Introduction to Social Science Methods: An Overview of Quantitative and Qualitative Methods

D-Lab
Nora Broege
Carmen Brick
Dec 7 – 8, 2015

Introduction to Social Science Methods: An Overview of Qualitative and Quantitative Methods

- Part I: Research Design
- Part II: Quantitative Research
- Part III: Qualitative Research (Carmen Brick)

Research Design

- Identify the problem to be studied

Research Design

- Identify the problem to be studied
  - Transform problem into a testable hypothesis/hypotheses
  - → An idea that will be tested through systematic investigation

Research Design

- Identify the problem to be studied
  - Transform problem into a testable hypothesis/hypotheses
  - → An idea that will be tested through systematic investigation
- Identify the population you need to examine in order to test your hypothesis/hypotheses

Research Design

- Identify the problem to be studied
  - Transform problem into a testable hypothesis/hypotheses
  - → An idea that will be tested through systematic investigation
- Identify the population you need to examine in order to test your hypothesis/hypotheses
  - Identify the sample you can reasonably access to gather data

Research Design

- Identify the problem to be studied
  - Transform problem into a testable hypothesis/hypotheses
  - → An idea that will be tested through systematic investigation
- Identify the population you need to examine in order to test your hypothesis/hypotheses
  - Identify the sample you can reasonably access to gather data
- Determine the appropriate method for data collection

Research Design

- Identify the problem to be studied
  - Transform problem into a testable hypothesis/hypotheses
  - → An idea that will be tested through systematic investigation
- Identify the population you need to examine in order to test your hypothesis/hypotheses
  - Identify the sample you can reasonably access to gather data
- Determine the appropriate method for data collection
- Determine the appropriate set of instruments to collect data

Research Design

- Identify the problem to be studied
  - Transform problem into a testable hypothesis/hypotheses
  - → An idea that will be tested through systematic investigation
- Identify the population you need to examine in order to test your hypothesis/hypotheses
  - Identify the sample you can reasonably access to gather data
- Determine the appropriate method for data collection
- Determine the appropriate set of instruments to collect data
- Collect data

Research Design

- Identify the problem to be studied
  - Transform problem into a testable hypothesis/hypotheses
  - → An idea that will be tested through systematic investigation
- Identify the population you need to examine in order to test your hypothesis/hypotheses
  - Identify the sample you can reasonably access to gather data
- Determine the appropriate method for data collection
- Determine the appropriate set of instruments to collect data
- Collect data
- Analyze data

Research Design

- Identify the problem to be studied
  - Transform problem into a testable hypothesis/hypotheses
  - → An idea that will be tested through systematic investigation
- Identify the population you need to examine in order to test your hypothesis/hypotheses
  - Identify the sample you can reasonably access to gather data
- Determine the appropriate method for data collection
- Determine the appropriate set of instruments to collect data
- Collect data
- Analyze data
- Interpret results

Research Design

- Unit of analysis/observation
  - Individuals or aggregates
    - Groups, institutions, organizations

Research Design

- Unit of analysis/observation
  - Individuals or aggregates
    - Groups, institutions, organizations
- Primary v. secondary data

Research Design

- Unit of analysis/observation
  - Individuals or aggregates
    - Groups, institutions, organizations
- Primary v. secondary data
  - Will you be collecting your own data or using preexisting data?
    - Often easier to use secondary data:
      - International data
      - Can't get a large enough sample size
      - Can't get nationally representative sample
      - Time constraints

Methods

- Depending on:
  - Type of data you want/need
  - Sample size
  - Access
  - Location
  - Time
  - Resources

Methods

- Depending on:
  - **Type of data you want/need**
    - Cross-sectional, longitudinal
    - Quantitative or qualitative
  - Sample size
  - Access
  - Location
  - Time
  - Resources

Methods

- Depending on:
  - Type of data you want/need
  - **Sample size**
    - Generalizability
    - Small- or large-N
  - Access
  - Location
  - Time
  - Resources

Methods

- Depending on:
  - Type of data you want/need
  - Sample size
  - **Access**
    - Is it a protected population? (e.g. minors/students)
    - Can you gain access?
    - Human subjects
  - Location
  - Time
  - Resources

Methods

- Depending on:
  - Type of data you want/need
  - Sample size
  - Access
  - **Location**
    - local, state, national, international
  - Time
  - Resources

Methods

- Depending on:
  - Type of data you want/need
  - Sample size
  - Access
  - Location
  - **Time**
    - Timeline for data collection
  - Resources

Methods

- Depending on:
  - Type of data you want/need
  - Sample size
  - Access
  - Location
  - Time
  - **Resources**
    - Are you conducting the research alone? (do you have RAs)
    - Cost of instrument design
    - Cost of data collection
    - Cost of analysis

