

The Quasi-Experimentals

EDP 618 Week 6

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Part I: Modern Descriptions of Experiments



Randomized

Units are assigned to conditions randomly

Randomly assigned units are probabilistically equivalent based on expectancy (if certain conditions are met)

Under the appropriate conditions, randomized experiments provide unbiased estimates of an effect

Example: Randomized controlled trials (RCT)

Quasi-Experiments

Units are assigned to conditions non-randomly

Assignment to conditions occurs by self-selection

Greater emphasis on enumerating and ruling out alternative explanations

Example: Regression discontinuity design (RDD)

Basic Design Elements and Notation



Notation



Variable	Description
X	treatment
O	observation
R	random assignment
NR	nonrandom assignment
\cancel{X}	removed treatment
X_+	treatment expected to produce an effect in one direction
X_-	conceptually opposite treatment expected to reverse an effect
C	cutting score
---	non-randomly formed groups
...	cohort

The Logic of Quasi-Experimentation



Rationale



- Quasi-experiments are often a necessity given practical and logistical constraints

- Greater emphasis on construct or external validity rather than cause-effect associations

Funding, ethics, administration

The intervention has already occurred

least common

somewhat common

most common

- Sometimes they are the best alternative, even if causal inferences are weaker than is possible with other designs

Central Principles

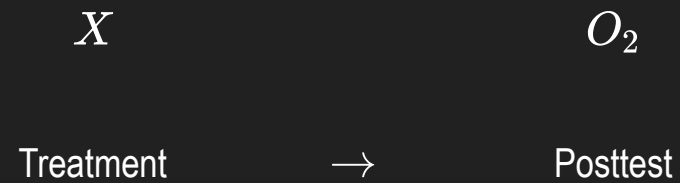


- Identification and study of plausible threats to internal validity
- Careful scrutiny of plausible alternative explanations for treatment-outcome covariation
- Primacy of control by design
- Use carefully planned and implemented design elements rather than statistical controls for anticipated confounds
- Coherent pattern matching
- Complex (a priori) causal hypotheses that reduce the plausibility of alternative explanations

Designs without Control Groups



One-Group Posttest Only Design



- Absence of pretest makes it difficult to know if change has occurred and absence of a control group makes it difficult to know what would have happened without treatment
- Known as a one-shot study

One-Group Pretest-Posttest Design



- Adding a pretest provides weak information concerning what might have happened to participants had the treatment not occurred
- Known as a pre-post study

One-Group Pretest-Posttest Design with Double Pretest



- Adding multiple pretests reduces the plausibility of maturation and regression effects
- Can confirm maturational trends

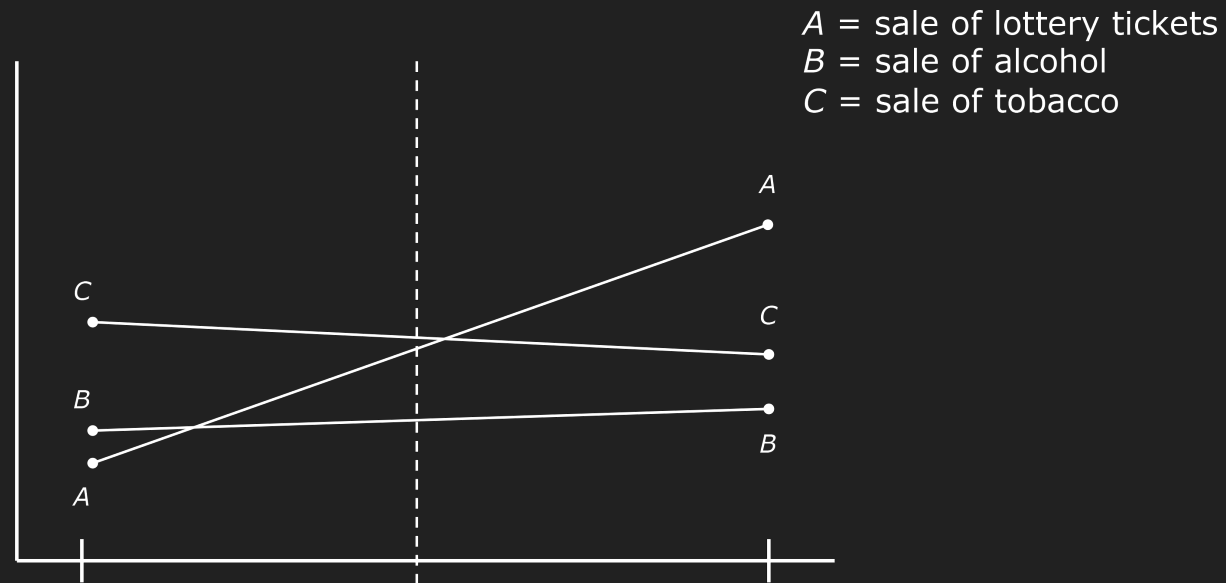
One-Group Pretest-Posttest Design Using a Nonequivalent Variable



- Measure A is expected to change because of treatment, B is not
- Both A and B are expected to respond to the same validity threats in the same way

Example

Lottery ticket sales in convenience stores after introduction of signs in store windows reading "did you buy your ticket?"



