NSU
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QUANTITATIVE RESEARCH METHODS

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Overview

- Research Paradigms
- Quantitative Research Designs
  - Experimental Designs
  - Nonexperimental Designs
    - Survey Research
    - Causal Comparative
    - Correlational

Research Paradigms

- Quantitative
- Qualitative
- Mixed Methods

Quantitative Methodology

- Generally involves collecting numerical data that can be subjected to statistical analysis
- Examples of data collection methodologies
  - Performance Tests
  - Personality Measures
  - Questionnaires (with closed-ended questions)
  - Content Analysis

Quantitative Research

- Trying to quantify variables of interest; questions must be measureable
- Key characteristic: data involves numbers
- Questions frequently address "how well or how much"
- Example:
  - What is the relationship between graduate students' level of interaction, measured by the number of 'hits' in the course, and students' grades in an online research methods course?

Qualitative Methodology

- Generally involves listening to the participants' voice and subjecting the data to analytic induction (e.g., finding common themes)
- More Exploratory in nature
- Examples of data collection methods
  - Interviews
  - Open-ended questionnaires
  - Observations
  - Content analysis
  - Focus Groups

Qualitative Research

- "There are times we wish to know not how many or how well, but simply how" (Shulman, 1988, p. 7).
- Key characteristic: data involves words or images
- Example:
  - What are the factors that influence a graduate student's experience in an online research methods course?

Important Note

- Most data collection methods can be either quantitative or qualitative depending on how you collect and analyze your data (i.e., the type of research paradigm you are following).
- Oftentimes you will find me say that interviews are more qualitative in nature; however, they can be quantitative as well.

Quantitative Research Designs

Research Design Overview

- Experimental Designs
- Nonexperimental Research Designs
  - Survey Designs
  - Causal-Comparative
  - Correlational Designs

Experimental Research Designs

- Involve the introduction of an intervention by the researcher to determine a **cause-and-effect** relationship
- Strongest type of design (pre → INT → post)!!
- To yield valid findings, these studies must be rigorous!!

Validity Issues in Experimental Research

- Can the change in the posttest be attributed only to the experimental treatment that was manipulated by the researcher?
- Must be able to control extraneous variables that could have undue influence!!

Internal Validity

- Extent to which these variables have been controlled by the researcher so that any observed effect can be attributed to the treatment variable.
- Factors affecting internal validity?

Threats to Internal Validity

- Attrition/Mortality
- Instrumentation
- Statistical Regression
- History
- Diffusion
- Maturation

External Validity

- Extent to which the findings can be applied to individuals and settings beyond those studied
- Factors affecting external validity?

Threats to External Validity

- Sample characteristics/selection
- Stimulus characteristics and settings
- Treatment variations

Types of Experimental Research Designs

- Control-Group Designs
  - Strongest type of design!!
  - Random assignment to experimental and control group
  - Experimental group: pre → INT → post
  - Control group: pre → NO → post
  - Example?

Types of Experimental Research Designs (cont'd)

- Single-Group Designs
  - When use of a control group is not possible
  - All individuals in the study receive the treatment
  - Design: pre → INT → post
  - Example?
  - Biggest drawback?

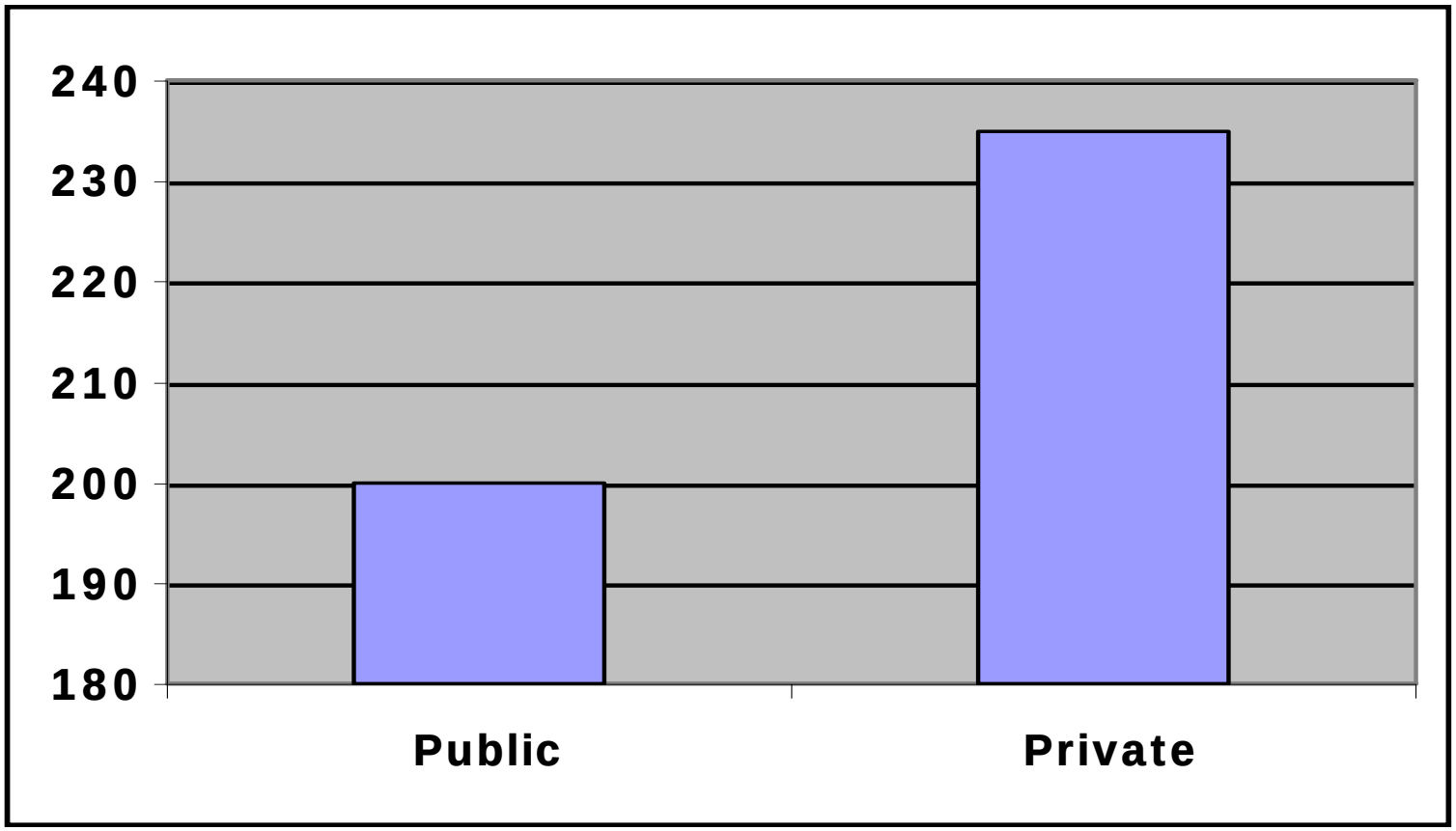
Experimental Research Designs (cont'd)

- Quasi-Experimental Research Designs
  - Random assignment of subjects is not possible (e.g., using a convenience sample)
  - Biggest problem???
  - We can control this through our data analysis (e.g., including a covariate).

