

UNDERSTANDING INFECTIONS & VACCINES (Level 3)

Description	Understand what an infection is and how vaccines play a role in reducing infection rate
Leading Question	How do vaccines work?
Total Time Required	1 hour a day for 5 days
Supplies Required	Paper, colored paper, pencils, colored pencils, one opaque plastic bag per student, 3 opaque baskets
Topics/concept covered	<ul style="list-style-type: none"> ● Cycle of infections ● Microorganisms that cause infection ● Vaccines and vaccination ● Herd immunity ● Disease timelines ● Graphs and plotting ● Report writing ● Measurements ● Percentages ● Creating a comic strip/educational pamphlet ● Creating a diseases infection prevention plan ● Critical thinking ● Creativity ● Communication
Learning Outcomes	<ul style="list-style-type: none"> ● Understand the cycle of infection ● Understand how microorganisms cause infections. ● Understand what a vaccine is and how it speeds up our response to infection ● Understand and explain herd immunity. ● Improve learner's literacy skills through report writing, interviews and creating a comic strip/educational pamphlet ● Improve learners numeracy skills around measurement, plotting graphs and timelines, percentages and their interpretation etc. ● Improve the learner's critical thinking, creativity and communication skills
Required Previous Learning	<ul style="list-style-type: none"> ● Concept of living and non-living organisms ● Understanding that living organisms are made up of cells

DAY 1

Today you will learn the cycle of infection and what an infection is

Suggested Duration

10 minutes

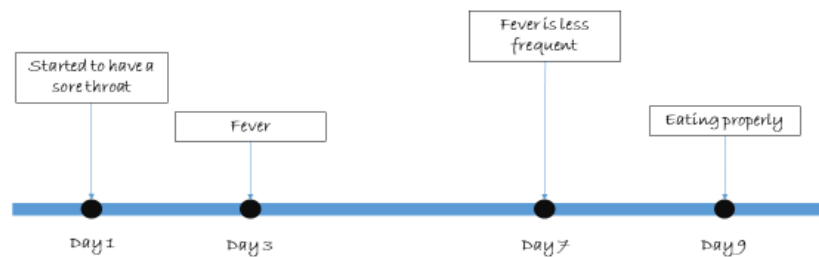
Activity and Description

- Learners discuss and share their experiences with getting sick and how the infection developed
 - o Do you remember the last time you fell ill?
 - o How did you feel?
 - o What could you and couldn't you do?

- Sickness Timeline Activity:

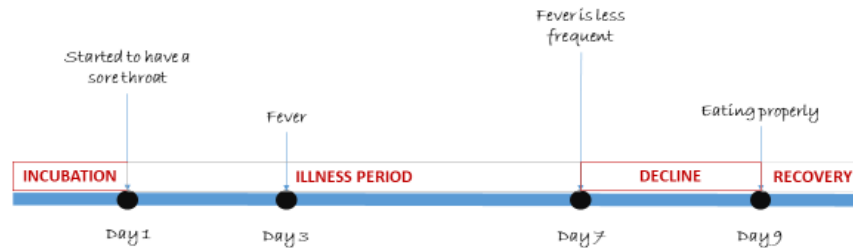
Ask the learners: Looking back at the past times you have been sick; how long does it take you on average to recover from a sickness? How many days does it take you from the time you start feeling the disease symptoms and feelings to when you get better? Can you plot this out on a timeline for your last sickness?

Learners are asked to draw a timeline of when they fell sick, labeling specific symptoms and feelings based on the discussion. Make it as detailed as possible, an example is shown below:



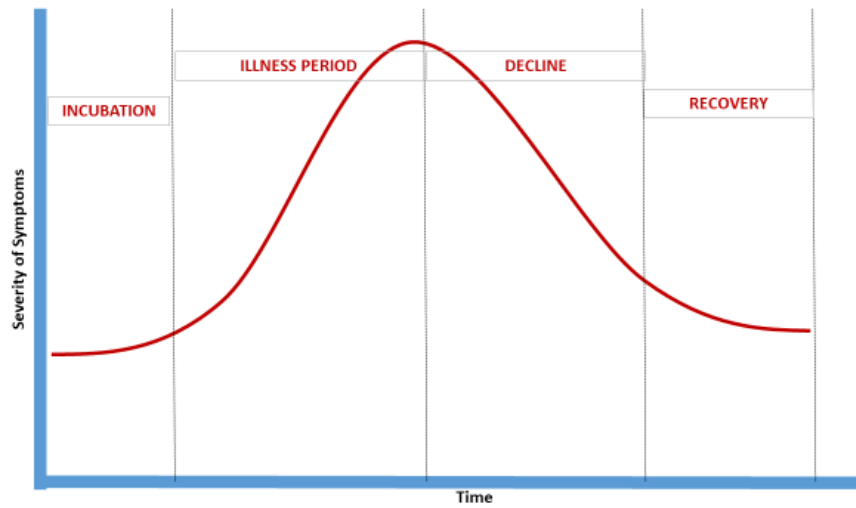
- The facilitator draws focus to the main stages in the learners' timeline and labels them as follows:
 - o Incubation – exposure to bacteria or virus (this might have not been said by the learners)
 - o Illness period – period of high symptoms

