

Research Questions and Survey Development

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Research Questions

Research Question

- Foundation of everything empirical
- 80% of the statistical consultant's time
- Directly influences:
 - Hypotheses
 - Research Design
 - Population and Sampling
 - Variables
 - Sample Size/Statistical Power/Effect Size
 - Database Structure and Management
 - Statistical Analysis
 - Publication, Presentation, and Dissemination of Findings

Research Question

- Turn clinical problems into research questions
- Answerable, attainable, and deductive
- Where to look for research questions?
 - YOUR clinical practice
 - YOUR patient population
 - Literature
 - Peers, colleagues, and mentors
 - Treatments, therapy, prognosis, and prevention

Feasible
Interesting
Novel
Ethical
Relevant

Feasible

- Time
- Resources
- Expertise
- Funding
- Clinical Environment
- Educational Environment
- Simulation Environment

Interesting

- Intrinsic motivation
- Personally rewarding
- Professionally rewarding
- Peer and colleagues
- Funding institutions (NIH, NSF, etc.)
- Serves an immediate clinical or educational need
- Nature of training in clinic vs. simulation

Novel

- New evidence
- “Gap” in the literature
- Replication of published studies
- Addition of confounders
- More precise and accurate outcomes
- Subgroups and disparities
- Methods of training
- Meeting guidelines

Ethical

- Institutional Review Board (IRB)
- Consequences of testing performance in simulation
- Effects of treatment and non-treatment

Relevant

- Influence clinical practice
- Improve upon clinical outcomes
- Increase training capacity with new educational interventions
- Development and testing of curriculum
- Quality improvement
- Change standard of care
- Meaningful contribution to the literature

Population

Intervention

Comparator

Outcome

PICO

- Population
 - Inclusion criteria
 - Exclusion criteria
- Intervention
 - Independent variable – first level
 - Grouping variable
 - Treatment
 - Characteristic
- Comparator
 - Control group – second level
 - Placebo
 - Does not possess characteristic
- Outcome
 - Scale of measurement
 - “Gold standard”

Population

- Must be described in order to make proper inferences and generalizations
- What is the population of interest?
 - Define in regards to inclusion criteria and exclusion criteria
- What are the inclusion criteria?
 - Characteristics that participants MUST possess to be included in the study
 - Demographic characteristics
 - Clinical characteristics
 - Geographic characteristics
 - Temporal characteristics
 - Objectively defined or deductive
- What are the exclusion criteria?
 - Characteristics that participants should not have
 - Likelihood of being lost to follow-up
 - Create "statistical noise" due to lack of data
 - High risk of potential adverse effects or comorbidities
 - Vague or inductive

