

Design and Analysis Challenges With Multilevel Implementation Data -- Part 2

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Randomizing Sites vs Therapists

3 Main issues

1. Inferential

2. Practical

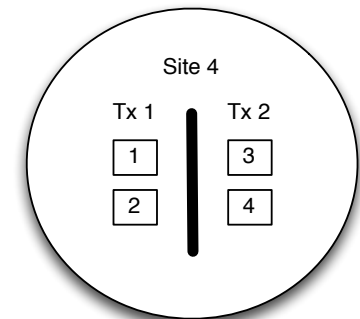
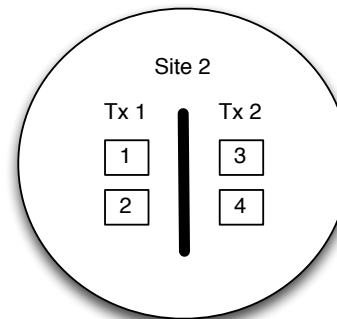
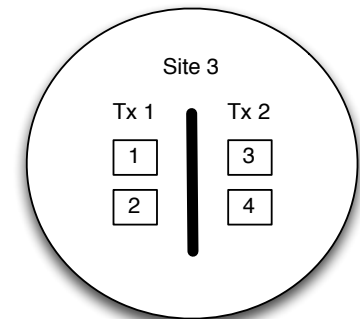
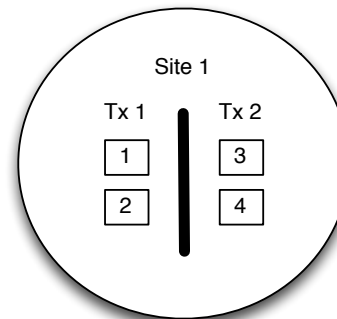
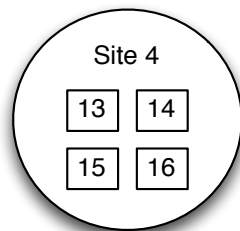
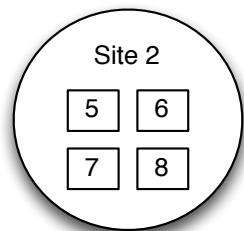
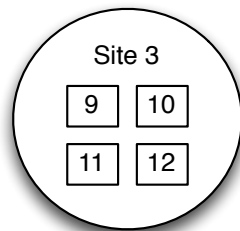
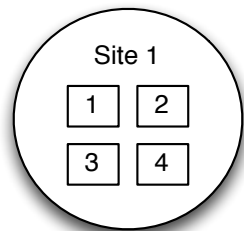
3. Statistical