Removed-Treatment Design



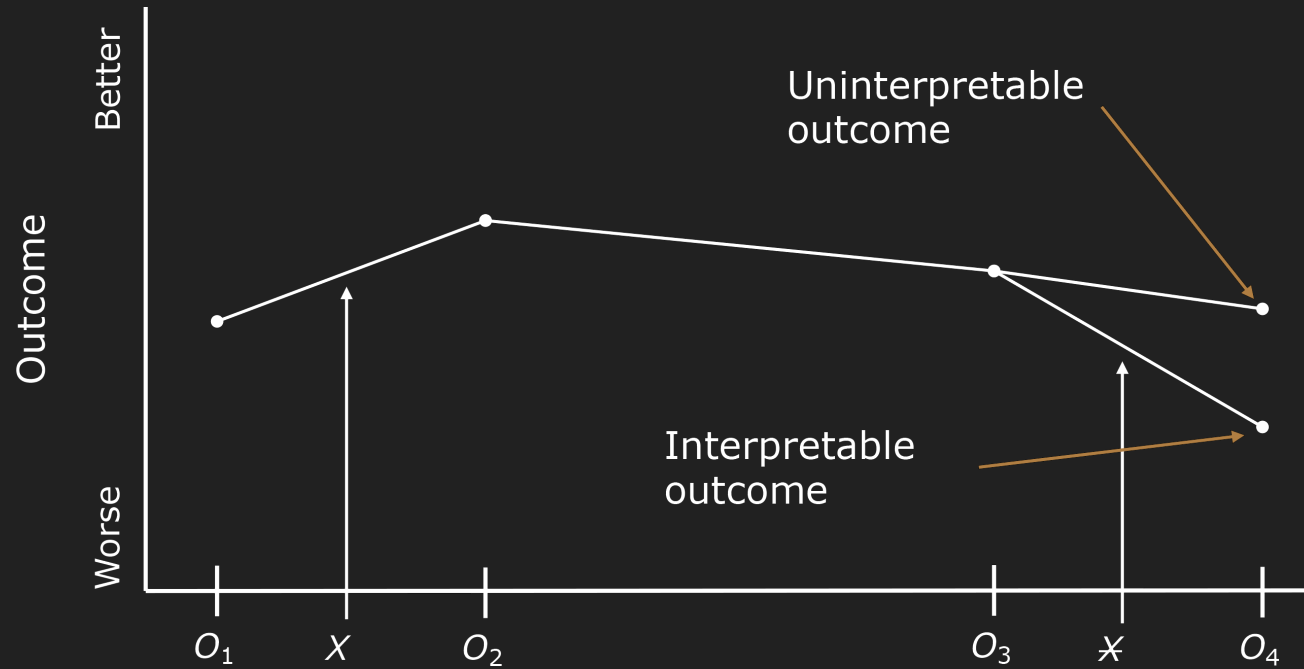
O_1 X O_2 O_3 ~~X~~ O_4

Pretest → Treatment → Posttest → Pretest → Removal → Posttest

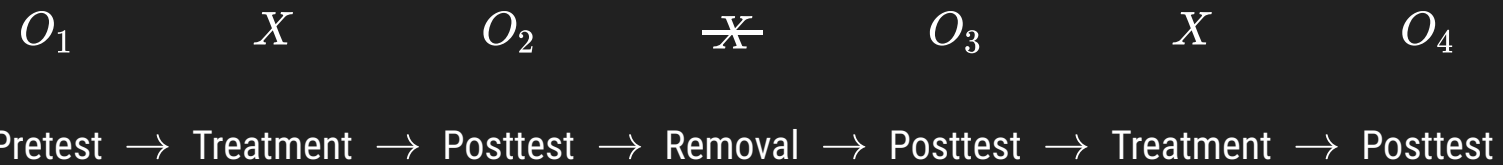
- Demonstrates that outcomes rise and fall with the presence or absence of treatment

Example

Generally interpretable outcome pattern



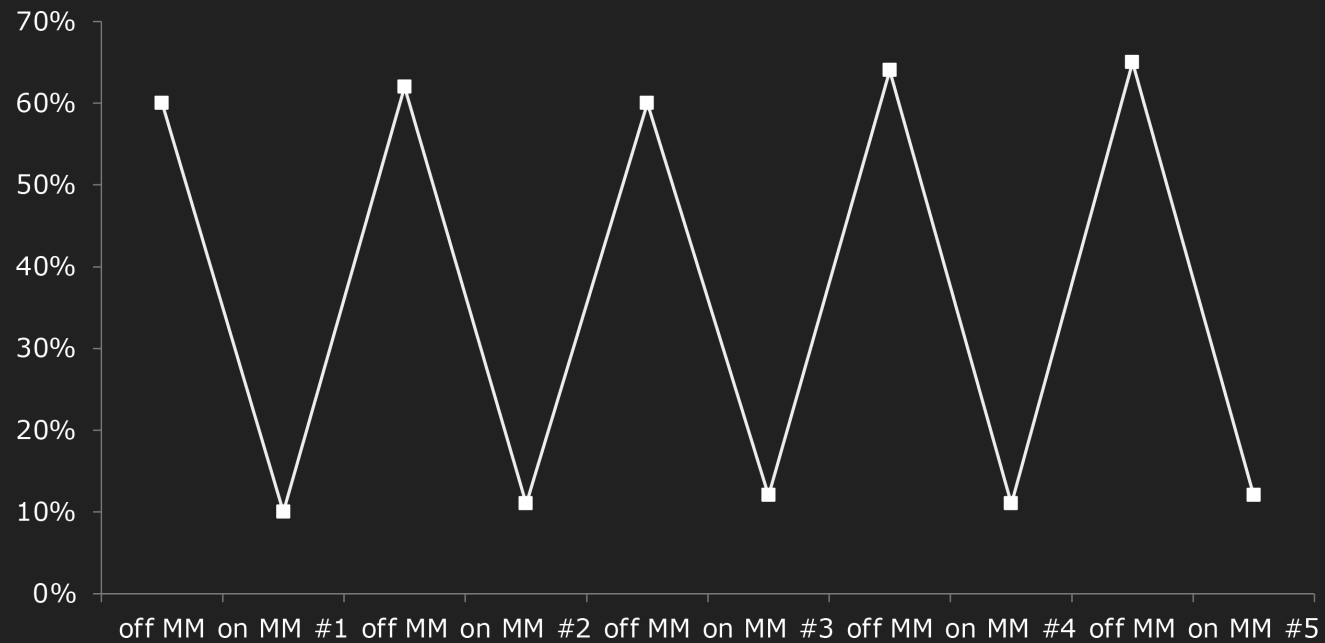
Repeated-Treatment Design



- Few threats could explain a close relationship between treatment introductions and removals and parallel outcome changes

Example

Mean narcotics use over multiple Methadone maintenance on/off conditions





$A - B$ Designs

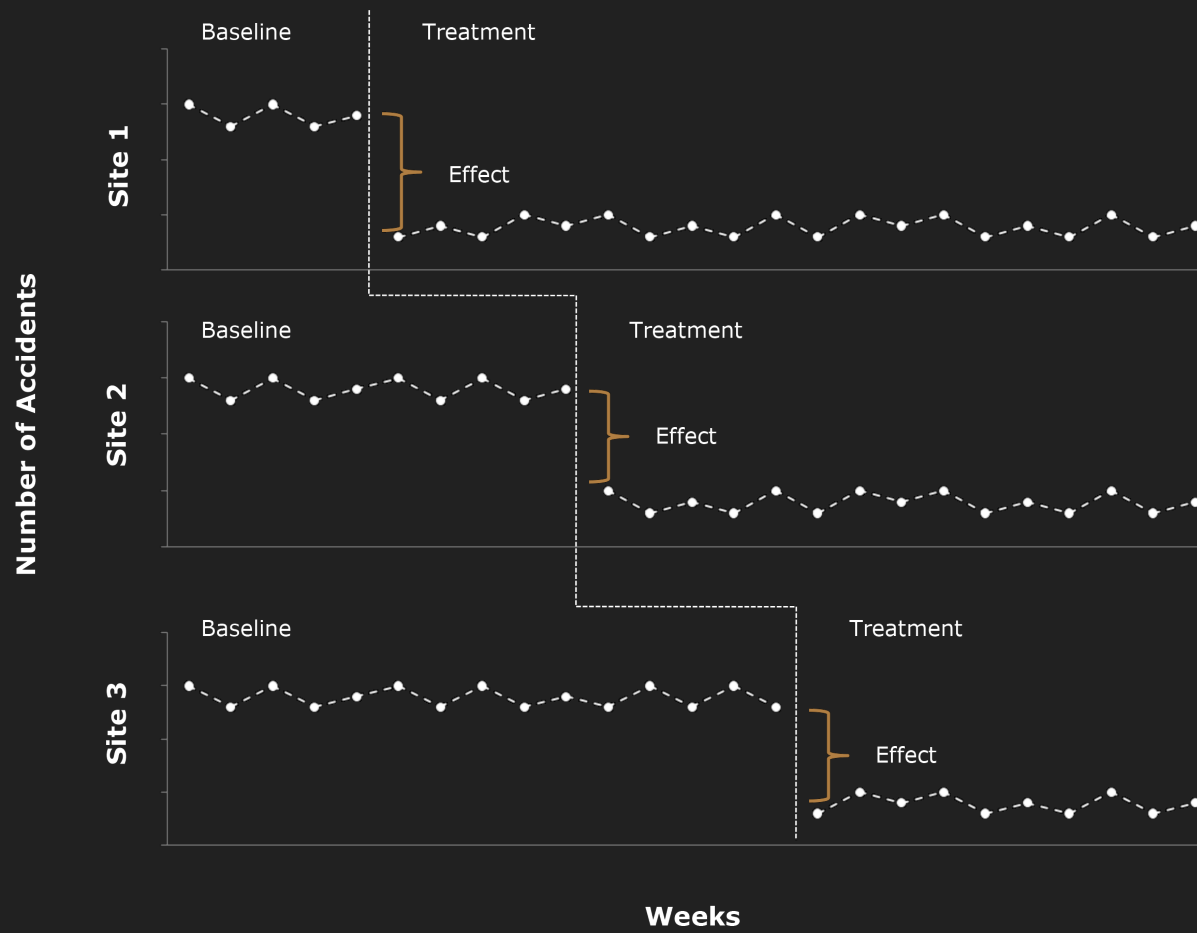
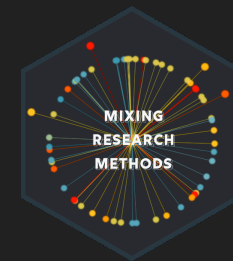
- Multiple-baseline design (a class of single-subject designs), or collection of $A - B$ designs, to assess the effects of an intervention across separate baselines
- Variables