Intervention

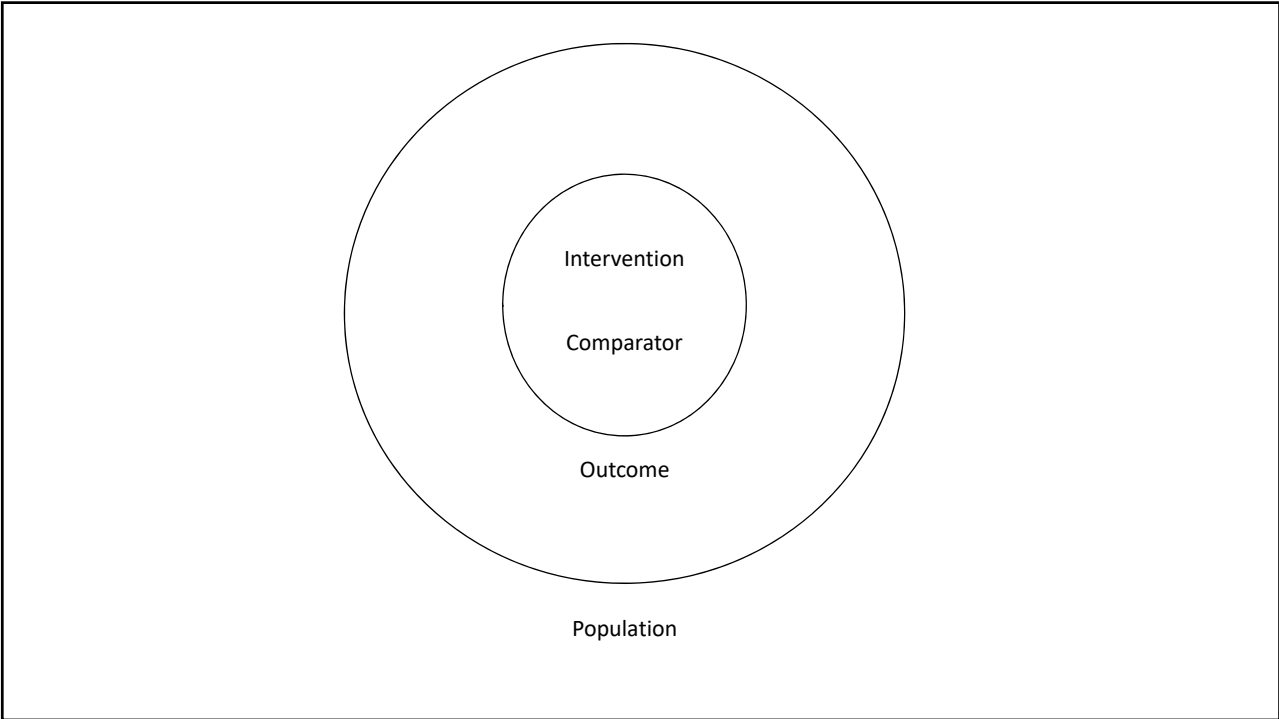
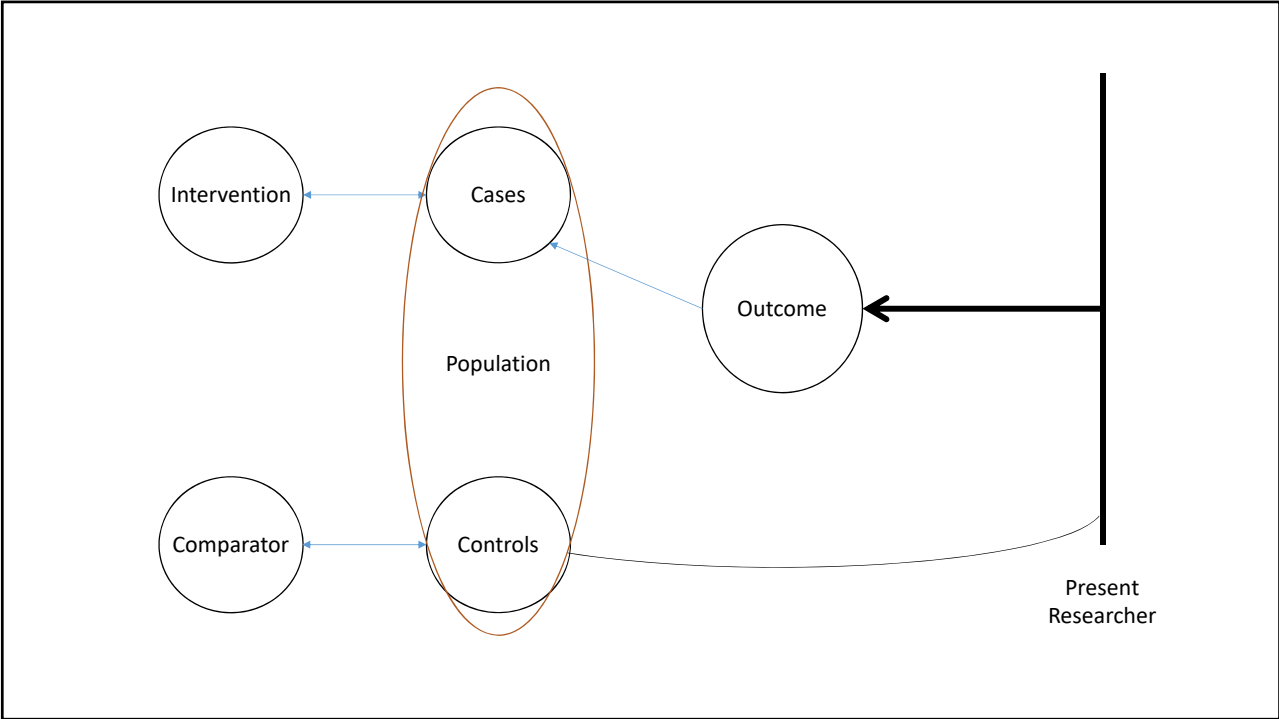
- Hypothesis-driven studies focus on the effects of an intervention or independent variable on an outcome
- Retrospective, observational studies
 - Group or treatment variable
 - Independent variable
 - What the researcher manipulates
 - Some association with the outcome
- Experimental studies
 - Treatment or intervention given to participants
 - Random assignment
 - Must be described vividly