Non-Equivalent Control Group

- Often times we want to evaluate the effectiveness of a program that is already in place, and we are not able to construct a treatment and a control group.
- For example, suppose we wanted to evaluate the effectiveness of public schools vs. private schools on academic achievement. We looked at the average NAEP math scores for 4th grade students in public and private schools and found the following:

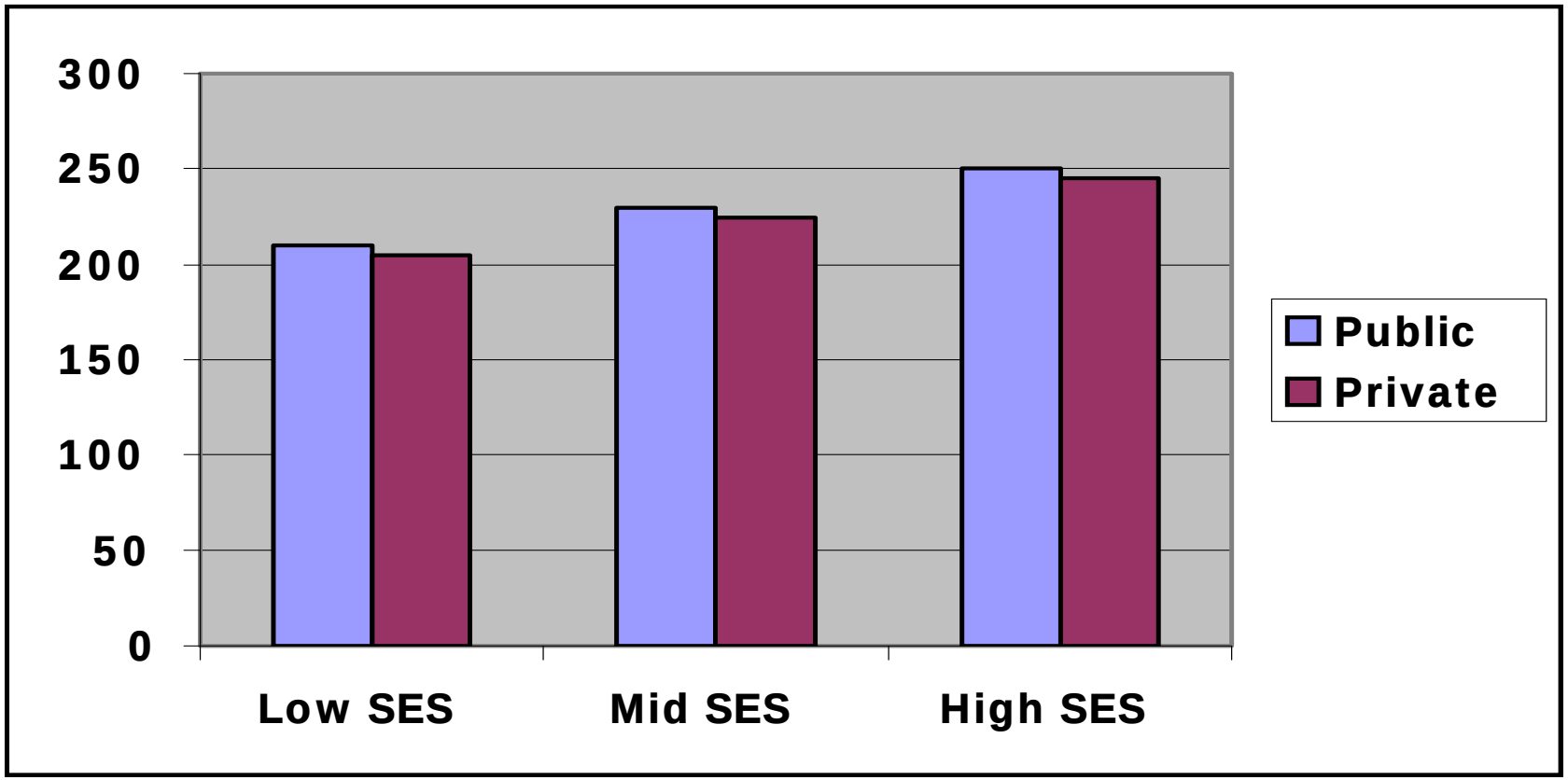
Non-equivalent Control Group (cont'd)



Non-equivalent Control Group (cont'd)

- What happens when we control for an extraneous variable such as SES (i.e., use SES as a covariate).

Non-equivalent Control Group (cont'd)



Non-equivalent Control Group (cont'd)

- When we compare public and private students of the same SES, we find there is little difference in their achievement. But because there are more high SES students in private schools, the overall comparison is misleading.

Interrupted Time Series Design

- Multiple historical measures on a treatment group only, before and after its exposure to the program
- When a control group is not possible; IF
  - Data on the treatment group can be obtained for several periods both before and after the participants are exposed to the program.
  - There is a change in scores immediately following the implementation of the program, and
  - There is a continuation of the change in subsequent time periods
- → considered good evidence that the intervention produced the change.