Quantitative Research

- Systematic empirical investigation of observable phenomena using statistical (computational) techniques
- Aims at causal explanation - answering "Why"
- Numeric analysis and measurement are the key parts of quantitative research that state the fundamental connection between observation and analytic statement(s)
- Quantitative methods are mostly used to justify the hypotheses and draw a general conclusion on selected hypotheses
- Statistics, tables and graphs, are often used to present the results of these methods

Quantitative Research

- Based on the idea that aspects of environment can be quantified, measured and expressed numerically
- The information about a phenomenon of environment is expressed in numeric terms that can be analysed by statistical and spatial methods
- The observations can be directly numeric information or can be classified into numeric variables

Quantitative Research

- Systematic empirical investigation of observable phenomena using statistical (computational) techniques
- Aims at causal explanation
  - Primarily answering "Why"
- Characteristics of quant research
  - Scientific
  - Positivist
  - Objective
  - Experimental
  - Macros (events/processes/relations)
  - Deductive
  - Hard/factual
  - Representative/generalizable
  - Apolitical
  - Realist

	Designs & Techniques	Methods	Details	Sample
QUANTITATIVE METHODS	Experimental Designs	Lab Experiment	Applying scientific method to experimentally examine an intervention in a controlled setting	2 or more groups
		Field Experiment	Applying the scientific method to experimentally examine an intervention in a real world setting	2 or more groups
		Quasi-Experimental	Selecting a group to test a variable w. out random pre-selection processes	2 or more groups
	Descriptive Designs	Survey/Questionnaire	Series of ques & other prompts to gather info from respondents	Large (most often), representative, often random sample
		Meta-Analysis	Statistical method for combining the results from a set of studies that address related hypotheses	2 or more pre-existing studies
		Case Study	In-depth investigation of an individual, group or event	At least 1 individual, group or event
		Applied Behavioral Analysis	An examination of individual responses to an intervention(s)	At least 1 individual
	Longitudinal	Experiments, surveys, case-study, applied-behavioral analysis	Applying a specific method & corresponding instruments to a sample over time	Individuals, groups or institutions over time (may be the same or similar)
	Pre-Test Designs	Pilot Study	Small scale preliminary study conducted before main research to check feasibility of research design, time line, instruments, etc … & make necessary changes	Small group who can inform/comment on research design
		Usability Testing	Evaluating a product (i.e. instrument) by testing it on a sample of potential users	Small group who can inform/comment on validity and reliability of instrument

EXPERIMENTAL DESIGNS

Experimental Research

- Compare two or more groups that are similar except for one factor or variable
- Can occur in lab or field (natural setting)
- Conditions can be highly controlled; variables can be manipulated by the researcher
- Tend to use randomized samples
- 2 groups – treatment & control

Quant Research - Experiments

- How does a factor influence the behavior of an individual or a group?
- Lab experiments
  - Require lab settings
  - Controlled environment
  - Results highly reliable
  - Develop cause & effect relationships
  - Can only use small samples – often too costly for large-N
  - Can only study snapshot of present (not past)
- Field experiments
  - Occur in naturally occurring environments
  - Examining an intervention in the real world
  - Subjects don't always know they are involved in experiment
  - Seen as having higher degree of external validity since occur in real world

Experiments - Examples

- Lab
  - Milgram exp
  - Zimbardo Prison exp
- Field
  - Drug/pharmaceutical trials
  - Poyner on reducing theft in public spaces

DESCRIPTIVE DESIGNS

DESCRIPTIVE DESIGNS
SURVEYS

Survey Research

- Use set of predetermined, standardized, questions
- Collect answers from representative sample
- Answers are categorized and analyzed so tendencies can be discerned

Quant Research - Survey

- Used to assess thoughts, opinions, feelings, habits, activity logs
- Primary v. secondary data
  - Developing survey instruments to conduct primary data can be difficult – may require piloting questionnaire
  - Order of the questions is v. important
  - Often easier to use secondary survey data or instruments
    - Instruments have been proven reliable
- Can be issues or reliability & validity relating to self-reports
  - Response bias
  - Can be checked/corrected by test-retest of questions and standardization procedures