Inferential Issues

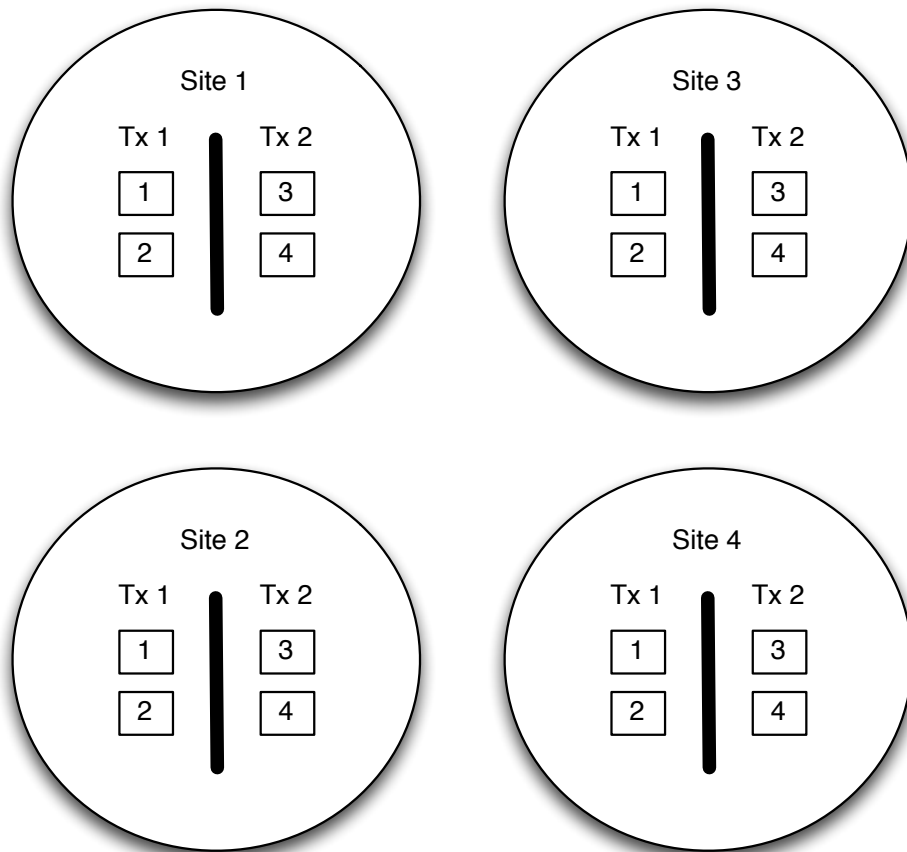
Nested versus Crossed

Treatment 1

Treatment 2

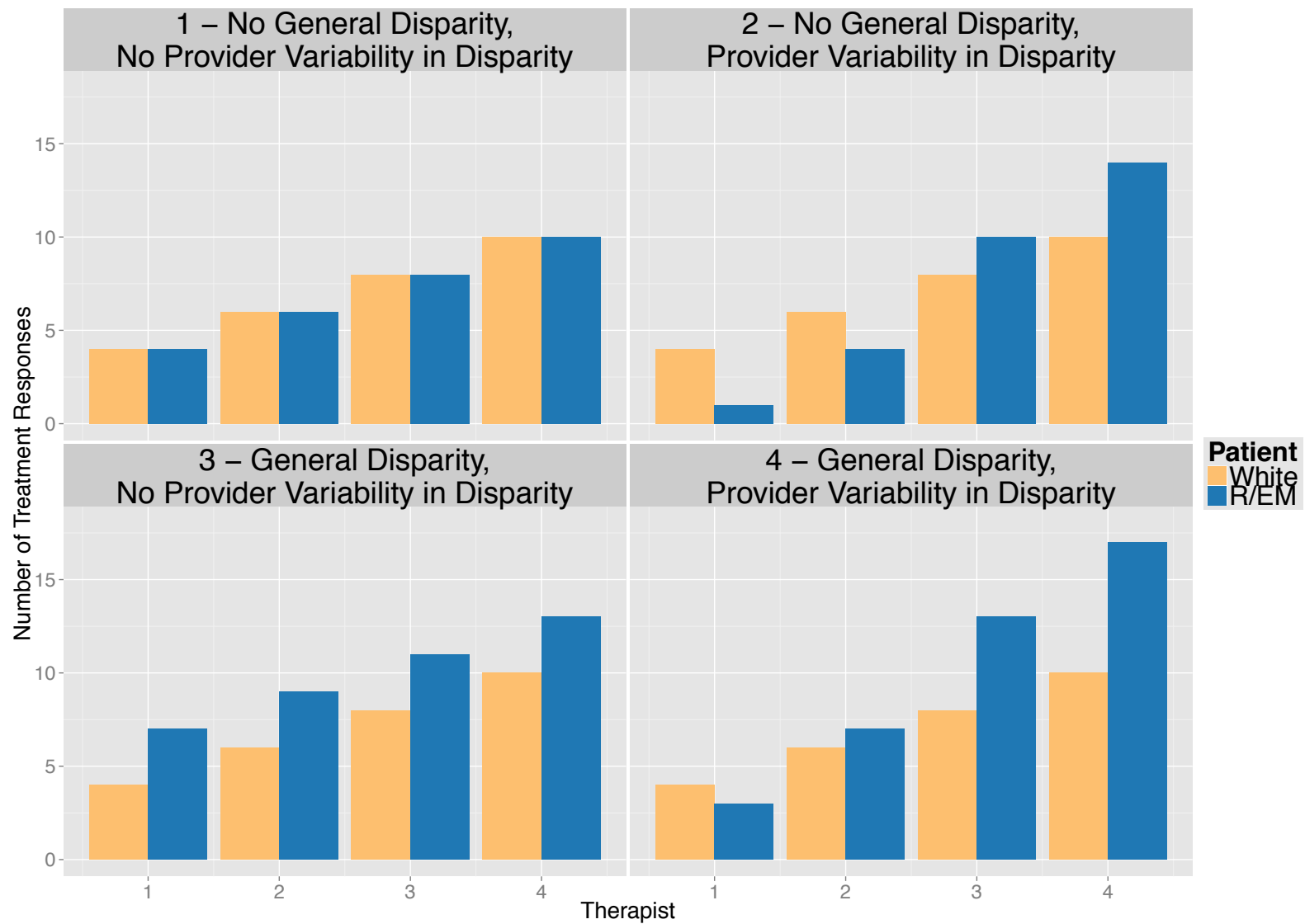


Inferential Issues



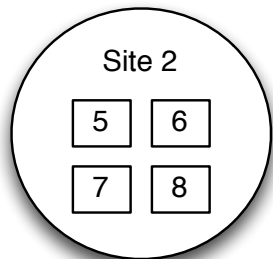
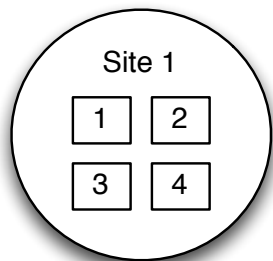
- Advantages of Crossed Design
 - Separate Site Effects from Treatment Effects
 - Site x Treatment interaction
- Disadvantages
 - Not all sites are well equipped
 - Resource intensive

Interactions in Crossed Designs

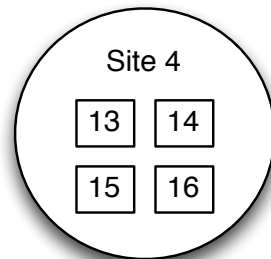
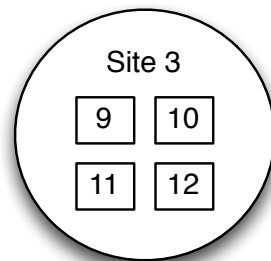


Inferential Issues

Treatment 1



Treatment 2



- Advantages of Nested Design
 - Can recruit sites amenable to a given treatment
 - No worry of cross over problems
- Disadvantages
 - Confounding