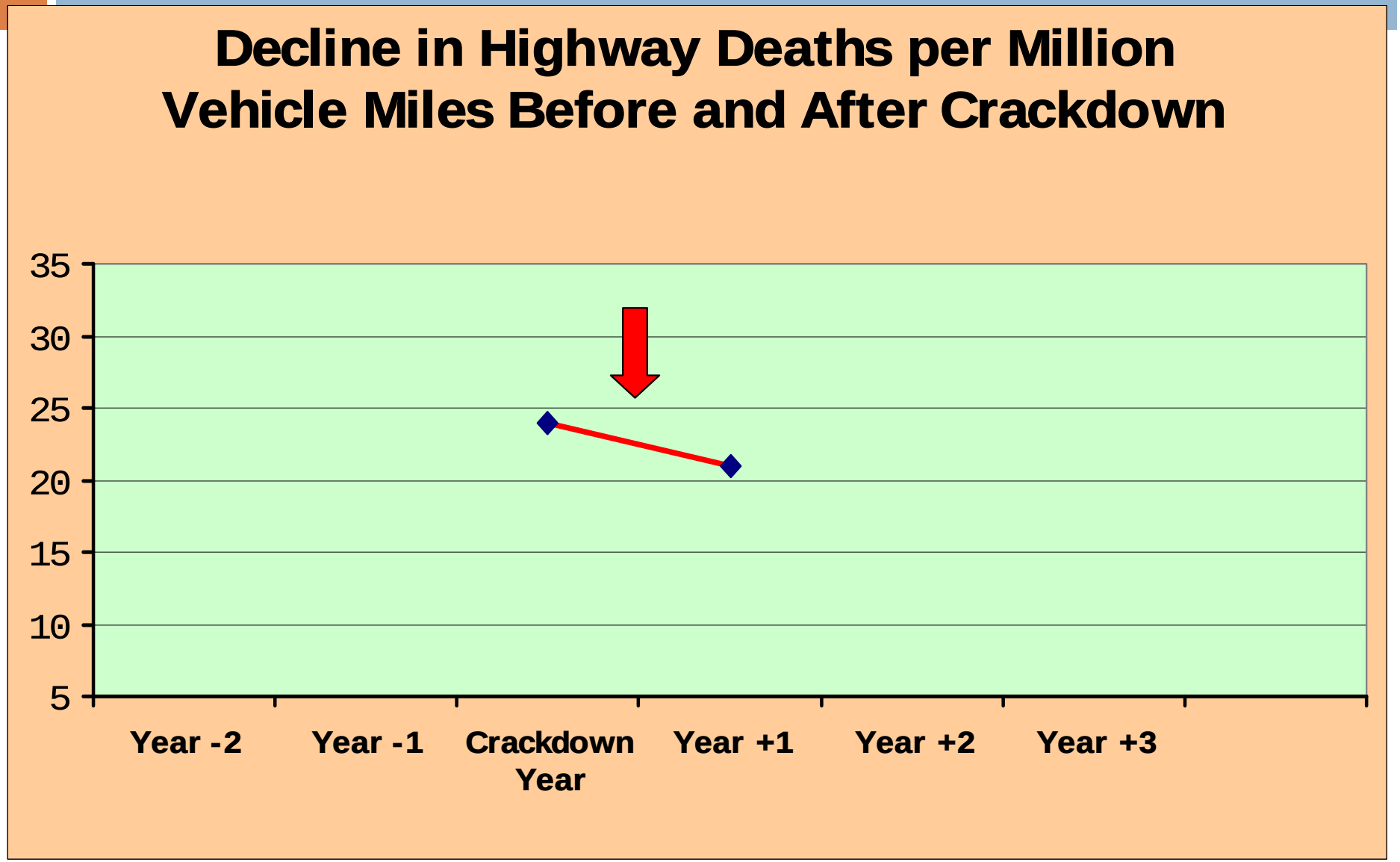
Illustration

Time

	1	2	3		4	5	6
Experimental Group	**0**	**0**	**0**	**X**	**X**	**X**	**X**

New program (X) is introduced

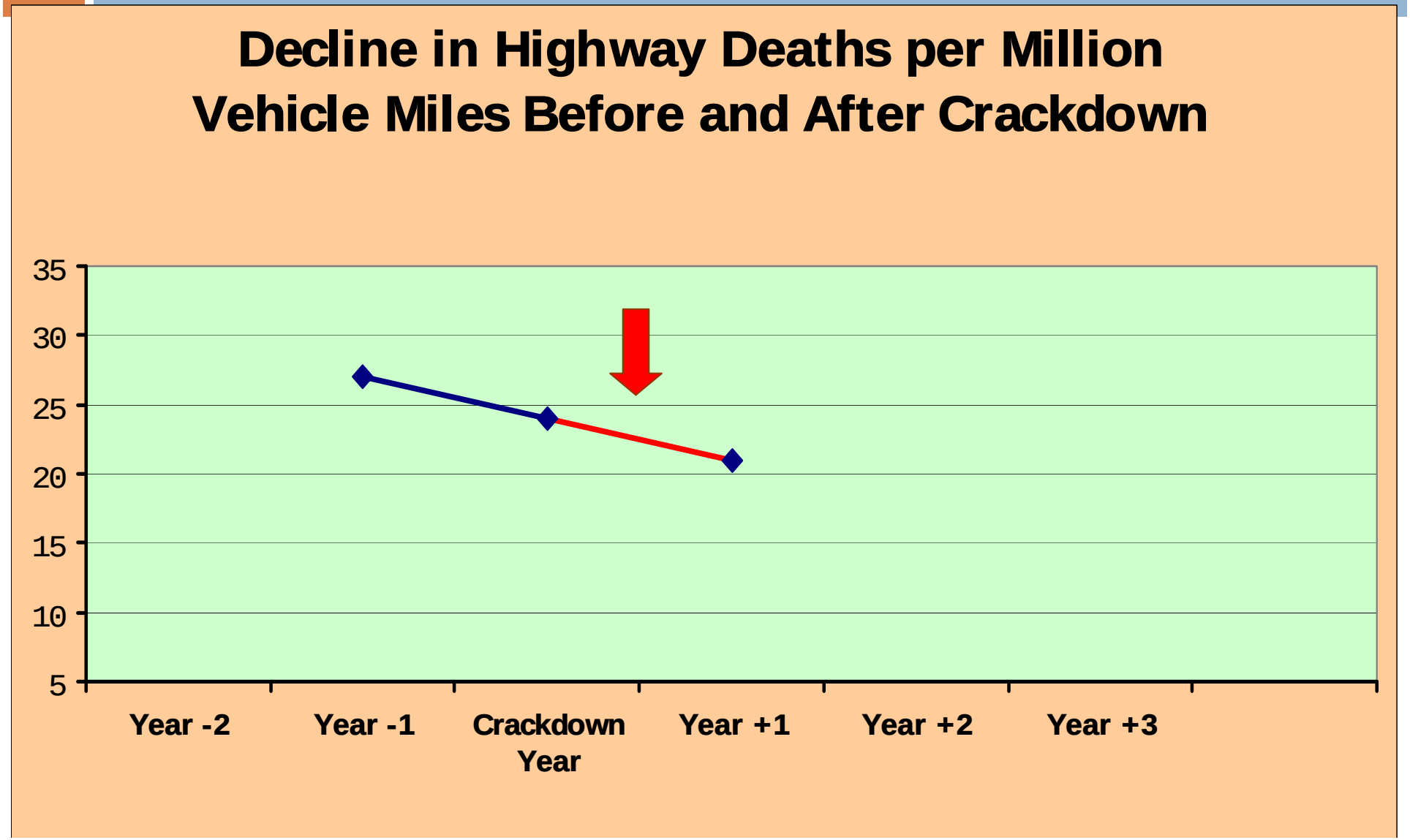
Campbell's Example of the Interrupted Time Series Design



