

UNDERSTANDING INFECTIONS AND VACCINES (LEVEL 2)

Description	Understand what an infection is and how vaccines play a role in reducing infection rate.
Leading Question	How can you help your community understand the importance of vaccines?
Subject	Science, Literacy
Total Time Required	1 hour a day for 5 days
Supplies Required	A4 papers, regular pencils, colored pencils, 3 opaque buckets, red paper and green paper
Learning Outcomes	<ul style="list-style-type: none"> ● Know that bacteria and viruses can cause disease. ● Understand how we work to prevent disease. ● Understand that a vaccine prevents disease and know what a vaccine contains. ● Know that our bodies produce antibodies to fight against disease when we get sick. ● Know how herd immunity works ● Learn how to write about science, ask scientific questions and think critically.
Previous Learning	<ul style="list-style-type: none"> ● Concept of living and non-living organisms

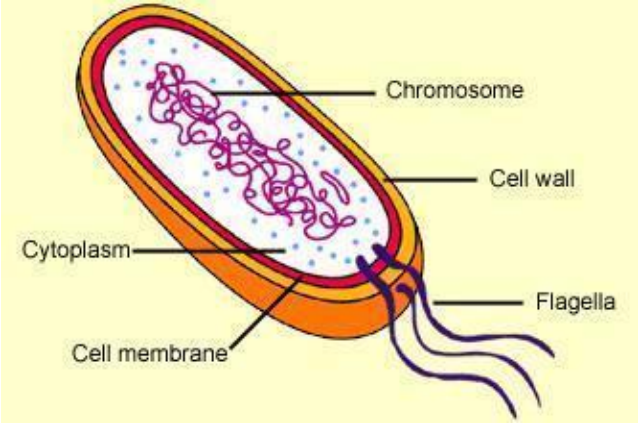
DAY 1

Today you will be introduced to the organisms that make us sick.

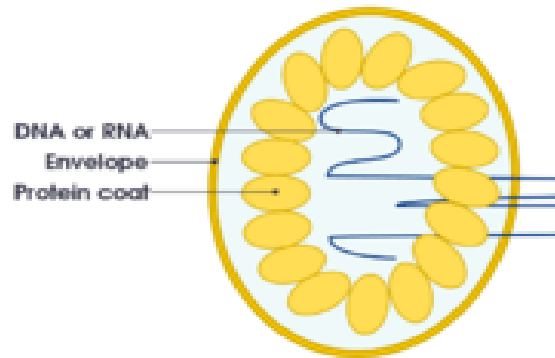
Suggested Duration	Activity and Description
10 Minutes	<p>Discussion: Have a conversation with the learners to understand how they think disease is caused. Here are a few questions that you can ask:</p> <ul style="list-style-type: none"> ● In times when you have been sick, how did you feel? What do you think caused it? ● What activities, do you think, are more likely to make you sick? (For example, swimming in lakes that are unclean, eating raw or undercooked food, being around a sick person etc.) ● Do you have any questions about disease based on some experiences you have had? ● What are the different things you feel and experience when you get sick? (For example, you feel tired, then you have fever for 2

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	<p>days, the fever then subsides and you take 2 days to recover and finally you feel back to normal after 5-7 days.</p>
<p>25 minutes</p>	<p>Introduction to disease causing microorganisms:</p> <ul style="list-style-type: none"> • Diseases are caused by small living things that enter our body – they are so small that we cannot see them with our eyes! • Based on the discussion you just had, ask the learner to list places where they think these diseases-causing living things can be found. For example, in water, in other living things, in food that we eat, on dirty surfaces like remotes and door handles etc. • Also ask the learner to list <i>from where</i> they think these small living things can enter our body. For example, through our nose, our mouth, through a small or large cut in the skin, through our eyes etc. <p>There are two types of microorganisms (<i>micro</i> meaning small and <i>organism</i> meaning an individual life form) that cause disease:</p> <ol style="list-style-type: none"> 1. Bacteria (there are good and bad bacteria) – these can live in most conditions including the extremely cold and the extremely hot 2. Viruses (there are only bad viruses) – these are parasites which means they live within other living life forms in order to survive <p>They come in many shapes and each one causes a different disease, here is what they might look like:</p> <p>Bacteria:</p> 

Virus:



- Ask the learner to describe, in their own words, some features of bacteria and viruses. What do you see and notice? What do you wonder about what you see?
- Why do you think we get sick when these enter our body?
(Answer: Our body is able to recognize cells that are its own and cells that are *not* its own. It tries to fight cells that are not its own because they can harm our body. During this fight we feel sick, get fever and feel tired. We feel better once our body has fought it off).

