

Financial Disclosure

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- ▶ *Neither I nor members of my immediate family have any financial interests to disclose relating to the content of this presentation.*

RESEARCH METHODOLOGY

Presented by,

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Lecture goals and objectives

Upon completion of this course, participants will be able to:

- ▶ Define the steps of developing a research project
- ▶ Design a study using specific types of research methodology
- ▶ Summarize a proposed study by giving an overview of the study, present an in-depth Literature Review, and describe whether the study may have significant results
- ▶ Design a research evaluation Program which includes Questions/Standards to determine its success

Developing a research study

- ▶ 1) What are the goals
- ▶ 2) Define the parameters
- ▶ 3) Writing a research proposal
- ▶ 3) What are the variables
- ▶ 4) How will data be collected, tabulated?
- ▶ 5) Is there bias?

What is Research:

A way to gather evidence to answer questions, gather facts and data

Research results:

What does it mean? Is it significant?

The research process:

Characteristics and requirements

Types of research:

Mode of inquiry perspective

Evaluation of Process: How?

Summary

The Research process:

Phase I: Deciding what to research

- Step I: Formulating a research problem

Phase II: Planning a research study

- Step II: Conceptualizing a research design
- Step III: Constructing an instrument for data collection
- Step IV: Selecting a sample
- Step V: Writing a research proposal

The Research Process

▶ Phase III: Conducting a research study

- Step VI: Collecting data
- Step VII: Processing and displaying data
- Step VIII: Writing a research report

➤ Research evaluation

➤ **STEP I. FORMULATING A RESEARCH PROBLEM**

- Reviewing the literature.
- Bringing clarity and focus to your research problem
- Improving your research methodology
- Broadening your knowledge base in your research area
- Enabling you to contextualize your findings

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- **Formulating a research problem**
 - The importance of formulating and selecting a research problem (background)
 - Formulation of research objectives
 - The study population
 - Establishing operational definitions
 - Formulating a research problem in qualitative research

Structure of Research Design

- ▶ 1: Overview, Literature Review, Program Design, Evaluation Questions/Standards
- ▶ 2: Study Design and Sampling Approaches
- ▶ 3: Data Sources, Measures, and Data Collection
- ▶ 4: Data Analysis Approaches and Economic Evaluation
- ▶ 5: Measuring Program Implementation (Process Evaluation & Qualitative Methods), Dissemination, Implementation
- ▶ 6: Results
- ▶ 7: Reliability

TYPES OF RESEARCH

- ▶ 1) DESCRIPTIVE Study- attempts to describe systematically a situation, problem, phenomenon, service or program, or provides information about, the living conditions of a community, or describes attitudes towards an issue. For example, it may attempt to describe the types of service provided by an organization, the administrative structure of an organization, the living conditions.
- ▶ 2) Correlational study to discover or establish the existence of a relationship/association/interdependence between two or more aspects of a situation. i.e. Relationship between Mortality and fertility; between technology and unemployment
- ▶ 3) Explanatory Research- attempts to clarify why and how there is a relationship between two aspects of a situation or phenomenon. This type of research attempts to explain, for example, why stressful living; results in heart attacks; why a decline in mortality is followed by a fertility decline;
- ▶ 4) Feasibility study or a pilot study : carried out to determine its feasibility. It is also called a **feasibility study** or a **pilot study**. It is usually carried out when a researcher wants to explore areas about which s/he has little or no knowledge.

