Study Guide — BI Problem 5: Public Health Issue (End-of-Unit Test)

Biomedical Innovations · Problem 5 — Public Health Issue · Modeled on the PLTW Guided Review format

Vocabulary to know cold

Term	Definition
Epidemiology	The study of the distribution and causes of health conditions in populations.
Incidence vs. prevalence	Incidence = new cases over a time period; prevalence = all existing cases at a point in time.
Point-source vs. propagated outbreaks	Point source = one common exposure giving a single peak; propagated = person-to-person spread giving r
Sensitivity	True-positive rate: diseased people who correctly test positive, divided by all diseased people.
Specificity	True-negative rate: healthy people who correctly test negative, divided by all healthy people.
Correlation vs. causation	Correlation = variables change together; causation = one variable directly produces a change in another. C
Confounding variable	An outside factor linked to both exposure and outcome that can distort an apparent relationship.
Relative risk	The risk in the exposed group divided by the risk in the comparison group.
Sample size	The number of participants; larger samples reduce random error and narrow the margin of error.
Standard curve	A graph of known concentrations versus signal (e.g., OD) used to read an unknown sample's concentration
Biohazardous waste	Used human-derived materials that may be infectious and must be discarded under regulated protocols.
Cold-chain transport	Keeping specimens chilled during transport to slow degradation and microbial growth and preserve valid re

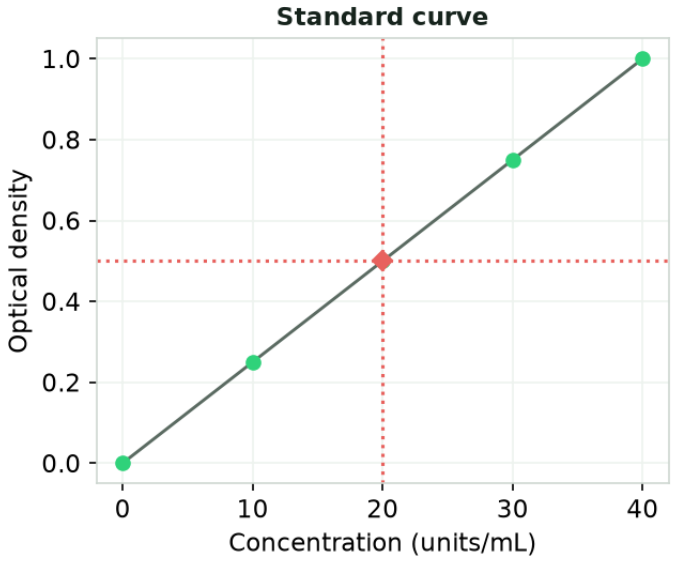
Worked examples (follow the reasoning)

Example 1. A test is given to 300 people. Of 100 who truly have the disease, 90 test positive. Of 200 healthy people, 190 test negative. Find the sensitivity and specificity.

- Sensitivity = true positives / all diseased = 90 / 100 = 0.90 = 90%.
- True negatives = 190; all healthy = 200.
- Specificity = true negatives / all healthy = 190 / 200 = 0.95 = 95%.
- Report both: a test can be highly specific yet miss some true cases (or vice versa).

Answer: Sensitivity = 90%, Specificity = 95%.

Example 2. Use the standard curve to estimate the concentration of a serosurvey sample that reads an optical density of 0.50.



- Find the unknown's signal on the y-axis: OD = 0.50.
- Trace horizontally to the line, then down to the x-axis.
- The matching concentration is the x value paired with y = 0.50.
- On this linear curve, y = 0.50 lines up with x = 20.

Answer: About 20 units/mL.

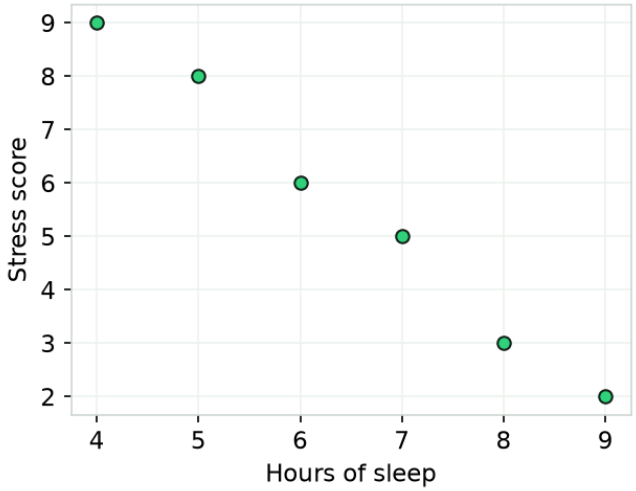
Example 3. A cohort study finds illness in 4% of an exposed group and 1% of an unexposed group. Calculate the relative risk and interpret it.