- o Period of decline – reduction in symptoms
- o Recovery – period to gain back strength



15 minutes

- In groups of 2, learners develop their own graph of how they perceive the infection to progress in terms of symptom severity.
 - o The y axis will represent the severity of symptoms, and the x axis the passage of time.
 - o Learners will think about how a line that represents the severity of symptoms will look. The line should go up and down depending on how strong or severe the symptoms of the disease are. For example, at the start of the disease, the symptoms might not be as severe, so the starting point for the line is low. It then increases to a peak stage in the middle, which means that the line will be upward sloping, and it finally reduces in severity towards the end, bringing the line down.
 - o Learners are to draw an upward sloping line if the severity of symptoms increases and a downward sloping line if the severity reduces. If there is no change in the severity of symptoms, draw a straight horizontal line.
- Learners present their graphs to each other and explain their reasoning
- An example graph:



20 minutes

- **Micro-organisms:**
Ask the learners: What do you think causes sicknesses in our body? What are different microorganisms that make our bodies get the different symptoms and bad feelings?

Potential answers: viruses, lice, bacteria, fungi etc

Learners can consult the internet or ask their parents/adults in their family to help them find answers to these questions.
- **Activity to introduce microorganisms –** Ask the learners what animals/living organisms do they think are present in these locations:
 - Garbage (Cats, rodents, ants, roaches)
 - Water (Whales, sharks, fish, plants)
 - Human hair (Lice, bacteria)
 - Inside our body (Bacteria, viruses, fungi)
- **Define microorganisms:** Microorganisms (for example, bacteria, viruses, fungi) are tiny, unseen living cells that can be good for us and can also cause harm to our bodies. There are different types of bacteria, fungi and viruses, and not all of them are bad!
- **Ask the learners to classify these microorganisms as good or bad:**
 - Bacteria that help make cheese out of milk
 - Fungus that helps make penicillin - medicines which cure common illnesses.
 - COVID-19 virus that causes sickness and death in some people

- o Fungus (yeast) that helps us make bread
- o Bacteria in water that causes people to get diseases like cholera
- o Bacteria in our gut that helps us digest food
- One of the learners draws one out of the 3 different microorganisms (without labeling them):

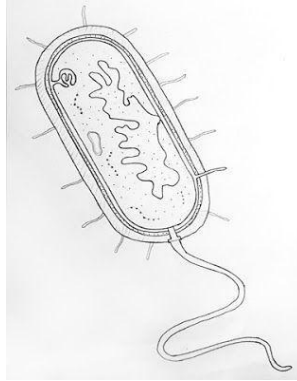


Figure 1

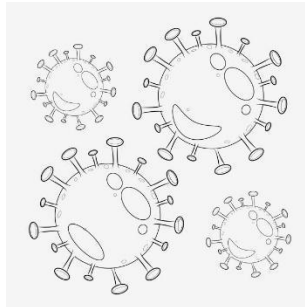


Figure 2

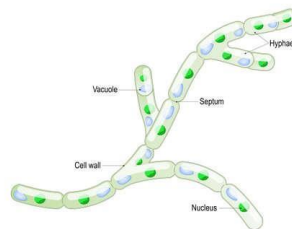


Figure 3

- The other learners will determine what the learner drew (classifying as one of the three microorganisms). Answer: figure 1: bacteria, figure 2: virus, figure 3: fungi
- Inform learners that bacteria, virus and fungi can be