Design Your Study

Phase II: Planning a research study

- Step II: Conceptualizing a research design

- ▶ 1) Discuss how each variable will be measured
- ▶ 2) Decide what your subjects are doing during the study
- ▶ 3) What are the design tools you are using and how are you using them
- ▶ 4) Study should be designed so it is reproducible

Identifying variables:

- What is a variable?
- The difference between a concept and a variable
 - Converting concepts into variables
- Types of variables
 - From a causal relationship
 - From the study design
 - Using a unit of measurement
- Types of measurement scales
 - Nominal or classificatory scale
 - Ordinal or ranking scale
 - Interval scale
 - Ratio scale

Variables

- ▶ In what form or from what kind of scale will data be provided? Matters because it dictates statistical tests and procedures you can use
 - ▶ **nominal** = categorical (e.g., names, type, gender)
 - ▶ two categories = dichotomous; many = polychotomous
 - ▶ proportions, %'s, mode (most frequent response)
 - ▶ **ordinal** = inherent order exists (e.g., education, disease severity, health ratings, agreement)
 - ▶ proportions, %'s, median (half above and half below)
 - ▶ **numerical**
 - ▶ continuous (e.g., age, weight, duration, lab values, temp)
 - ▶ discrete (e.g., clinic visits, number of deliveries)
 - ▶ means, standard deviations, etc.

Example: *Thinking about Variable Types*

- ▶ **Dependent variable (“outcomes”)**
 - ▶ Variable you aim to predict or explain
 - ▶ Examples: mortality, health status, function, quality of care, efficiency, cost, learning, performance
- ▶ **Independent variable (“predictors”)**
 - ▶ Variable(s) used to predict or explain the outcome
 - ▶ Examples: age, gender, social support, acculturation, health status, program participation

DEPENDENT VS INDEPENDENT VARIABLE

- ▶ **Children are chosen for the evaluation according to whether they have had all recommended vaccinations or not; they are followed for 5 years and their health status is monitored**
 - ▶ Independent variable:
 - ▶ Dependent variable:
 - ▶ What kind of study design does this sound like? What statistical test would you use to evaluate changes in the dependent variable?

Example: *Thinking about Variable Types*

Table 1. Description of Evaluation Participants at Baseline

<i>How to describe your sample</i>	Type of variable?	How to analyze it?
Age		
Gender		
Race-ethnicity		
Education		
Socioeconomic status		
Knowledge		
Health status		
# primary care visits		

Table 1. Baseline Description of Participants in Experimental and Control Groups

Characteristic	Experimental (n=150)	Control (n=148)
Age >65	29%	32%
% Female	62%	48%
% Medicaid	80%	90%
% Nonwhite	50%	45%
% Hx MI past 5 years	10%	5%

Basic Evaluation “Shell” Table: *Description of Program Participants*

Baseline Characteristics	Program Participants (N=1,000)
Age	Mean \pm SD years (or % in diff age groups)
Gender	% male
Race-ethnicity	% nonwhite
Body mass index (BMI)	Mean \pm SD (or % over BMI 30)
Patient satisfaction (overall)	% very satisfied
Primary care utilization (past year)	Mean \pm SD PC visits (or % >5 visits/past year)

Constructing hypotheses:

- **The definition of a hypothesis**
- **The functions of a hypothesis**
- **The testing of a hypothesis**
- **Characteristics of a hypothesis**

The research design:

- What is a research design?
- The functions of a research design
- The theory of causality and the research design

Selecting a study design -explains how to find answers to research question

- Is crucial to arrive at valid findings, comparisons, conclusions
 - quantitative and qualitative study designs
 - quantitative research (number of contacts)
 - Study designs based on the reference period
 - Study on the nature of the investigation

Designs commonly used in quantitative research

- The cross-over comparative experimental design
- The replicated cross-sectional design
- Trend studies
- Cohort studies
- Panel studies
- Blind studies
- Double-blind studies

Study designs in qualitative research:

- Case study
- Oral history
- Focus groups/group interviews
- Participant observation
- Holistic research
- Community discussion forums
- Philosophy-guided designs
- Action research: Feminist research
- Participatory and collaborative research

PHASE	PHASE I	PHASE II	PHASE III
Main Task	<p>DECIDING</p> <p>↓</p> <p>WHAT (RESEARCH QUESTIONS TO ANSWER)</p>	<p>PLANNING</p> <p>↓</p> <p>HOW (TO GATHER EVIDENCE TO ANSWER RESEARCH QUESTIONS)</p>	<p>UNDERTAKING</p> <p>↓</p> <p>COLLECTING (The required information)</p>