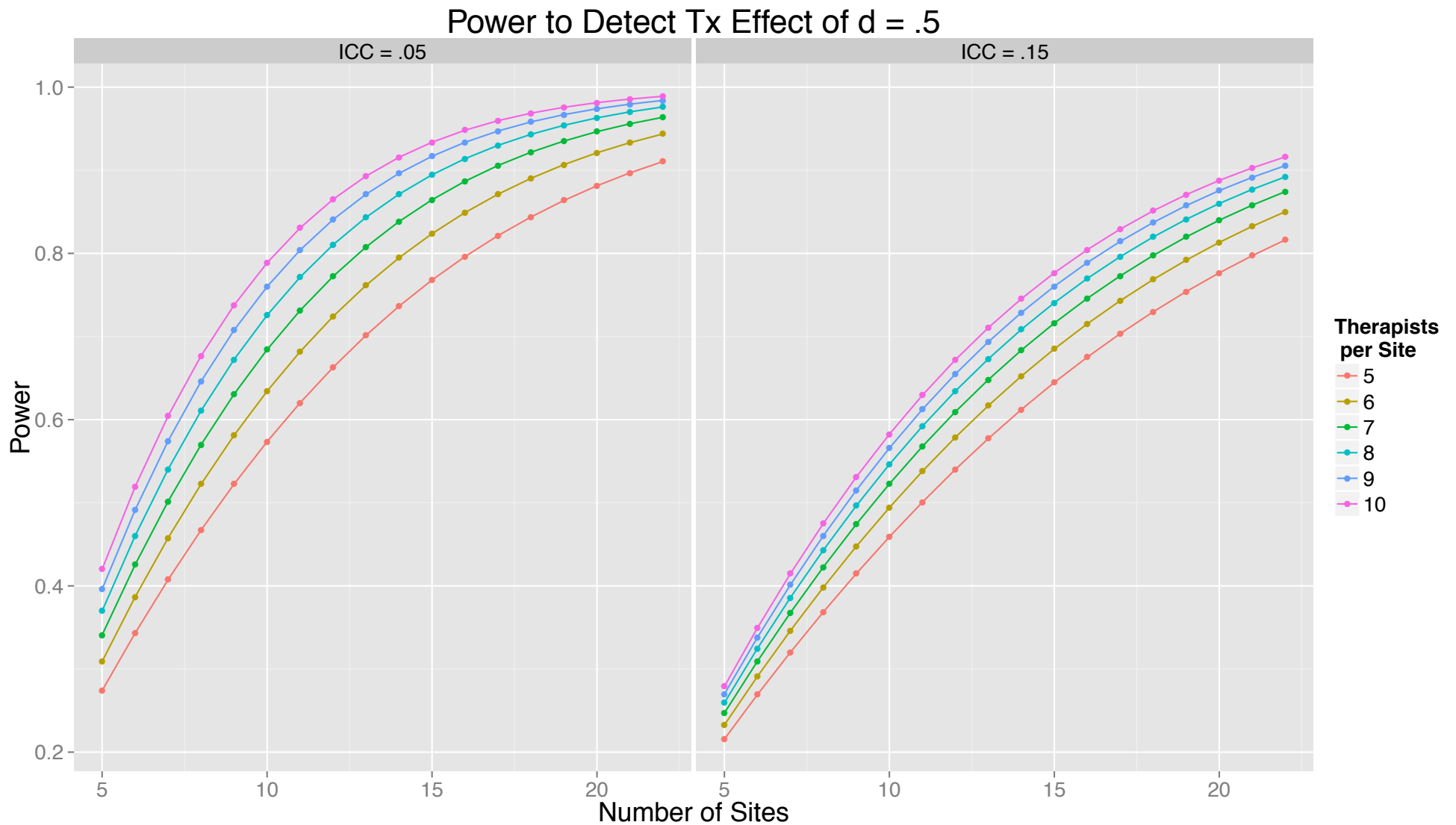
Statistical Issues

- Sites versus Therapists is largely a power issue
- Can fit a model to either design

Statistical Issues

- Assume a nested design
 - Sites deliver only a single treatment
- Options regarding sample size
 - Increase number of sites
 - Increase patients per site

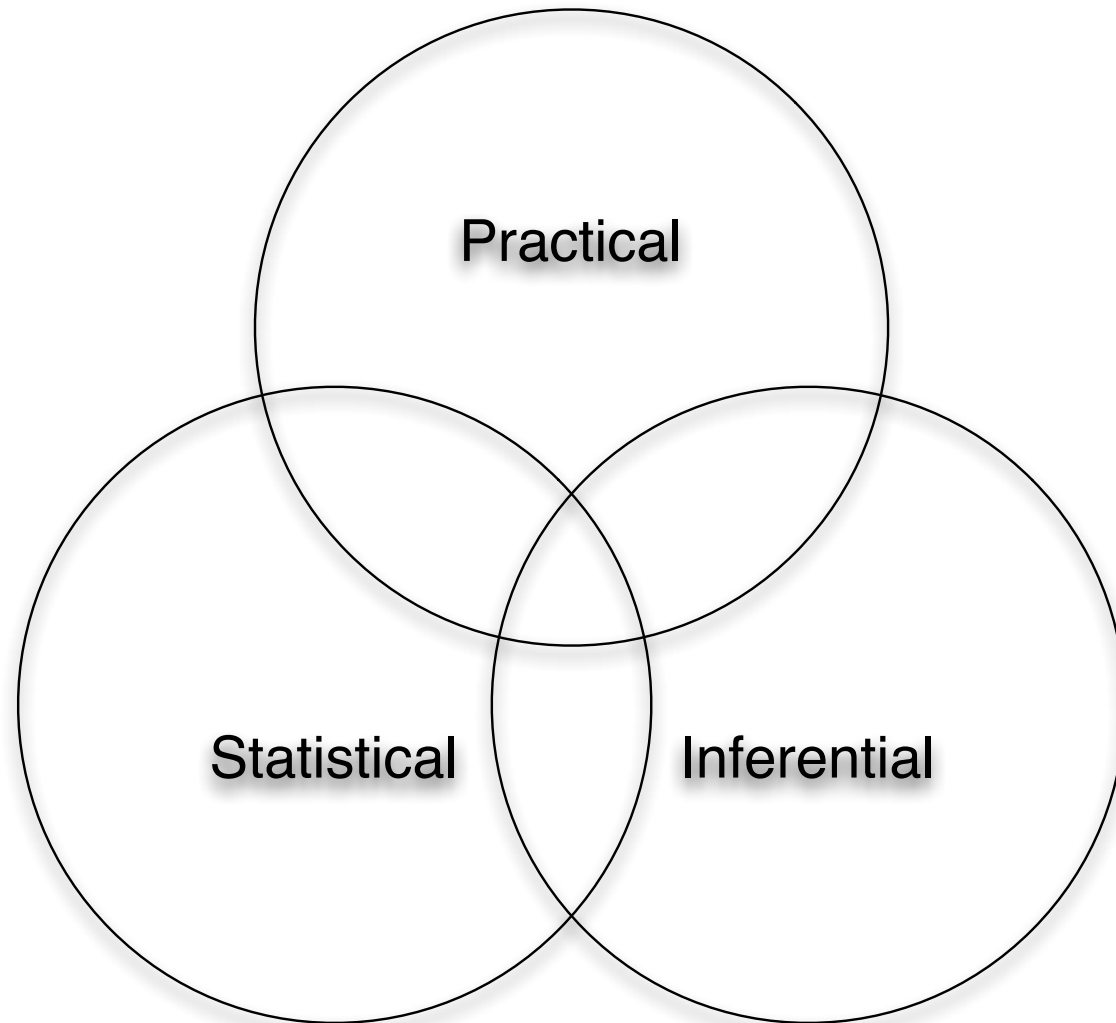
Increasing the Number of Sites Gives Biggest Bump in Power