A = baseline

B = treatment

- The intervention is introduced in a staggered manner and the baseline provides a predicted level of the dependent variable in absence of the treatment
- $A - B - A$ designs are sometimes called removal designs (i.e., the treatment is removed)

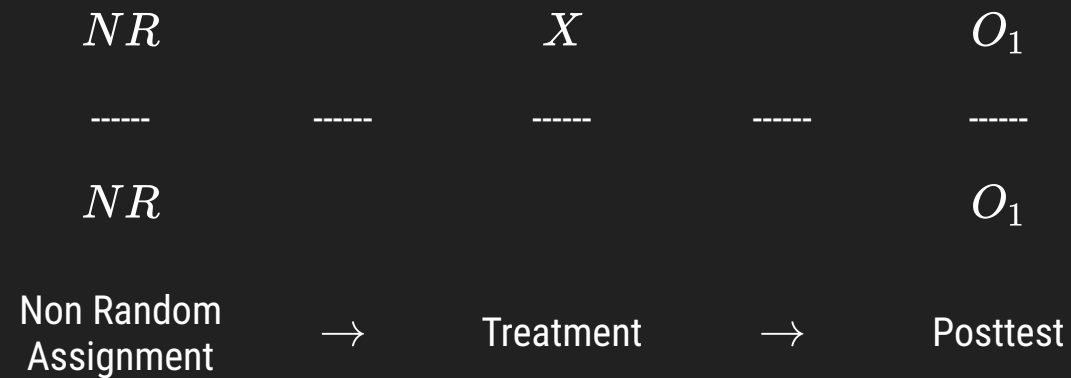
Example



Designs that use a Control Group but no Pretest



Posttest-Only Design with Nonequivalent Control Group



- Unknown pretest group differences make it extremely difficult to separate treatment effects from selection effects



Posttest-Only Design using an Independent Sample Pretest



Assumes overlapping group membership

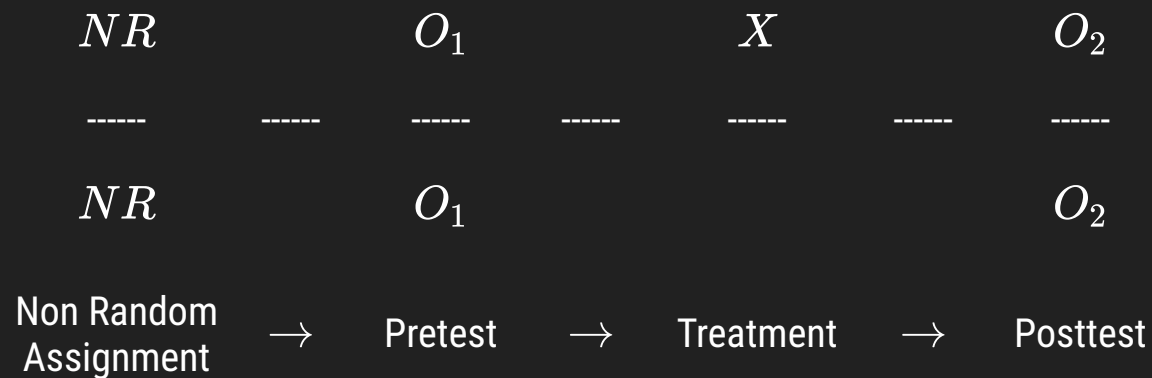
- Pretest measurements may be reactive
- Cannot follow same groups over time
- When interested in studying intact communities whose members change over time

Case Control Studies



- Predominant method for many forms of epidemiological research
- Used to identify factors that may contribute to a condition by comparing subjects who have that condition (i.e., *cases*) with those who do not have the condition but are otherwise similar (i.e., *controls*)
- Example: Used to determine the association between smoking and lung cancer

Untreated Control Group Design with Dependent Pretest and Posttest Samples



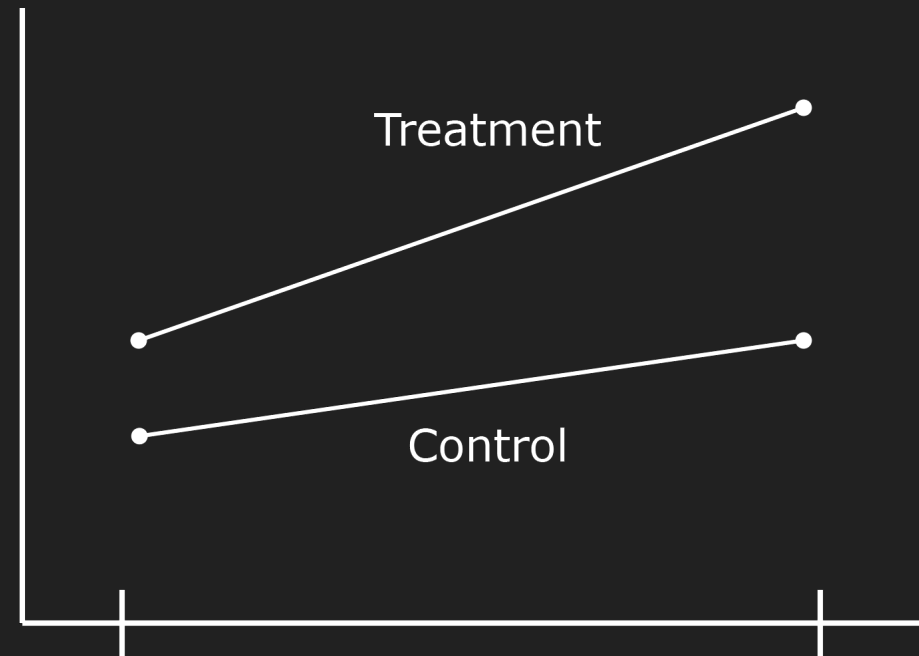
- A selection bias is always present, but the pretest observation allows for determining the magnitude and direction of bias