Survey - Examples

- General Social Survey
- US Census

The GSS Data Explorer BETA

A New Gateway to Data from the General Social Survey

AMERICAN COMMUNITY SURVEY

U.S. CENSUS BUREAU

DESCRIPTIVE DESIGNS
META-ANALYSIS

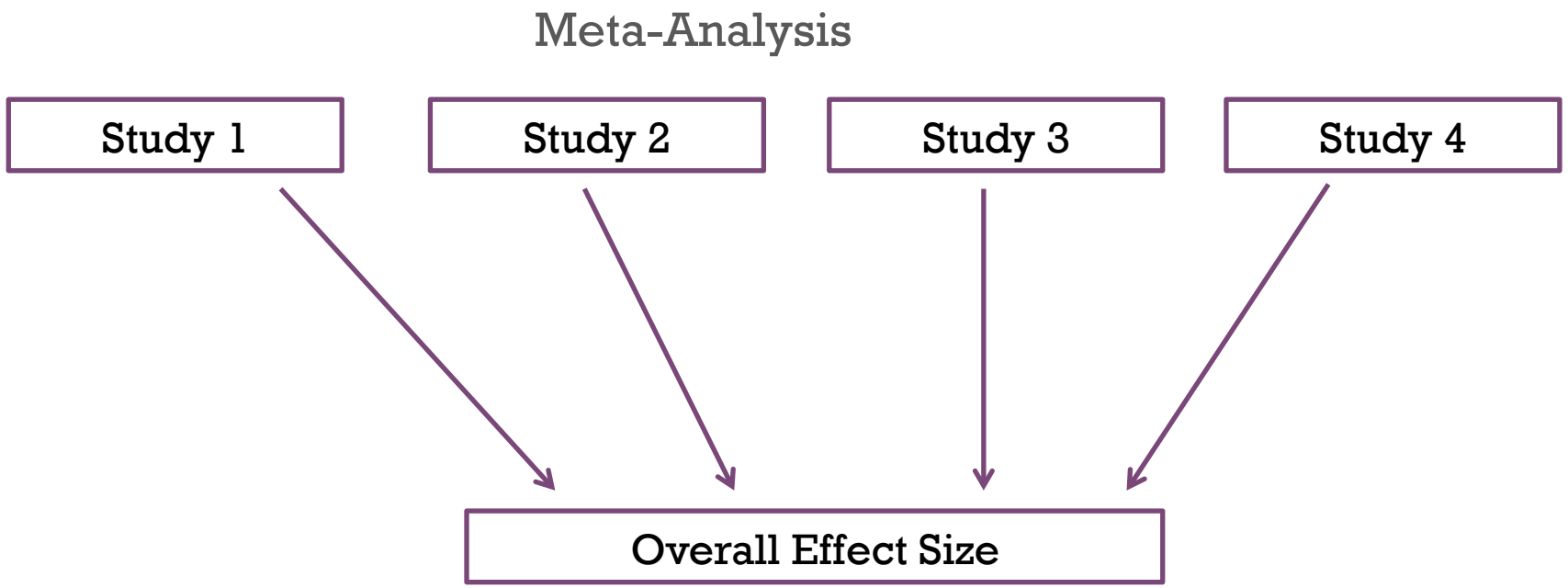
Meta-Analysis

- Numerous experimental studies with reported statistical analysis are compared
- Distinguishes trends
- Effect size (the influence of the independent variable on the dependent variable) can be compared
- Similar studies can yield a common truth
- Conducting research about previous research