Practical Issues

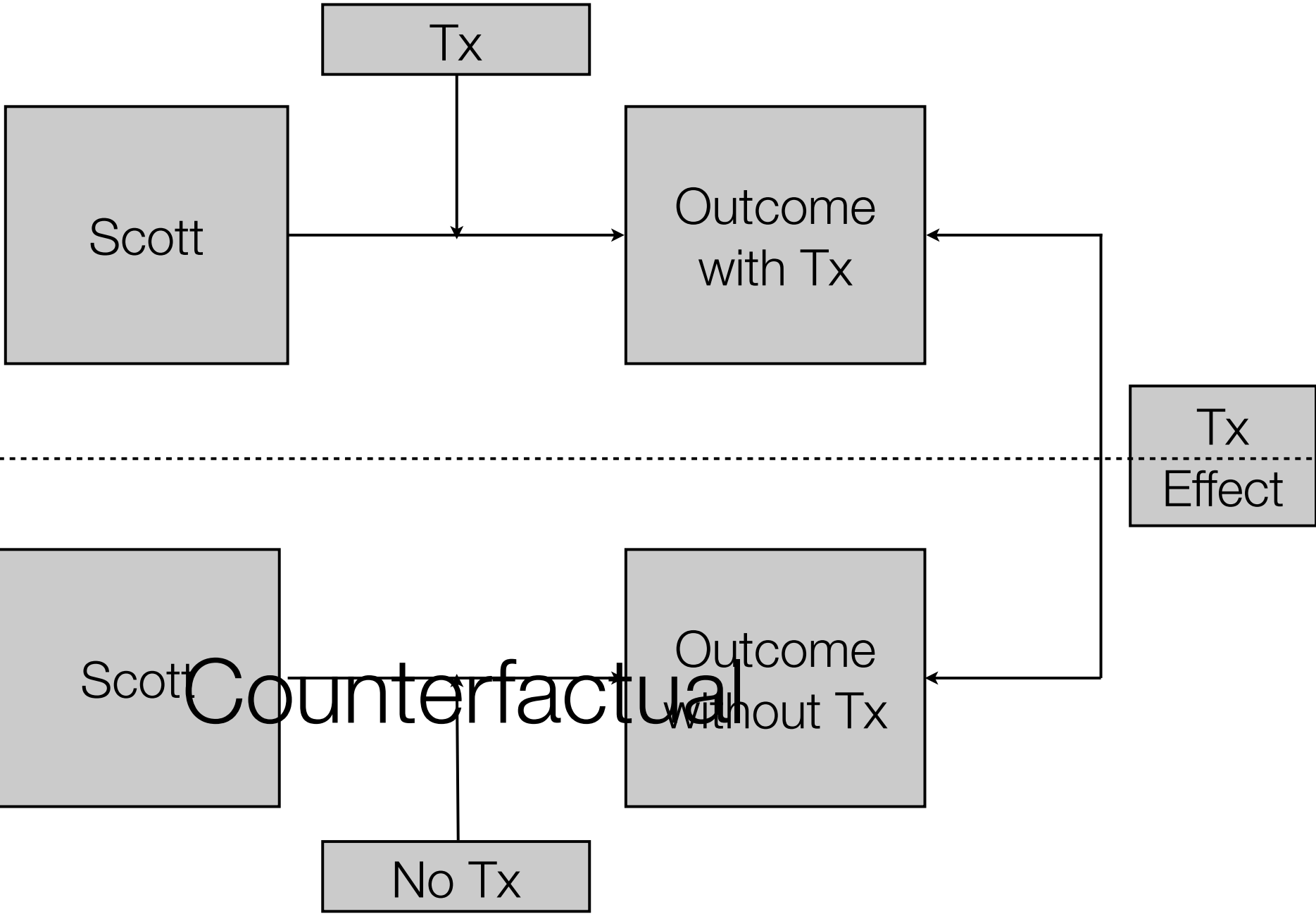
- Resource limits
 - Too costly to add new sites (no other sites available)
 - Too resource intensive to provide training for all treatments at all sites
 - Limited number of therapists who are able/willing to provide a treatment

