M5–M8 Mixed Quiz 3 (15 MC)

2025-08-26

1 Questions

1) M5 — Which best describes a pilot study?

- A. The final investigation with full sample
- B. A small-scale preliminary test to refine methods, instruments, and variables
- C. A literature review only
- D. A replication by another group after publication

2) M6 — A load cell saturates above 500 N. Data above 500 N show a plateau. This is:

- A. Quantisation error
- B. Sensor saturation; extend range or choose a different transducer
- C. Drift
- D. Hysteresis

3) M7 — A claim cites only cherry-picked studies with positive outcomes. This exemplifies:

- A. Publication bias
- B. Selection bias in evidence use
- C. Recall bias
- D. Attrition bias

4) M8 — Which is most appropriate when weighing competing stakeholder values?

- A. Choose the majority view automatically
- B. Use a transparent framework (criteria, weighting, evidence) and record reasons for decisions
- C. Defer to a single expert
- D. Select the cheapest option

5) M5 — Which improves accuracy most directly?

- A. Averaging repeats

- B. Calibration against traceable standards and correcting systematic error
- C. Increasing sample size without calibration
- D. Converting to SI base units

6) M6 — A digital filter reduces high-frequency noise. Which risk must be managed?

- A. Increased random error
- B. Phase lag distorting time-critical features
- C. Sensor drift
- D. ADC clipping

7) M7 — An observational study finds a strong association between two variables. To strengthen causal inference you should:

- A. Increase p-value threshold
- B. Control confounders, establish temporality, dose–response, and plausibility
- C. Only use cross-sectional data
- D. Ignore negative controls

8) M8 — The most ethical handling of secondary data containing personal information is to:

- A. Share raw identifiable data for transparency
- B. De-identify data, store securely, and comply with consent conditions and law
- C. Delete immediately after analysis regardless of consent
- D. Email datasets to collaborators without encryption

9) M5 — Which graph is most appropriate for showing repeatability of a measurement method?

- A. Pie chart
- B. Box-and-whisker plot of repeated measures
- C. Sankey diagram
- D. Choropleth map

10) M6 — The sensitivity of a sensor is best defined as:

- A. The smallest change it can detect (resolution)
- B. The slope of output vs input over a specified range
- C. The time taken to reach steady state
- D. The uncertainty in calibration

11) M7 — A study reports an impressive effect size, but confidence intervals are wide. This implies:

- A. High precision
- B. Low precision; more data or better design needed
- C. No bias present
- D. Publication bias

12) M8 — In presenting findings to a non-expert audience, the best approach is to:

- A. Use technical jargon to be precise
- B. Use clear visuals, analogies, SI units, and define terms
- C. Use emotive language to persuade
- D. Avoid numbers to prevent confusion

13) M5 — Random error primarily affects:

- A. Validity only
- B. Reliability/precision; it can be reduced by replication and averaging
- C. Accuracy only
- D. Ethical approval

14) M6 — A sensor has a response time (time constant) of 2.0 s. A step change is applied. Approximately how long to reach ~95% of final value?

- A. 2 s
- B. 4 s
- C. 6 s
- D. 10 s

15) M7/M8 — A meta-analysis of multiple RCTs finds no effect; one small study finds a large effect. Best conclusion?

- A. Adopt the intervention based on the large effect
- B. Weight the totality of evidence; meta-analysis is more reliable than a single small outlier
- C. Discard the meta-analysis
- D. Results are identical

2 Answer key

Q	Ans	Rationale
1	B	Pilot studies refine design before full study.
2	B	Saturation beyond range flattens output.
3	B	Selective citation of positive studies.
4	B	Transparent, criteria-based decision framework.
5	B	Calibration corrects systematic error → improves accuracy.
6	B	Filters can add phase lag.
7	B	Bradford-Hill style considerations.
8	B	De-identify, secure storage, lawful use.
9	B	Box plots display spread/repeatability.
10	B	Sensitivity = slope.
11	B	Wide CI low precision.
12	B	Audience-appropriate communication.

Q	Ans	Rationale
13	B	Random error → precision.
14	C	~3 6 s for ~95% (first-order).
15	B	Synthesis across RCTs outweighs a small outlier.