Explain that over the next days we will learn more about the mechanism.

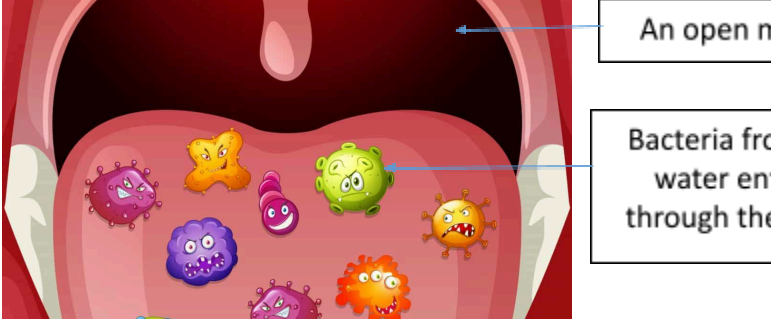
- COVID-19 is a virus. When this virus enters our body we get sick. Some ways that COVID-19 is thought to spread is through:
 - Water droplets – if you are infected, sneezing and coughing close to others can make others sick too.
 - Contacting contaminated surfaces

20 minutes

Create a visual depiction of how bacteria and viruses can enter our body.

On the last day of this project the learner will create a persuasive brochure to present what they know about infections and vaccines and how vaccines help prevent disease. This activity is in preparation for the final brochure.

- Based on what the learner learnt today, ask them to:

	<ul style="list-style-type: none"> ○ Illustrate and label a diagram showing how and where a bacteria or virus can enter our body. ○ Write a short description of the illustration ○ Here is an example: <div style="text-align: center;">  </div> <p>The diagram shows bacteria entering through an open mouth. Bacteria can be found in uncooked food or dirty water. If we eat or drink these, we allow bad bacteria to enter our body and this can make us sick.</p>
<p>5 minutes</p>	<p>Show and tell:</p> <ul style="list-style-type: none"> ● In pairs, share your image and description with each other. Ask each other one scientific question about your partners' image and description after reading it. <p>A scientific question is an investigative or thought-provoking question, such as:</p> <ul style="list-style-type: none"> ● What is it in uncooked food that makes us sick? ● You have drawn (<i>insert what fellow learner has drawn here</i>), can you explain why you chose this specific way over an alternative way of representing it?

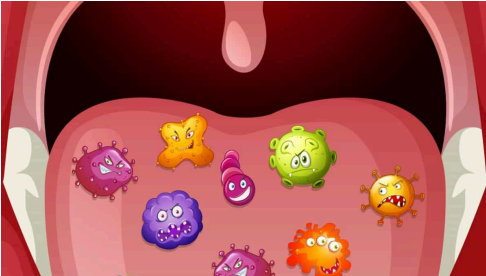
DAY 2

Today you will learn how we can prevent infection.

Suggested Duration	Activity and Description
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<p>10 minutes</p>	<p>Discussion: Have a conversation with the learners to understand how much they know about good hygiene practices and ways to remain disease-free. Here are some questions you can ask:</p> <ol style="list-style-type: none"> 1. What are some ways we can avoid being sick? (Some answers might include eating healthy, washing hands, staying active etc.) 2. Because of the COVID-19 pandemic we all have to wear masks, why do you think we do this? (Answer: to avoid spreading COVID-19 virus through sneezes and coughs.)
<p>10 minutes</p>	<p>Why do disease prevention mechanisms work?</p> <p>For each of the prevention mechanisms listed below, ask the learners why they think it prevents disease:</p> <ol style="list-style-type: none"> 1. Cooking food at high temperatures 2. Washing hands with soap and water 3. Covering our nose and mouth when sneezing or coughing 4. Cleaning open wounds 5. Covering open wounds with a Band-Aid <p>(Answers):</p> <ol style="list-style-type: none"> 1. Bacteria on meat and vegetables die at high temperatures. 2. The addition of soap kills bacteria. 3. It stops the spread of any bacteria that is in the water droplets of your cough and/or sneeze. 4. Bacteria or viruses can enter through open wounds so disinfecting the area kills any microorganisms. 5. Bacteria or viruses can enter through open wounds, so keeping the cut covered can reduce chances of microorganisms entering.
<p>30 minutes</p>	<p>How our body fights disease:</p> <ul style="list-style-type: none"> ● Once a bacteria or virus enters our body, (refer to the image you drew yesterday), 