Outcome Pattern 1



Both groups grow apart at different average rates in the same direction

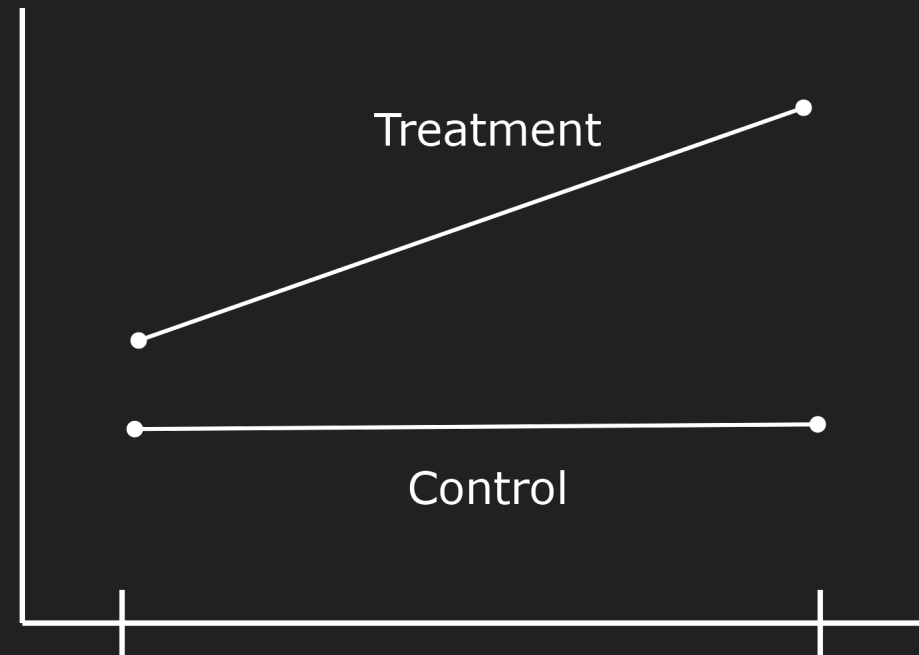
This pattern is consistent with treatment effects and can sometimes be causally interpreted, but it is subject to numerous threats, especially selection-maturation



Outcome Pattern 2

Spontaneous growth only occurs in the treatment group

Not a lot of reliance can be placed on this pattern as the reasons why spontaneous growth only occurred in the treatment group must be explained (e.g., selection-maturation)

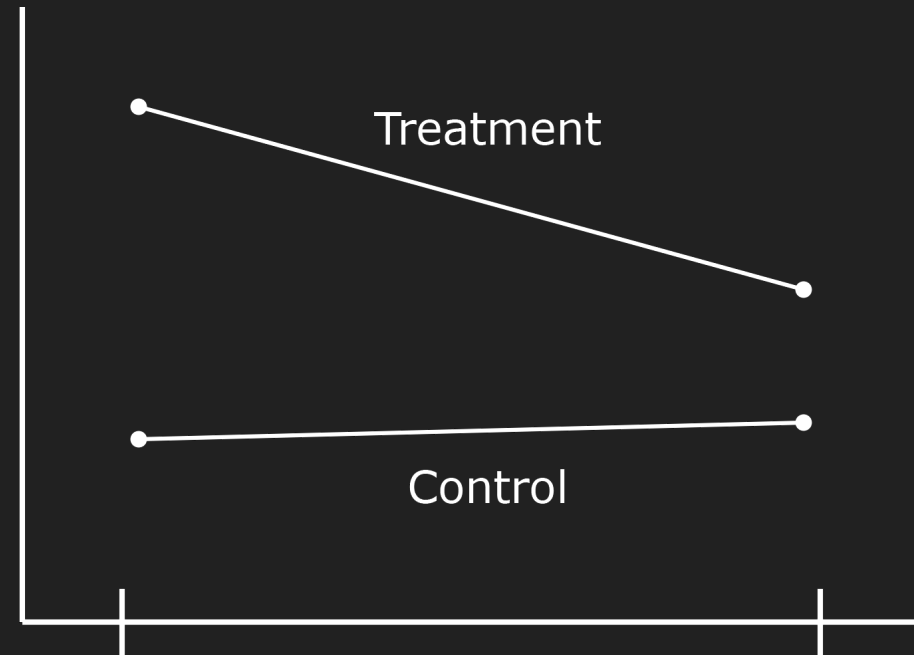


Outcome Pattern 3



Initial pretest differences favoring the treatment group diminish over time

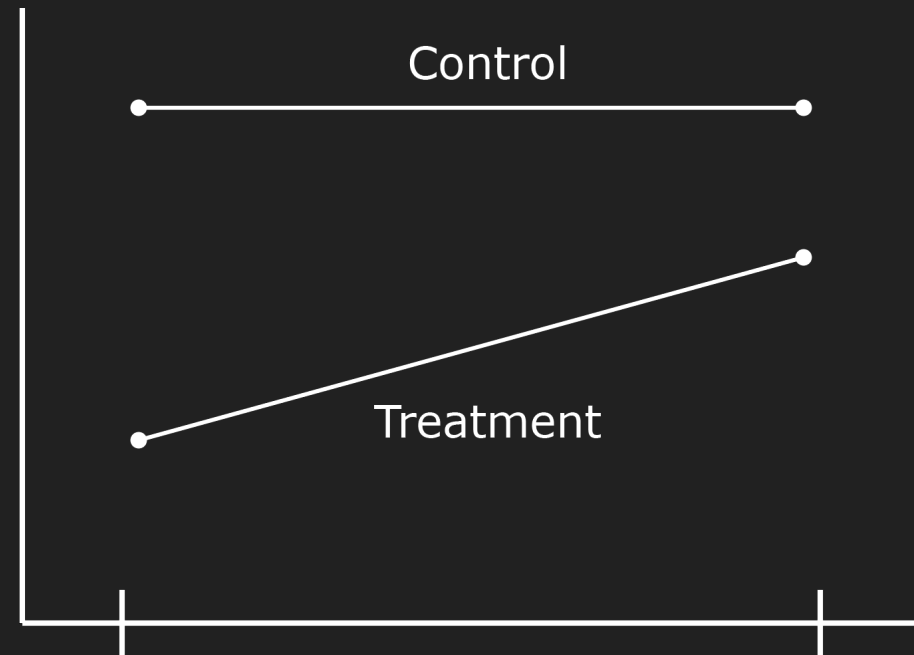
Same internal validity threats as outcome patterns #1 and #2 except that selection-maturation threats are less plausible



Outcome Pattern 4

Initial pretest differences favoring the control group diminish over time

Subject to numerous validity threats (e.g., selection-instrumentation, selection-history), but generally can be causally interpreted