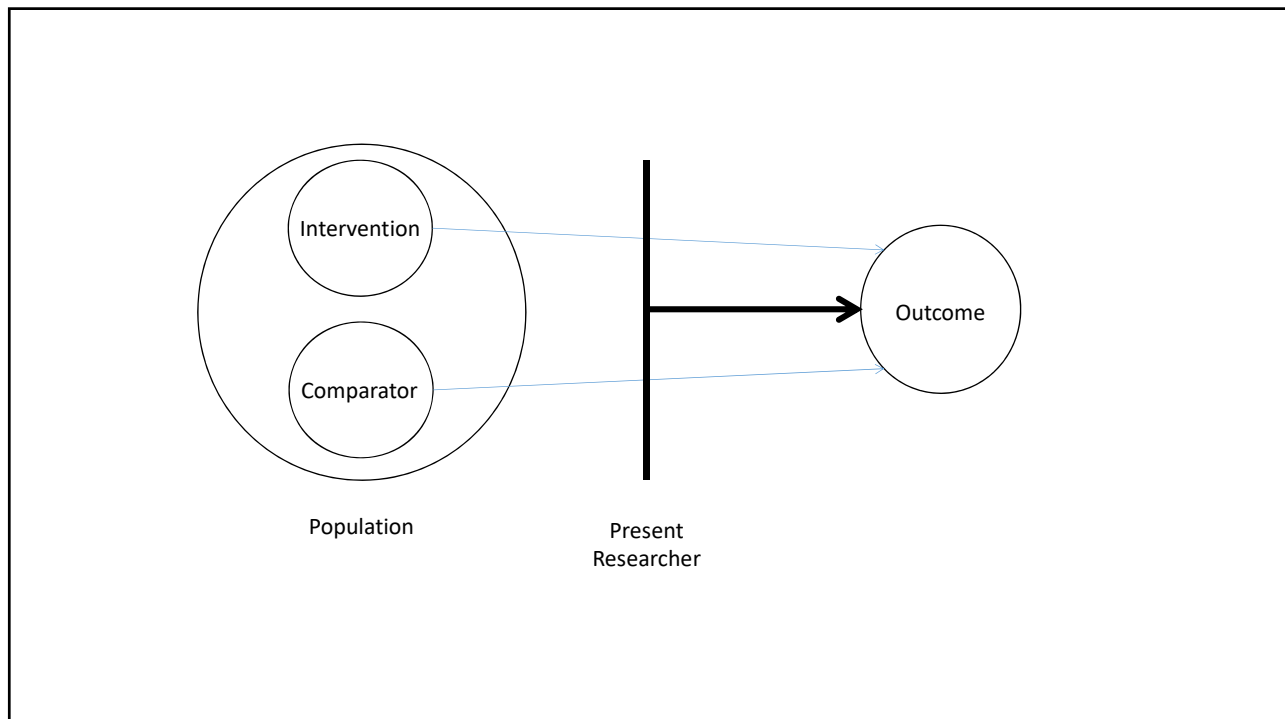
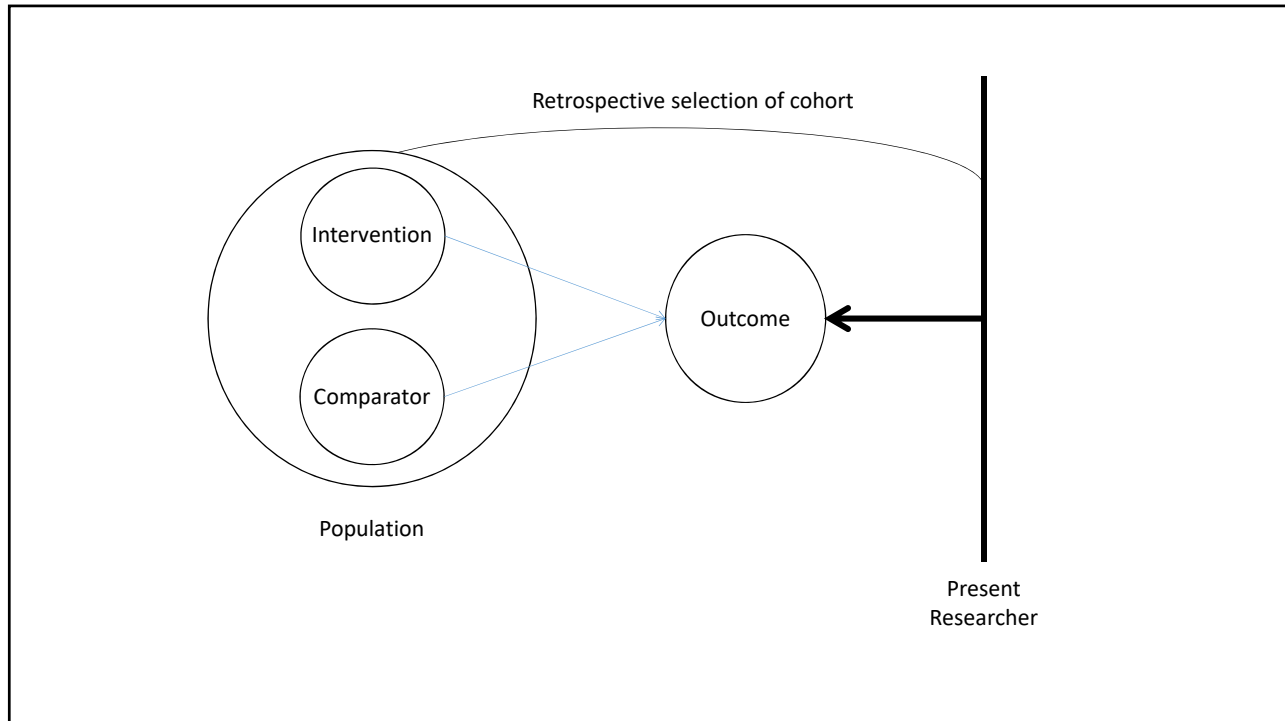
Comparator