- Our body tries to fight the bacteria or virus off because the bacteria or virus can harm our body.
What do you think our body does to fight the bad bacteria or virus? An illustration is shown below to get you thinking:



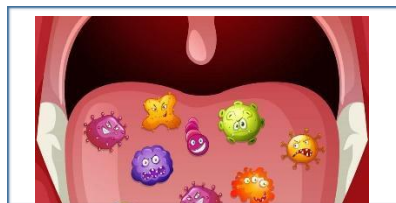
- During the fight our body gets sick.
Ask the learner to name these “fighters”. Some names they might come up with could include, soldiers, policemen, good guys etc. (ensure they do not use the name ‘good bacteria’ or ‘good virus’)
- Once the fighters have defeated the bacteria or virus, we feel better.

You already created a diagram of (i) the bad bacteria invading on day 1.

Draw the 2 remaining scenes of (ii) our fighters fighting the bad bacteria and (iii) our fighters winning. For each scene **write a description** that includes how we are feeling during this time.

Main takeaway: Ensure the learner is aware of how our body is feeling at each of the 3 stages.


An example is shown below with suggested examples of what you may choose to draw:



The image shows bacteria entering through an open mouth. Bacteria can be found in uncooked food or dirty water. At this stage we don't feel sick yet.

If we eat or drink these, we allow bad bacteria to enter our body and this can make us sick.



	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p><i>Illustration of antibodies created and fighting the bad bacteria or virus</i></p> </div> <div style="text-align: center; margin-bottom: 10px;">  </div> <div style="border: 1px solid black; padding: 5px;"> <p><i>Illustration of antibodies defeating the bad bacteria or virus.</i></p> </div> <p>Fighters are made in our body, this can take 1-2 days.</p> <p>The fighters created fight off the bacteria. This could take between 2-3 days.</p> <p>We feel sick for ~5 days during this and we usually take medicines to help reduce fever.</p> <p>When our fighters win and the bacteria are killed, we feel better again!</p>
<p>10 minutes</p>	<p>Think about it:</p> <p>Once bacteria enter our body, it takes time for our body to recognize them and make fighters – during this time we remain sick. The fighters created are called antibodies.</p> <ul style="list-style-type: none"> ● We feel sick once the bacteria has entered our body and when our body is fighting the bacteria. How long is this time period usually? (Answer: ~5 days) ● How do you think we can shorten the time we are sick? (Answer: Have antibodies prepared early or recognize the bad bacteria/virus in a shorter time).

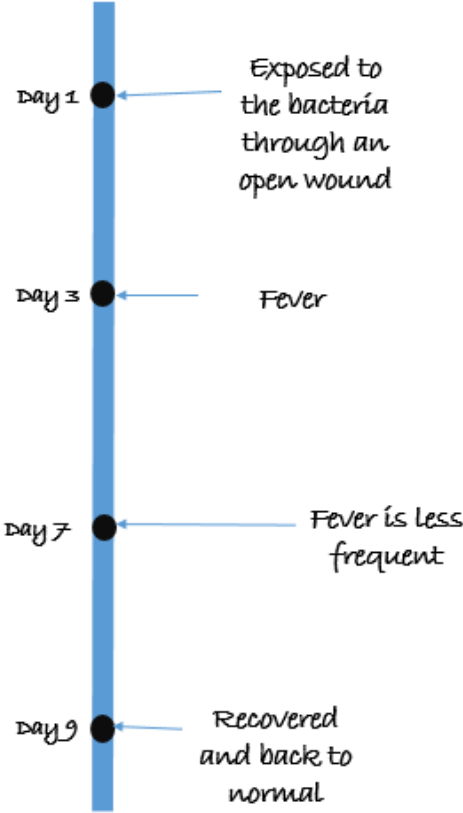
DAY 3

Today you will learn about the normal infection pattern or cycle.

Suggested Duration	Activity and Description
<p>15 minutes</p>	<p>Based on yesterday's final discussion, create an illustrated timeline of the events that take place when we get sick. From the time of exposure to when we recover from the disease.</p> <ul style="list-style-type: none"> ● An example is shown below: Include reasons why each stage takes place and add as much detail as you can.