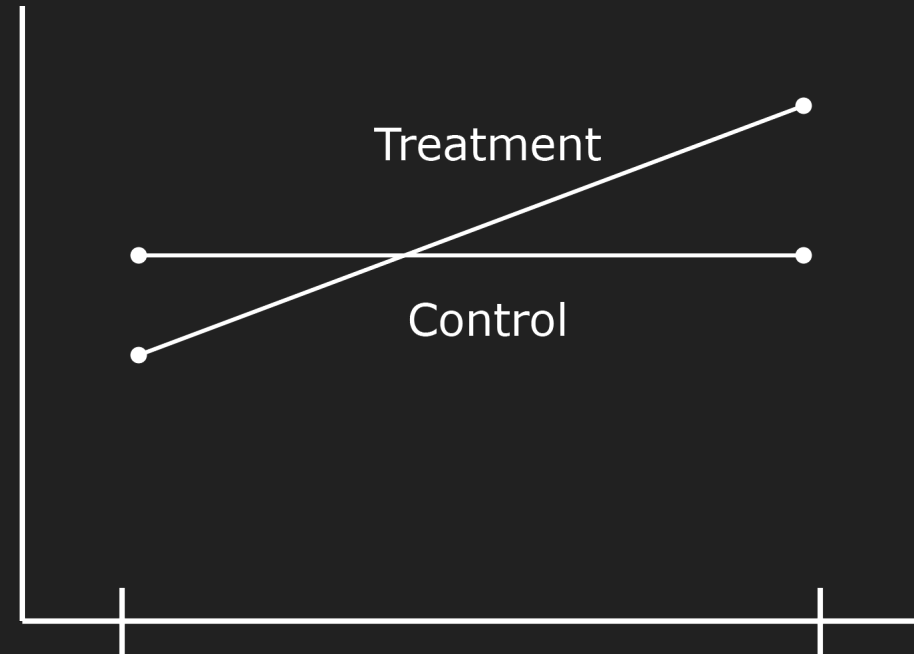


Outcome Pattern 5

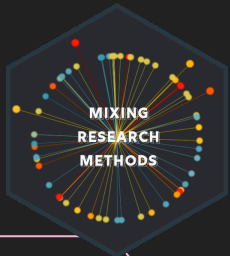


Outcomes that crossover in the direction of relationships

Most amenable to causal interpretation and most threats cannot plausibly explain this pattern



Modeling Selection Bias



Sample matching / Stratified sampling

Pair samples so that the participants share every characteristic except for the one under investigation / Sample specific proportions of individuals from various subpopulations¹ within a larger population

Instrumental variable analysis

Statistical modeling of covariates believed to explain selection biases

Hidden bias analysis

Difference with respect to unmeasured variables/characteristics

Sensitivity analysis

Detect hidden bias that would be needed to explain observed differences

Propensity score analysis

Predict probabilities² of group membership which are then used for matching or as covariate

¹ aka *strata*

² aka *propensities*



Interrupted Time-Series

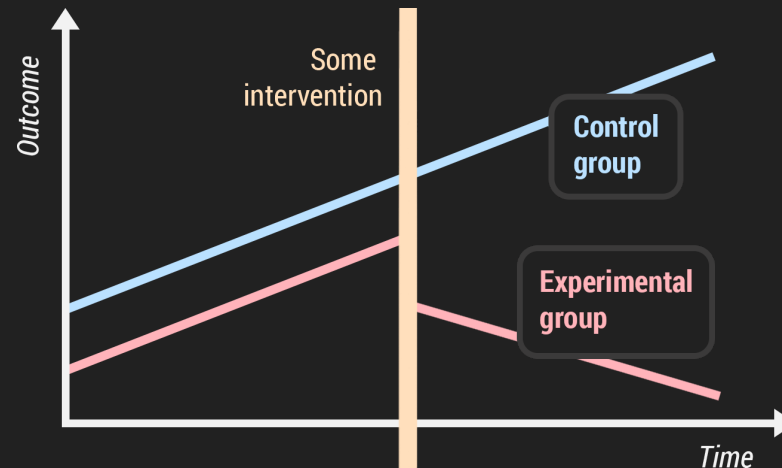
tracking a period before and after an intervention at a known point in time to assess the intervention's effects within a single group/population

Observations can be made over a period

aka a *time series*

An exact point is known where a treatment or intervention occurred

aka an *interruption*



Types of Effects



Form

slope or intercept changes

Permanence

changes from continuous to discontinuous (or visa versa)

Level

changes read as instantaneous or delayed

Autocorrelation



occurs when observation at one point in time depends from observations at another point in time
effects must be modeled and removed from a time-series before assessing treatment impact

Trends

an upwards or downwards shift in a data set over time

Average life expectancy at birth, population of the Earth

Seasonality

observations that coincide with seasonal patterns

sales of ice cream, average global temperature

Cyclicity

data rise and fall, but without a fixed frequency and duration caused

time getting out of bed, traffic congestion

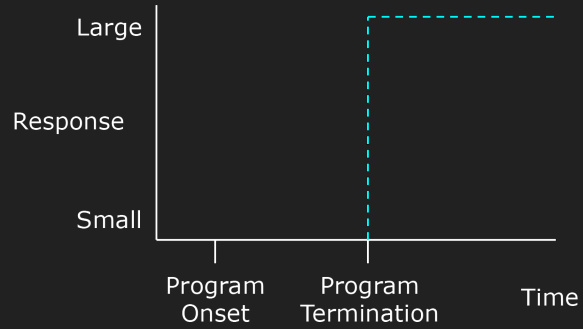
Noise

Random variations

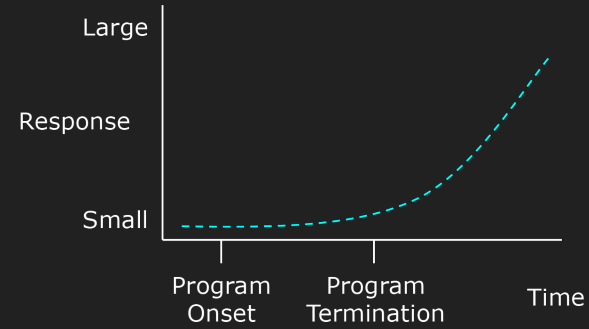
level of wellbeing dependent on prior rest, sneezing incessantly



