

Picking the Right Research Question

Mary-Claire Roghmann, MD, MS
Department of Epidemiology
and Public Health

Overview

- Why should I do research?
- How do I find a mentor?
- How do I pick my research question?
- How do I answer the question?

Why do research?

- Explore research as a career option
 - Undergraduate Student
 - Grad School vs. Professional School
 - Professional Student/Resident/Clinical Fellow
 - Academic Medicine/Pharma
- Develops critical thinking/problem solving skills/team work that is needed in healthcare (and other fields)

Overview

- Why should I do research?
- *How do I find a mentor?*
- How do I pick my research question?
- How do I answer the question?

Before you look for a mentor I

- Know what you want from mentor
 - Personal role model
 - Academic guidance
 - Research mentor
- Know what you want out of the research experience
 - Time frame
 - Skill set, poster, publication

Before you look for a mentor II

- List the specific opportunities you want
 - Lab skills vs. presentations vs. manuscripts vs. grant writing
- Write down your professional goals
 - Immediate: 3 months
 - Short term: 1 year
 - Long term: 5 years

Surveying the Landscape

- Meet with faculty you know throughout the institution
 - Ask for other recommendations for people who might be a good fit
- The **time** issue
 - Make clear from initial meetings what you want
 - Be persistent- follow through
- Market yourself
- Tell the mentor how s/he can be helpful
- Be appreciative from the start

Expectations for a Research Project- MD et al. Scientist Track

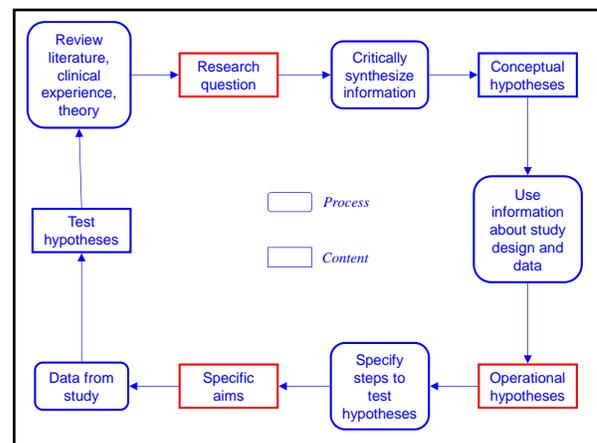
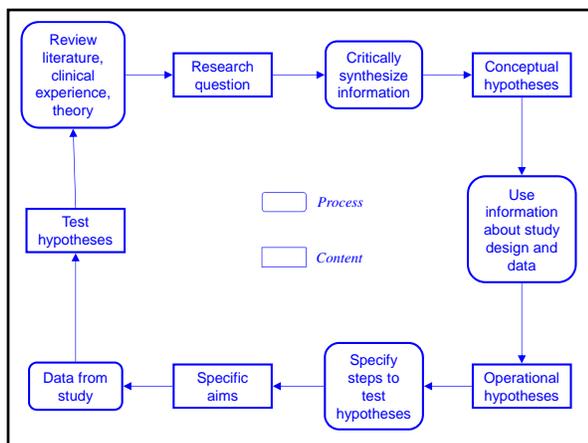
- | | |
|---|--|
| <ul style="list-style-type: none"> • High school <ul style="list-style-type: none"> - Do anything your mentor wants you to do • Undergraduate <ul style="list-style-type: none"> - Follow a single project • Professional <ul style="list-style-type: none"> - Participate in all aspects of a project | <ul style="list-style-type: none"> • Resident <ul style="list-style-type: none"> - Initiate a simple project • Clinical Fellow <ul style="list-style-type: none"> - Initiate and/or participate in multiple projects • Junior Faculty <ul style="list-style-type: none"> - Initiate a complex project |
|---|--|

Expectations for a Research Project- PhD Scientist Track

- | | |
|---|--|
| <ul style="list-style-type: none"> • High school <ul style="list-style-type: none"> - Do anything your mentor wants you to do • Undergraduate <ul style="list-style-type: none"> - Follow a single project • Graduate <ul style="list-style-type: none"> - Initiate multiple simple projects | <ul style="list-style-type: none"> • Post doc <ul style="list-style-type: none"> - Initiate and/or participate in multiple complex projects • Junior Faculty <ul style="list-style-type: none"> - Initiate a portfolio of projects |
|---|--|

Overview

- Why should I do research?
- How do I find a mentor?
- **How do I pick my research question?**
- How do I answer the question?