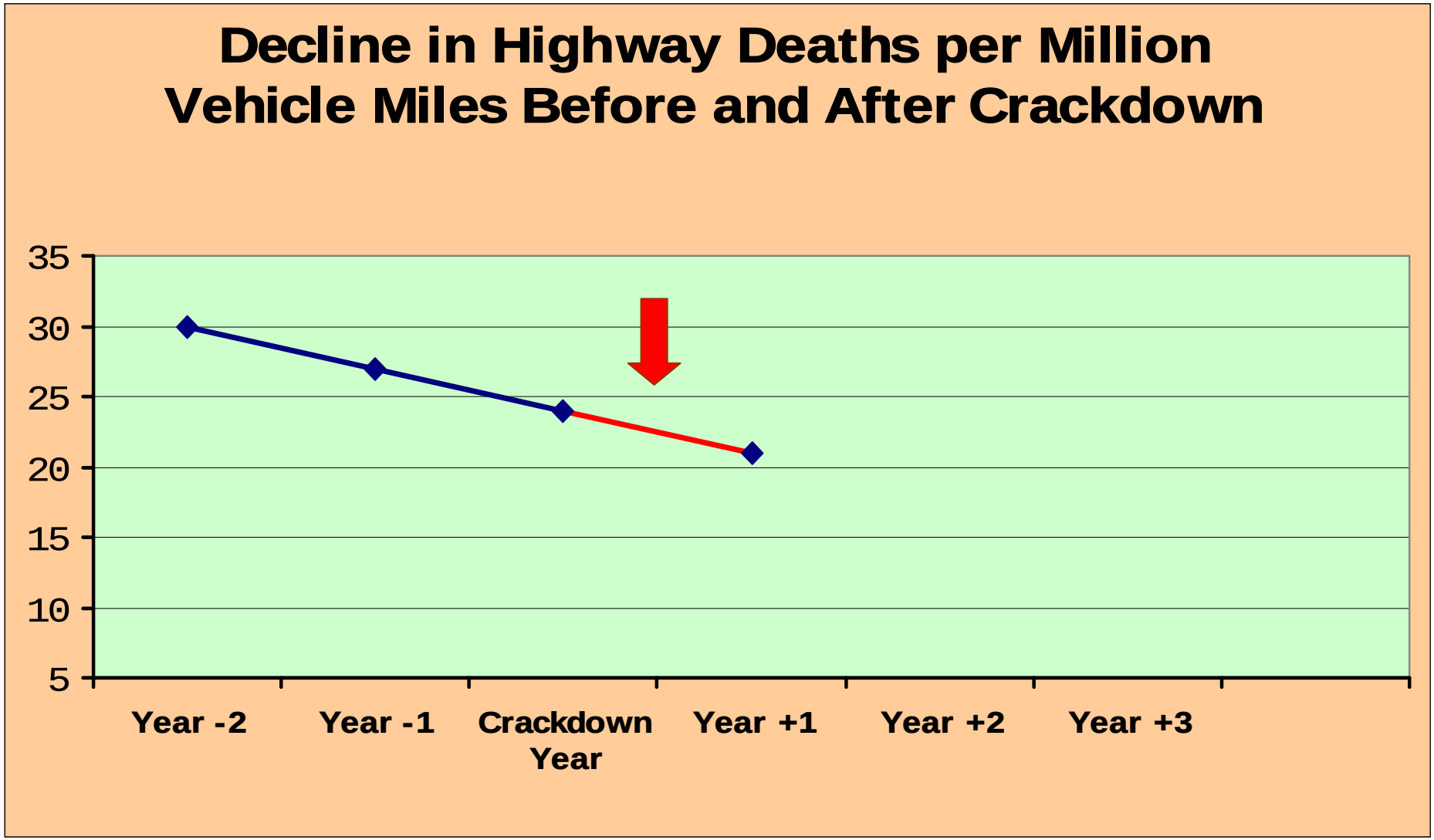
Example (cont'd)

- Number of highway deaths went down after the Police cracked down; therefore, the crackdown must have been an effective method for decreasing the number of highway deaths.
- Or was it? Let's look at the data more closely.

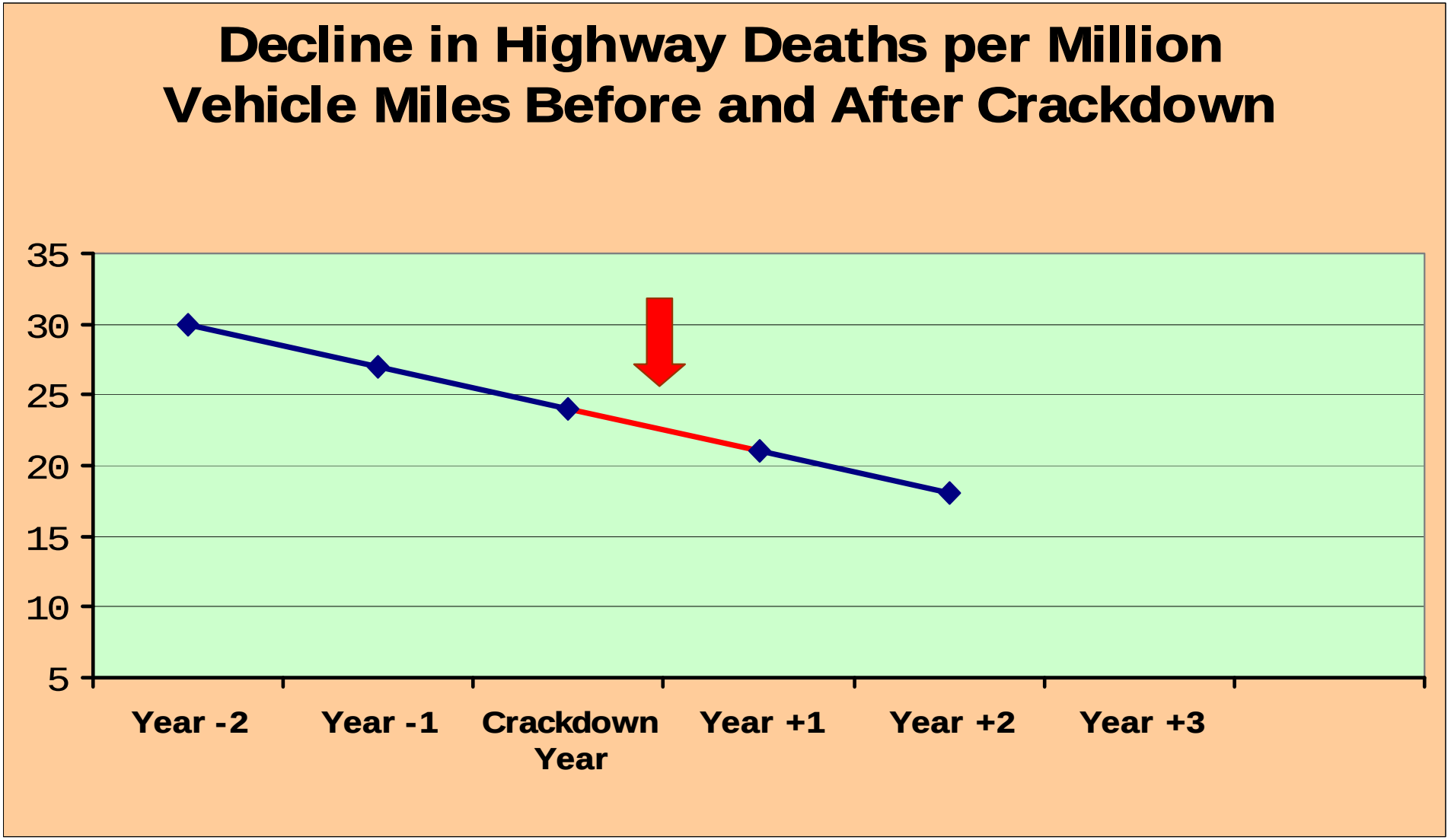
Interrupted Time Series Design (cont'd)