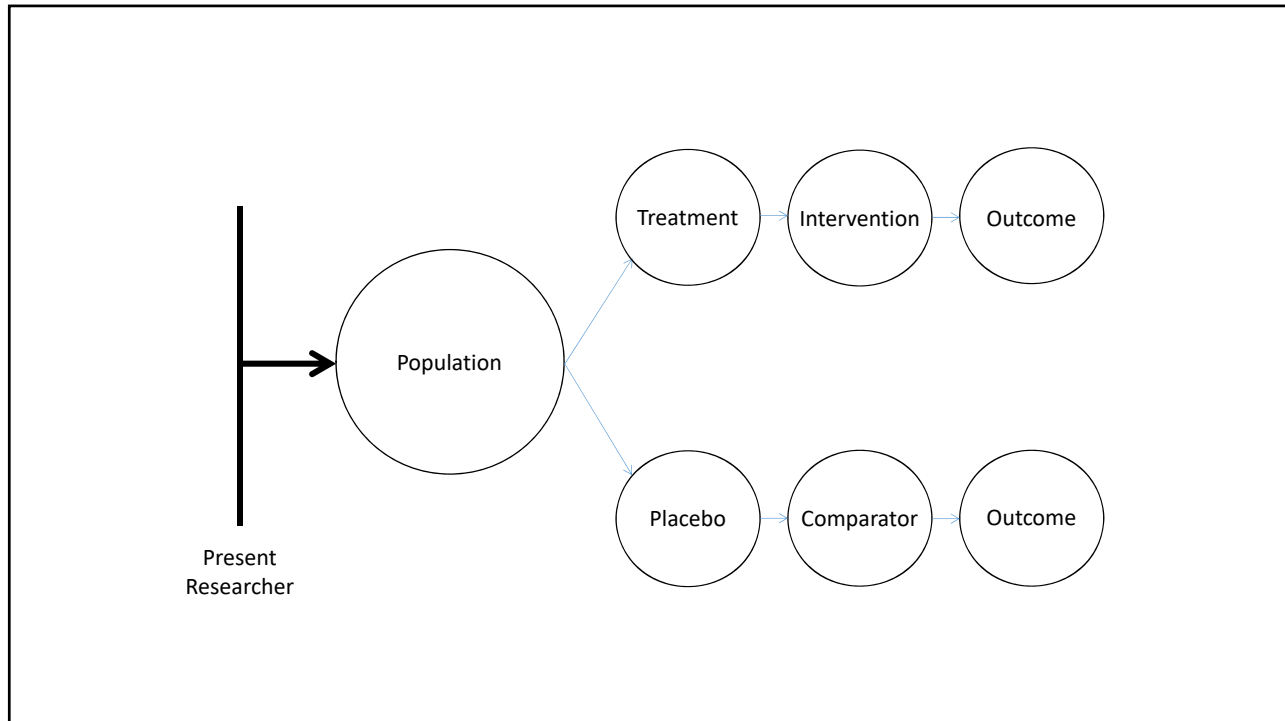
- Fundamental and requisite need for comparison group to establish treatment effects or treatment efficacy
- Retrospective, observational studies
 - Control or comparison group
 - Independent variable
 - Researcher choose comparator group
- Experimental studies
 - Control or placebo treatment given to participants
 - Random assignment
 - Active or inactive control treatments must be explained