The Research Proposal

- ▶ *What* are you proposing to do; *how* you plan to find answers to what you are proposing; *why* you selected the proposed strategies of investigation.
- ▶ Contents of a research proposal:
 - ▶ Information about your study: an introduction,
 - ▶ including a brief literature review; theoretical framework that is the foundation of your study;
 - ▶ conceptual framework which constitutes the basis of your study;
 - ▶ Objectives or research questions of your study; hypotheses to be tested.

THE RESEARCH PROPOSAL

- ▶ Statement of the Objectives of the study
- ▶ List hypothesis, if you are testing anything
- ▶ The study design
- ▶ The setting for your study
- ▶ The research instrument you plan to use
- ▶ Information on sample size and sampling design
- ▶ Information on data processing procedures
- ▶ An outline of the proposed report
- ▶ Problems and limitations of the study
- ▶ Proposed time frame

RESEARCH PROPOSAL (CON'T)

- ▶ Study design
- ▶ The setting Measurement procedures
- ▶ Ethical issues
- ▶ Sampling Analysis of data
- ▶ Structure of the report
- ▶ Problems and limitations
- ▶ Appendix
- ▶ Work schedule

How are you going to get the measures you need?

▶ Primary data collection

- ▶ Needed when there is no suitable, accessible existing data source
- ▶ Data collected specifically for evaluation purposes (surveys, interviews, observations, chart reviews)
- ▶ More expensive (requires developing survey instruments, forms and data collection staff/time)

Selecting a Method of Data Collection

- ▶ Collecting data using primary sources:
 - ▶ Observation
 - ▶ The interview
 - ▶ The questionnaire

DATA COLLECTION

Constructing a research instrument in quantitative research

- Asking personal and sensitive questions
- Pre-testing a research instrument :Prerequisites for data
- Constructing a research instrument in qualitative research
- Collecting data using secondary sources
- Problems with using data from secondary sources

SELECTING A SAMPLE

- ▶ Sampling in quantitative and qualitative research
- ▶ Concept and principles of sampling
- ▶ Types of sampling
 - ▶ 1) Non-random/non-probability sampling designs in quantitative
 - ▶ 2) Random /probability research
 - ▶ 3) Systematic sampling design: a 'mixed' design
- ▶ The calculation of sample size
- ▶ Sampling in qualitative research
- ▶ Avoid bias and attain maximum precision for resources available

What is bias? Sample size?

What is Qualitative/Quantitative research>?

- ▶ **BIAS:** A systematic distortion of the relationship between a treatment, risk factor or exposure and clinical outcomes is denoted by the term 'bias'. Three types of bias can be distinguished: information bias, selection bias, and confounding
- ▶ **QUALITATIVE RESEARCH:** Is a scientific method of observation to gather non-numerical data. This type of research "refers to the meanings, concepts definitions, characteristics, metaphors, symbols, and description of things" and not to their "counts or measures. Used to uncover trends in thought and opinions, and dive deeper into the problem. Include focus groups (group discussions), individual interviews, and participation/observations.
- ▶ **QUANTITATIVE RESEARCH:** Is a structured way of collecting and analyzing data obtained from different sources. Large numbers of respondents and descriptive findings are required. Emphasis on objective measurements and the statistical, mathematical, or numerical analysis of data collected through polls, questionnaires, and surveys, or by manipulating pre-existing statistical data using computational techniques.

What is Sample size?

