



# Infection Prevention and Control (IPC): Vaccinations

**In this lesson, students will take part in a simulation to see how vaccines are used to prevent the spread of infections and discover the significance of herd immunity.**

## Curriculum Links

### Science

- Working scientifically
- Cells and organisation
- Experimental skills and investigations
- Analysis and evaluation

### PSHE/RSHE

- Health and prevention

### English

- Reading
- Writing

### Geography

- Human and physical geography
- Geographical skills and fieldwork

## Key Words

Antibody, Antigen, Immune system, Immunity, Vaccines, White blood cell

## @ Weblink

[e-bug.eu/eng/KS3/lesson/Vaccinations](http://e-bug.eu/eng/KS3/lesson/Vaccinations)

## Learning Outcomes

**All Students will:**

- Understand that the human body has many natural defences to fight infection, including the 3 main lines of defence.
- Understand that both vaccines and becoming infected and developing natural immunity help prevent a range of bacterial and viral infections.
- Understand that the most common infections such as the common cold or sore throat are not prevented by vaccines.

## Resources Required

### Main Activity: Herd Immunity Class Simulation

#### *Per Student*

- One of each coloured cards taken from SH1 through SH5

- Copy of SW1

### Extension Activity: World Map Activity

#### *Per student*

- Copy of SW2

## Advance Preparation

1. Laminate or stick a copy of SH1-SH5 to some thick card and cut out a coloured square for each student. These can be collected at the end of the class for future use.
2. Copy SW1 and SW2 for each student.
3. Copy of TS1 Teacher Answers

## Fascinating fact

In the 1918 flu pandemic, commonly known as the Spanish Flu, 20 million people died prior to the discovery of the flu vaccine.

## Supporting Materials

TS1 - Herd Immunity Scenario Answer Sheet

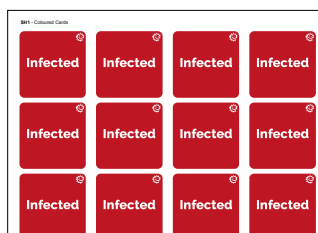
**Herd Immunity Scenario: Teacher Answer Sheet**

Day	Number of Students vaccinated					
	25%		50%		75%	
	Infected	Immune	Infected	Immune	Infected	Immune
1						
2						
3						
4						
5						
6						
7						

The results in this table will vary depending on the number of people in the class and where the vaccinated people are positioned in relation to the susceptible people. There will however be a decreasing trend of infected people as more people get vaccinated.

As more people get vaccinated, what happens to the spread of the infection?  
Vaccination programmes make it extremely difficult for diseases to spread in a community. As more people get vaccinated or become infected and develop

TS1 Herd Immunity Scenario Answers



SH1-5 Coloured cards

SW1 - Herd Immunity Scenario

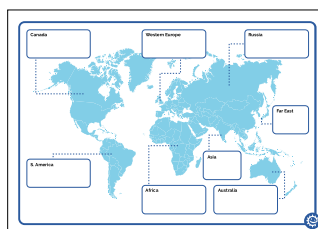
**Herd Immunity Scenario: Student Worksheet**

Use this sheet to record your observations after each stage of the scenario. Then add your conclusions.

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As more people get vaccinated, what happens to the spread of the infection?

SW1 Herd Immunity Scenario



SW2 World Map

# Lesson Plan



## Introduction

1. Begin the lesson by asking students which vaccines/immunisations they have had, e.g. polio, MMR or any holiday vaccinations and if they know what the vaccines were for.
2. Explain that immune means that you are protected from the serious effects of infection and that immunisation is a way of increasing the body's protective immunity to both bacterial and viral diseases.
3. Explain that vaccines are a small, inactive and harmless amount of the microbe/disease which teaches our body how to fight the harmful microbe when or if we get attacked by the disease.
4. Explain how vaccines work. Explain that antibodies pass from mother to child through the placenta in the womb and breast milk after birth helping to protect new-born babies from disease. However, this doesn't work for all diseases, e.g. women are given a vaccine when they are pregnant to protect their unborn baby from whooping cough. This will provide protection from when the baby is born until they are old enough to have their own vaccine (8 weeks old).
5. Remind students that each type of microbe has an outer coating which is unique to the microbe, but because some microbes change their outer coats so quickly, it is difficult for scientists to make vaccines for these infections, or, like the flu vaccine, a new one has to be made each year.