Research Questions

- Capture the uncertainty about a health problem that the investigator can resolve
 - Specific, clear and focused
 - Not a topic
- No shortage of questions
 - But defining the problem takes time

Problem vs. Topic

- A difficult problem in treating brain tumors is their resistance to traditional chemotherapy due partly to the blood brain barrier which prevent access. In order to address....
- Brain tumors are a difficult problem as reflected by their poor prognosis. We are interested in learning more about the blood brain barrier, an important first step in developing more effective therapy

Topic vs. Problem

- Patients with MRSA infections have a higher mortality than patients with MSSA infections. Understanding the risk factors for MRSA infection will help us prevent these infections.
- Patients with MRSA infections often receive inadequate empiric antibiotic therapy which may contribute to their poorer outcomes. In order to address this issue, we have developed a new algorithm for empiric ...

Develop a Research Problem that

- Matches your (and your mentor's) background and training
 - Closeness of match to mentor depends on your level of training
- Will have an impact on the field
 - Advance scientific knowledge (concepts, methods, technologies)
 - Is a logical next step from what is known
 - what you have done if you are faculty
 - Change how we diagnose, treat, prevent disease (clinical practice)

Origins of a Research Question I

- Master the literature
 - Gain from the experience of others
 - Mentors, colleagues
 - Write a meta-analyses or systemic review in your area of interest
 - Health Sciences Library Resources
 - Attend professional meetings
 - Recent work in posters and presentations

Cummings, Browner, Hulley, Designing Clinical Research, 2001

Origins of a Research Question II

- Be alert to new ideas and techniques
 - Skeptical attitude towards prevailing beliefs
 - Learn about new technologies
- Keep your mind open to questions
 - Observation of patients
 - Teaching
 - During rounds
 - Preparing a lecture

Cummings, Browner, Hulley, Designing Clinical Research, 2001

Research Question must be

- F Feasible
- I Interesting
- N Novel
- E Ethical
- R Relevant

Cummings, Browner, Hulley, 2001

Is it Feasible?

- Are there an adequate number of subjects?
 - Sample size calculations
- Is there adequate technical expertise in how the variables are measured?
- Affordable in time and money
 - <250K/year
- Manageable in scope

Is it Interesting?

- Anticipate the Results before Doing the Study (Expected Outcomes)
 - Is it interesting to you?
 - What would you do next?
 - Is it interesting to others?
 - Mentors
 - Colleagues
 - Peer-reviewed publication/Study Section
 - Funding agencies

Is it Novel?

- Will it contribute new information?
 - Thorough review of the literature
 - Consultation with experts
 - Searching NIH Reporter
- Does the project employ or develop new concepts, approaches, methodologies, tools or technologies?

<http://projectreporter.nih.gov/reporter.cfm>

A question need not be totally original.

- whether a previous observation can be replicated
- whether the findings in one population also apply to others
- confirmatory study is particularly useful if it avoids the weaknesses of previous studies

<http://projectreporter.nih.gov/reporter.cfm>

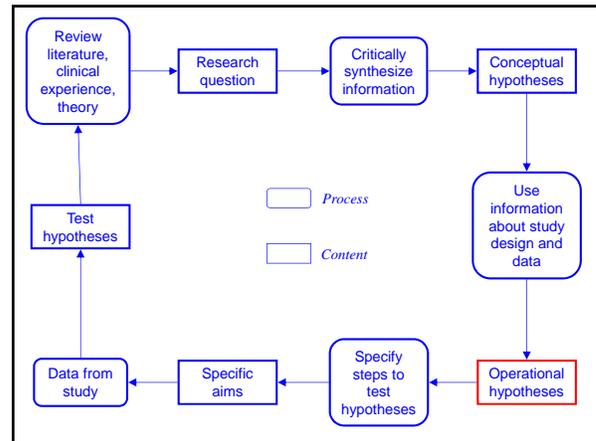
Is it Ethical?

- Can the question be answered without harming the patient?
- Benefits must outweigh risk.

- Seek IRB approval before you submit your grant
 - Human Subjects Section

Is it Relevant?