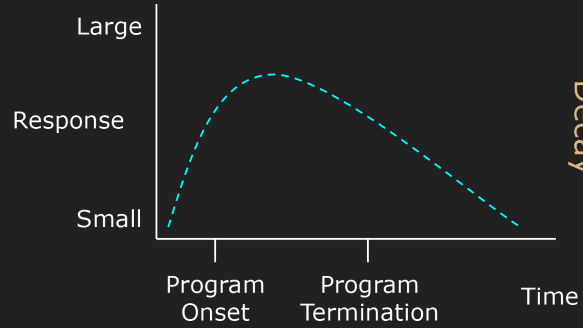
Immediate Effect,
No Decay



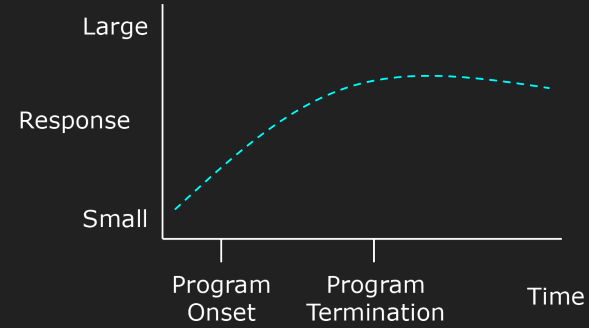
Delayed Effect



Immediate Effect,
Rapid Decay



Early Effect, Slow
Decay

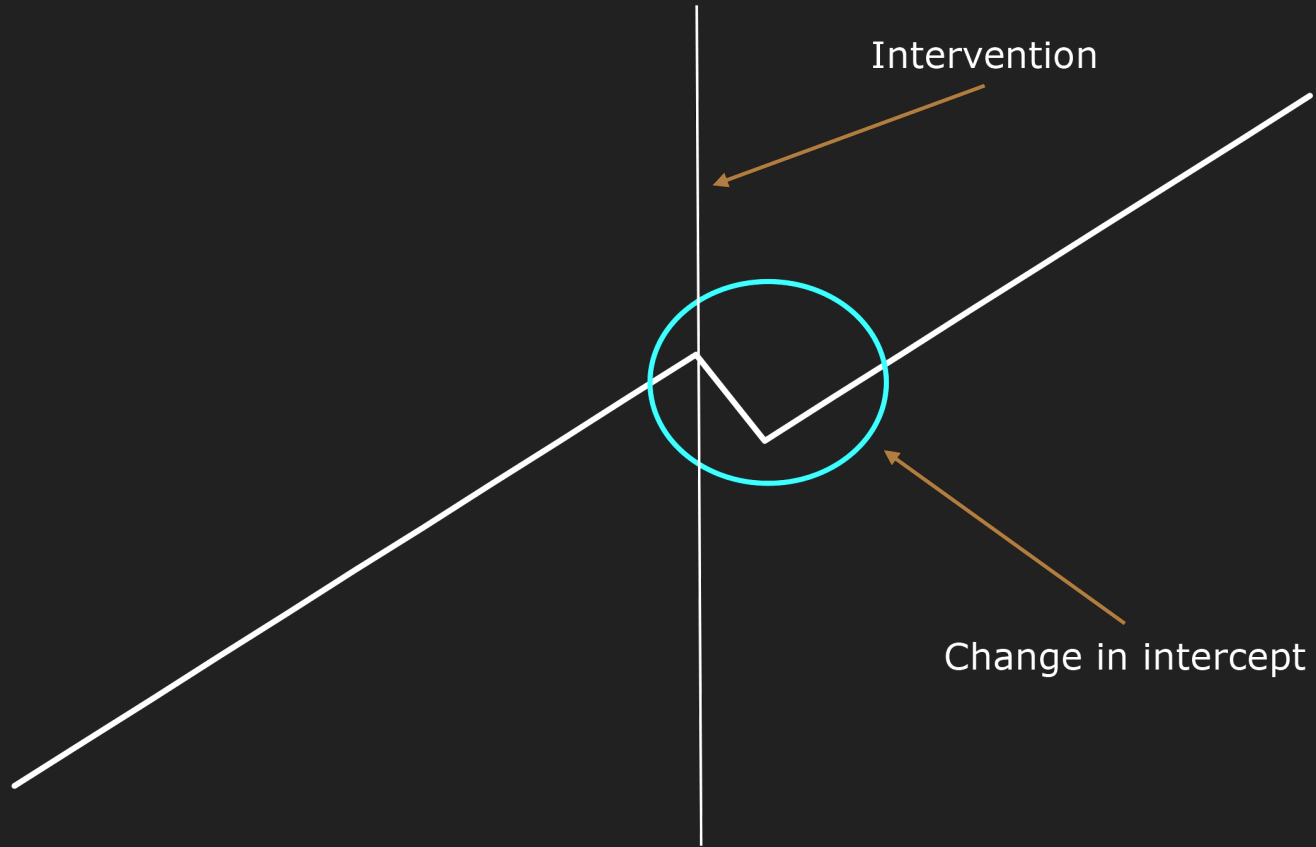


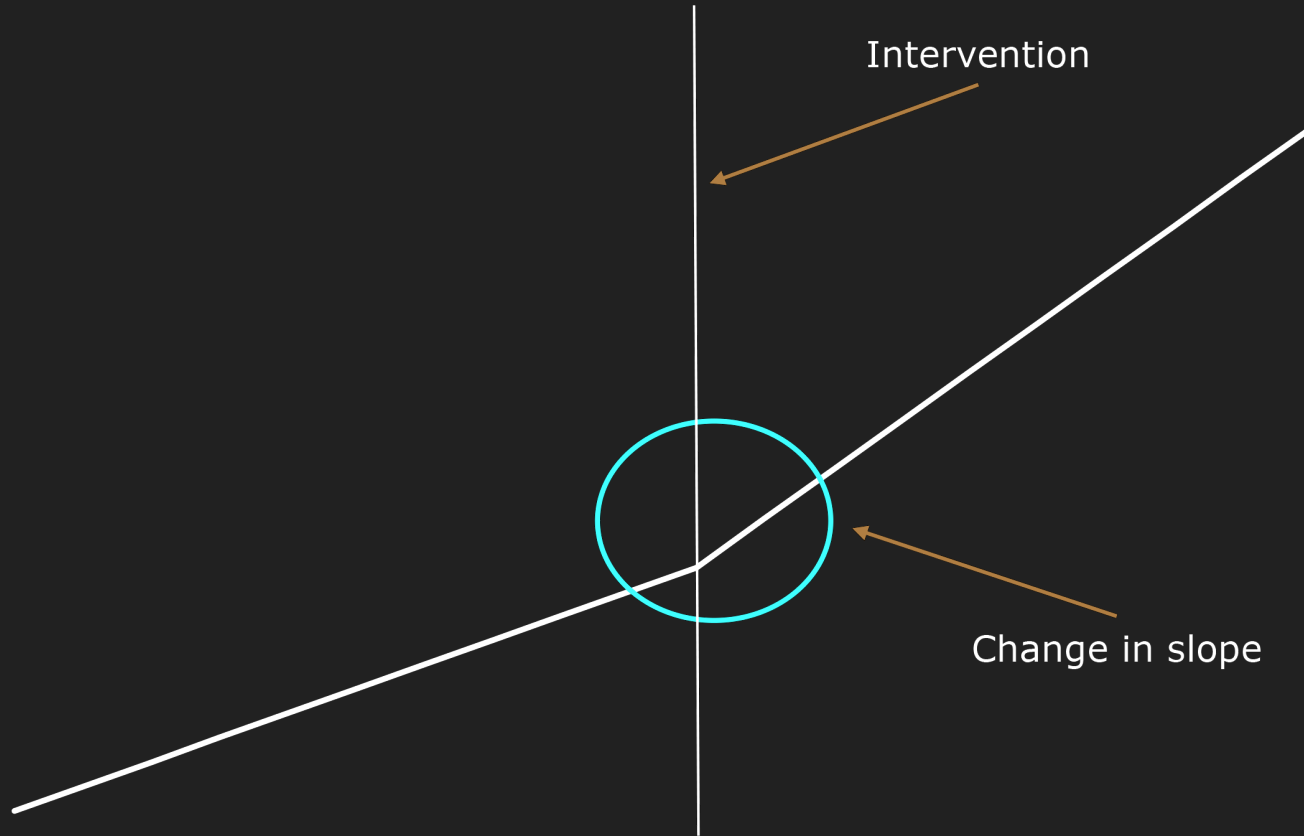