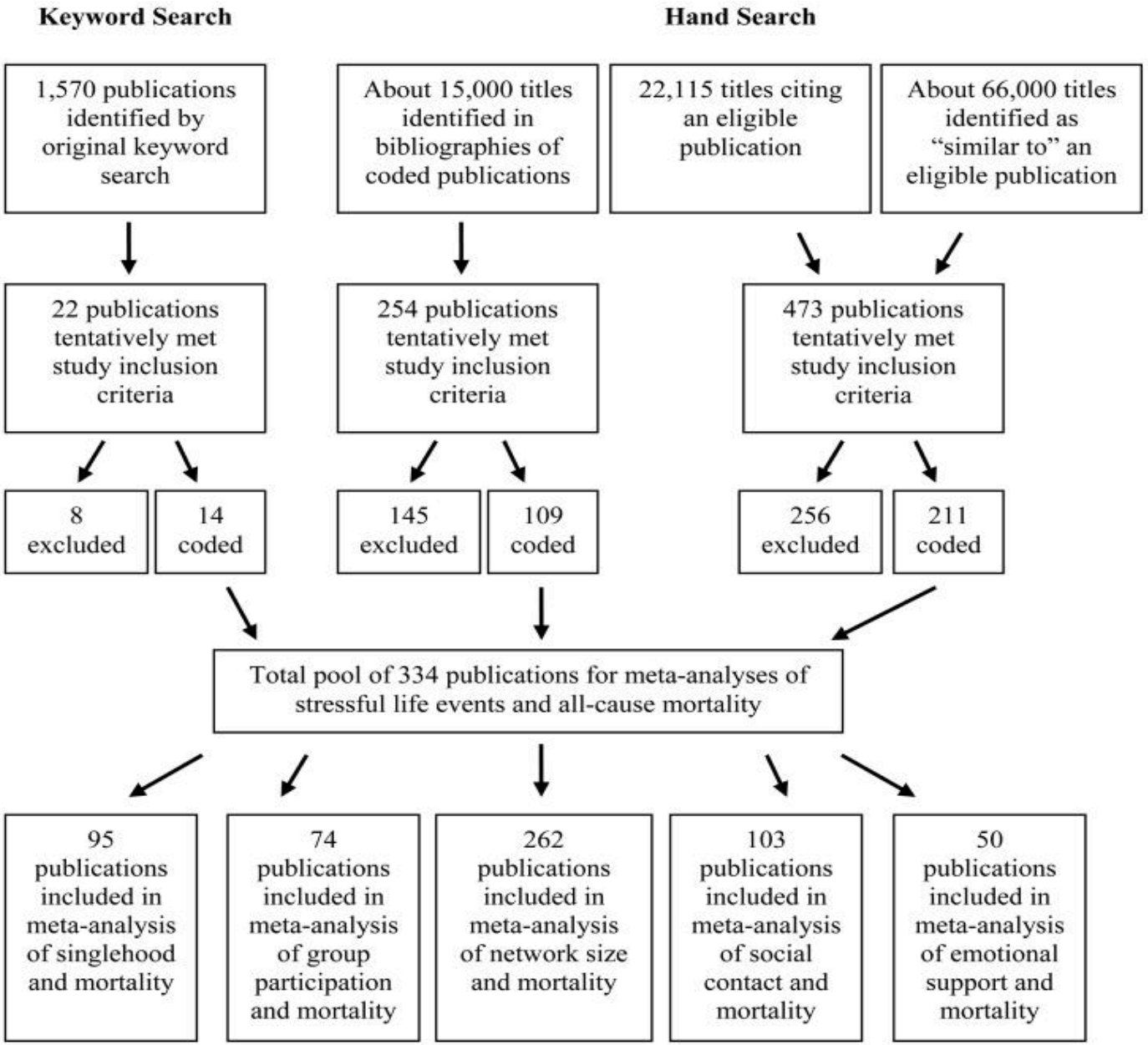
Quant Research – Meta-Analysis

- Using a statistical approach to combine the results from multiple studies in an effort to increase power (vs. individual studies)
- Improves estimates of effect size
- Can also resolve uncertainty when reports disagree
- Can only be used if a common statistical measure is included across studies
- Results generalizable to larger population
- Precision & accuracy of estimates can be improved as you add more data
- Hypothesis testing can be applied to summary estimates
- Does not predict the results of a single, larger study
- Can't control for sources of bias – a meta-analysis of badly designed studies will produce bad statistics

Meta-Analysis - Examples



+ Meta-Analysis - Examples



DESCRIPTIVE DESIGNS CASE STUDIES

Quant Research - Case Study

- Also called single case design
- Describes numerically a specific case (can be organization, group, event, action or individual)
- May test or generate hypotheses
- Results often presented with tables and graphs

Quant Research – Case Study

- Up-close, detailed examination of a subject & related contextual conditions
  - → an empirical inquiry that investigates a phenomenon within its real world contexts
- Holistic approach
- Not to be confused w. qualitative research – can be a mix of quantitative and qualitative data
- No random sample – information oriented sampling
  - Outlier cases may reveal more than a representative case
- Types of cases:
  - Explanatory
  - Exploratory
  - Multiple-case study
  - Intrinsic
  - Instrumental
  - Collective

+ Case Study - Examples

Case study type	Details	Example	Small N	Large N
Explanatory	Seeking an answer to a question on the causal links in real life interventions that may be too complex for survey or experimental strategies	Analyzing a web-based e-commerce site in Colombia		✔
Exploratory	Explore situations when intervention has no clear, single set of outcomes	An observational study of the development and implementation of a teacher-student relationship	✔	✔
Multiple-case	Explore differences btwn & within cases – goal is to replicate findings across cases	Applying the multiple case study method to different social services available to violent crime victims		✔
Intrinsic	When intent is to better understand the case, it's particularities and ordinariness	An examination of how Alzheimer's effects couples	✔	
Instrumental	Provides insight into an issue or helps to refine a theory – the actual case is of secondary interest (unlike intrinsic)	Examining the components of individual behavior that indicate the potential for domestic violence	✔	✔
Collective	Similar to multiple-case	A collective case study of stress among HS math teachers	✔	✔

DESCRIPTIVE DESIGNS
APPLIED BEHAVIORAL ANALYSIS

Quant Research - Applied Behavior Analysis

- Developing and analyzing procedures that produce effective and beneficial changes in behavior
- Examine the individual's responses in different situations (conditions) across time
- Usually conducted in experimental form
- Also known as behavior modification

Quant Research – Applied Behavioral Analysis

- All studies require:
  - At least 1 participant
  - At least 1 behavior (dependent variable)
  - At least 1 setting
  - A system for measuring the behavior
  - At least 1 treatment/intervention
  - Manipulations of the independent variable so that its effects on the dependent variable may be analyzed
  - A beneficial intervention (for the participant)
- Usually small-N studies
- Require manipulation and control of method