# Main Activity: Herd Immunity Class Simulation

- 1 Make sure everyone has a red, white, blue and yellow card
- 2 25% of the class will be provided with a piece of paper saying 'vaccinated' and the rest with 'susceptible' – don't let anyone see what card you have
- 3 The person in the middle of the class raises their hand with the red card
- 4 The people next to the red card 'infected' person are now infected, and so on
- 5 Only 'vaccinated' people are not infected
- 6 Continue the game by holding blue recovering cards to mark day 2
- 7 Now, we will repeat the game with 50% and 75% vaccinated



## Herd Immunity Class Simulation

**Scenario 1 – Demonstration of the spread of infection and immunity through vaccination**

This activity is best completed with the entire class. Explain to the class that they are going to simulate how vaccinations stop people getting ill.

Provide everyone in the class with a red (infected), white (immune), blue (recovering but still infectious) and yellow (vaccinated) card (SH1 – SH5).

1. Ensure that each student has a set of cards. Explain to the class that in this scenario they are going to observe what happens during vaccination programmes.
2. Explain that you are going to give each of them a piece of paper that will either say 'vaccinated' or 'susceptible'. They must not show their paper to anyone else and must not hold up their vaccinated card unless touched by an infected person.

### a. 25% vaccinated: 75% susceptible

Give 25% of the students the paper with the word vaccination (yellow card) and the rest of the class the paper with the word susceptible (purple card).

3. Select a person in the middle of the class and ask them to hold up their red card. Explain that they are now infected by a disease. Ask them to touch one person in their vicinity. This person is now infected and they must hold up a red card however, when a vaccinated person is exposed to the infection they will hold up their yellow card (vaccinated) and will not transmit the infection onto anyone else. This marks the end of day one. We say the end of day one because it takes that long for the infection to incubate and for the first symptoms of the infection to manifest themselves.

4. After a few seconds tell the class it is now day two. Student one should now be holding a blue card i.e. s/he is recovering but still infectious. Student two should now be holding a red card. Ask each of these students to touch someone different in their vicinity. These two people are now infected and they must hold up a red card. This marks the end of day two.

5. After a few seconds tell the class it is now day three.

- a. Student one should now be holding a white card i.e. s/he is now immune.

This person is a normal healthy individual with a healthy immune system therefore they were able to fight off the disease and develop immunity.

- b. Student two should now be holding a blue card, i.e. s/he is recovering but still infectious.

- c. Student three and four should be holding red cards i.e. they are now infected.

6. Continue steps 1 – 3 for up to 7 days and ask students to complete the Scenario section of their worksheets (SW1, answers on TS1).

- a 50% vaccinated: 50% susceptible

As above, however, give 50% of the students the yellow 'vaccinated' card and the rest of the class the purple 'susceptible' card.

- b 75% vaccinated: 25% susceptible

As above, however, give 75% of the students the yellow 'vaccinated' card and the rest of the class the purple 'susceptible' card.

Students will observe a downward trend in infection as more people get vaccinated. It may be beneficial at this point to explain the term 'herd immunity'. Herd Immunity is a type of immunity which occurs when the vaccination or infection of a portion of a population provides protection to unprotected individuals.

## Extension Activity

### World Map Activity

Provide the class with a copy of SW2.

Ask students to study the world map and record the vaccines that are required for specific countries in each region.

Students should also name the disease that the vaccine provides protection for and the microbe that causes the disease.

Ask students to use government, NHS, World Health Organisation and UK Health Security Agency websites (if website access is available) to help them to investigate current vaccine information.

## Learning Consolidation

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



## Discussion

Check for student understanding by discussing these points.

Why is vaccination not only a personal health issue but also a public health issue? Many infectious diseases are extremely contagious, we can vaccinate ourselves against the disease but other people who are not vaccinated can contract the disease and spread it further to unvaccinated people. If more people are vaccinated the disease is prevented from circulating. This is why herd immunity prevents epidemics. In today's society where global travel is relatively cheap and easy, an infected person can carry a disease across the world within 24 hours.

What needs to be done to completely eliminate an infectious disease?

A vaccination programme which reaches all target groups on a widespread continual basis is the only means to completely eliminate a disease. However, it is not possible to eliminate all diseases in this manner as some infectious diseases e.g. avian flu, have other reservoirs (places where they can live and multiply) outside humans.

Why hasn't the flu vaccine eliminated the influenza virus?

A vaccine works by tricking the body into making specific antibodies to combat a particular infectious disease, these antibodies then attach themselves to the antigens in the outer coat of the virus. The influenza virus has the ability to mutate and modify their outer coat quickly meaning that scientists need to create a new vaccine every year.



## Herd Immunity Scenario: Teacher Answer Sheet

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### As more people get vaccinated, what happens to the spread of the infection?