- Relative risk = risk in exposed / risk in unexposed.
- Substitute: 4% / 1% = 0.04 / 0.01 = 4.
- A relative risk of 4 means the exposed group has 4 times the risk of the unexposed group.
- Remember this is an association; confounders should be checked before claiming cause.

Answer: Relative risk = 4 (exposed have 4x the risk); association, not proof of cause.

Practice questions (with reasoning)

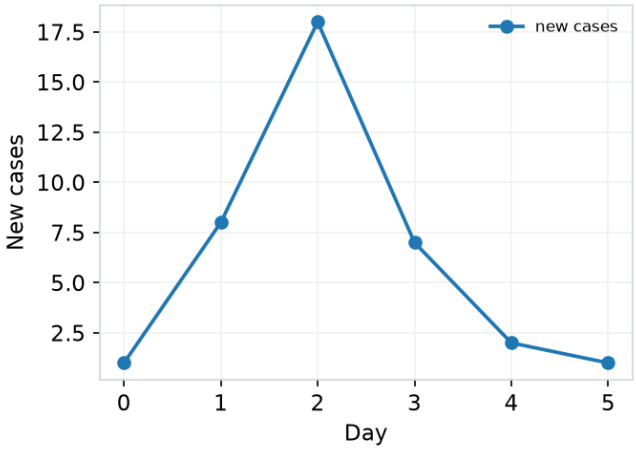
1. A scatter plot shows hours of sleep going up as reported stress goes down. This is a



A. positive correlation
B. negative correlation
C. proof sleep removes stress
D. no correlation

Answer: B. As sleep increases, stress decreases, which is a negative correlation; the plot cannot prove cause.

2. An epidemic curve with one sharp peak that quickly rises and falls indicates a



A. propagated outbreak
B. point-source outbreak
C. endemic baseline
D. measurement error

Answer: B. A single sharp peak signals a common point-source exposure at one time.

3. A researcher concludes a vitamin prevents colds based only on the fact that vitamin users reported fewer colds in a survey. The strongest weakness is that

A. the sample was too large
B. confounding and lack of a controlled, randomized design mean correlation is not causation
C. colds cannot be counted
D. surveys are never useful

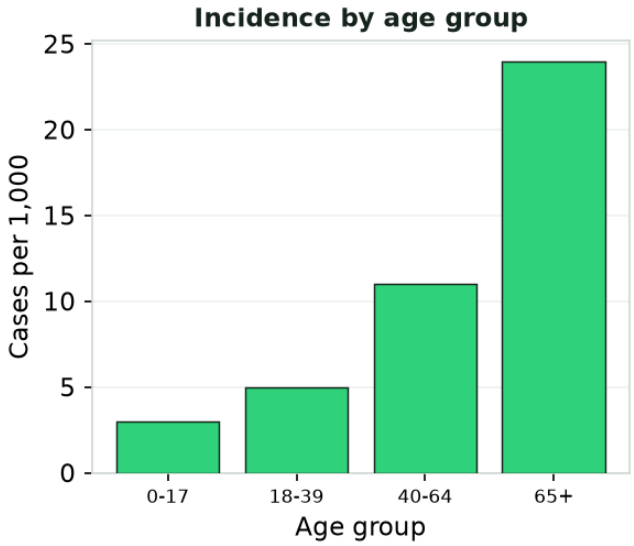
Answer: B. Observational survey data are vulnerable to confounders; a randomized controlled trial is needed to infer causation.

4. Which item belongs in regulated biohazardous waste rather than the regular trash?

A. A clean paper data sheet
B. A blood-contaminated pipette tip
C. An empty cardboard box
D. A dry, unused glove

Answer: B. Material contaminated with human blood is biohazardous and must be discarded under regulated protocols.

5. The bar graph shows the disease incidence rate per 1,000 people for four age groups in a community study. Which group has the highest rate?



A. 0-17
B. 18-39
C. 40-64
D. 65+

Answer: D. The 65+ bar is tallest at 24 cases per 1,000, the highest rate of the four groups.