	<p>beneficial, but they can also all cause disease.</p>
<p>5 minutes</p>	<ul style="list-style-type: none"> ● Discussion question: How do you think these microbes enter our body? Some ways through which this happens is through touch, through bodily fluids (blood and mucus), through contaminated food and water, through the air etc.
<p>10 minutes</p>	<ul style="list-style-type: none"> ● Learners participate in an infection activity to learn how fast an infection can spread from one person to another: <ul style="list-style-type: none"> ○ The learners walk around the room freely ○ One learner is given a sheet of colored paper ○ When this learner meets other learners at arms distance away, they tear a piece off their paper and hand it to them ○ The facilitator randomly yells “multiply” at different times. When this happens, learners will tear the pieces of paper in their hands into two. ○ Learners will give each other pieces of their paper when they get close to one another, but they must have at least one piece of paper left in their hand. ○ The activity ends when everyone has at least one piece of paper and the entire group is therefore “infected”. ● Debrief: Facilitator explains that “multiply” is to mimic bacterial multiplication/reproduction and that the activity is an illustration of how fast disease can spread within a community of people. ● Reflection questions are conducted by the facilitator. The learners are asked the following questions: <ul style="list-style-type: none"> ○ Imagine the paper was bacteria, how long would the disease take to spread in our community? ○ If there is an infectious disease in our community, how can we make sure the spread is slower? ○ What did you learn from this activity about how disease spreads?

10 minutes	<ul style="list-style-type: none"> • Day's Learning Reflection: <p>Thinking about the activities from today, can you tell us:</p> <ul style="list-style-type: none"> - Three things you have learned - Two things you found interesting - One thing that you still have a question about <ul style="list-style-type: none"> • Educators can respond to the learner's question where possible
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DAY 2

Today you will learn what a vaccine is.

Suggested Duration	Activity and Description
5 minutes	<ul style="list-style-type: none"> • Understanding vaccination: <p>Ask the learners to check online or to interview one of their parents/an adult in their community using the following questions:</p> <ul style="list-style-type: none"> - What is a vaccine? - What does it mean to be vaccinated? - What is the benefit of being vaccinated? <p>Potential answer: A vaccination is a preventative measure taken to protect us from diseases through an injection.</p> <p>The vaccine contains some part of the germ or the poison that the germ makes, but the vaccine does not make you sick because the bacteria or virus in the vaccine is either dead or weakened. It is not as strong as the live bacteria or virus you would get if you caught the disease. Vaccines help your body to protect itself from getting sick in the future.</p>
5 minutes	<ul style="list-style-type: none"> • Hand out a piece of paper to each student and request that they write down "yes" or "no" to if they've ever been vaccinated • The paper is folded up and handed in, the facilitator then counts how many of each set of answers (yes and no) exists <p>Note: Do not reveal information about whether someone is</p>

vaccinated or not to protect their privacy.

- Have a brief discussion on reasons why some people vaccinate, and others do not. Below are some guiding questions and sample responses:
 - What are some reasons people get vaccinated?
 - It provides immunity against fatal diseases
 - Vaccines are safe and tested
 - If more people are vaccinated than unvaccinated, diseases would spread slower.
 - What are some reasons people do not get vaccinated?
 - People might be taking medication for other diseases and might not know if it is safe to take both the vaccine and the other medication at the same time
 - Religious reasons
 - Mistrust of science
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20 minutes

- Discussion question: How many of you have had chickenpox or know someone who has? Did you or that person get it for the second time? Did you know that, in most cases, people only get chickenpox once in their lifetime!
Have you wondered why?
- Introduce the idea that our bodies are able to “remember” bacteria and viruses and respond faster the second time because our body knows how to fight the disease. So, when the germ attacks our body the second time, our body remembers it and fights it. We call this becoming “immune” to diseases.
- An activity to illustrate memory response is conducted:
 - Carry a tray containing 10 household objects.
 - The tray is covered with a cloth.
 - The learners are allowed to look at the tray without the cloth for 15 seconds before the cloth is put back on.
 - The learners are to list the objects from memory.
 - The learners then get another 15 second look at the tray and list down the objects from memory.
 - The learners determine how many correct objects were recalled from memory both times.
 - The activity is repeated with different objects.
- Discuss with the learners the situations in which their response was more accurate.
 - Students are able to respond more accurately in the instance where they had seen the objects before (not for the first time)
 - In which instance were the students able to list the objects faster?