Outcome

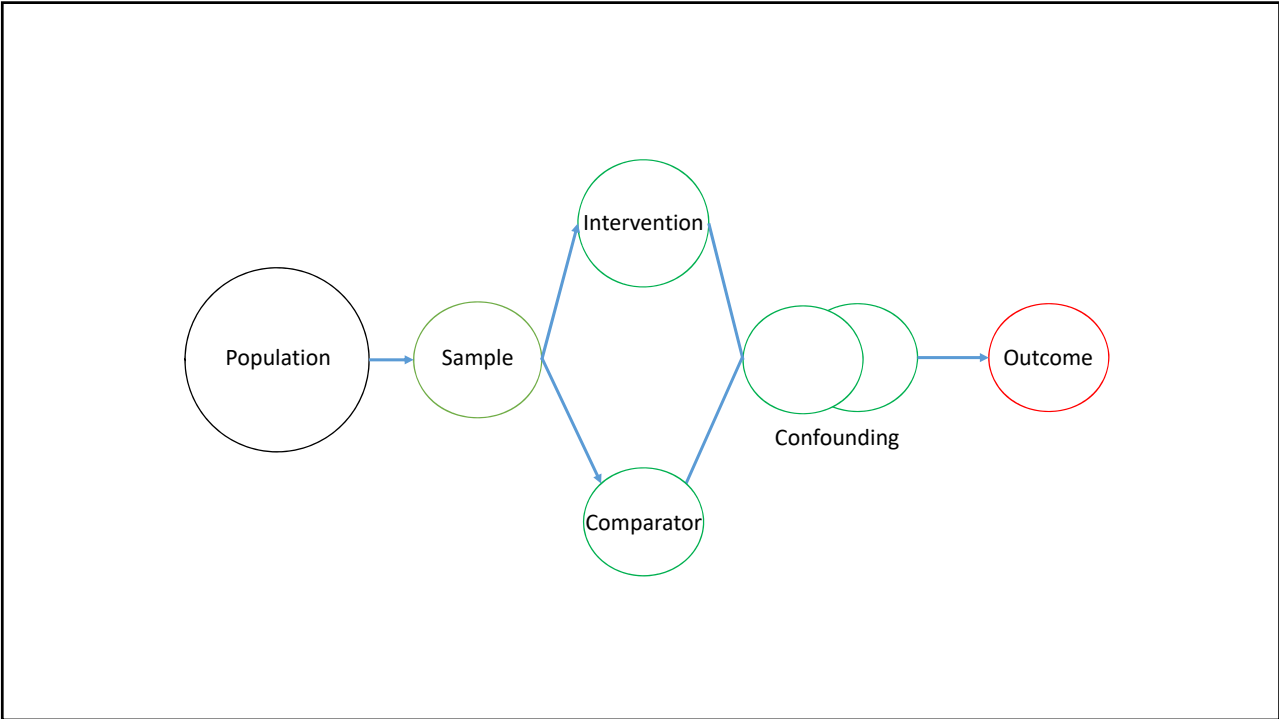
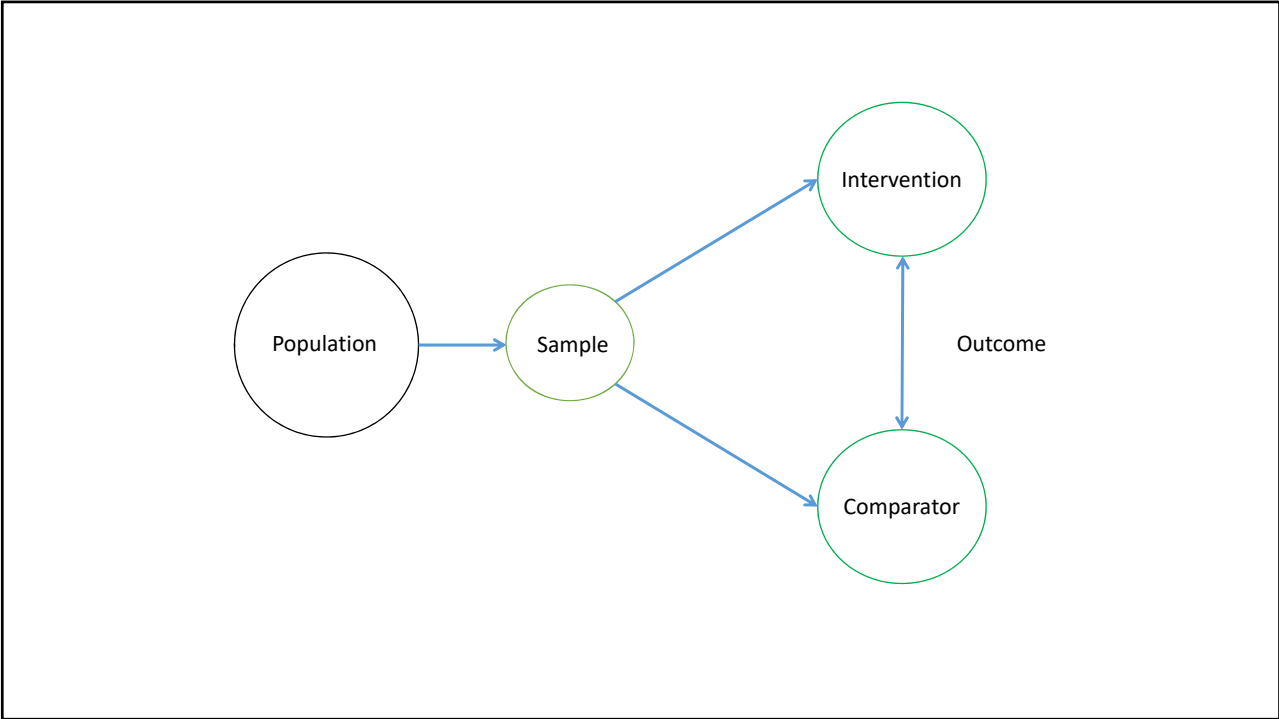
- The outcome is what researchers measure for in research
- Hypothesized relationship between intervention/independent variable and the outcome variable
- Also known as a dependent variable
- “Gold standard” method of measuring the outcome
- Scale of measurement of the outcome influences:
 - Statistical power
 - Nature of effect size
 - Needed sample size
 - Sample size calculation
 - Choice of statistical test used







		Outcome	
		Yes	No
Population	Intervention	107	39
	Comparator	17	71



Secondary Research Questions

- Scientific practitioners often want to ask numerous questions
- Secondary, tertiary, and ancillary questions come from the literature and informed/inquisitive thinking based on clinical experience
- Secondary questions are also associated with measuring for new variables, untested associations, or other outcomes
- Only ask these questions as needed, Type I errors increase as more questions are asked, all should be hypothesis-driven

PICO Search Engine

- National Institutes of Health (NIH)
- Search MEDLINE and PubMed using PICO framework
- Excellent tool
- <https://pubmedhh.nlm.nih.gov/nlmd/pico/piconew.php>