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	 <p>Day 1 ← Exposed to the bacteria through an open wound</p> <p>Day 3 ← Fever</p> <p>Day 7 ← Fever is less frequent</p> <p>Day 9 ← Recovered and back to normal</p>
<p>15 minutes</p>	<p>An introduction to vaccines:</p> <ul style="list-style-type: none"> ● Discussion questions: Have you heard of the word ‘vaccine’? What do you think a vaccine is and what do you think a vaccine does? When do we take it? ● A vaccine is injected to help us fight a bacterial or viral infection before we are infected! ● The vaccine contains <i>some part</i> of the bacteria or virus which tricks our body into thinking there is an invasion. The bacteria/virus in vaccines are not alive and cannot harm us but our bodies react to anything that tries to enter it. ● If our body thinks it’s getting invaded, what do you think it makes? (Answer: creates antibodies)

	<ul style="list-style-type: none"> ● But there is no infection so the antibodies wait until there is a real infection and they fight off the bacteria or virus faster than usual.
<p>20 minutes</p>	<ul style="list-style-type: none"> ● Create a labelled diagram showing how a vaccine helps create antibodies in our body. <div data-bbox="516 541 1393 1018" data-label="Image"> </div> <ul style="list-style-type: none"> ● Write a short description of the events taking place in the diagram you drew.
<p>10 minutes</p>	<p>Think about it:</p> <ul style="list-style-type: none"> ● Do you think it's expected that we feel tired or get a slight fever after a vaccine? Why or why not? (Answer: Yes, it is expected because our body is making antibodies and attempting to kill the invading bacteria in response to the part of the bacteria or virus that has entered). ● What do you think are the benefits of getting vaccinated? List them. (Possible answers: <ol style="list-style-type: none"> 1. A real infection will not be as severe because antibodies are already ready. 2. A real infection will not last as long or will not be felt at all because antibodies recognize the bacteria earlier.

	<p>3. You reduce the chances of making others around you sick because you are sick for a shorter time or not sick at all.)</p> <ul style="list-style-type: none"> Do you think one vaccine will create antibodies for all diseases? Or do we need to take a different vaccine to create antibodies for each disease? Discuss this with a partner. (Answer: Each bacteria that causes a specific disease is different so the antibodies needed are different. This means each disease has its own vaccine.)
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DAY 4

Today you will learn what herd immunity is.

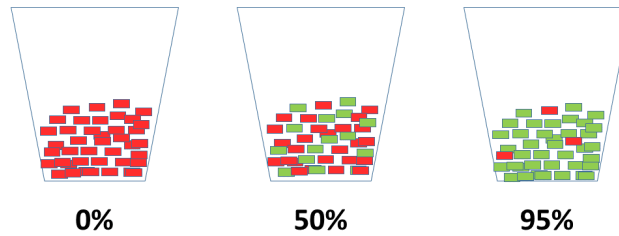
Suggested Duration	Activity and Description
10 minutes	<ul style="list-style-type: none"> Discussion questions: <ul style="list-style-type: none"> Why are vaccines important? What are some reasons that a person might choose to not get vaccinated? (Possible answers: it does not pair well with other medicines they are taking, religious reasons, they are too young or too old, they have a known allergy etc.) What is one way we can help protect them whilst also keeping ourselves safe? (Answer: Have a large number of vaccinated people in the community. This way the vaccinated people are less likely to get sick and therefore less likely to spread disease to someone who is unable to get the vaccine).
40 minutes	<p>Numeracy activity to demonstrate herd immunity:</p> <ul style="list-style-type: none"> Students are introduced to the concept of vaccinating a significant portion of the community in order to curb the spread of infection. <ul style="list-style-type: none"> Label 3 opaque buckets or baskets, with the tags "0%, 50% and 95%". For this activity red paper is unvaccinated and green paper is vaccinated. In the 0% bucket, get the students to place 60 torn up small pieces of red paper.

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In the 50% bucket, they need to place 60 papers in total but half should be red papers and half should be green papers. Get the learners to calculate how many papers of each color they need to place. (Answer: 30 pieces each).
In the 95% bucket, the students place 3 red papers and 57 green papers.

The illustration below shows an example:



- o Students will be acting as the infectious bad bacteria.
- o Each student takes a turn dipping their hands, while closing their eyes, into each bucket and taking a handful of papers. They write down the number of papers they have in each color, after collecting papers from each bucket, using the first table below. Learners should return the papers back into the same bucket once the numbers are recorded.

