Biostatistics & Epidemiology/Population Health/Interpretation of Medical Literature

United States Medical Licensing Examination (USMLE) Step 1

3 to 5% of Step 2 CK · 9 sections · content outline and specifications

This system covers biostatistics, epidemiology, population health, and reading medical research. It is about 3% to 5% of Step 2 CK, and its items test practice-based learning and improvement or, for screening, health maintenance. Questions often give a 2 x 2 table, a trial result, or a short journal abstract, and then ask what it means for one patient in front of you. You must calculate a measure, name a design or a bias, and decide whether a result is valid and applies to your patient. Set up the table carefully, check which row or column is the denominator, and always ask what the number changes in patient care.

You should be able to: After this guide, a learner should be able to calculate and explain test accuracy, risk and treatment-effect measures, judge a study's design, bias and statistics, apply current screening advice, and decide whether a trial abstract applies to the patient in front of them.

Every section: the key point and the trap

1 Diagnostic tests: sensitivity, specificity and predictive values

Set up the 2 x 2 table with disease (by the reference standard) in columns and the test result in rows. Cells: true positive (TP), false positive (FP), false negative (FN), true negative (TN).

Trap: The commonest error is reading the wrong direction. Sensitivity and specificity are read down the disease columns. Predictive values are read across the test rows. If the stem asks about a patient with a positive test, the answer is a predictive value.

2 Likelihood ratios and post-test probability

LR+ = sensitivity / (1 - specificity). LR- = (1 - sensitivity) / specificity. Likelihood ratios do not depend on prevalence.

Trap: Do not multiply a probability by a likelihood ratio. Convert to odds first, multiply, then convert back. For small probabilities the error is small, but at 20% or more it gives wrong answers.

3 Measures of risk and treatment effect

Relative risk (RR) = risk in exposed / risk in unexposed. It is used in cohort studies and trials. RR = 1 means no effect.

Trap: Check the denominator before you divide. RRR divides by the control risk, not the treated risk. NNT uses the difference between groups, never the event rate in one group alone.

4 Study designs and the strength of evidence

Randomized controlled trials (RCTs) give the strongest single-study evidence of cause, because randomization balances known and unknown confounders.

Trap: Decide the design by the direction of the study, not by the words 'prospective' or 'retrospective'. If the study chooses people by outcome, it is case-control. If it chooses people by exposure and looks for outcomes, it is a cohort, even when the data are old records.

5 Bias, confounding and effect modification

Selection bias: the people studied differ from the target population (for example, volunteers, hospital patients or loss to follow-up). Randomization and complete follow-up reduce it.

Trap: Do not call every stratified result 'confounding'. When the strata disagree with each other, the answer is effect modification, and you should report the result separately for each group.

6 Statistical inference: p values, confidence intervals and power

The null hypothesis says there is no difference. The p value is the chance of a result this extreme or more if the null hypothesis is true. A p value below alpha (usually 0.05) is called significant.

Trap: A nonsignificant result does not prove 'no effect', especially in a small trial. Say the study found no significant difference and ask whether it had enough power.

7 Screening principles and screening biases

Screening is worth doing when the disease is common and serious, has a detectable early stage, has an effective early treatment, and the test is safe, acceptable and affordable.

Trap: Longer survival in screened patients does not prove screening works. Look for a fall in deaths from the disease in a randomized trial; otherwise suspect lead-time bias, length-time bias or overdiagnosis.

8 Outbreak investigation and population health

Steps: confirm the diagnosis and that an outbreak exists (more cases than expected), define a case, find and count cases, describe them by time, place and person, form a hypothesis, test it, then control and report.

Trap: Do not pick the food with the most ill people. A food that almost everyone ate will have many ill people even if it is safe. Compare attack rates between eaters and non-eaters.

9 Reading a clinical trial abstract

Start with the question: who were the patients (PICO: patients, intervention, comparison, outcome)? Read the inclusion and exclusion criteria.

Trap: Do not stop at 'statistically significant'. A strong result in the wrong population is still the wrong evidence for your patient, and a relative risk reduction can hide a small absolute benefit.

Key terms

Sensitivity: The share of people with a disease who test positive.

Specificity: The share of people without a disease who test negative.

Predictive value: The chance that a test result (positive or negative) is correct for the person tested.

Likelihood ratio: How much a test result changes the odds of disease.

Relative risk: The risk in exposed or treated people divided by the risk in unexposed or control people.

Odds ratio: The odds of exposure in cases divided by the odds of exposure in controls.

Number needed to treat: How many patients must be treated for a set time to prevent one bad outcome.

Confounder: A third factor linked to both an exposure and an outcome that distorts the link between them.

Confidence interval: A range that likely contains the true value of an effect.

Power: The chance that a study finds a real difference when one exists.

Lead-time bias: Survival looks longer only because screening finds the disease earlier.

Attack rate: The share of exposed people who become ill in an outbreak.

External validity: How well a study's results apply to patients outside the study.

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