*Vaccination programmes make it extremely difficult for diseases to spread in a community. As more people get vaccinated or become infected and develop natural immunity they become immune to the disease therefore the disease cannot spread.*

### Conclusions

1 What is herd immunity?

*Herd immunity (or community immunity) describes a type of immunity that occurs when vaccination of a portion of the population or becoming infected and developing natural immunity provides protection to unprotected individuals.*

2 What happens when vaccination drops to a low level within a community?

*When the vaccination drops to a low level, people start contracting the disease again leading to a re-emergence of the disease.*

3 Why is a vaccine regarded as a preventative measure and not a treatment?

*Vaccines are used to boost the body's immunity so that when a microbe does enter the body, the immune system is ready to fight it preventing the microbe causing a serious infection.*

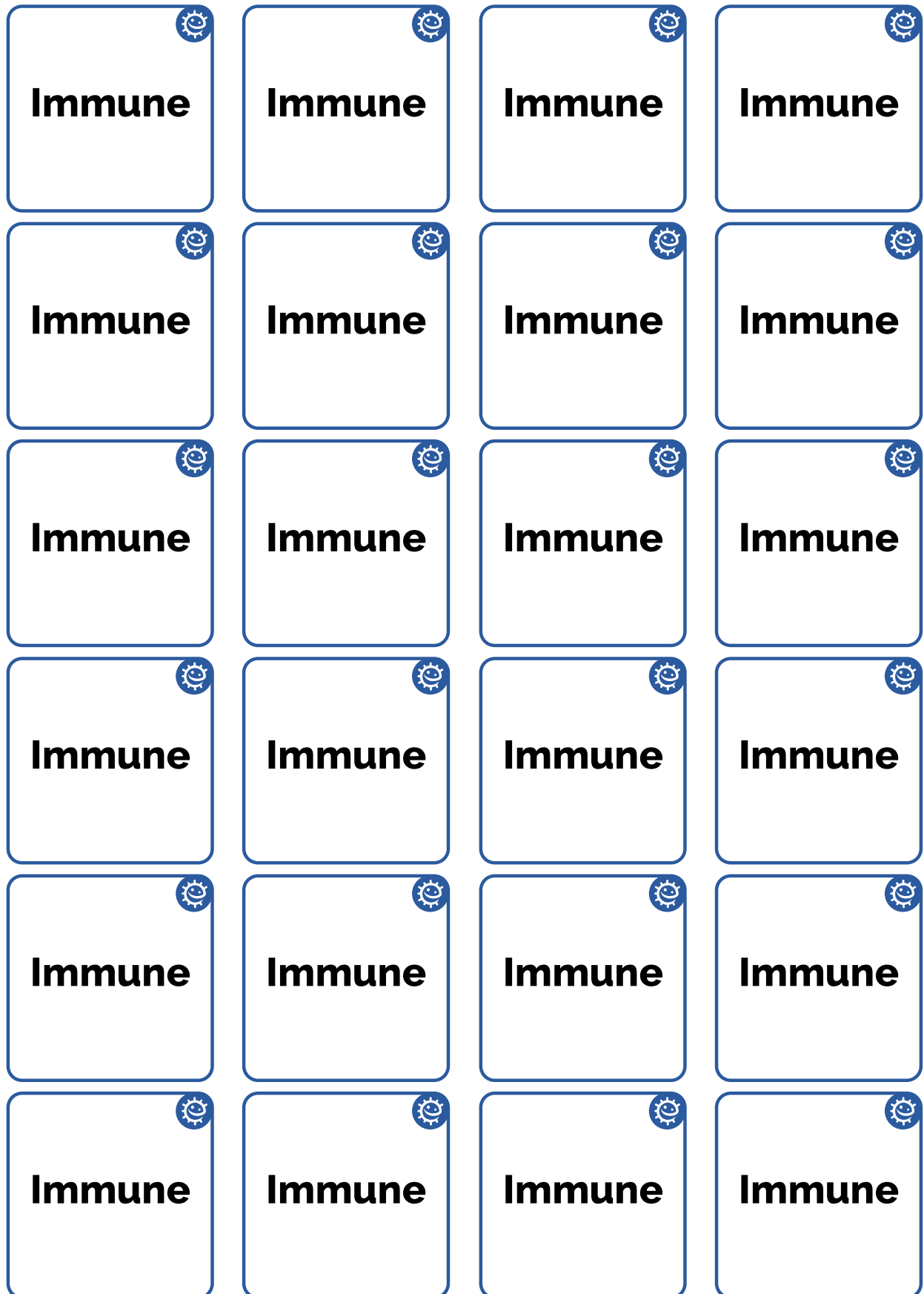


















## Herd Immunity Scenario: Student Worksheet

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Then add your conclusions

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Draw a graph to illustrate the results.

### Conclusions

1 What is herd immunity?

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2 What happens when vaccination drops to a low level within a community?

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3 Why is a vaccine regarded as a preventative measure and not a treatment?

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