Applied Behavior Analysis - Example

- Testing interventions for autistic students

STRUCTURED TEACHING TECHNIQUES (DTT = Discrete Trial Teaching)	NATURALISTIC TEACHING TECHNIQUES (PRT = Pivotal Response Treatment)
Teaching motor imitation: Prompt imitation of actions (e.g. clap hands) ↓ reinforce correct response with edible or preferred toy	**Teaching motor imitation:** A child likes cars. Prompt imitation of actions using preferred toy (e.g. drive car) ↓ reinforce correct response with car toy
Teaching identification of colours: Using shapes in different colours ↓ reinforce correct colour with edible or preferred toy	**Teaching identification of colours:** A child likes manipulating play-dough Use play-dough with different colour pieces ↓ reinforce correct colour by offering the playdough of the colour identified
Teaching identification of familiar people: Using flashcards with photos of familiar people ↓ reinforce correct name with edible or preferred toy	**Teaching identification of familiar people:** Play with familiar people ↓ reinforce correct name with tickles or cuddles from that person

LONGITUDINAL DESIGNS

Quant Research - Longitudinal

- Individual or group research conducted across time, often decades
- Cohort Study: data is gathered from the same subjects repeatedly, over time
- Panel study: data is gathered from similar subjects, over time
- May be conducted using other methods (surveys, case studies)
- Studying developmental trends, the lifespan

Quant Research - Longitudinal

- Subject attrition is major problem
  - "missing data"
  - Replacing with participants w. similar characteristics
- Preserving confidentiality is also difficult
- Specific standardized tools may change over time
- Mostly observational – observe the state of things w.out manipulation → may have less causal power than experiments
- **BUT** the inclusion of repeated observations at the individual level → more power than cross-sectional observational studies
- Exclude time invariant unobserved differences
- Include temporally ordered events
- Allow researchers to distinguish short v. long term phenomena

Longitudinal - Example

- Survey Data
  - National Longitudinal Survey of Youth (ages 12-16 in 1997)
- Case Study
  - "UP" – British documentary of 14 British children starting in 1964

Quant Methods - Instruments

- Printed images, paper/pencil
- Online
  - Survey Monkey
  - Zoomerang
  - Poll Daddy
    - Additional online survey instruments
- Electronic devices: Smart phones, ipads, bio-physio readers, computers

Quant Methods - Instruments

- Online
  - **Survey Monkey**

1. What is your students ID #?

2. Did you parents graduate from college?

- Yes, both parents graduated from college
- Yes, 1 parent graduated from college
- No, my parents did not graduate from college
- No, 1 or both of my parents did not graduate from college, but they did attend