Summary



Quasi-Experimental Designs

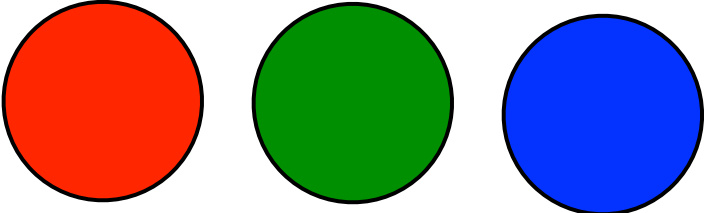
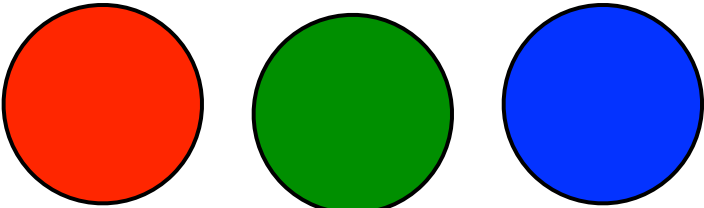
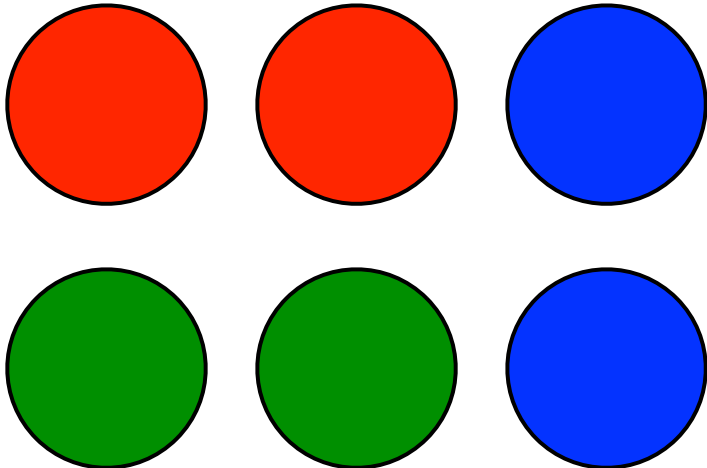
- Counterfactual
- Interrupted Time Series Design
- Regression Discontinuity



What to do? - Approximate the Counterfactual

Randomize

Treatment

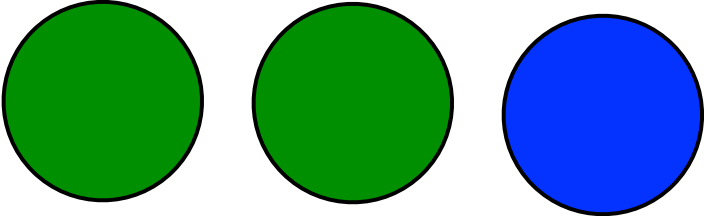
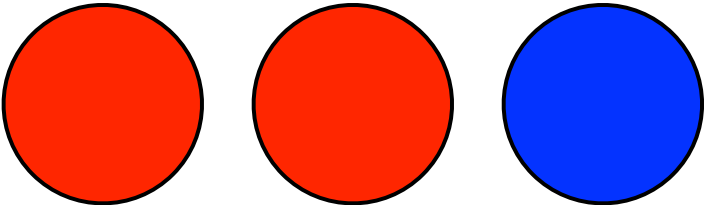
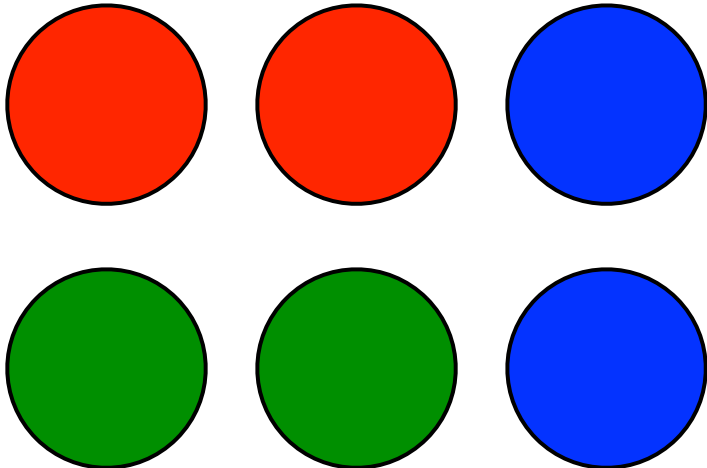


