causing microbes is said to be infected. Discuss the difference between an infectious microbe and a non-infectious one. Discuss with students the various routes of transmission, i.e. touch, water, food, body fluid and air. Identify any infectious diseases mentioned in the brainstorming session and how they are transmitted.

Main Activity: Harmful Microbes and Their Diseases

1 Discover the different types of infectious diseases caused by harmful microbes and their characteristics

2 By working in groups, fill in the various subheadings (symptoms, transmission, treatment)

3 Present your results to the class



Disease Match

1. Infectious Microbes

Infectious Microbe	Disease
Bacteria	
Virus	
Fungi	

2. Symptoms

Symptoms	Disease
Asymptomatic	
Fever	
Rash	
Sore throat	
Tiredness	
Lodges	
White discharge	

3. Transmission

Transmission	Disease
Animal contact	
Blood	
Touch	
Inhalation	
Mouth to mouth	

4. Prevention of Infection

Prevention	Disease
Wash hands	
Cover mouth and nose	
Use a condom	
Avoid unnecessary antibiotic use	
Vaccination	

5. Treatment of Infection

Treatment	Disease
Antibiotics	
Rest	
Antivirals	
Flu shot	

Procedure

1. Group your diseases with the headings in the headings in SW1/2.
2. Do you notice any similarities or differences between the diseases based on each of the headings?

Harmful Microbes and Their Diseases

1. This activity should be carried out in groups of 3 – 5 people. Explain that during this activity students are going to learn about some infectious diseases that cause problems in the world today.
2. Provide each group with the disease cards found in SH1 – SH3. (Differentiated version: SH4 – SH5).
3. Tell the class that sometimes scientists need to group diseases under different headings to address different problems. Each group should research the headings on SW1. (Differentiated version: SW2) for each disease. Teacher answers can be found at TS1-2.
4. Ask each group to complete SW1 (Differentiated version: SW2) for the first heading – Infectious agent. After a few minutes, ask a spokesperson in each group to read out their results. Write all the results on a white board for discussion.

5. After each heading in SW1/2 is complete, discuss the results with the class.

- a. **Infectious organism:** Remind students that there are three main types of microbes. It is important to identify the microbe causing the disease in order to treat the disease properly, e.g. antibiotics cannot be used to treat viruses.
- b. **Symptoms:** Students may notice that some diseases exhibit similar symptoms, e.g. fever or rash. You may wish to discuss how important it is for people to visit their doctor when they are ill to receive a correct and accurate diagnosis.
- c. **Transmission:** Many diseases are transmitted very easily through touch or by inhalation. Other diseases are quite specific and require the transfer of blood or other bodily fluids.
- d. **Preventative measures:** People can prevent the spread of, and protect themselves against, infection by a few simple steps. Regular hand

washing and covering our coughs and sneezes has been shown to reduce the incidence of many common infections. The correct use of a condom can reduce the transmission of many STIs.

- e. **Treatment:** It is important to note here that not all illnesses require medical treatment; some require bed rest and an increased fluid intake; however, painkillers may be used to alleviate some of the symptoms. Highlight to the students that antibiotics are only used to treat bacterial infections.

Main Activity 2: Harmful Microbes Fill in the Blanks

This activity can be conducted in small groups or as an individual task. Making use of classroom devices with internet access and/or textbooks, ask students to research the disease-causing microbes in SW3 to fill in the gaps. Answers can be found at TS3. There is a row empty for students to select their own pathogenic (harmful) microbe to research. Once completed, this table can serve as a great way to consolidate information.

Extension Activities

Outbreak activity

Divide the class into groups of 4-5 to facilitate group discussion. Choose an infectious disease or have the class make up their own. For example, you could base this activity on a foodborne disease (food poisoning), COVID-19 or a fictional disease.

1. Tell the class that they are the public health team for your local council, there has been an outbreak of an

infectious disease meaning lots of people have become sick with the same thing. It is the responsibility of the class to co-ordinate a response.