Survey Development

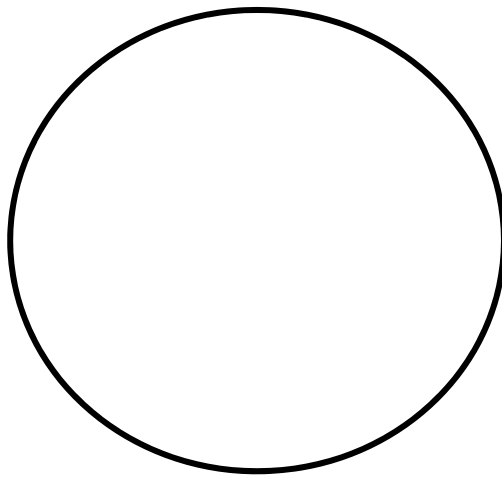
Four Reasons for Creating a Survey

1. Establishing Prevalence
2. Comparing “Known-groups”
3. Validating Constructs
4. Assessing Change Across Time

The Eight Steps for Creating Surveys

1. Create a Construct Specification
2. Expert Review of the Construct Specification
3. Choose a Survey Methodology
4. Write the Survey Items
5. Pretest the Survey
6. Structure the Survey
7. Survey Pilot Study
8. Survey Validation Study

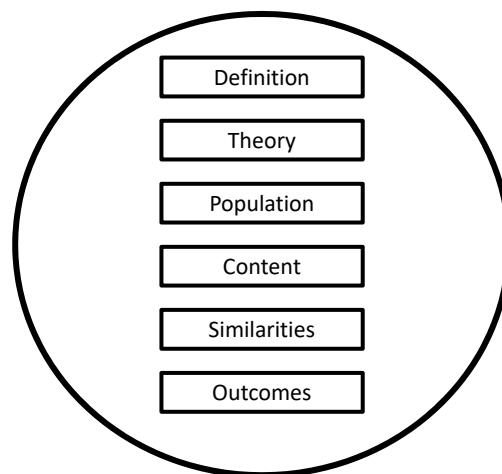
What is the construct?



Construct Specification

1. Operational Definition of the Construct
2. Theoretical, Conceptual, or Physiological Framework
3. Population of Interest – Inclusion and Exclusion Criteria
4. Recruitment of Participants
5. Resources, Administration, and Time
6. Purpose of the Survey Instrument
7. Conceptually or Theoretically Similar Constructs
8. Specific Outcomes of the Survey Instrument

What is the construct?



Construct Specification Components

1. Operationalize Each Content Area
2. Identify Specific Components or Items
 3. Describe Components
 4. Describe Response Sets
 5. Provide Citations
 6. Table of Specifications
 7. Expert Review
8. Integration of Revisions