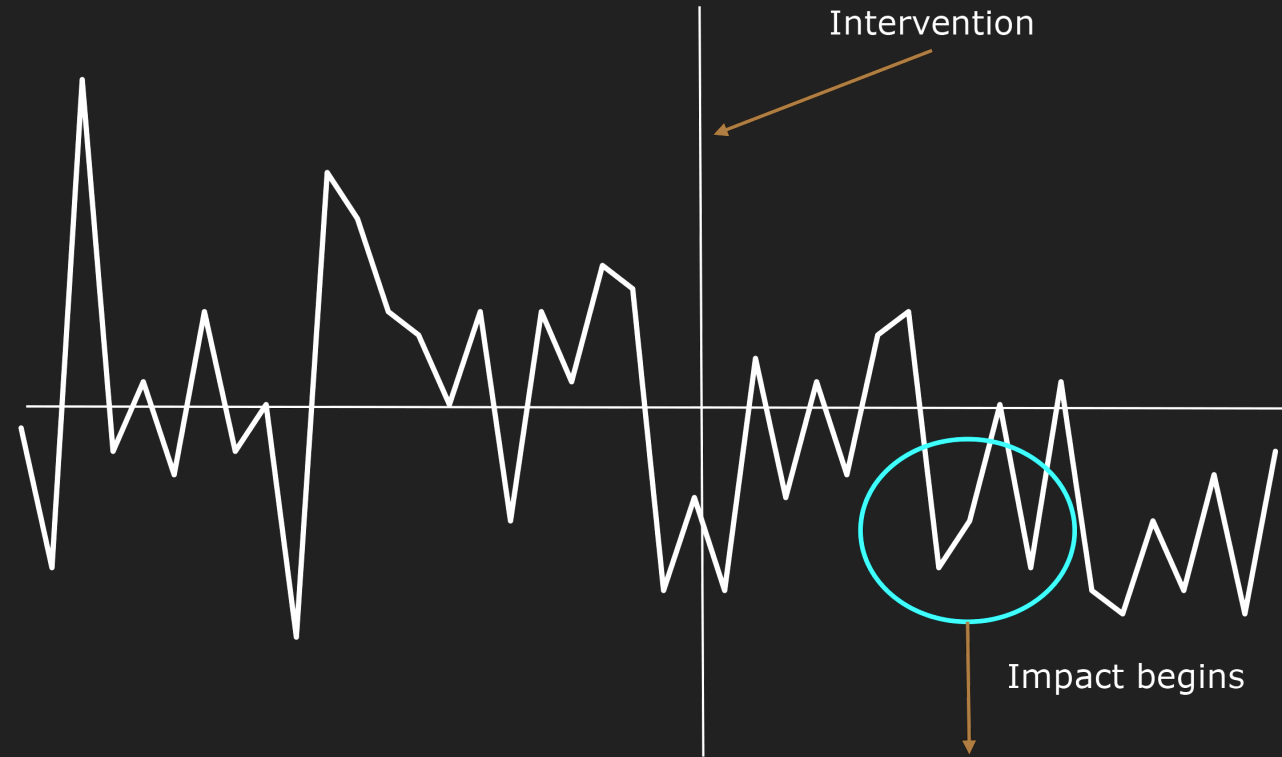
O_1 O_2 O_3 O_4 O_5 X O_6 O_7 O_8 O_9 O_{10}

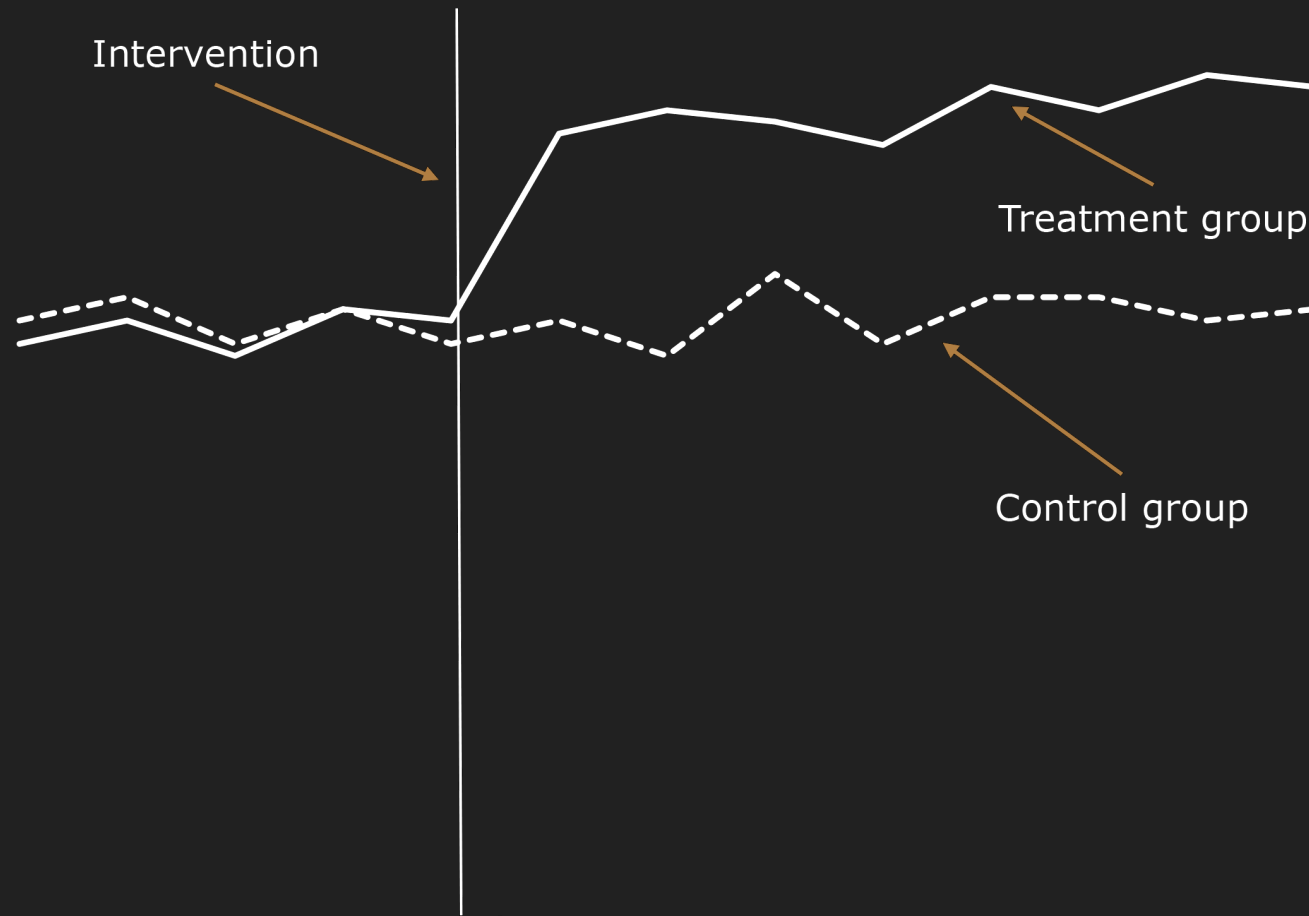
Pretest → Pretest → Pretest → Pretest → Pretest → Treatment → Posttest → Posttest → Posttest → Posttest → Posttest