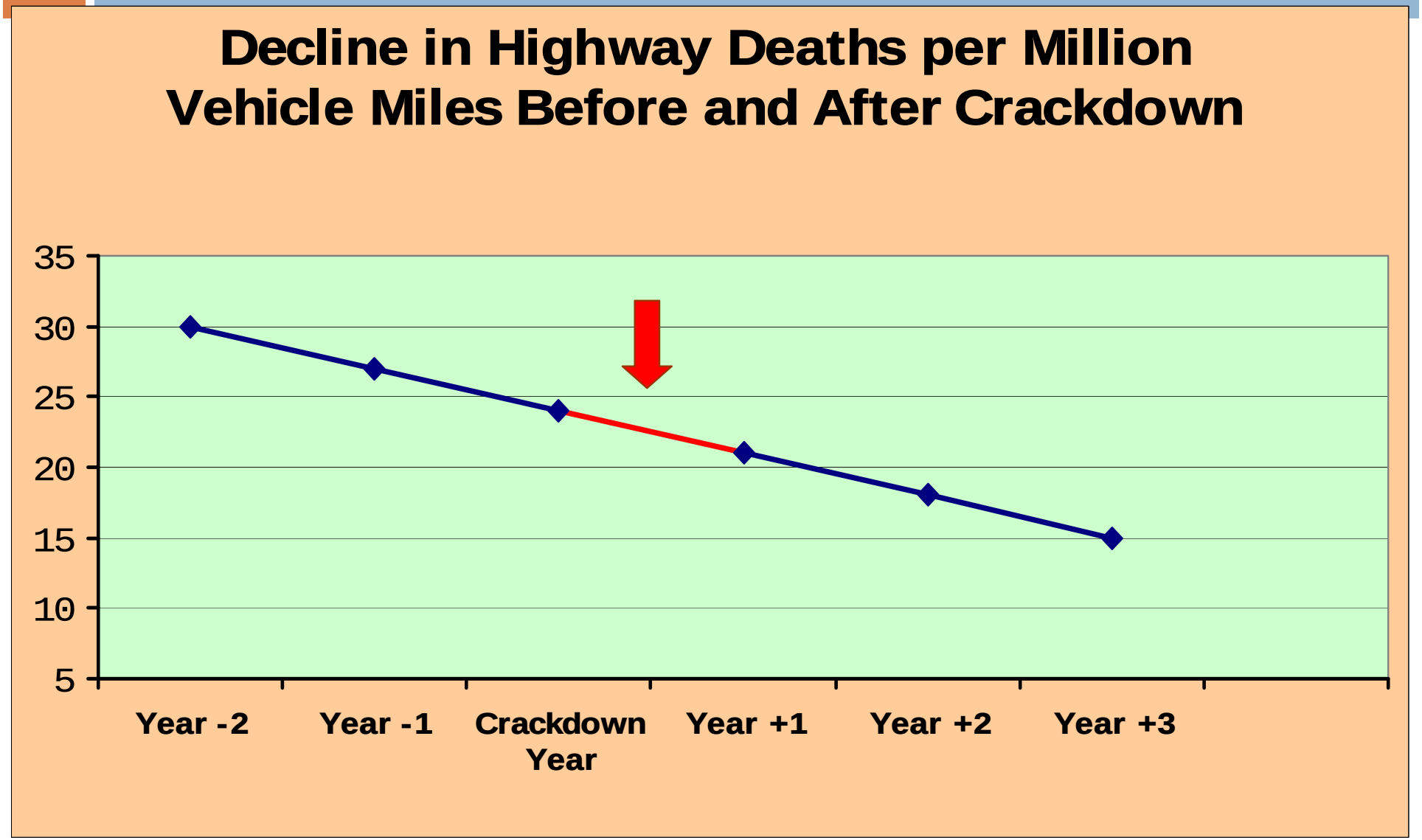
Interrupted Time Series Design (cont'd)



Interrupted Time Series Design (cont'd)

