Achievable

USMLE STEP 1 DUMP SHEET

Biostatistics and ethics

The 2 × 2 table

	Disease	No disease
Exposed or test +	a (TP)	b (FP)
Unexposed or test −	c (FN)	d (TN)

- RR $= [a/(a+b)] \div [c/(c+d)]$ (cohort)
- OR $= ad/bc$ (case-control); ≈ RR if disease is rare
- Attributable risk $= a/(a+b) - c/(c+d)$
- AR% $= (RR-1)/RR$; RRR $= 1 - RR$
- ARR (absolute risk reduction) = control − treated risk
- NNT $= 1/\text{ARR}$; NNH $= 1/\text{risk increase}$
- **Flu vaccine:** 45% vs 10% ill: ARR 35%, NNT ≈ 3

Disease frequency

- **Incidence:** new cases ÷ population at risk (cohort)
- **Prevalence:** all cases ÷ population (cross-sectional)
- **Prevalence ≈ incidence × duration:** longer survival raises it
- **Prevention:** primary (vaccine), secondary (screen), tertiary

Test characteristics

- Sensitivity $= a/(a+c)$; specificity $= d/(b+d)$
- PPV $= a/(a+b)$; NPV $= d/(c+d)$
- **Prevalence up:** PPV up, NPV down; sensitivity, specificity unchanged
- **Screen** with high sensitivity; **confirm** with high specificity
- **Lower cutoff:** sensitivity up, specificity down
- $\text{LR}^+ = \text{sens}/(1-\text{spec})$; $\text{LR}^- = (1-\text{sens})/\text{spec}$
- **Post-test odds** = pretest odds × LR

Hypothesis testing

- **Type I (α):** reject a true null (false positive); α = 0.05
- **Type II (β):** miss a real difference. **Power** = 1 − β (≥ 0.8)
- **Raise power:** bigger sample or effect, higher α
- **p ≤ 0.05:** reject the null
- **95% CI** containing 0 (a difference) or 1 (RR, OR): not significant
- **Correlation r:** −1 to +1, linear only; r^2 = variance explained

Study designs

Design	Groups chosen by	Measure	Notes
Cross-sectional	Nothing; one point in time	Prevalence	Fast, cheap; no causation
Case-control	Disease, then look back	Odds ratio	Rare disease, long latency; recall bias
Cohort	Exposure, then follow	Relative risk	Rare exposure; shows temporality; retrospective uses records
RCT	Random assignment	Relative risk, NNT	Best for causation; randomizing controls confounding

Bias

- **Selection:** sample not representative
- **Recall:** cases remember exposure better
- **Confounding:** third factor tied to both exposure and outcome
- **Lead time:** early diagnosis mimics longer survival
- **Observer:** prevented by blinding
- **Hawthorne:** subjects change when watched

Distributions

- **Normal:** mean = median = mode; ±1, 2, 3 SD: 68, 95, 99.7%
- **Right skew:** mode < median < mean
- **Left skew:** mean < median < mode
- **SEM** $= \text{SD}/\sqrt{n}$; 95% CI = mean ± 1.96 SEM

Drug development

- **Phase 1:** 20—100 people; safety, dose
- **Phase 2:** hundreds of patients; efficacy
- **Phase 3:** 300—3000; adverse reactions
- **Phase 4:** after approval; surveillance

Ethics

- **Autonomy:** a capable patient may refuse any treatment, and withdraw consent any time
- **Consent exceptions:** emergency, incompetence, therapeutic privilege, waiver
- **Minors:** parent consents, except emergencies, contraception, pregnancy, STIs, drug use
- **Emancipated minors** (married, military, self-supporting) consent for themselves
- **Living will** states wishes; **durable power of attorney** names a decision maker
- **Break confidentiality:** reportable disease, child or elder abuse, threat to a person