<p>15 minutes</p>	<ul style="list-style-type: none"> ● Based on the previous activity, learners are introduced to the following concepts: <ul style="list-style-type: none"> ○ The second time learners saw the set of objects, the response was faster and more accurate; this is like the <i>memory response</i> is in our body. If our body has seen the disease before, it can respond faster and we will be sick for a shorter time. ○ When there was a different set of objects, the response was different; this is called <i>specificity</i>. Every disease requires our body to respond differently. ○ Key takeaway: If we have been exposed to the disease before, our response is faster than if it is our first time. Our body responds to every infection in a different way ● Students are told that vaccines contain a <i>harmless part of</i> the bacteria that causes infection. It is harmless because the bacteria was either made very weak or killed before being used to make the vaccine ● A vaccine is like a fake infection that is injected into the body so that our body gets prepared with a response in case a real infection happens. We are introducing our body to a weak infection to prepare it for a real infection. ● This is why when we get vaccinated, we may show mild symptoms of fever, headache, etc, for a day or two. This is normal and we will be completely healthy and prepared to fight the real infection later if we catch it. ● Remember that each infection requires its own response in order for the infection to go away and it varies for different types of germs.
<p>15 minutes</p>	<p>Vaccines are common in our society today but who created the first vaccine and how was it done?</p> <ul style="list-style-type: none"> ● In 1796 Edward Jenner created a vaccine against smallpox virus through observation. ● Smallpox was a disease with about a 17% fatality rate – this means that 17% of people who get the disease die. It is one of the very few diseases that were completely eradicated through vaccination. Humans today do not get Smallpox anymore thanks to vaccines. ● Edward Jenner noticed that those who had contracted cowpox (a different disease) did not contract smallpox.

	<ul style="list-style-type: none"> • Can you think of possible reasons why? • The vaccine for smallpox contains parts of the cowpox virus in order for people’s bodies to create fighters against the disease • When the person is then exposed to smallpox their body is prepared! Millions of lives were saved through this vaccine!
<p>10 minutes</p>	<ul style="list-style-type: none"> • Day’s Learning Reflection: <p>Thinking about the activities from today, can you tell us:</p> <ul style="list-style-type: none"> - Three things you have learned - Two things you found interesting - One thing that you still have a question about <p>Respond to the learners question where possible.</p>

DAY 3

Today you will learn about different types of vaccines and how vaccines affect the infection cycle.

<p>Suggested Duration</p>	<p>Activity and Description</p>
<p>15 minutes</p>	<ul style="list-style-type: none"> • In groups of 2, learners conduct a dialogue between a “human body” and an “infection” as the infection tries to invade the body. In their dialogue, learners can choose to make the infection successful or to have the body fight off the infection). • Learners then switch roles taking turns to play the “infection” and the “human body”. • At the end of the activity each group briefly presents a summary of their conversations to the rest of the group.
<p>10 minutes</p>	<ul style="list-style-type: none"> • Different types of vaccines: Learners will research the various types of vaccines either on the internet or by interviewing an adult or their parents. If the parents do not know, learners can visit a nearby health center or find a medical field worker in the community to learn more about these. Learners can use the following guiding questions in their research:

	<ul style="list-style-type: none"> - What are the different types of vaccines? - How do they work? - What are the differences between them? <p>Answers:</p> <ul style="list-style-type: none"> o Inactivated vaccines (dead version of the microorganism): When someone takes this type of vaccine, they will have to take extra doses (called booster shots) at a later time because the vaccine is very weak. Some examples include rabies and flu vaccines. o Live vaccines (weakened form of the microorganism): This type contains live microorganisms that have been weakened. It provides more long-term immunity against the disease. Some examples include measles and chickenpox vaccines. o mRNA vaccines: These are a new type of vaccines that tell the body's cells to produce copies of a recognizable (but harmless) virus protein. The body recognizes that the protein should not be there and fights it off. The virus used in this vaccine is not live. The example is the COVID-19 vaccine.
<p>15 minutes</p>	<ul style="list-style-type: none"> ● Learners go back to the timeline of symptom severity they made on Day 1 and are asked to come up with an informed guess (in groups of 2) of how each stage is affected by a vaccine and why. ● The theories are then presented to the rest of the group ● Learners will create, then arrange in order, flashcards based on how the vaccine works. They will create one flash card (the size of their palm) with each statement: <ul style="list-style-type: none"> o Person takes the vaccine for a specific virus X o The person's body creates "fighters" against this specific virus and stores these fighters. o After some time the person is exposed to virus X o Virus X enters the body through the mouth