2. Have the groups discuss who would be involved in responding to an outbreak: nurses, doctors, public health officials, government, scientist, epidemiologists, all play a vital role in public health. More information about these careers in public health can be researched online (NHS public health, prospects.ac.uk).

- To start them off you can ask them who they would go to if they got sick. Who would that person tell? Who would the doctor tell? What would those people do? What advice would the government give? What can the public health officials do to keep to government advice and keep cases down? Are there existing methods of diagnosis or treatment? Do vaccines exist for this disease?
- You can create a flow-chart to record the chain of command.

3. As public health officials they must decide how they can stop the spread of the infection. What questions would they ask that could help them stop the spread of the sickness?
 - How many people are sick? How is the infectious agent spreading? Who needs to know about this? Students should be encouraged to list as many questions as possible and share the most frequent with the class.

This exercise should give the students a little more understanding of how individuals, groups and organisations work together to respond to outbreaks.

4. To finish give the students the following scenario:

Three main outbreaks have been identified in the local area:

- A school
- Leisure centre
- Office building

Ask the students in their groups to create a plan to communicate with the local residents about stopping the spread of the disease.

Outbreak Activity 2

Ask students to research an infectious disease and produce a visual timeline to be presented at the next lesson. The timeline should include reference to the following:

- A history of the disease
- The microbe involved
- Rate of transmission
- Symptoms, and treatment
- Mortality rates

Guest Speaker

To bring the learning to life, you may wish to invite your local authority public health lead to talk about the local response to Covid-19 and the procedures that were established.

Learning Consolidation

Ask students to write a paragraph or three statements to summarise what they have learned during the lesson.

Check for understanding by asking students if the following statements are true or false.

1. Microbes that can cause diseases are called pathogens. Diseases caused by such microbes are said to be infectious diseases.

Answer: True

2. Microbes can pass from one person to another only by touch.

Answer: False, microbes can pass from one person to another by a number of different routes – air, touch, water, food, aerosols (coughs and sneezes).

3. Some new infectious agents can cause epidemics (community) or travel all over the world causing a pandemic.

Answer: True

Discussion

Check for understanding by asking the students the following questions:

What is a disease?

An illness or sickness characterised by specific signs or symptoms.

What is an infectious disease?

An infectious disease is a disease that is caused by a microbe and can be spread to other people.

Why do we see infectious diseases that used to be found in a single region, all over the world today?

Many infectious diseases start in a specific region or country. In the past the infection could be easily contained or isolated. Today, however, people travel faster, more quickly and further than ever before. A person travelling from Australia to England can make the journey in under a day, with or without flight changes en route. If this person has a new strain of the flu virus, they could spread it to anyone they came into contact with at their transfer airport and people they came into contact with when they landed in England. These people could also carry the flu to other people they come into contact with all over the world. Within a few days, this new strain of influenza virus could be found worldwide. You may want to discuss how quickly the virus causing the disease COVID-19 spread around the world.





Answer Sheet

1. Infectious Microbes

Infectious Microbe	Disease
Bacteria	Bacterial meningitis, Chlamydia, MRSA
Virus	HIV, Chickenpox, Flu, Measles, Glandular Fever
Fungi	Thrush

2. Symptoms

Symptoms	Disease
Asymptomatic	Chlamydia, MRSA
Fever	Flu, Measles, Chickenpox, Bacterial meningitis
Rash	Bacterial meningitis, Chickenpox, Measles,
Sore throat	Flu, Glandular fever
Tiredness	Glandular fever
Lesions	HIV
Whitish discharge	Chlamydia, Thrush

Points to Note

MRSA is an antibiotic resistant bacterium, it is specifically resistant to methicillin and some other commonly used antibiotics. Its resistance status is attributed to the overuse and misuse of this and other antibiotics. Treatment is still via antibiotic therapy, however, MRSA is also developing resistance to these as well.