- Will it
 - guide further research?
 - logical next step
 - change clinical management?
 - diagnosis, treatment, prevention
 - influence health policy?
 - Clinical or public health guidelines



Hypotheses

- Testable propositions that can be accepted or rejected on the basis of empirical observations derived from your study
 - Specify two or more variables
 - measurable
 - Specify how the variables are related
 - increase
 - decrease

Hypothesis Template



Classroom Exercise: Critique of Hypotheses

Outline for Evaluating Hypotheses

- What is the hypothesis? Is it testable?
- What are the variables?
 - Which is the outcome variable (dependent variable, disease)?
 - Which is the study variable (independent variable, exposure)?
 - Are they measurable?
 - How are they related?

Write a hypothesis from a research question I

- **Data set:** 1400 women who underwent elective hysterectomy for non-malignant reasons; followed for complications and quality of life measures over the next two years
- **Research question:** Do women on hormone replacement therapy (HRT) gain more weight?

Write a hypothesis from a research question II

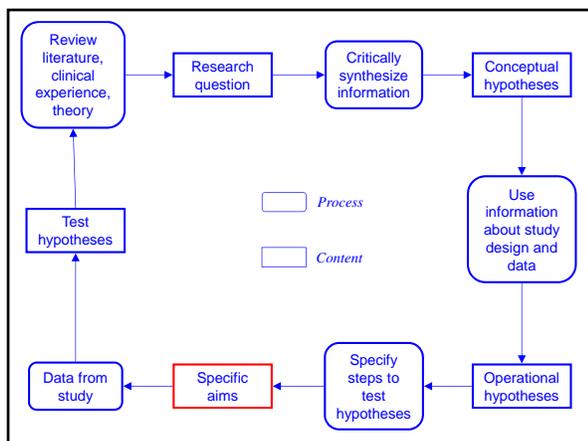
- Study variable
- Outcome variable
- Relationship
- Hormone replacement therapy
- Weight change
- Increase

Write a hypothesis from a research question III

- Women on hormone replacement therapy will have an increase in their weight compared to pre-hysterectomy compared to women not on hormone replacement therapy.

Overview

- Why should I do research?
- How do I find a mentor?
- How do I pick my research question?
- *How do I answer the question?*



Specific Aim

- Exact statements of what you want to do in the proposed project
 - What you need to do to test the hypotheses
 - "Experiment" or study
 - Design and methods
 - An aim has a working hypothesis
- Project = 1-2 aims at most
- Grant = 3-5 aims at most

Specific aims direct your grant (and your research project)

- For each aim
 - Experimental design and methods
 - Hypothesis
 - Data and Analysis
 - to test your hypothesis

Specific aim

- Perform a secondary analysis of an existing cohort study of women immediately post-hysterectomy to estimate the effect of hormone replacement therapy on weight gain after hysterectomy
- Hypothesis: Women on hormone replacement therapy will have an increase in their weight compared to pre-hysterectomy compared to women not on hormone replacement therapy.

Sub-aims for testing Hypothesis

- Define and measure HRT
- Define and measure change in weight
- Evaluate the association between HRT and weight change
- Identify potential confounders and effect modifiers
- Develop a multiple variable model to estimate the association between HRT and weight change

Homework Assignment: Review of Specific Aims

Will go over on Friday during
my grants talk

Course Objectives

- | | |
|--------------------------------|--|
| ✓ Identify a research question | • Identify institutional resources |
| • Pick a study design | • Appreciate the ethical, legal and regulatory issues in human subjects research |
| • Collect and manage data | • Understand the multidisciplinary nature of research |
| • Analyze data | • Recognize career opportunities in clinical and translational research |
| • Write an abstract | |
| • Present a poster | |
| • Give an oral presentation | |
| • Publish a paper | |
| • Prepare a grant | |

Conclusions

- Research provides tremendous opportunity for personal growth and professional advancement
- Choose your mentors and projects with thought
- Have fun!

Bibliography

- Chapter 2 Conceiving the Research Question in "Designing Clinical Research", Hulley et al 4th Edition
- Office of Research Career Development Grant writing workshops
 - <http://www.medschool.umaryland.edu/biomedical/>
- Ronald Kahn. Picking a Research Question. NEJM, 1994, Vol 33, No. 21 p.1530