3. Did you take Algebra before 9th grade?

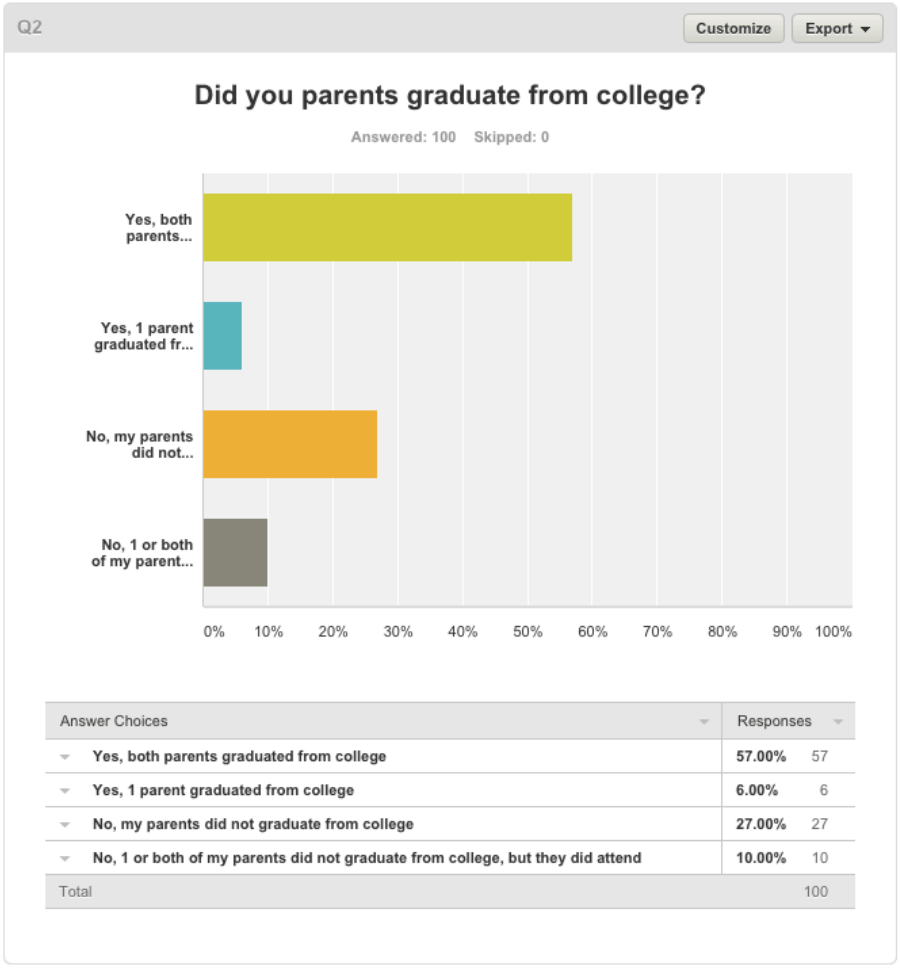
- Yes
- No
- Don't know/remember

4. Were any of your HS courses honors?

- Yes
- No
- Don't know/remember

Quant Methods - Instruments

- Online
  - **Survey Monkey**



Answer Choices	Responses	
Yes, both parents graduated from college	57.00%	57
Yes, 1 parent graduated from college	6.00%	6
No, my parents did not graduate from college	27.00%	27
No, 1 or both of my parents did not graduate from college, but they did attend	10.00%	10
Total		100

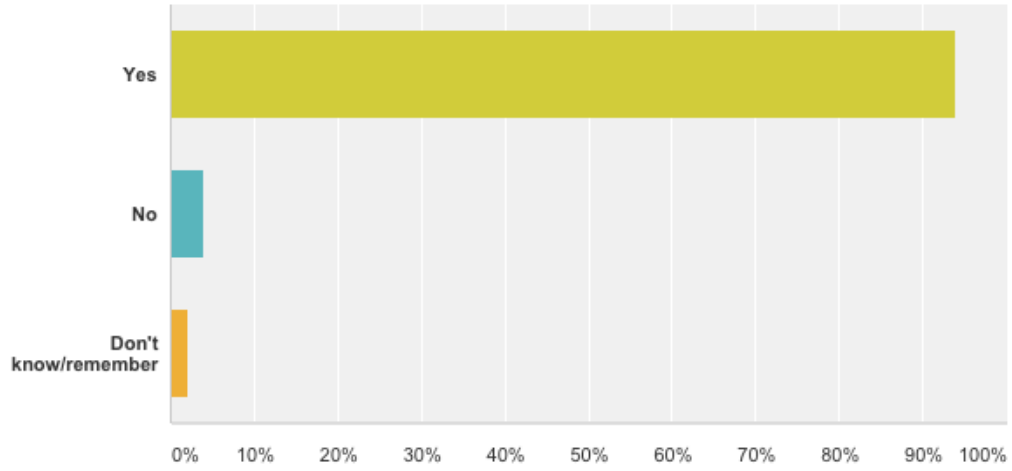
Quant Methods - Instruments

- Online
  - **Survey Monkey**

Q3 Customize Export

Did you take Algebra before 9th grade?

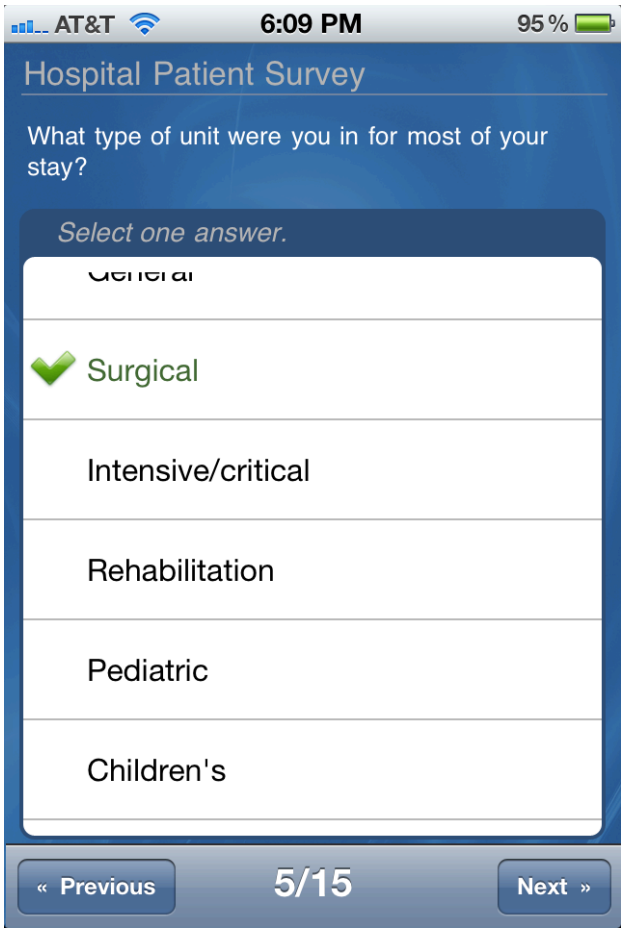
Answered: 100 Skipped: 0



Answer Choices	Responses	
Yes	94.00%	94
No	4.00%	4
Don't know/remember	2.00%	2
Total		100

