Defence against disease

International Baccalaureate · IB Diploma · Biology · SL

Scope and prerequisites

This handout covers selected SL topics for the course first assessed in 2025; it is not the whole syllabus.

Prerequisites: read the stated quantities and units, and use arithmetic and the model conditions below.

The examples are original and fictional: they are not real measurements or real student investigations.

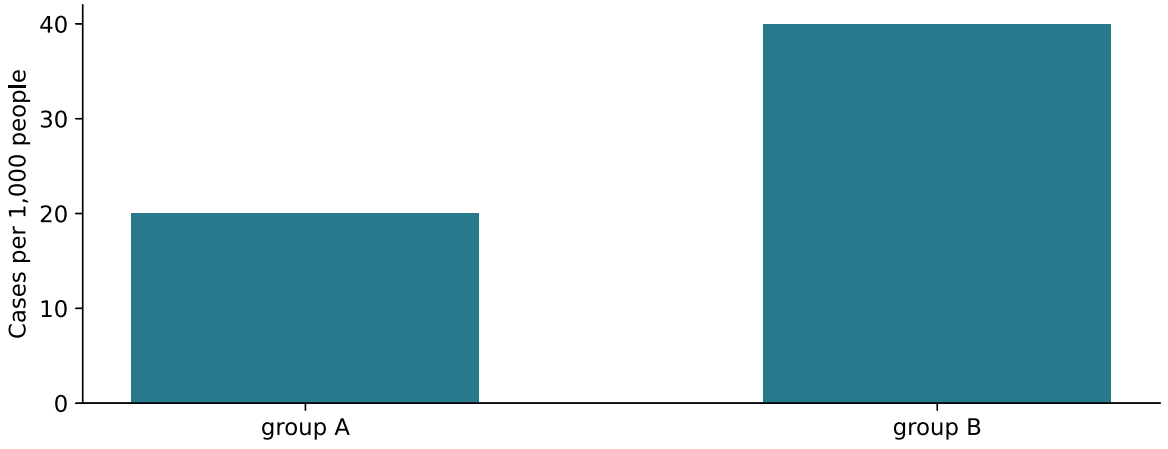
Disease transmission and immune response

What would explain this observation?

- An antibiotic may help against a bacterial infection but fail against a viral illness. Treatment depends on the causal organism and the evidence supporting diagnosis.

Build the model

- **Pathogens** cause infectious disease.
- Physical barriers, phagocytosis and specific immune responses reduce infection.
- Antibodies bind particular **antigens**.
- Vaccination exposes the immune system to antigen safely enough to develop memory.
- pathogen : An agent that causes disease.
- antigen: A structure recognized by a specific immune response.



Rates per 1,000 people compare groups of different sizes fairly

Choose evidence that can test it

- After vaccination, memory cells can support a faster secondary response.
- Antibiotic resistance arises through heritable variation and selection; an individual bacterium does not choose to become resistant because it needs to survive.

In the lab: Use published infection data to compare rates per equal population size. Distinguish prevalence at a time from new cases over a period. In school, use safe simulations or approved cultures rather than collecting unknown pathogens.

Work from known quantities

- Known: 18 cases occur in 900 people.
- Rate per 1,000 = cases / population × 1,000.
- Rate = 18/900 × 1,000 = 20 cases per 1,000.
- A second group with 10 cases in 250 people has 40 per 1,000, even though it has fewer cases.

Your turn: 12 cases occur among 600 people. Find cases per 1,000 people.

Check the conclusion and its limits

- Antibiotics do not act on viruses in the same way they act on bacteria.
- A vaccine is not an immediate cure for an established infection.

Not true: Every antibiotic is effective against every viral infection. Antibiotics act on bacterial structures and processes that viruses do not have, so they cannot cure a viral infection. Using them against viruses adds selection pressure for resistance without benefit.

Key:

- Pathogens cause infectious disease.
- After vaccination, memory cells can support a faster secondary response.
- Watch for: antibiotics do not act on viruses in the same way they act on bacteria.

Write from 45 cases per 1,000 people

- 18 cases occur among 400 people.
- Find cases per 1,000 people. Antibiotics do not treat viral infections.