	<ul style="list-style-type: none"> o The person’s body recognizes the virus because they were exposed to it through the vaccine o The person’s body has already made “fighters” against virus X so deploys these “fighters” or white blood cells. o The virus is fought off by the white blood cells and the person is only sick for a very short amount of time or is not sick at all. <ul style="list-style-type: none"> ● After writing these down, learners will shuffle the flashcards and rearrange them ● Discuss the correct sequence with the learners (as given above) once done.
<p>20 minutes</p>	<ul style="list-style-type: none"> ● Literacy extension - Learners will write a newspaper article based on the prompt below: <ul style="list-style-type: none"> o A new vaccine has been discovered and you are a news reporter writing an article on it. Make sure the information used in the article is correct and include the following details: the type of vaccine that it is, details on who discovered it and general information on the benefits of vaccinations. The report should have the following structure: <ul style="list-style-type: none"> - Headline - Place, Date - Introduction - Body (in 2 paragraphs) <ul style="list-style-type: none"> ▪ Type of vaccine ▪ Who discovered it ▪ Benefits of vaccination - Conclusion ● Learners can pick any vaccine such as the COVID-19 vaccine, the polio vaccine and the chickenpox vaccine after researching them. ● Once done, the learners will read their article out loud.
<p>10 minutes</p>	<ul style="list-style-type: none"> ● Day’s Learning Reflection: <p>Thinking about the activities from today, can you tell us:</p>

- Three things you have learned
 - Two things you found interesting
 - One thing that you still have a question about
- Respond to the learner's question where possible

DAY 4

Today you will participate in the Infection Tracking Activity and understand herd immunity

Suggested Duration

5 minutes

Activity and Description

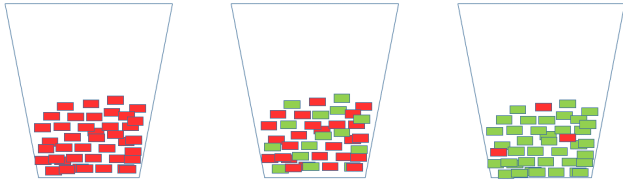
- Herd immunity:

Learners will research on the internet or ask their parent/adult in the community/a medical practitioner within their community on the concept of herd immunity using the following questions:

- Can a community become immune to a specific infection?
- What makes an infection disappear in a community or have less impact on the community?
- What is herd immunity and how does it occur?

Possible answers: Communities become immune to certain infections when they achieve herd immunity. *Herd immunity* means resistance to (a particular) infection as a result of many people in the community being immune. Herd immunity is best achieved through the vaccination of everyone in the community against the disease. A large proportion of a population would need to be vaccinated, lowering the overall amount of virus that exists and making it less able to spread in the whole population.

<p>5 minutes</p>	<ul style="list-style-type: none"> ● Infection Tracking Activity setup At least 4 to 5 people are needed for this activity. <ul style="list-style-type: none"> ○ One learner is “infected”, but the others do not know which one among them is infected (the infected learner is given red colored pieces of paper in a bag) ○ The rest of the community are infection-free (these learners also have plastic bags with paper, but their papers inside are white) ○ about 5-10 pieces of paper should be used in each bag depending on the number of players ○ One person from the community has been “vaccinated” Other learners do not know who is vaccinated except the vaccinated person themselves and the facilitator/parent
<p>25 minutes</p>	<ul style="list-style-type: none"> ● Infection Tracking Activity <ul style="list-style-type: none"> ○ The students are encouraged to greet one another and mimic daily activities such as talking, playing etc. Each time an interaction occurs, students swap pieces of paper ○ The vaccinated student accepts red paper when given but should discard it afterward ○ When an infection-free student (with white paper) is handed red paper, they are now infected and should tear pieces of this paper to hand out to other students during interactions ○ Round one ends when each learner has spoken to at least 75% of the class ● Learners then sit in a circle and the facilitator asks the infected learners and the vaccinated learner to reveal themselves ● Have a brief discussion on the effectiveness of one learner being vaccinated in the group. How did this affect the group? What if more than one person was vaccinated? What do you think would happen then?

	<ul style="list-style-type: none"> • The activity and the discussion are repeated with half of the learners vaccinated each round until at least 75% of the learners have been vaccinated. • The conclusion is that when more people are vaccinated, even if the virus is introduced in a community, it does not affect a lot of people. Therefore, the community develops 'herd immunity'.
<p>25 minutes</p>	<p>Numeracy extension:</p> <ul style="list-style-type: none"> • Learners will do the following activity to understand the concept of herd immunity, where a significant portion of the community are vaccinated in order to curb the spread of infection. <ul style="list-style-type: none"> o Label 3 opaque buckets or baskets, with the following tags: "0%, 50% and 95%". o For this activity, use 60 pieces of red paper which will represent unvaccinated people and 60 pieces of green paper to represent vaccinated ones. o In the 0% bucket, get the learners to place 60 torn up small pieces of red paper. In the 50% bucket, they need to place half red papers and half green papers (30 pieces each). In the 95%, get the learners to calculate how many green and red papers they need to place. (3 red papers and 57 green papers) The illustration below shows an example: <div style="text-align: center;">  <p style="display: flex; justify-content: space-around; margin-top: 5px;"> 0% 50% 95% </p> </div> <ul style="list-style-type: none"> o Learners will act as the infection. o Each learner takes a turn dipping their hands, while closing their eyes, into each