Control

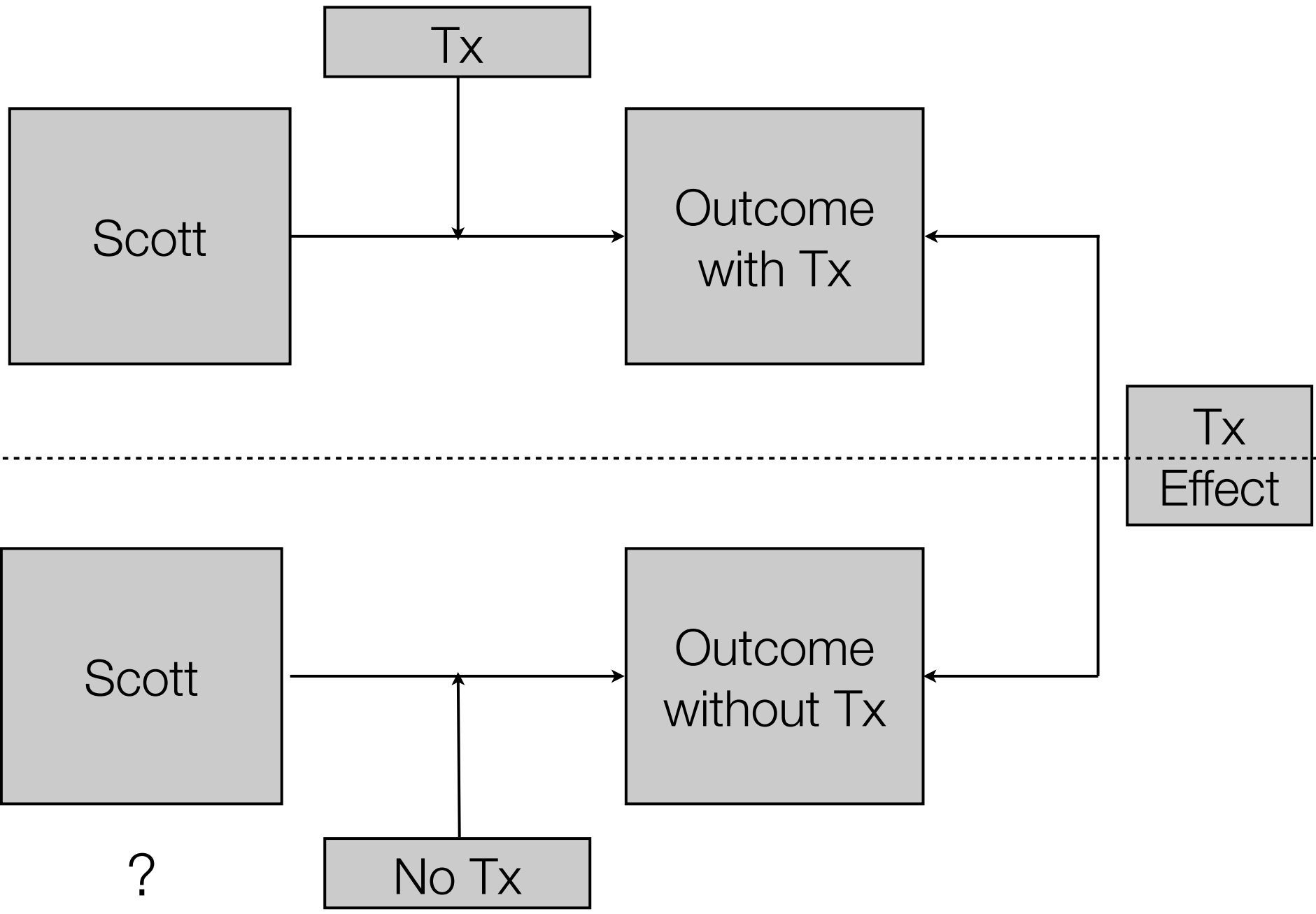
Quasi-experiments

Non-random

Treatment

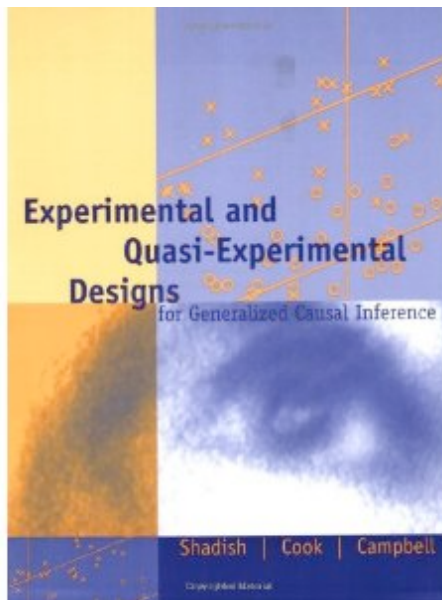


Control



Dealing with Threats to Validity

- 1. Identify and study plausible threats**
- 2. Control for threats via design elements**



Shadish, Cook, & Campbell: Experimental and quasi-experimental designs for generalized causal inference

