Exercise walk-through

12.3
Bias, confounding and causation

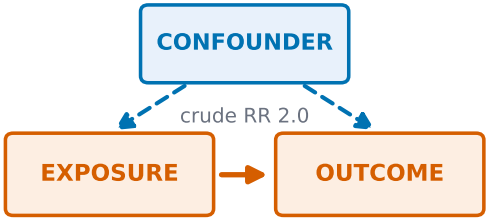
University Medicine

Bias, confounding and causation

1. **Failures Selection bias** (who counts), information/recall bias (what is remembered), **confounding** (third variable on both paths).
2. **Proof** Crude RR 2.0 collapsing to 1.0 in both strata = the third variable was the confounder.
3. **Causation** Hill's viewpoints with temporality first: strength, consistency, dose-response, plausibility; randomisation prevents confounding prospectively.

The confounding triangle and its cure

the triangle



a third variable on BOTH paths —
linked to exposure AND outcome

the stratification test

	exposed	unexposed	RR
crude	**32/200**	**16/200**	**2.0**
non-smk	2/50	6/150	1.0
smoker	30/150	10/50	1.0

RR = 1.0 inside every stratum
→ the third variable WAS the confounder

bias vs confounding — different failures, different cures

SELECTION bias: who gets into the study
INFORMATION/recall bias: what is remembered
systematic error in design or measurement

confounding: a real third variable — fix by randomisation (prospective), stratification, or design; temporality is Hills non-negotiable

The confounder sits on the back path - stratify and the spurious association collapses.

Exercises 2.1·2.3

2.1 Sick patients recall exposures more keenly – name the bias. [3]

2.2 What must a confounder be associated with (two things)? [3]

2.3 Which Hill viewpoint is non-negotiable? [3]

Exercises 2.1–2.3

2.1 Sick patients recall exposures more keenly – name the bias. [3]

2.1

- Recall (information) bias – measurement differs by group ✓.

2.2 What must a confounder be associated with (two things)? [3]

2.2

- The exposure AND the outcome – both paths ✓.

2.3 Which Hill viewpoint is non-negotiable? [3]

2.3

- Temporality – cause precedes effect ✓.

Exercise 3.1

3.1 A synthetic crude table: exposed 24/200 events; unexposed 12/200 (RR 2.0). Stratification by a third variable: stratum A 20/100 vs 10/100; stratum B 4/100 vs 2/100.

Compute the stratum RRs (2.0 and 2.0) ✓ and conclude that the third variable is NOT the confounder here (the association survives within strata) ✓. Explain what result WOULD have indicted the third variable (RR $\approx$ 1.0 inside every stratum) and why ✓. [8]

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3.1 A synthetic crude table: exposed 24/200 events; unexposed 12/200 (RR 2.0). Stratification by a third variable: stratum A 20/100 vs 10/100; stratum B 4/100 vs 2/100.

Compute the stratum RRs (2.0 and 2.0) ✓ and conclude that the third variable is NOT the confounder here (the association survives within strata) ✓. Explain what result WOULD have indicted the third variable (RR ≈ 1.0 inside every stratum) and why ✓. [8]

3.1

- Stratum A: 20/100 vs 10/100 → RR 2.0 ✓.
- Stratum B: 4/100 vs 2/100 → RR 2.0 ✓.
- The association survives within strata – the third variable is not the confounder ✓.
- Indictment needs RR collapsing toward 1.0 in every stratum – the crude association was then the mix of strata ✓.

Exercise 3.2

3.2 A fictional abstract: coffee drinkers show twice the disease rate.

List the three appraisal questions (who was selected; how was exposure measured; what confounder would need both links) ✓. Apply two Hill viewpoints (temporality: exposure measured before disease? dose-response: more coffee, more disease?) and state what each would demand ✓. [7]

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3.2

- Who was selected (response rates, health-worker effect) ✓.
- How exposure was measured (recall differs by disease status) ✓.
- Confounder profile: linked to coffee AND to the outcome (e.g. smoking) ✓.
- Temporality demands exposure recorded before disease; dose-response demands rising risk with rising intake ✓.