

# Stages of Research

RHS 481

Lecture 3

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# Identifying a problem

- State a question that can be answerable
- A solution to the question must be possible
- The stated question directs the researcher to use a scientific approach to reach a solution

# Identifying a problem

- Sometimes identifying a research problem or asking a research question may be more difficult than solving it!!!!

# Necessary attributes for a researcher

- **Ability to think:**

“don’t accept what people say or write; ask yourself or others or the literature – is this really so, what is the evidence, how good is it, could I verify or disprove that point, how would I go about it and what would I need”

(Ritchie, 1996)

# Necessary attributes for a researcher

- **Attitude** toward the scientific method or the advancement of the profession
  - interest, curiosity, and motivation
  - enthusiastic students will find the research experience enjoyable

# Necessary attributes for a researcher

- **Technical knowledge** in the research area
  - experienced researchers identify new problems every time a research project is in progress

# Necessary attributes for a researcher

- Students must be able to:
  - Identify problems requiring research
  - Design an experiment to answer the question being asked
  - Select an instrument (or methods) to collect data
  - Record data and interpret the findings in light of the evidence collected
  - Describe adequately the problem, methods, and design used to collect data, and present the results through oral and written presentation

# Where do research problems come from?

- Casual observation in the clinical setting
  - Not all techniques used in the clinics are based on facts
- Theory testing
  - Theory = guess
  - Most therapeutic approaches are based on theory, and therefore must be tested scientifically



# Where do research problems come from?

- Reading and analyzing the literature in a specific area of interest
- Controversial issues or contradictory research findings
- Replication of previous research to show consistency of findings OR uncover questionable conclusions

# Delimiting the problem

- = narrowing down the problem to a question that can be answered
- Broad problems can not be solved in a single investigation
- A general problem should be subdivided into many questions which should be answered separately, then information gathered can be pieced together

# Delimiting the problem

## Example

- **Global problem:** how can the quadriceps muscle force be enhanced?
- **Delimited problems:**
  - Which exercise is best for strengthening the quadriceps? (concentric, eccentric, isometric, isokinetic)
  - What is the best rate of exercise?
  - What effect do hip position have on force?
  - Does electrical stimulation of muscle during exercise affect strength gains?

# Literature review

- Purpose: to discover what is known about a certain topic
- You should look for 4 things about the topic:
  - Theory
  - Facts
  - Opinions
  - Methods

# Example

- A physiotherapist wanting to treat patients with continuous passive motion (CPM) needs to know:
  - Theories about how CPM works
  - Facts about protocols and results
  - Opinions of therapists on the future of clinical use of CPM
  - Methods that others used to assess effects of CPM

# Types of literature

- Primary sources: original reports of research (journal articles, theses and dissertations, conference abstracts and proceedings)
- Secondary sources: in which authors summarize their own work and the work of others (book chapters, review articles)

# Evaluating the literature

1. Classify the variables
2. Compare purposes and conclusions
3. Describe design and control elements
4. Identify threats to validity
5. Compare the study with other research  
(does it add new information?)
6. Evaluate the utility of the study

# Conducting a literature review

- Obtain a “relatively” complete set of articles on the topic
- Decide which articles are relevant to the your question
- Identify the designs and variables used previously to address the question
- Determine the validity of the studies
- Make comparisons across studies
- Specify problems that need further study



# Research proposal

- **Title**
- **Investigators**
- **Problem statement:**
  - Two or more paragraphs putting the problem in the context of related literature
- **Purpose:**
  - Primary / secondary purposes
  - May be stated as: “the purpose is to answer the following questions.....”

# Research proposal

- **Methods:**
  - Participants
  - Procedures
  - Data analysis

# Subjects (participants) selection

- ***Sampling*** = the process by which a subgroup of subjects is selected for study from a larger group of potential subjects
- ***Assignment*** = the process by which subjects in the sample are assigned to groups within the study

# Significance of sampling

- Sampling methods influence the characteristics of the sample, which in turn influence the generalizability (external validity) of the research

# Population versus Sample

- ***Population*** = the total group of interest
- ***Sample*** = the subgroup of the group of  
interest

# Sampling

```
graph TD; A[Sampling] --> B[Probability sampling: Involves randomization Preferable Generalizable]; A --> C[Non-probability sampling: No randomization Common in physical therapy];
```

**Probability sampling:**  
Involves randomization  
Preferable  
Generalizable

**Non-probability sampling:**  
No randomization  
Common in physical therapy

# Probability sampling

- Probability samples have less “sampling error” than non-probability samples
- Better approximation of the target population
- Involves randomization

# Probability sampling

## 1) **Simple random sampling:**

- Each member of the population has an equal chance of being selected for the sample, and selection of each subject is independent of selection of other subjects
- Using random numbers from tables generated by a computer
- Difficult to implement in large samples



# Probability sampling

## 1) **Simple random sampling:**

- Example: writing patients names on cards and putting them in a hat and drawing from the hat
- Less commonly used

# Probability sampling

## 2) **Systematic sampling:**

- The researcher selects the  $n$ th person on a list
- May introduce systematic error (bias)
- Example: selecting patients who had operations on the same days

# Probability sampling

## 3) **Stratified sampling:**

- When certain subjects must be represented in adequate numbers within the sample or when it is important to preserve the proportions of the subgroups in the population within the sample
- Requires that the researcher sets classification boundaries

# Probability sampling

## 3) **Stratified sampling:**

- Example: when we collect data on patients from several hospitals, we need adequate number of patients from each hospital

# Probability sampling

## 4) **Cluster sampling:**

- The use of naturally occurring clusters as the sampling units
- Used when an appropriate sampling frame does not exist or when logistical constraints limit the researcher's ability to travel

# Probability sampling

## 4) **Cluster sampling:**

- Examples: cluster sampling of few physical therapy departments and then few therapists within each department... Or to conduct a nation wide study on the outcome of total knee replacement

# Non-probability sampling

- Absence of randomization
- Widely used in physical therapy (mainly due to limited funding and resources)

# Non-probability sampling

## 1) **Sample of convenience:**

- The use of readily available subjects
- Example: using a sample of convenience of patients in certain diagnostic category at a single hospital



# Non-probability sampling

## 2) **Snowball sampling:**

- When the potential members of the sample are difficult to identify
- Researchers identify few subjects who are then asked to identify other potential members of the sample
- Example: examining patients who returned to sports activities earlier than recommended after a ligament surgery (despite the therapists advice against that)

# Non-probability sampling

## 3) **Purposive sampling:**

- When a researcher has a specific reason for selecting particular subjects for study
- Commonly used in qualitative research which is interested in developing an in-depth understanding of particular situation

# Example

- To study different educational modes for teaching children:
- There are 40 elementary schools in the district.
  - **random sample:** if the researcher randomly selects two of the schools
  - **sample of convenience:** if the researcher selects 2 schools which are close to his work
  - **purposive sample:** if the researcher selects the 1<sup>st</sup> school because the students are from families with high income and the 2<sup>nd</sup> school which has students from families with modest income