How to Properly Design and Interpret Clinical Trials

Key Elements to a Clinical Trial

- Identify the question
- State research aims, objectives and hypothesis
- Determine endpoints
- Choose a design
- Create an analytic plan
- Justify sample size

Identifying the Question

- Adequate background to support the question
- Single most important aspect of a study
- Avoid vague questions
- What defines a good research question?
  — FINER: Feasible, Interesting, Novel, Ethical, Relevant
- What are the specific elements of a good research question?
  — PICOT: Population, Intervention, Comparison, Outcome, Timing

FINER

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No Disclosures

Modified from Hulley & Cummings et al, Designing Clinical Research, 4th ed., 2013
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### PICOT: Specific Elements of a Research Question
- **Population**
  - What population are you interested in?
- **Intervention**
  - What is the investigational intervention?
- **Comparison**
  - What is the comparison group?
- **Outcome**
  - What will be measured, improved, or affected?
- **Timing**
  - What is the appropriate time for study and follow-up?

### Research Aims, Objectives & Hypothesis
- Identifying the question
- State research aims and objectives
  - Typically one primary aim
  - Concrete with measurable outcomes
- Developing a Hypothesis
  - Why is necessary to establish the hypothesis *a priori?*
    - Affects design of trial
    - Affects sample size
    - Impacts interpretation of results

### Endpoints
- Identifying the question
- State research aims and objectives
- Determine endpoints
  - Aims ≠ Endpoints
  - Quantifiable
  - Measure of “effect” of interest (patient level)

### Design
- Identifying the question
- State research aims and objectives
- Determine endpoints
- Choose a design
  - Pilot, Phase I, II, III
  - Based on the aims and endpoints
  - Other considerations: patient population, accrual possibility, other trial results

### Choosing a Design
- Pilot Study: examines feasibility of an approach with goal of implementing on a larger scale
  - Evaluates feasibility of recruitment, randomization, assessment of procedures, new methods, and novel interventions
  - Does not evaluate a hypothesis or assess safety, efficacy or effectiveness
- Phase I: Evaluate safety, determine safe dosage range, identify side effects
- Phase II: Assesses effectiveness and further evaluate safety
- Phase III: Large number treated to confirm effectiveness, monitor side effects, compare to standard treatments
Analytic Plan

- Identifying the question
- State research aims and objectives
- Determine endpoints
- Choose a design
- Create an analytic plan
  - Plan for each AIM of the study
  - Goals?
    - Compare, estimate, test a hypothesis

Sample Size

- Identifying the question
- State research aims and objectives
- Determine endpoints
- Choose a design
- Create an analytic plan
- Justify sample size
  - Power or Precision
  - Based on primary aim

*Discussing all of the above with a biostatistician

Summary

- Most important aspect of a study is to identify a question based on sound research
- Involve a biostatistician in the process to appropriately design and power a study
- Executing a trial takes time and team work

Thank you