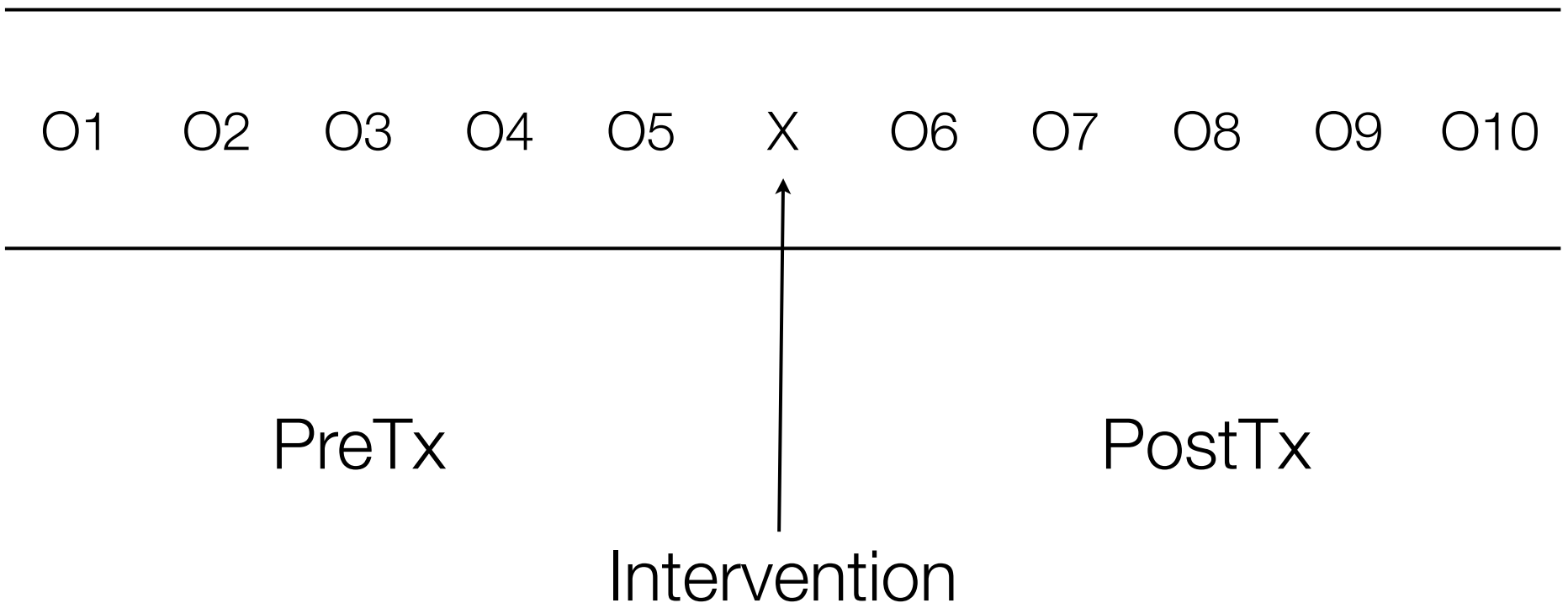
Dissemination

Family Therapy for Delinquency

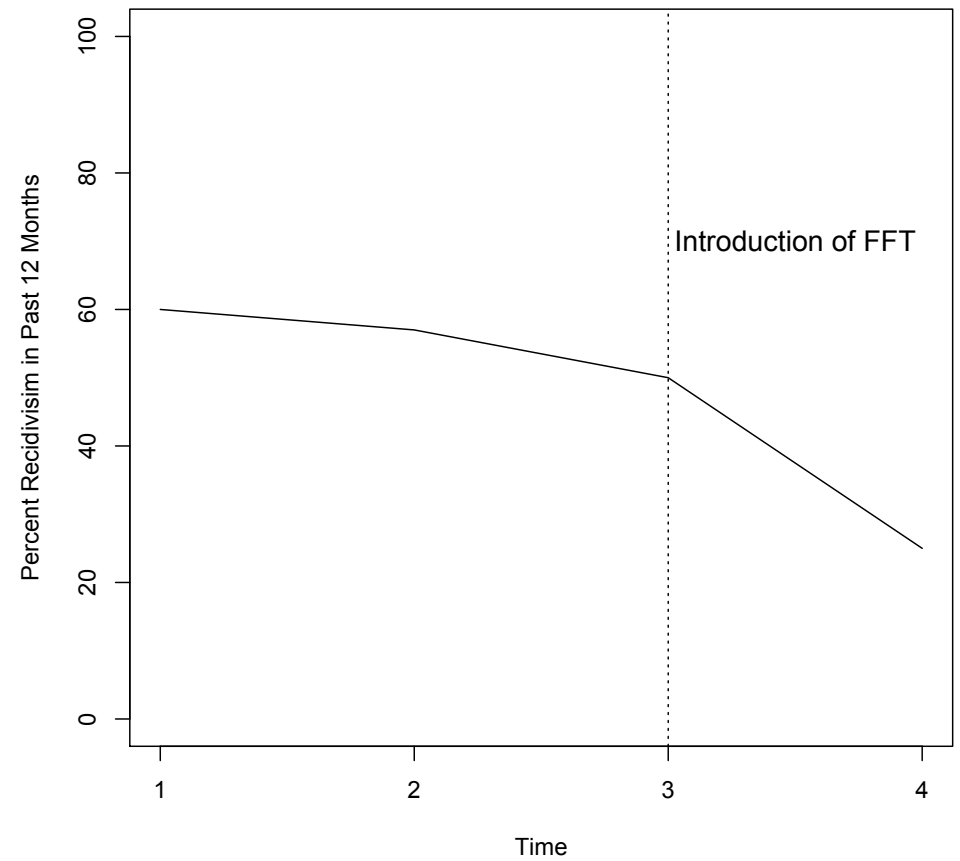
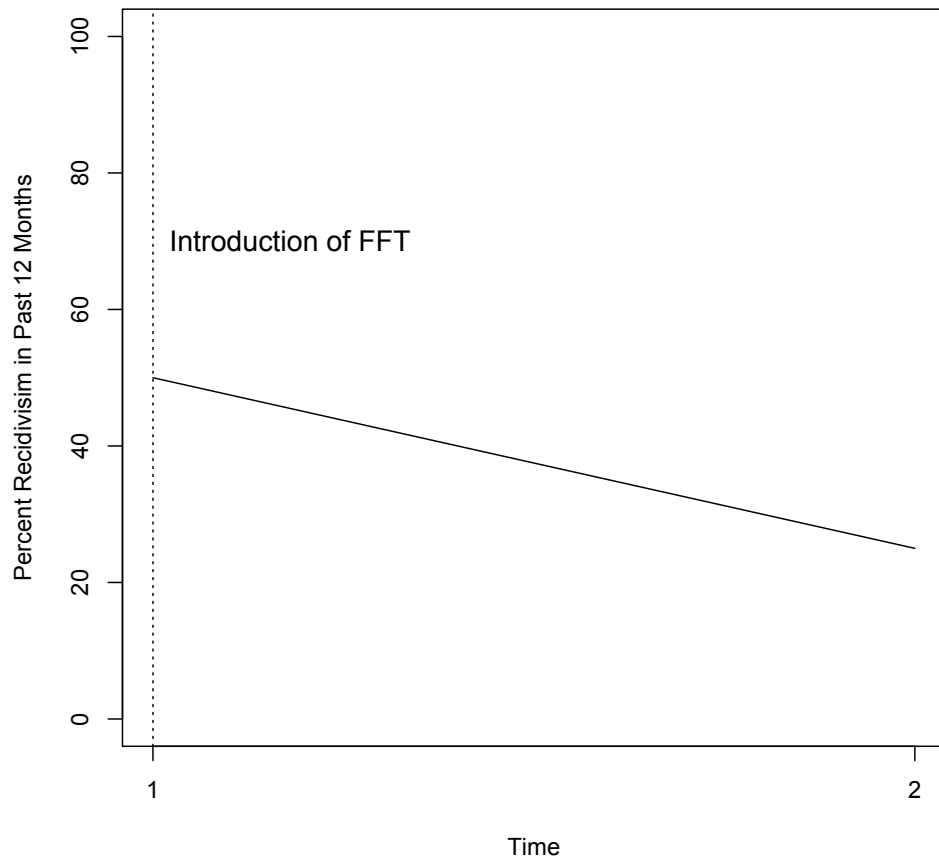
- Suppose you want to implement FFT for delinquency
- Court ordered (highly delinquent)
- Threat to Validity
 - Regression to Mean
 - Maturation

Interrupted Time Series Designs

- Do repeated observations change following the introduction of an intervention?
 - Sudden change or change in trend