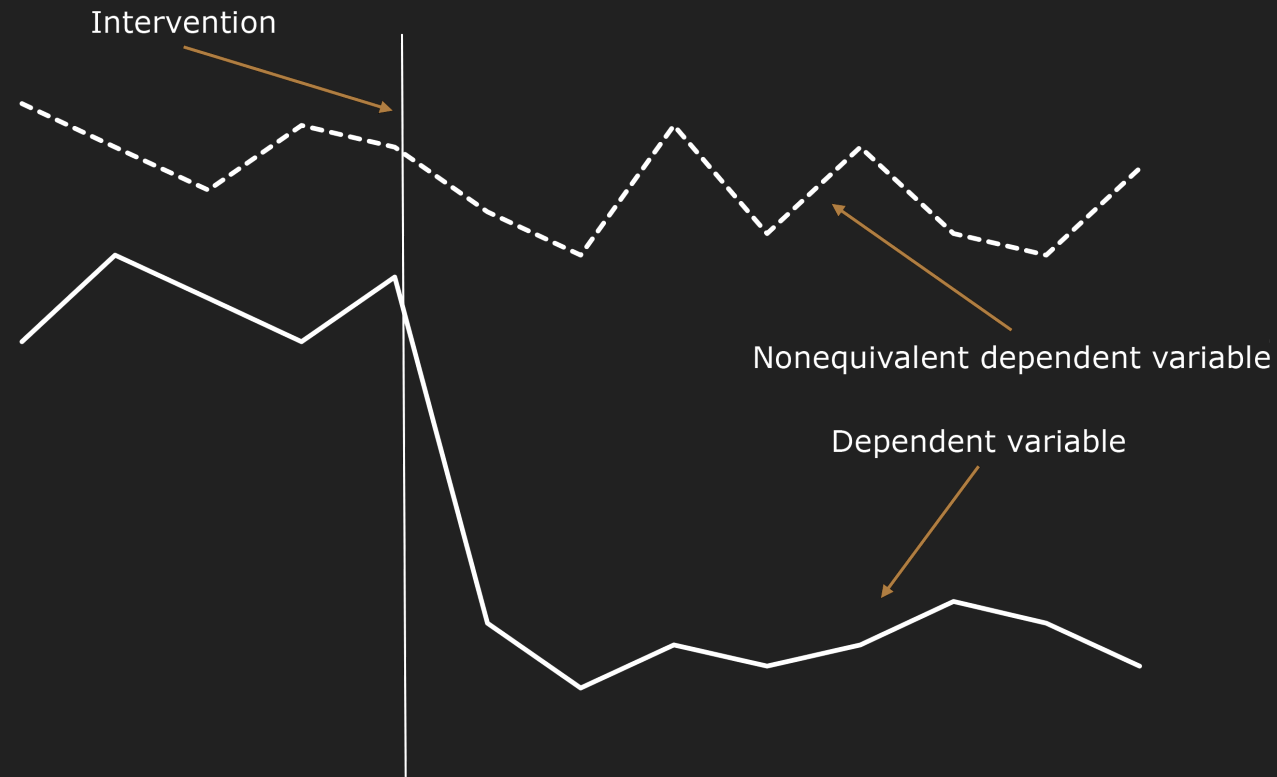
- The basic interrupted time-series design requires one treatment group with many observations before and after a treatment

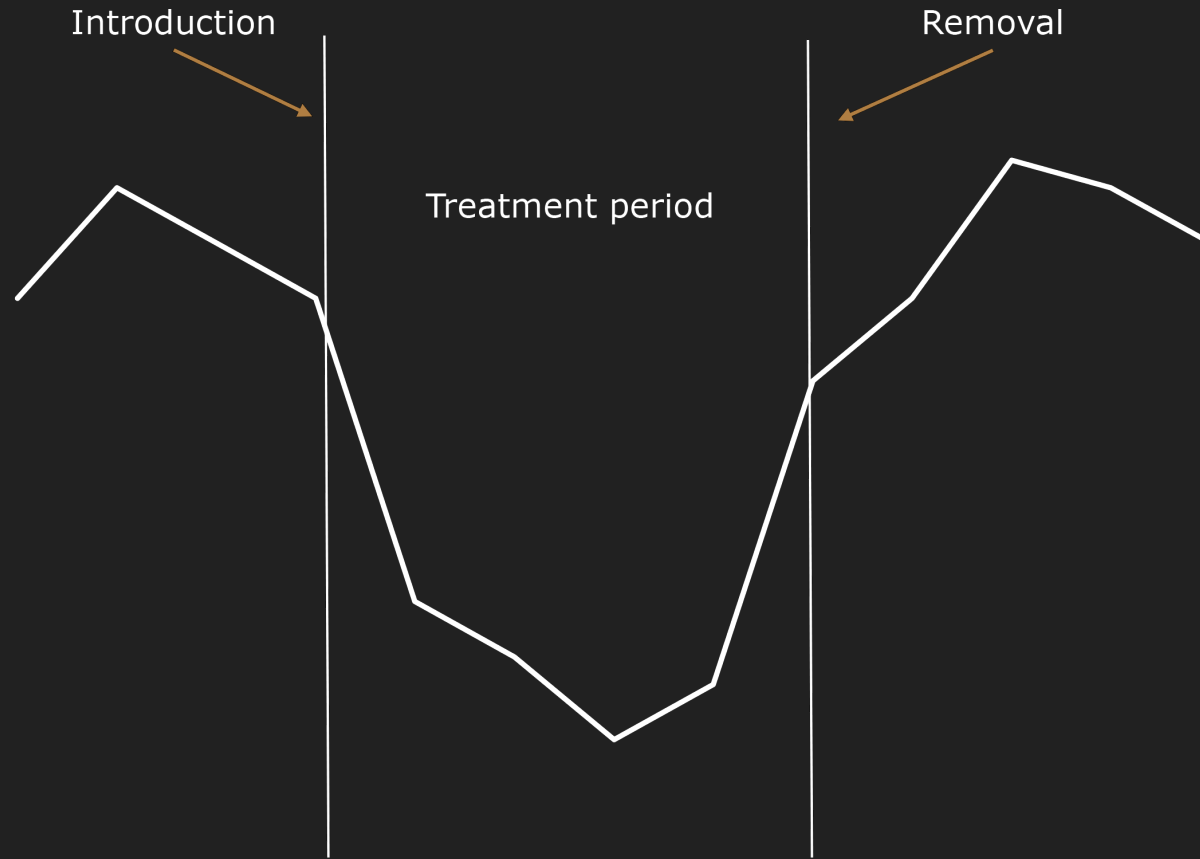












Part II: Mixed Methods Evaluations



Branches



Methods

emphasis on the use of research methods in the form of techniques used to conduct the evaluations

Use

emphasis on utility

Values

emphasis on an evaluand

Social Justice

emphasis on marginalized groups in society and their advocates, the need to explicitly address issues of power, and the design of evaluations to create change

Methods Branch

- quantitatively driven mixed methods designs
- priority on the use of randomized controlled trials



Use Branch



- prioritize the need to assist key program stakeholders in program decision making
- concerned for the ways in which evaluation information will be used and focus specifically on those who will use the information

Values Branch

- values and subjective meaning
- values with a secondary concern for methods



Social Justice Branch

- addresses issues of power
- design of evaluations to support social transformation



Task



In groups of two or three, design a mixed methods evaluation study with a QED to address the efficacy of a drug of your choice. First review the content from Chapters 1 and 2 in Mertens (2017). Then be ready to present a multi page slideshow addressing the following criteria

your research question

the type of mixed methods evaluation

how the study addresses for any deficiencies with your chosen QED

a context specific picture of both the study and specific QED, respectively

any additional information that should help us to understand the overall narrative

That's It!

Any questions?



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