- ▶ **Sample size:** Measures the number of individual samples measured or observations used in a survey or experiment. For example, if you test 100 samples of soil for evidence of acid rain, your sample size is 100. If an online survey returned 10,000 completed questionnaires, your sample size is 10,000. In statistics, **sample size is generally represented by the variable "n"**.
- ▶ To determine the sample size needed for an experiment or survey, researchers take a number of desired factors into account. First, **the total size of the population being studied** must be considered -- a survey that is looking to draw conclusions about a certain Country for example, will need a much larger sample size than one specifically focused on a City.
- ▶ Researchers will also need to consider the **margin of error**, the reliability that the data collected is generally accurate; and the **confidence level**, the probability that your margin of error is accurate. Finally, researchers must take into account the **standard deviation** they expect to see in the data. Standard deviation measures how much individual pieces of data vary from the average data measured.

Collecting Primary Data through Surveys

- ▶ Primary data needed when existing data are insufficient
- ▶ Surveys contains a series of questions (survey items) that collect information on your measures
- ▶ Survey construction often appears as “common sense” but resulting data may be seriously misleading if concepts are not clearly defined and questions unambiguously phrased

COLLECTING DATA

Ethical issues to consider concerning research participants

- Collecting information
- Seeking consent
- Providing incentives
- Seeking sensitive information
- The possibility of causing harm to participants
- Maintaining confidentiality
- Ethical issues to consider relating to the researcher
- Avoiding bias

Ethical issues relating to the researcher

- Provision or deprivation of a treatment
- Using inappropriate research methodology
- Incorrect reporting
- Inappropriate use of the information
- Ethical issues regarding the sponsoring organization
- Restrictions imposed by the sponsoring organization
- The misuse of information
- Avoid bias

Types of Survey Questions (Items)

▶ Forced-choice (closed-ended) items

- ▶ “What is the main advantage of using multiple choice questions rather than essay questions in surveys?”
 - Can be scored quickly and objectively
 - Are best at measuring complex behaviors
 - Can have more than one right answer
 - Are the least threatening of the question types

Types of Survey Questions (Items)

- ▶ **Open-ended item**

- ▶ “What is the main advantage of using multiple choice questions rather than essay questions in surveys?”

- ▶ Answer here: _____

- ▶ *What were the three most useful parts of the program*

- ▶ Respondent A

- ▶ Respondent B

Closed-Ended Questions

Please rate how satisfied you were with each of the following aspects of the teaching program (circle one for each row).

	Definitely not satisfied	Not satisfied	Satisfied	Definitely Satisfied
Program textbook	4	3	2	1
Instructor knowledge of subject matter	4	3	2	1
Lecture topics	4	3	2	1
On-site experience	4	3	2	1
Other, specify _____ _____	4	3	2	1

Surveys

- ▶ **Language needs to match respondent characteristics**
 - ▶ Education level
 - ▶ Cultural milieu (slang, colloquialisms, terms)
 - ▶ Professional norms/standards
 - ▶ Regional or location context
- ▶ **Content needs to match likely knowledge and familiarity of respondent**
 - ▶ Right respondent for the question being asked?
 - ▶ Uncomfortable for respondent if can't answer
- ▶ **A good survey is not “cheap”** (can pull most from existing instruments, published scales)

Flesch-Kincaid Grade Level Index, Flesch Reading Ease formula,
Gunning Fog, SMOG Index, Automated Readability Index, etc.

How to Get Started Collecting Data

▶ Recruit sites

- ▶ What kind of sites do you need (type, location)? What will it take to get them to participate?

▶ Recruit participants

- ▶ Informed consent procedures, respondent burden
- ▶ Risks and benefits, language, who to contact
- ▶ Incentives, compensation
- ▶ Vulnerable populations
 - ▶ safeguard patients' interests
 - ▶ guard against intrusions, coercive tactics
 - ▶ build in monitoring and oversight every step of the way

How to Collect Survey Data

- ▶ **Mail surveys** (very common, relatively low cost, need accurate addresses)
- ▶ **Telephone interviews** (more expensive, trained interviewers) vs. **in-person interviews** (may ↑ cooperation, response quality)
- ▶ **Email transmission** (issues of privacy, ? email addresses)
- ▶ **Web-based surveys** (increasingly common, requires web access/knowledge among respondents, “spam” issues)