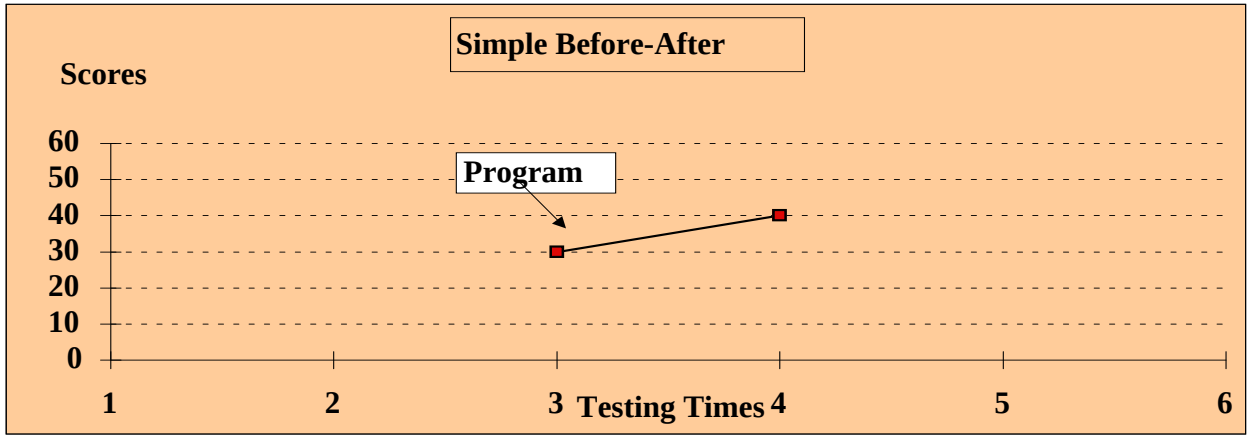


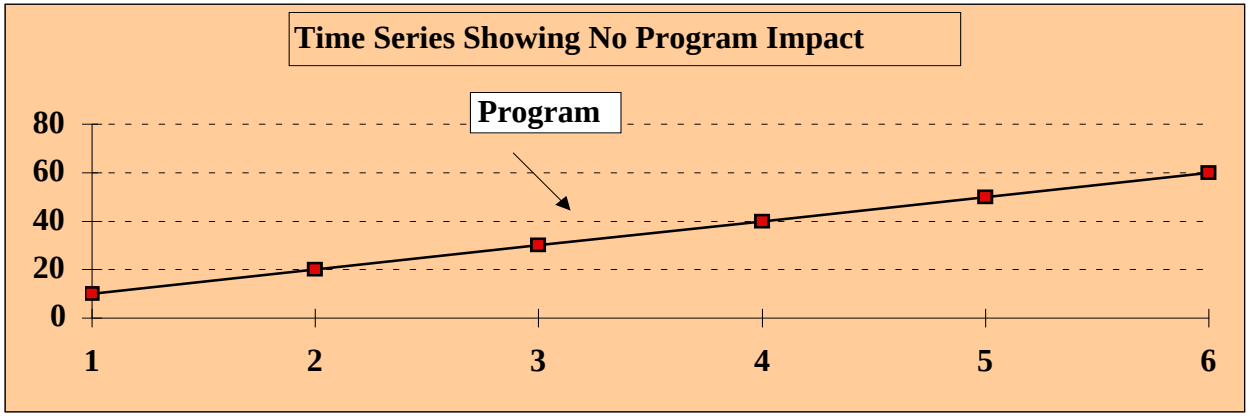
Interrupted Time Series Design (cont'd)

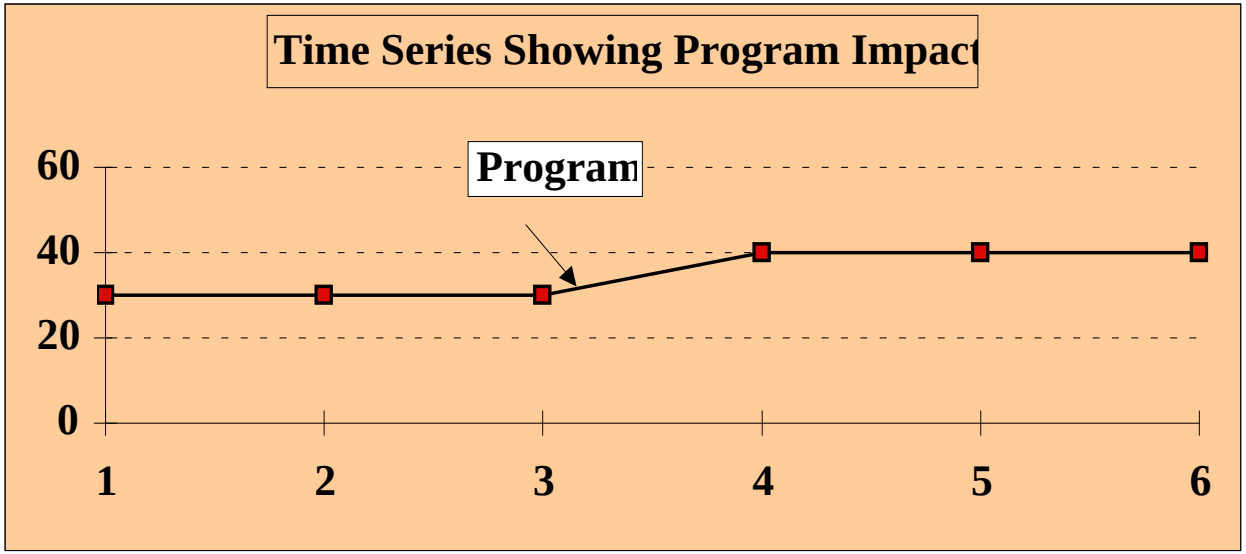


Example (cont'd)

- The trend in the data suggests the number of highway deaths were decreasing steadily anyway and that the crackdown had no effect on the number of deaths.


Simple Before-After
Scores
60
50
40
30
20
10
0
Program
1
2
3
Testing Times
4
5
6


Time Series Showing No Program Impact
Program
80
60
40
20
0
1
2
3
4
5
6


Time Series Showing Program Impact
Program
60
40
20
0
1
2
3
4
5
6

Experimental Research Designs (cont'd)

- Factorial Designs
  - The researcher determines the effect of two or more IVs (factors) on a DV
  - Example: Effects of home language and curriculum on reading comprehension.

Nonexperimental Research Designs

- Involve the study of behavior, cognition, attitude, etc. without any intervention by the researcher.
  - Survey Designs
  - Causal-Comparative
  - Correlational

Survey Designs

- Procedures in **quantitative** research in which investigators administer a survey to a sample or to the entire population of people in order to describe the attitudes, opinions, behaviors, or characteristics of the population.

When to Use a Survey

- To assess trends
- To assess opinions, beliefs, and attitudes
- For follow-up analyses
- For evaluations

Creswell, J. W. (2008). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (3rd ed.). Upper Saddle River, NJ: Pearson Education.

Common Research Questions for Surveys

- The most common research questions in survey research address participants' perceptions, attitudes, or opinions, using descriptive, comparative, or relationship questions.
  - Example 1: What are teacher's attitudes towards inclusion?
  - Example 2: What is the difference in attitudes toward inclusion between teachers who have had training in special education and those who have not had training in special education?
  - Example 3: What is the relationship between teachers' perceptions of inclusion and students' academic achievement?

Common Research Questions for Surveys (cont.)

- Research questions in survey research also assess trends in the population.
  - How have college presidents' beliefs about state funding and accountability changed from 2001 to 2010?
- Surveys can also be used in other types of research, such as program evaluation.
  - Have students' attitudes towards writing changed as a result of a writing-across-the-curriculum program?

Determine the Survey Design

- Types of Survey Designs
  - Cross-sectional
  - Longitudinal

Creswell, J. W. (2008). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (3rd ed.). Upper Saddle River, NJ: Pearson Education.

Cross-Sectional Surveys

- The researcher collects data at one point in time.
- Types of information gathered
  - Information on current attitudes, beliefs, opinions, or practices of individuals
  - Comparison of two or more educational groups in terms of attitudes, beliefs, opinions, or practices
  - Measurement of community needs for educational services as they relate to programs, courses, facilities projects, or involvement in community planning.
  - Evaluation of a program in order to provide useful information to decision makers
  - Large-scale assessment of students or staff (national or state-wide)

Creswell, J. W. (2008). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (3rd ed.). Upper Saddle River, NJ: Pearson Education.