	<p>bucket and taking a handful of papers. They write down and calculate the percentage of red and green papers they have.</p> <ul style="list-style-type: none"> o The red papers is the number of people they were able to infect, while the green is those who are vaccinated and therefore unaffected by the infection (which is represented by the learner) o Reflection question: <ul style="list-style-type: none"> - How many “people” were they able to infect in each case? - What is the effect of having more people in our community vaccinated? - 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 at the same rate? <ul style="list-style-type: none"> ● Remind learners that this is a demonstration of how herd immunity works.
10 minutes	<ul style="list-style-type: none"> ● Day’s Learning Reflection: <p>Thinking about the activities from today, can you tell us:</p> <ul style="list-style-type: none"> - Three things you have learned - Two things you found interesting - One thing that you still have a question about <p>Respond to the learners’ question where possible</p>

Today you will create a comic strip or educational brochure on a bacteria and vaccine of your choice!

Suggested Duration

45 minutes

Activity and Description

- Create a comic strip or an educational pamphlet/brochure to share what you learned about how vaccines work, with your community. Include:
 - What a vaccine contains and the different types of vaccines
 - How the vaccine works
 - How the vaccine affects the infection cycle (in the form of a graph or timeline)
 - What herd immunity is and how it benefits the community
 - What we need to do to achieve herd immunity

Alternatively,

- Learners will create an action plan on how to avoid infections within their home/community. Learners will research in their home or immediate community to find out what the common infections are in the community using the information learned from this project. They can also consult with either a medical practitioner or an adult/parent at home for this activity.
- The learner will then develop a home/community infection avoidance plan in a table like the one below:

Infection	Microorganism that causes it	How it spreads	How to prevent it
COVID-19	Virus	Respiratory droplets produced when an infected person coughs or sneezes.	Wearing a face mask Social distancing Vaccination

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15 minutes

Critique and revision:

Learners present all the day's work to their parents or family members for feedback and suggestions for improvement. The parents or family members provide feedback using the following format:

Praise: What did you like about the learner's work?

Question: Do you have any questions or clarifications about their work?

Suggestions: In what areas does the learner need to improve their work?

10 minutes

- Day's Learning Reflection:

Thinking about the activities from today and overall throughout the project, can you tell us:

- Three things you have learned
- Two things you found interesting
- One thing that you still have a question about

Respond to the learners' question where possible

Assessment Criteria

Students' participation in the infection tracking activity reflection session

- Demonstrate an understanding of how an infection spreads and understand how the activity shows this.

Students' participation in the memory response discussion

- Demonstrated understanding of how a memory response helps speed up our immune response to disease

Newspaper article on vaccine discovery

- The article must be at least 2 pages long and contain a clear introduction, body and conclusion paragraphs.
- The article must show use of correct grammar and spelling

- The article must be addressed to the general public and explain jargon to those who are unfamiliar with the new concepts.
- The article must show sound understanding on how a vaccine works.

Educational brochure or comic strip

- Understanding of infection cycle, memory response, herd immunity and the vaccine mechanism to an acceptable degree
- Demonstrate creativity in the illustrations used to explain scientific concepts
- Demonstrate creativity in the layout of the brochure or comic strip
- Final presentation accurately shows a clear understanding of all the concepts (infection cycle, memory response, herd immunity and vaccine mechanism).
- The brochure must be a three-fold brochure and the comic strip must be at least of A4 size.

Enrichment

Students can prepare the following: (Literacy Extension)

- Write a speech on the topic “Should citizens pay to get vaccines in their country?”
- Research and create timelines illustrating the origin of vaccines and their impact for any 2 diseases.

Students can learn more about how vaccines work by watching this video:

<https://www.youtube.com/watch?v=bglXkienTSk>

Simplification

If students do not understand percentages, the numeracy extension activity on Day 4 can be simplified by the facilitator putting the correct number of papers in each bucket beforehand.

If students do not know how to plot points in a graph, the graph-related activity on Day 1 need not be conducted.