1.6 Interpreting health-risk data and studies

Name: _____ Class: _____ Date: _____ **Total: 23 marks**

KEY WORDS confounder • correlation • causation • double-blind • placebo

Objective

Practise statements 1.15–1.18: reading illness and mortality data, judging study design, and the discipline of separating correlation from causation.

1 Key knowledge and worked examples

The four questions of every health study

1. **Who was studied?** Sample size, how selected, who dropped out.
2. **What was controlled?** Matching, placebo, blinding, **confounders** such as age, smoking, wealth.
3. **What was measured, and how?** Self-report vs measured; the endpoint (illness? death? a marker?).
4. **What is claimed?** Correlation, dose–response, mechanism, or cause?

Correlation is not causation

Two variables can move together because one causes the other, because a third factor causes both, or by chance. Evidence for causation needs: a plausible mechanism, a dose–response pattern, timing (cause before effect), and strength/consistency across studies.

Worked example: percentage change in standard form

A country's diabetes cases rise from 2.4×10^6 to 3.1×10^6. Increase $= 0.7 \times 10^6$. Percentage change $= 0.7/2.4 \times 100 \approx 29\%$. Deaths per 100 000: with 7 400 deaths in a population of 3.7×10^7, rate $= 7400/370 = 20$ per 100 000 – always state the denominator unit.

2 Practice

2.1 State the difference between correlation and causation. [2]

2.2 Give two examples of confounders in a study linking coffee drinking to heart disease. [2]

2.3 A study reports "30 % of participants who took vitamin C developed colds, compared with 32 % of those who did not." Comment on the size of this difference. [2]

3 Exam-style questions

3.1 The table shows deaths per 100 000 people from coronary heart disease in a country over four decades.

Decade	Men	Women
1980s	410	180
1990s	330	140
2000s	240	110
2010s	170	80

Calculate the percentage decrease for men between the 1980s and 2010s, compare it with the decrease for women over the same period, and suggest two explanations for the fall that a health authority could claim credit for. [6]

3.2 A newspaper headline says "Eating breakfast cereal makes children taller." The study behind it surveyed 2 000 children aged 7–11 and found cereal eaters were on average 3 cm taller. Give three questions you would ask about the study design before accepting the causal claim, and explain how each could produce the observed association without cereal causing growth. [6]

3.3 A trial of a new statin assigns 5 000 patients randomly to statin or identical placebo; neither patient nor doctor knows which. After five years, LDL-cholesterol is 32 % lower in the statin group and heart attacks are 18 % fewer. Explain why the random assignment and double-blinding allow a causal claim here, unlike the survey in 3.2. [5]

Solutions

Original-task marking: M1 method, A1 accuracy, B1 reasoning.

2.1 Correlation: two variables change together in the data. Causation: changes in one directly produce changes in the other – which needs more evidence than association alone.

2.2 Any two of: smoking, age, stress, diet overall, income, physical activity – factors linked to both coffee habits and heart disease.

2.3 The difference (2 percentage points) is very small relative to the group sizes and is likely within chance variation; without confidence intervals or a significance test no conclusion can be drawn.

3.1 Men: $(410-170)/410 \times 100 = 58.5 \approx 59\%$ decrease. Women: $(180-80)/180 \times 100 \approx 56\%$ – similar scale. Explanations: statin and blood-pressure treatment lowering LDL and hypertension at population scale; smoking bans and health education reducing smoking; (accept improved emergency treatment keeping people alive, or screening).

3.2 Any three well-explained: Who were the cereal eaters – richer families? Better overall nutrition would make them taller for reasons beyond cereal. Was total diet or income recorded? Cereal may simply mark a better-fed household. Height measured how, and by whom, with the same instrument for all? Measurement bias could inflate a small gap. Reverse timing: taller children may eat more breakfast, not vice versa.

3.3 Random assignment balances known and unknown confounders between the groups, so the groups differ only in treatment. Blinding prevents expectation effects – patients reporting differently and doctors treating differently. With LDL measured 32 % lower and events 18 % fewer against a matched control group, the difference is attributable to the statin.