Quant Methods - Instruments

- Electronic devices: Smart phones, ipads, bio-physio readers, computers



METHOD SELECTED, NOW WHAT?
MEASUREMENT CRITERIA

Measurement Criteria

- Objectivity
- Accuracy
- Precision
- Reliability
- Validity

Measurement Criteria

- Objectivity - researchers stand outside the phenomena they study. Data collected are free from bias
- Accuracy – Are the methods adequate to answer your questions; reveal credible information; convey important information?

Measurement Criteria

- Objectivity - researchers stand outside the phenomena they study
  - Data collected are free from bias
- Accuracy – Are the methods adequate to answer your questions?
  - Do they reveal credible information?
  - Do they convey important information?
- Precision – How trustable are the measure?
  - How confident is the result?
  - Pilot testing & Usability testing

Measurement Criteria

- Objectivity - researchers stand outside the phenomena they study. Data collected are free from bias
- Accuracy – Are the methods adequate to answer your questions; reveal credible information; convey important information?
- Precision – How trustable are the measure; how confident is the result?
  - Pilot testing & Usability testing
- Reliability - if something was measured again using the same instrument, would it produce the same or nearly the same results?
  - Yielding consistent results over time or under similar conditions

Measurement Criteria

- Objectivity - researchers stand outside the phenomena they study. Data collected are free from bias
- Accuracy – Are the methods adequate to answer your questions; reveal credible information; convey important information?
- Precision – How trustable are the measure; how confident is the result?
  - Pilot testing & Usability testing
- Reliability - if something was measured again using the same instrument, would it produce the same or nearly the same results?
  - Yielding consistent results over time or under similar conditions
- Validity – do the measures reflect all the facets you are attempting to study?

Content Validity

- The extent to which the items on a testing tool (that being used to measure the dependent variable) reflect all of the facets being studied
- All aspects are sampled

Criterion-Related Validity

- Also called predictive validity
- The extent to which a testing tool yields data that allow the researcher to make accurate predictions about the dependent variable

Construct Validity

- The extent to which the testing tool measures what it is supposed to measure
- Relationship between the items on the tool and the dependent variable
- Also relates to actual (physical) construction of a written tool (e.g. Dean's Survey) and how this impacts the accuracy of the results

Internal Validity

- Relates to the internal aspects of a study and their effect on the outcome:
  - Researcher planning and preparation
  - Judgment – participants should feel free of judgement
  - Control for potential confounding variables

External Validity

- Relates to the extent to which findings can generalize beyond the actual study participants
- "How valid are these results for a different group of people, a different setting, or other conditions of testing, etc.?"

METHOD SELECTED✔
MEASUREMENT CRITERIA✔
ANALYSIS

+ Quantitative Research

- Summarizing data
  - variables; simple statistics; effect statistics and statistical models; complex models

Quantitative Research

- Summarizing data
  - variables; simple statistics; effect statistics and statistical models; complex models
- Generalizing from sample to population
  - precision of estimate, confidence limits, statistical significance, p value, errors

Quantitative Research

- Summarizing data
  - variables; simple statistics; effect statistics and statistical models; complex models
- Generalizing from sample to population
  - precision of estimate, confidence limits, statistical significance, p value, errors
- Data are a set of values of one or more variables

Quantitative Research

- Summarizing data
  - variables; simple statistics; effect statistics and statistical models; complex models
- Generalizing from sample to population
  - precision of estimate, confidence limits, statistical significance, p value, errors
- Data are a set of values of one or more variables
  - A variable is something that has different values.
    - Values can be numbers or names, depending on the variable:
      - Numeric – year of birth
      - Counting - number of natural disasters
      - Ordinal – highest level of education (values are numbers or names/labels)
      - Nominal – gender (values are names/labels)

Independent Variable

- The variable that is controlled or manipulated by the researcher
- The variable that is thought to have some effect upon the dependent variable
- The one difference between the treatment (experimental) and control groups

Dependent Variable

- That which is measured
- The outcome
- That which is influenced or affected by the dependent variable

Quantitative Research

Y (dep variable)	X (ind variable)	Model/Test	Effect statistics
Numeric	Numeric	Regression	Slope, intercept, correlation
Numeric	Nominal	T-test, ANOVA	Mean difference
Nominal	Nominal	Chi-square	Frequency difference or ratio
Nominal	Numeric	Categorical	Frequency ratio per …

Analysis Programs

- Software (all except SAS available on D-Lab machines)
  - Stata
  - SPSS
  - SAS
  - R
  - Python
  - GIS
  - Excel

Pros of Quantitative Research?