Phenomenological Perception

1. Time
2. The body
3. Others
4. The world

Six Types of Surveys

1. Tests
2. Rating Scales
3. Performance Ratings
4. Checklists
5. Psychological Instruments
6. Inventories

Six Parts of Surveys

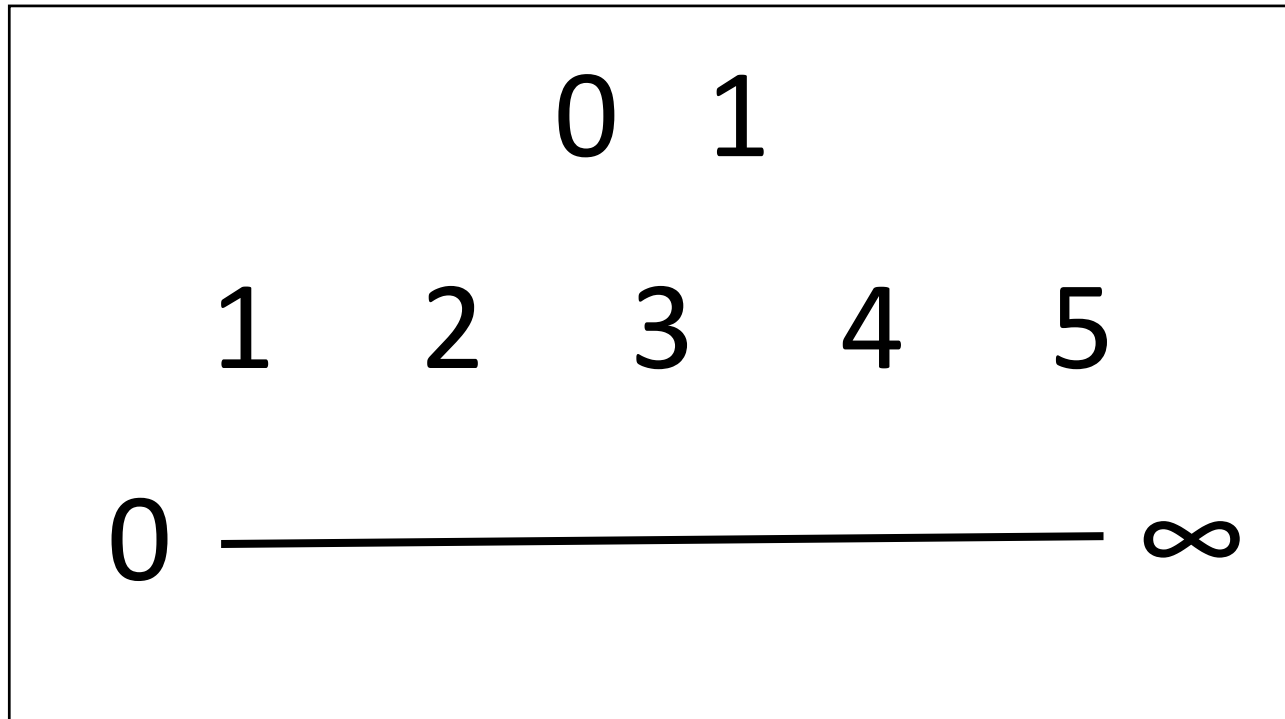
1. Survey Title
2. Survey Introduction
3. Survey Instructions
4. Survey Items
5. Survey Demographic Items
6. Closing Statement

Modes of Survey Administration

1. One-on-one Interview
2. Group Administration
3. Telephone Administration
4. Postal Mail
5. Electronic Administration

Writing Survey Instrument Items

- Two parts to any survey item
 - Item stem
 - Response set
- Logical flow between item stem and response set
- Written to cover only ONE topic or concept
- Reflect the citations and allocated percentages of construct specification
- Construct-alignment
- Same tense for all items
- Write in the “positive” sense of understanding
- Write twice as many items as you think you will need



Steps for Pretesting a Survey

1. Select a Small Sample ($n = 5-10$)
2. Administer the Survey Items
3. Conduct a Focus Group
4. Integrate Feedback

Formally Structure a Survey

1. All Six Survey Parts Pretested
2. Professional Presentation
3. Trial Runs
4. Post, Publish, or Print

Survey Pilot Study

1. Sample Size ($n = 150 - 300$)
2. Statistical Assumptions
3. Principal Component Analysis (PCA)
4. Reliability Analysis

Survey Validation Study

1. Sample Size ($n = 300 - 1,000$)
2. Statistical Assumptions
3. Confirmatory Factor Analysis (CFA)
4. Validity Analysis

Psychometrics

Reliability

- Internal Consistency
 - Cronbach's alpha (α)
 - Split-half
 - Kuder-Richardson 20 (KR-20)
- Test-Retest
 - Spearman-Brown
- Alternate/Parallel Forms
- Inter-rater
 - Kappa
 - Intraclass Correlation Coefficient
- Principal Components Analysis (PCA)

Validity

- Construct Validity
- Concurrent Validity
- Predictive Validity
- Content Validity
- Known-groups Validity
- Convergent Validity
- Divergent Validity
- Incremental Validity
- Face Validity
- Confirmatory Factor Analysis (CFA)

Validity Measures

- Construct Validity
 - All forms of validity
- Predictive Validity
 - Ability to predict for future occurrences
- Concurrent Validity
 - Ability to predict for current events
- Convergent Validity
 - Correlation with similar constructs
- Divergent (discriminant) Validity
 - Correlation with dissimilar constructs
- Known-groups Validity
 - Differentiate between existing groups in a population
- Correlations and between-subjects statistics used primarily

Precision in Measurement:

1. Reliability
2. Stability
3. Confidence
4. Consistency

Accuracy in Measurement:

1. Validity
2. Utility
3. Interpretability
4. Generalizability