Biostats 101

Seminar 1: Statistics in the Research Process

Outline
- Research Process
- Analysis Plan
- Power/Sample Size
- Descriptive Stats
- Estimation
- Hypothesis Testing
- Conclusions

Introduction

- Outline
  - Greater Research Process
  - Statistics in the Research Process
    - Experimental Design
      - Statistical Analysis Plan
      - Power and Sample Size
    - Data Collection and Description
    - Descriptive Statistics
    - Inferential Statistics
      - Estimation
      - Hypothesis Testing
      - Conclusions

Greater Research Process

- Investigator Roles and Activities—what's your role?
  - PI
  - Coinvestigator(s)
  - PRA(s)
  - Consumer of medical research
  - Other Clinical or lab Professionals

Greater Research Process

- Statistician Roles and Activities—what's my role?
  - Not “dropping off laundry”
  - Usually not “technician”
  - “Black box” not useful
  - Coauthor/coinvestigator most useful
    - Regular meetings
    - Involved in all phases of research

Statistics in the Research Process

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**Statistics in the Research Process**

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**Data Collection and Description**

- Focused on the Sample (not the population)
- Data Collection
- Data Description

**Statistical Analysis Plan**

- Research Process
- Analysis Plan
- Power/Sample Size
- Descriptive Stats
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- Hypothesis Testing
- Conclusions

- SAP Includes:
  - Research question
  - Population
  - Outcome
  - Primary predictor
  - Covariates
  - Missing data methods
  - Model selection methods
  - Analyses in order

**Power, sample size and effect size**

- Research Process
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- Variables included:
  - Power
  - Sample size
  - Effect size
  - Variability
  - Significance level
Data Collection

- Done in clinical, lab, or database setting
- Monitor for data completeness (clinical trial)
- Should be informed by Statistical Analysis Plan
  - Collection methods
  - Dataset organization and formatting

Descriptive/Sample Statistics

Summary measures describe data
- Likely/typical data values
- Noise/variability in data
- Proportions and odds

Estimation

Point estimate
- Descriptive/sample stats give estimate of population parameter
- Descriptive/sample stat formula may correct for bias

Hypothesis Testing

Statistical Hypothesis:
- Quantifiable/falsifiable statement about population parameter
Hypothesis test:
- Reject or fail to reject
- Uses data/estimates and probability
- Done with p-values, critical values, or confidence intervals

Conclusions/Dissemination

Include the following:
- Point estimate
- Interval estimate (confidence interval)
- P-value
- Decision to reject or fail to reject hypothesis
### Statistics in the Research Process

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For statistical help, go to:  
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