

5.1 Disease transmission and immune response

Name: _____ Class: _____ Date: _____

Total: 10 marks

KEY WORDS pathogen • antigen

Objective

Disease transmission and immune response. Supported HL concept preparation; original classroom practice, not an official IB paper or assessed learner work.

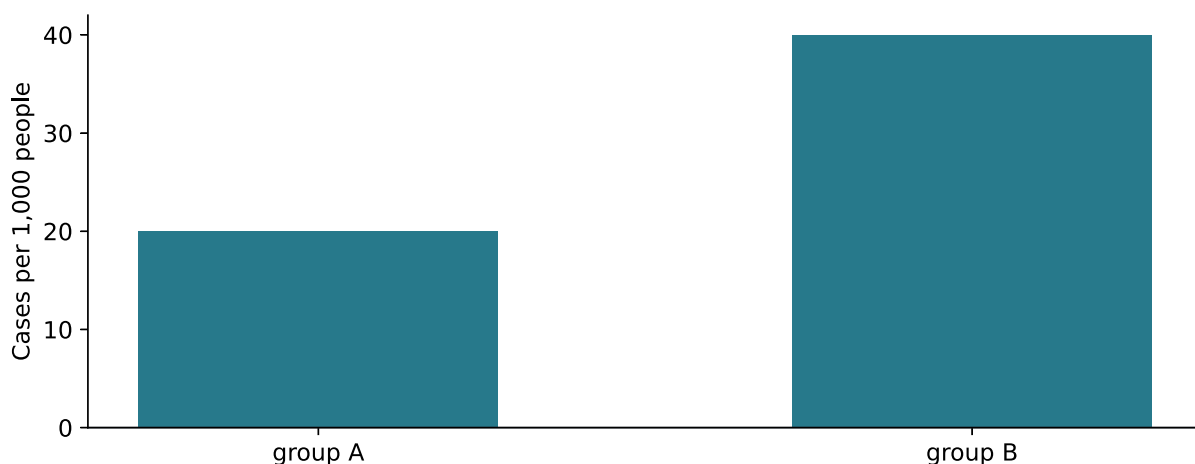
1 Key knowledge and worked examples

■ 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.
- Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

■ 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.



■ 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.
- 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

- State the known values and their units. Choose the relation because its assumptions fit this case, then rearrange before substitution.
- Known: 18 cases occur in 900 people. Rate per 1,000 = cases / population $\times$ 1,000. Rate = $18/900 \times 1,000 = 20$ cases per 1,000. A second group with 10 cases in 250 people has 40 per 1,000, even though it has fewer cases.

Example:

12 cases occur among 600 people. Find cases per 1,000 people. Use the same sequence: known quantities $\rightarrow$ model $\rightarrow$ relation $\rightarrow$ substitution $\rightarrow$ unit and interpretation.

■ 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.
- Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

Warn:

Every antibiotic is effective against every viral infection. This claim is false: 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.

Key:

Disease transmission and immune response: 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.

2 Practice

2.1 What explains the spread of antibiotic resistance? Choose one answer.

- **A** Bacteria deliberately change all their genes
- **B** Resistant variants survive and reproduce more successfully
- **C** Antibiotics turn viruses into bacteria

[1]

2.2 12 cases occur among 600 people. Find cases per 1,000 people. Show the relation, substitution and units.

[2]

2.3 Decide whether this claim is true and justify: Every antibiotic is effective against every viral infection.

[2]

2.4 An agent that causes disease: write the technical term.

[1]

3 Exam-style questions

3.1 Fictional samples report 12 cases in 600 people and 8 in 200. Compare rates and identify what else is needed before concluding one exposure caused disease. [4]