Longitudinal Surveys

- Involves collecting data about trends with the same population, changes in a cohort group or subpopulation, or changes in a panel group of the same individuals over time.
- Types
  - **Trend**: Changes in a population over time
  - **Cohort**: Changes in a subpopulation group identified by a common characteristic over time
  - **Panel**: Changes in the same people over time

Creswell, J. W. (2008). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (3rd ed.). Upper Saddle River, NJ: Pearson Education.

Nonexperimental Research Designs (cont'd)

- Causal-Comparative
  - Purpose is to compare two or more groups in order to explore possible causes or effects of a phenomenon
  - Example: Effects of type of classroom (inclusion vs. non-inclusion) on academic achievement
  - Ex-post facto designs most common – use of archival data

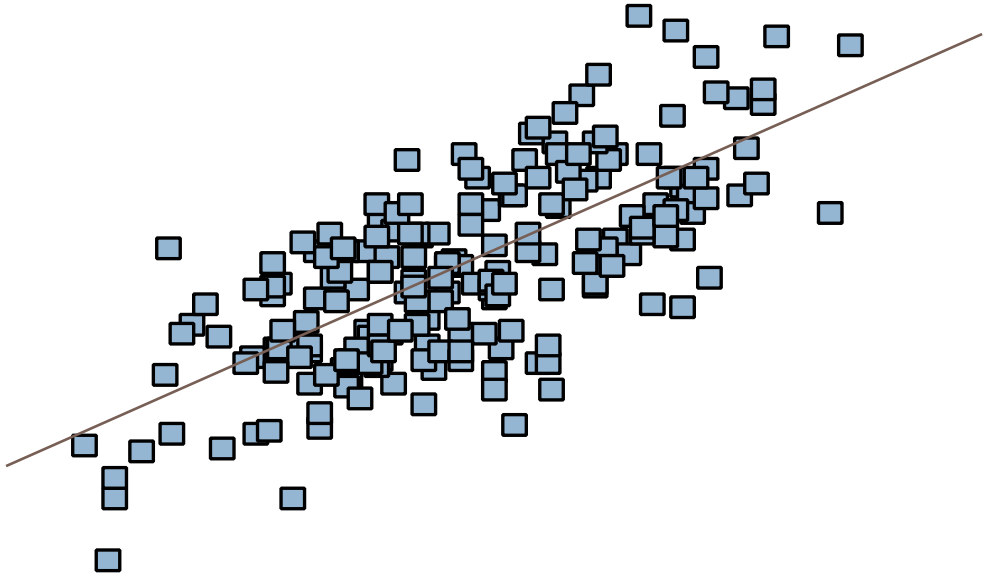
Nonexperimental Research Designs (cont'd)

- Correlational
  - Purpose is to measure the degree of association (or relationship) between 2 or more variables or sets of scores.
  - Example: Relationship between age and satisfaction in an online course.

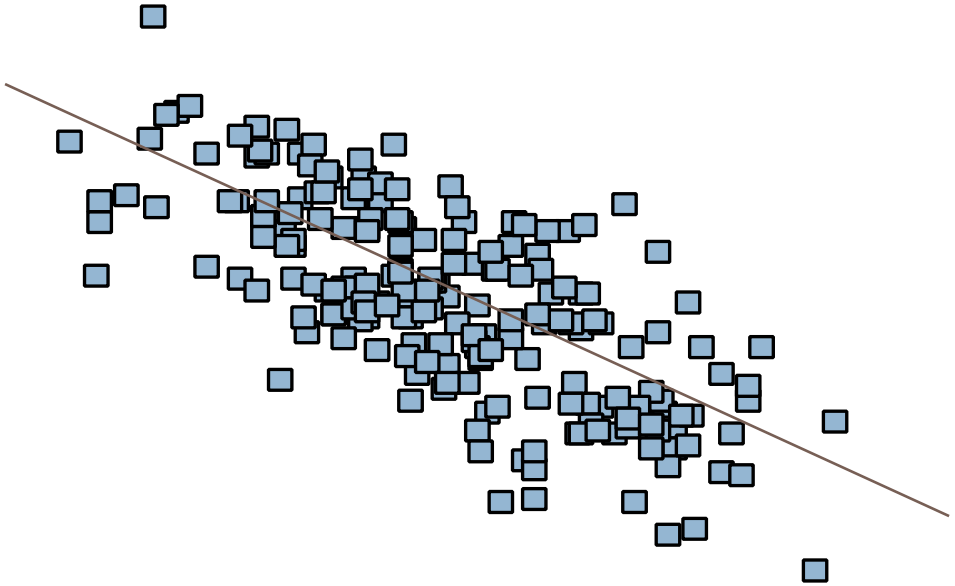
Characteristics of a Correlation

- Scatterplots can help us describe both the direction and the strength of the correlation
- The direction of a correlation can either be positive or negative
- The strength of a correlation can range from weak (or none = 0) to strong (perfect = |1|)

