Logistics

12/7 office hours 12-1PM
12/12 office hours 12-1PM

Look over:
- HW assignments
- Midterm exams
- Discussion slides

N-Z Hodson 210 9AM-12PM 12/13

1 double sided 3x5 index card

50MC, 3-4 guest lecture questions

Extra Tips

- Make sure to check whether a question is asking for survival or death
- For cumulative incidence, check for loss to followup

Module 1 - Descriptive

History of epi

- John Snow (cholera)
- Semmelweis (handwashing after autopsy)
- Jenner (smallpox vaccine)
- Graunt (life table)
- Lind (scurvy, controlled trial)
- Typhoid Mary [Q]

Definition of epi

- study of distribution and determinants of health-related states or events in specified populations and the application of this knowledge to the control of health problems

Core functions

- Assessment, policy development, assurance
- Prevention - Primary, Secondary, Tertiary [Q]

Morbidity and mortality

- Prevalence - burden of disease = $pop(cases)$ / $pop(total)$ [Q]
- Incidence - risk of disease
  - Cumulative = new cases/total pop at risk [Q]
  - Incidence rate = new cases/total pop-time at risk [Q]
  - Assumes complete followup
- Using prevalence versus incidence [Q]
- Mortality rate
  - All-cause = $P(deaths(total) \mid pop_{midyear})$ [Q]
  - Cause-specific = $P(deaths(disease) \mid pop_{midyear})$ [Q]
- Case fatality rate - severity of disease = $P(deaths \mid disease)$ [Q]
- Proportionate mortality - proportion of deaths due to disease = $P(death(disease) \mid death)$ [Q]
- Age-adjusted mortality rate (direct adjustment) = $\sum_{a \in age} \quad pop(standard, age) * \frac{\#deaths_{age}}{pop(group,age)} / \sum_{a \in age} \quad pop(standard, age)$ [Q]

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Sp18 Q1
Fa18 Q1

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Fa18 Q16

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Fa18 Q4,17

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- Standardized mortality ratio (indirect adjustment) = $number\ of\ deaths\ in\ subpop\ /\ (mortality\ rate\ of\ standard\ *\ subpop)$ [Q] [Q]
- Observed survival
  - Life table [Q]
  - Kaplan-Meier method [Q]
  - Life table versus Kaplan-Meier [Q]

Outbreak investigations and disease surveillance

- Endemic versus epidemic versus pandemic [Q]
- Herd immunity - resistance of a group of people to a disease based on proportion of people immune to disease, applies to person-to-person transmission [Q]
- Types of outbreaks [Q]
  - Common source
    - Point source - food outbreak
    - Continuous - broken fountain
    - Intermittent - common flu
  - Propagated - HFM
  - Mixed
  - Using epi curve
- Attack rate
- Identifying probable cause of outbreak [Q]
- Incubation period, via cross-tabulation [Q]
- Types of surveillance
  - Sentinel - pick certain sites
  - Syndromic - between symptoms and diagnosis
  - Passive - mandatory reported diseases
  - Active
  - Identify type [Q]
- Sources of data - medical records, emergency departments, 911 calls, or nonclinical data from schools, labs, surveys, etc.

Measures of validity and reliability

- Validity - expresses degree to which a specified measurement measures what it purports to measure, sensitive and specificity are fixed characteristics of the test, predictive values depend on the prevalence of the disease, often for new tools [Q]
  - Sensitivity = P(test positive | disease)
  - Specificity = P(test negative | no disease) [Q]
  - Net sensitivity simultaneous = inclusion exclusion
  - Net specificity simultaneous = product rule
  - Net sensitivity sequential = product rule
  - Net specificity = inclusion exclusion

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F18 Q6

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Sp18 Q21
Fa18 Q22

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Fa18 Q11

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Sp18 Q8,15
Fa18 Q10

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Sp18 Q10
Fa18 Q13,24

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Fa18 Q7

    - Simultaneous and sequential testing - simultaneous captures positive for either, so high sensitivity, sequential captures test negative for either, so high specificity [Q]
    - PPV = P(disease | positive test), increases with prevalence
    - NPV = P(no disease | negative test) [Q]
    - NNH
    - NNT [Q]
    - ITT [Q]
- Reliability - degree to which the results can be replicated for a specified measurement procedure, aka repeatability, precision, comparing one tool to itself
    - intra and inter observer agreement
    - Kappa statistic - won't have to calculate, only interpret [Q]

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Fa18 Q2,12

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Sp18 Q23

Module 2 - Study Designs

Types of populations

- Target
- Source
- Study
- [Q]

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Validity in study design

- Internal validity - need to consider methodological problems, bias, confounding, random error, must be established before generalizing to external bias
- External validity

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Types of study design

- Clinical Trial
- Cohort
- Case control
- Cross-sectional
- Ecologic
- Identify type

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Module 3 - Analysis and Inference

Measures

- Calculate and interpret each measure
- Use in appropriate study design

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Ratios

- Relative risk (trial, cohort)
- Prevalence ratio (cross-sectional)
- Odds ratio (case control)
  - Matched and unmatched
- RR is roughly OR when disease is rare

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Differences

- Risk difference
- Prevalence difference
- Attributable risk

Necessary versus sufficient

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- Necessary - disease won't develop w/out exposure
- Sufficient - exposure guarantees disease

Epidemiological guidelines for suggesting causation

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- Temporality (only one that is necessary)
- Strength of association
- Dose-response gradient
- Consistency/replication
- Coherence (biological plausibility)
- Experiment (cessation of exposure)
- Analogy
- Consideration of alternate explanations
- Specificity of association

Chance

- p value, sample size, precision of confidence interval determined by sample size, type I, II errors

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Bias

- systematic/non-random error in design, conduct or analysis of study
- Selection bias - difference in characteristics between those who take part in a study versus those that do not

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- Information bias - flaw in data collection or measurement that results in different quality/accuracy between comparison groups

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- Identify type

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Confounding

- Associated with exposure

- Cause of outcome
- Not in the causal pathway
- Control in study design
    - Restriction on confounding variable
    - Matching in a case-control study
    - Randomization in a clinical trial
- Control in the data analysis
    - Stratification
    - Adjustment

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Effect modification

- Make a list of potential confounders and effect modifiers
- Calculate crude measure of association for exposure and outcome of interest, calculate measures for stratified

Module 4 - Applications of Epi