3. Transmission

Transmission	Disease
Sexual contact	Chlamydia, HIV, Thrush
Blood	Bacterial meningitis, HIV
Touch	Flu, Measles, Chickenpox, MRSA
Inhalation	Flu, Measles, Chickenpox, Bacterial meningitis
Mouth to mouth	Flu, Glandular fever

4. Prevention of Infection

Prevention	Disease
Wash hands	Flu, Measles, Chickenpox, MRSA, Bacterial meningitis
Cover coughs and sneezes	Flu, Measles, Chickenpox, Bacterial meningitis
Use a condom	Chlamydia, HIV, Thrush
Avoid unnecessary antibiotic use	MRSA, Thrush
Vaccination	Chickenpox, Measles, Flu

5. Treatment of Infection

Treatment	Disease
Antibiotics	Chlamydia, Bacterial meningitis, MRSA
Bed Rest	Chickenpox, Glandular fever, Measles, Flu
Antifungals	Thrush
Fluid Intake	Chickenpox, Glandular fever, Measles, Flu





Answer Sheet

1. Infectious Microbes

Infectious Microbe	Disease
Bacteria	Chlamydia
Virus	Chickenpox, Flu, Measles
Fungi	Thrush

2. Symptoms

Symptoms	Disease
Asymptomatic	Chlamydia
Fever	Flu, Measles, Chickenpox
Rash	Chickenpox, Measles
Sore throat	Flu
Whitish discharge	Chlamydia, Thrush

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Transmission	Disease
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Use a condom	Chlamydia, Thrush
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5. Treatment of Infection

Treatment	Disease
Antibiotics	Chlamydia
Bed Rest	Chickenpox, Measles, Flu
Antifungals	Thrush
Fluid Intake	Chickenpox, Measles, Flu





Harmful Microbes Fill in the Blanks

Disease	Pathogen	Transmission	Symptoms	Prevention	Treatment	Problems
HIV/AIDS	Virus	Exchange of bodily fluids (e.g. sharing needles) and breast milk from infected mother	Early - flu like symptoms. Later - immune system so damaged that get infections easily	Barrier during intercourse, screening of blood, not sharing needles and bottle feeding. No vaccine	Anti-retroviral drugs allow sufferers to live very long life. Stem cell transplants (novel treatment in early stages of research and development)	Fatal if not treated. In some people, the virus has become resistant to the antiretroviral medication leading to concerns for the future of HIV treatment.
Measles	Virus	Inhalation of droplets from sneezes and coughs	Red rash and fever	MMR Vaccine	No treatment	Can be fatal if there are complications.
Salmonella	Bacteria	Contaminated food or food prepared in unhygienic conditions	Fever, abdominal cramps, vomiting and diarrhoea.	Good food hygiene	Antibiotics given to the young and very old to prevent severe dehydrations.	Can cause long term health problems, though this is rare. The bacteria are becoming resistant to some antibiotics.
Gonorrhoea	Bacteria	Sexually transmitted	Early symptoms include yellow/green discharge from infected areas and pain when urinating.	Condoms	Antibiotics	If untreated can lead to infertility, ectopic pregnancy and pelvic pain. The bacteria are becoming resistant to antibiotics meaning they are more difficult to treat.





Harmful microbes fill in the blanks

Disease	Pathogen	Transmission	Symptoms	Prevention	Treatment	Problems
Malaria	Protist	Vector - mosquito	Flu like symptoms	Preventing mosquitos from breeding and mosquito needs treated with insecticide.	Anti-malarial drugs	Fatal if not treated, with children under 5 the most vulnerable group. In some regions, antimalarial drug resistance has become a problem.
COVID-19	Virus	Droplet transmission	Flu like symptoms	Wearing a face cover Practicing social distancing COVID-19 vaccine	Symptomatic treatments	Long term effects of disease unknown – ongoing research in this area