- Clear interpretations
- Make sense of and organize perceptions
- Careful scrutiny (logical, sequential, controlled)
- Reduce researcher bias
- Results may be understood by individuals in other disciplines

Cons of Quantitative Research?

- Can not assist in understanding issues in which basic variables have not been identified or clarified
- Only 1 or 2 questions can be studied at a time, rather than the whole of an event or experience
- Complex issues (emotional response, personal values, etc.) can not always be reduced to numbers
- Difficulties in distinguishing opinions and facts from surveys
- Results from surveys sometime have serious limitations
- People's perceptions and scientific observation may contradict

Quantitative vs. Qualitative

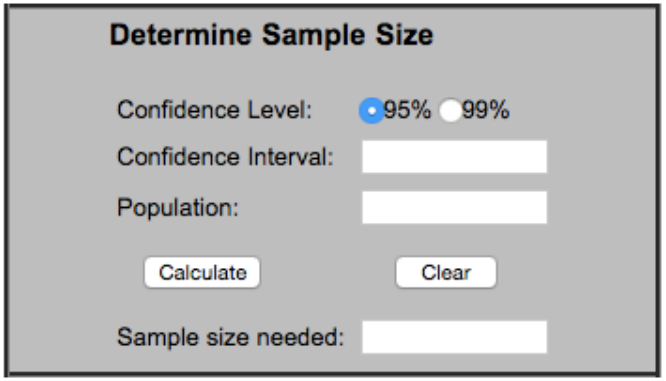
- There is/shouldn't be a rivalry between quantitative and qualitative methods
  - Each can be used to confirm the other
- Quantitative data and findings have underlying qualitative dimension
  - Qualitative data can also add description, detail and texture to quantitative data
- Quite often availability of data and its characteristics determine the method and what is possible – not a preference for one over the other

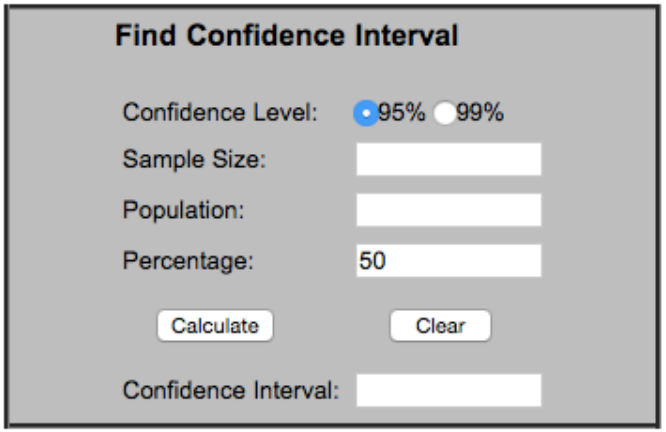
Quantitative vs. Qualitative

- There is/shouldn't be a rivalry between quantitative and qualitative methods
  - Each can be used to confirm the other
- Quantitative data and findings have underlying qualitative dimension
  - Qualitative data can also add description, detail and texture to quantitative data
- Quite often availability of data and its characteristics determine the method and what is possible – not a preference for one over the other
- Both quantitative and qualitative research can aim at description of built environment
- Complementary - not contradictory
  - different kinds of research questions and objects of research
  - different perspectives on the same research objects / questions (methodological triangulation)

Best Practices – Sample Size

- Sample size
  - Data collection – a large enough sample so that missing data won't become an issue
  - Sample size calculator - how to generalize to population





Best Practices – Things to Consider

- Time constraints
  - Choose the method that best suits your research time
    - 1 year is not enough for a longitudinal study
- Resource constraints
  - Choose the method that best suits your budget and resources available
    - If you don't have access to a lab, a lab experiment is unrealistic
- Access
  - Do you have access to a generalizable sample?

Best Practices

- Ethics
  - Maintaining respect for participants
  - Can participants opt out at any point?
  - Balancing benefit & harm
    - Will participation cause harm?
    - Does the potential benefit outweigh any potential harm (psychological effects, stress, anxiety, time)
  - Will the method allow protection of anonymity?
    - Anonymity – pseudonyming is key!!
  - How involved will the researcher be – will he/she bias results?

Thank You!

- References/Resources
  - *The Practice of Social Research* – Earl Babbie
  - *Statistical Methods for the Social Sciences* – Agresti & Finlay
  - Sage Research Methods - http://srmo.sagepub.com/
  - Ethics: Guidelines for Research Ethics
  - Best Practices: NIH Office of Behavioral and Social Sciences Research
  - Statistics – www.ats.ucla.edu
  - Workshops & consulting – www.dlab.berkeley.edu

- If you have any further questions or comments, please feel free to email me, nbroege@berkeley.edu