Processing and Displaying data

- Methods of communicating and displaying analyzed data
- Text
- Tables
- Graphs
- Role of Statistics

Summary

Measurement Chart

MEASURES	How measured	Sample	Timing and duration of measures	Content
Quality of life	Patient interviews	100/group (split by gender)	1-mo. pre and 1-mo. post; 1-hr interviews (CRA)	Emotional, physical, social function; health beliefs
Oral Health status	Oral exam	All persons in experimental and control groups	1-mo. pre- and 6-mos post; 30 minute exam	Presence/absence of caries/periodontal conditions
Demographic features	Self admin surveys	Diabetics in clinic A and clinic B	1-mo. before program starts; <5mins	Gender, age, ethnicity, income

Source: Adapted from Fink A. Evaluation Fundamentals. Sage: Thousand Oaks, CA, 2005.

EVALUATION PROCESS

- ▶ Undertaking an evaluation: the process
- ▶ Step 1: Determining the purpose of evaluation
- ▶ Step 2: Developing objectives or evaluation questions
- ▶ Step 3: Converting concepts into indicators into variables
- ▶ Step 4: Developing evaluation methodology
- ▶ Step 5: Collecting data
- ▶ Step 6: Analyzing data
- ▶ Step 7: Writing an evaluation report
- ▶ Step 8: Sharing findings with stakeholders Involving stakeholders in evaluation Ethics in evaluation
- ▶ Summary

DESIGN STUDY AND SAMPLING PLAN

► REFERENCES:

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Data Quality

- ▶ Quality of measurement critical part of credibility of evaluation results
 - ▶ **Reliability**
 - ▶ inter-rater: extent to which two or more individuals agree
 - ▶ intra-rater: same individual's consistency over time
 - ▶ **Validity:**
 - ▶ degree to which your measure assesses what it's supposed to measure (i.e., "truth" or accuracy)
 - ▶ Example (criterion validity) = closest to what we think of as accuracy (does it measure what it's supposed to?)
 - ▶ driver's test accurately predicts how well some group of persons can operate a car (concurrent validity)
 - ▶ performance on MCAT predicts how well students will do in medical school (predictive validity)

WRITING A RESEARCH REPORT

- ▶ Developing an outline
- ▶ Writing about a variable
- ▶ Referencing
- ▶ Writing a bibliography

Goal Statement	Evaluation Question	Evaluation Standard
Improve children's consumption of fruit and vegetables	1. Was Program A associated with improved consumption of fruit and vegetables?	<ul style="list-style-type: none">• Statistically significant increase in mean # fruit and vegetable servings per week
Increase children's activity level	1. Was Program A associated with increased activity levels?	<ul style="list-style-type: none">• Statistically significant increase in mean time spent in physical movement during recess and lunch
Reduce childhood obesity	1. Was Program A associated with lower obesity rates?	<ul style="list-style-type: none">• Statistically significant decline in mean child BMI• Statistically significant increase in % of children at normal BMI

QUESTION:

- ▶ **Was Program A associated with improved consumption of fruit and vegetables?**
 - Statistically significant increase in mean # fruit and vegetable servings per week
- **Increase children's activity level :**
 - Was Program A associated with increased activity levels? Statistically significant increase in mean time spent in physical movement during recess and lunch

SUMMARY-

Phase I: Decide what to research

Phase II: Plan a research study/conceptualize a design

Construct instrument for data collection

Selecting a sample

Writing a research proposal

Phase III: Conduct a research study

Collect data

Process and display data

Write research report

Research evaluation

Research process:

- ▶ 1) Define the goals and objectives of the study
- ▶ 2) Define the parameters
- ▶ 3) Writing a research proposal
- ▶ 3) What are the variables
- ▶ 4) How will data be collected, tabulated?
- ▶ 5) Is there bias?