Number of red and green gathered

Bucket	Number of red gathered	Number of Green gathered	Total
0%	5	0	5
50%	4	4	8
95%	0	6	6

Once all the learners have completed the first table, each learners fills out their own second table:

Optional: Percentage of red and green gathered

Bucket	Percentage red gathered	Percentage green gathered
0%	$5/5 = 100\%$	$0/5 = 0\%$
50%	$4/8 = 50\%$	

	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="width: 100px;">95%</td> <td style="width: 100px;"></td> <td style="width: 100px;"></td> </tr> </table> <p>Since the learners are the “bad bacteria”, the number of red papers (unvaccinated) they picked up reflects how many people they were able to infect.</p>	95%		
95%				
10 minutes	<ul style="list-style-type: none"> ● Reflection questions: <ul style="list-style-type: none"> ○ How many “people” were you able to infect in each case? ○ What is the effect of having more people in our community vaccinated? What happened when you took papers from the 95% bucket? How many people did you infect? ○ If more people are vaccinated what does that do to the chances of getting the disease? ○ If more people are vaccinated can the disease still spread fast? ● State that this is a demonstration of herd immunity. Herd immunity is when a group of people becomes resistant to an infection as a result of many in the community being immune due to vaccination or because many have were infected previously. 			

DAY 5

Today you will create a persuasive brochure about infections and vaccines.

Suggested Duration	Activity and Description
10 minutes	<ul style="list-style-type: none"> ● Gather all the illustrations, descriptions and figures you created during the past 4 days. These include the following: <ul style="list-style-type: none"> ○ How viruses enter our body ○ How our body fights disease ○ Timeline of events during an infection ○ Vaccine helping to create fighters ○ Tables filled out during herd immunity activity ● Decide the title of your brochure and your main message. Your main message must include a component about the benefits of vaccines and why people should get vaccinated. Some examples of your main message and titles could be:

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	<ol style="list-style-type: none"> 1. The cycle of infection – why do we get sick and how can vaccines prevent diseases? 2. Vaccines can help us fight bad bacteria and viruses! 3. What is herd immunity and how does it help us stay safe?
<p>5 minutes</p>	<ul style="list-style-type: none"> ● Create your brochure by folding an A4 paper into 3, as shown below: <div data-bbox="516 470 1187 758" data-label="Image"> </div> <p>You have 1 cover page for your title and 5 pages for information.</p> <ul style="list-style-type: none"> ● Write the title of your brochure on the cover page
<p>45 minutes</p>	<ul style="list-style-type: none"> ● On the remaining 5 pages (marked with arrows), paste in your relevant illustrations from the previous days and write a sequential series of events to <u>explain your main message</u>. <div data-bbox="435 1066 818 1423" data-label="Image"> </div> <ul style="list-style-type: none"> ● For example, if your main message is “vaccines can help us fight infection”, your brochure could contain the following information with illustrations: <ul style="list-style-type: none"> ○ Page 1 – What causes an infection? (Illustration of what a bacteria and virus is including where they are commonly found and how they can enter our body). ○ Page 2 and 3 – How does an infection progress? ○ Page 4 – How can a vaccine reduce the time for which we are sick? Why should you get vaccinated?

	<ul style="list-style-type: none"> o Page 5 – What are the other advantages of vaccines? Is it common to have vaccine side effects? ● Share your brochure with at least 1 family member or friend who does not know about infections and vaccines and answer any questions they might have. Convince them that vaccines can help prevent diseases.
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Additional enrichment activities:	<p>Students can write and present the following (literacy extension):</p> <p>Imagine and describe yourself creating a vaccine – what would you create it for? How would you go about making it? What will you name it? Whom will you share it with?</p> <p>Write a 1 page proposal describing your ideas and thoughts. Then, present it to your fellow learners, friends and family.</p>
Modifications for simplification	<p>If the learner is unable to write their own descriptions of the diagram they have drawn, encourage them to verbally share what their diagram depicts. Additionally, the facilitator can create a fill in the blanks worksheet so the learner has to pick the correct word to describe each illustration instead of writing the entire description themselves.</p>

ASSESSMENT CRITERIA

Students' participation in discussion questions throughout the 5 days.

- Assess the level of engagement, thoughtfulness and linking of new concepts learnt to experiences they have had with disease.
- Disease prevention discussion answers: Demonstration of critical thinking and application of new concepts when describing why they think disease prevention mechanisms work.
- The learner asks good thought-provoking questions from the facilitator and other learners' during discussion sessions

Observation skills

- Assess the extent to which the learners' illustrations contain detail. Have the concepts learned during the lesson been translated to their drawings?
- Assess their answers to observation-based discussion questions. Do their answers contain detail? Are accurate similarities and differences being identified?

Disease timeline illustration

- Clear evidence that the learner has linked their experience with disease to the new science that they have been taught

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Brochure

- Assess whether the brochure has a main message and focus that is consistent. A clear main message is seen and the brochure is appropriately titled.
- Accuracy – the brochure is scientifically accurate to the degree that the learners have been taught.