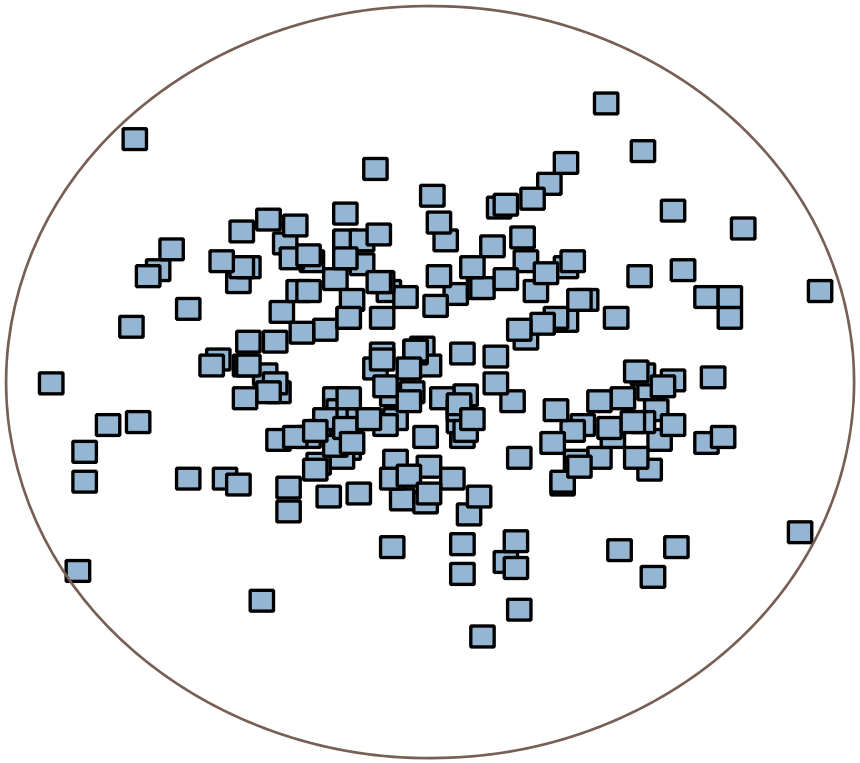
Scatterplot of a Positive Correlation



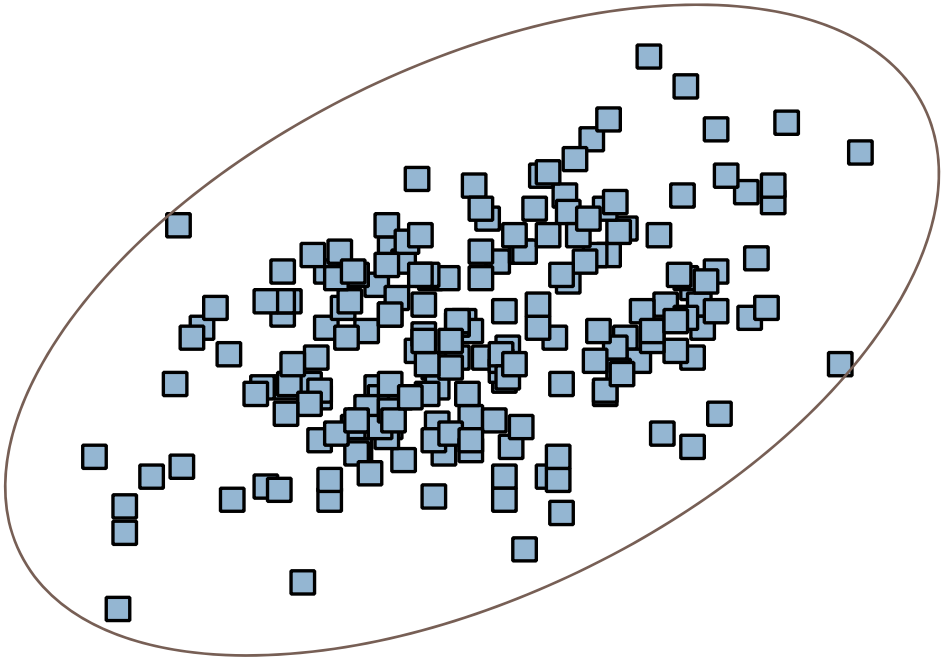
Scatterplot of a Negative Correlation



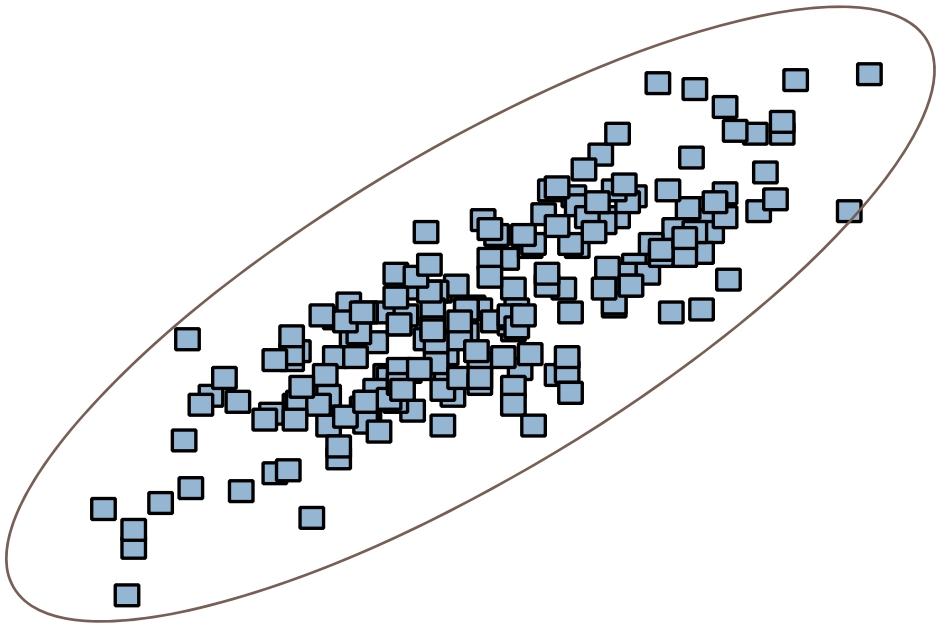
No Correlation



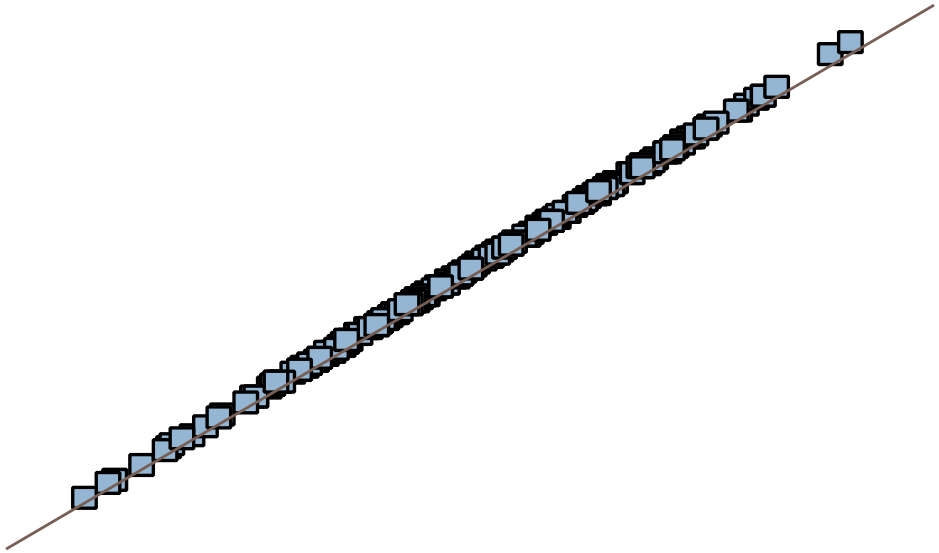
Weak Correlation



Strong Correlation



Perfect Correlation



Correlational Designs

- Explanatory
  - Researchers attempt to explain the relationship between two or more variables
  - Example: What is the relationship between student engagement and number of posts in an online course?

- Predictive
  - Researchers attempt to predict the relationship between two or more variables
  - Example: What is the online course variables significantly predict student engagement?