Design Element -- Additional Measurements



Interrupted Time Series

- Can add a control condition

O1	O2	O3	O4	O5	X	O6	O7	O8	O9	O10
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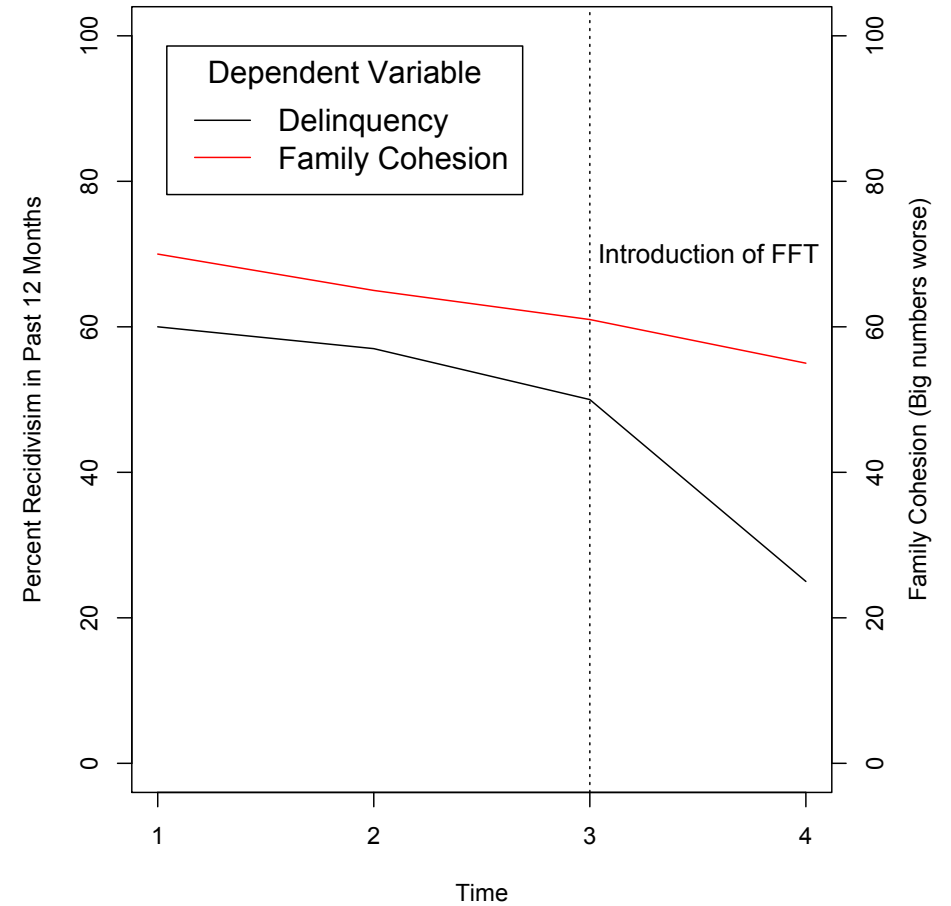
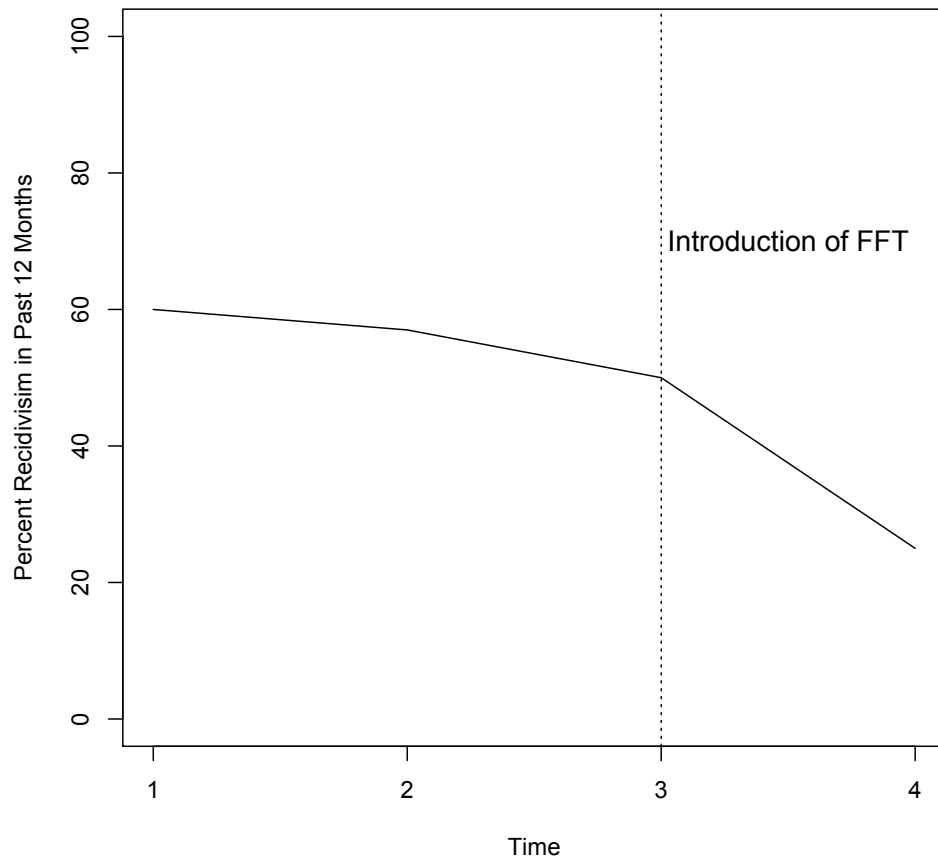
O1	O2	O3	O4	O5		O6	O7	O8	O9	O10
----	----	----	----	----	--	----	----	----	----	-----

Interrupted Time Series

- Add a non-equivalent Dependent Variable

O1	O2	O3	O4	O5	X	O6	O7	O8	O9	O10
O1*	O2*	O3*	O4*	O5*	X	O6*	O7*	O8*	O9*	O10*

Design Element -- Non-equivalent DV

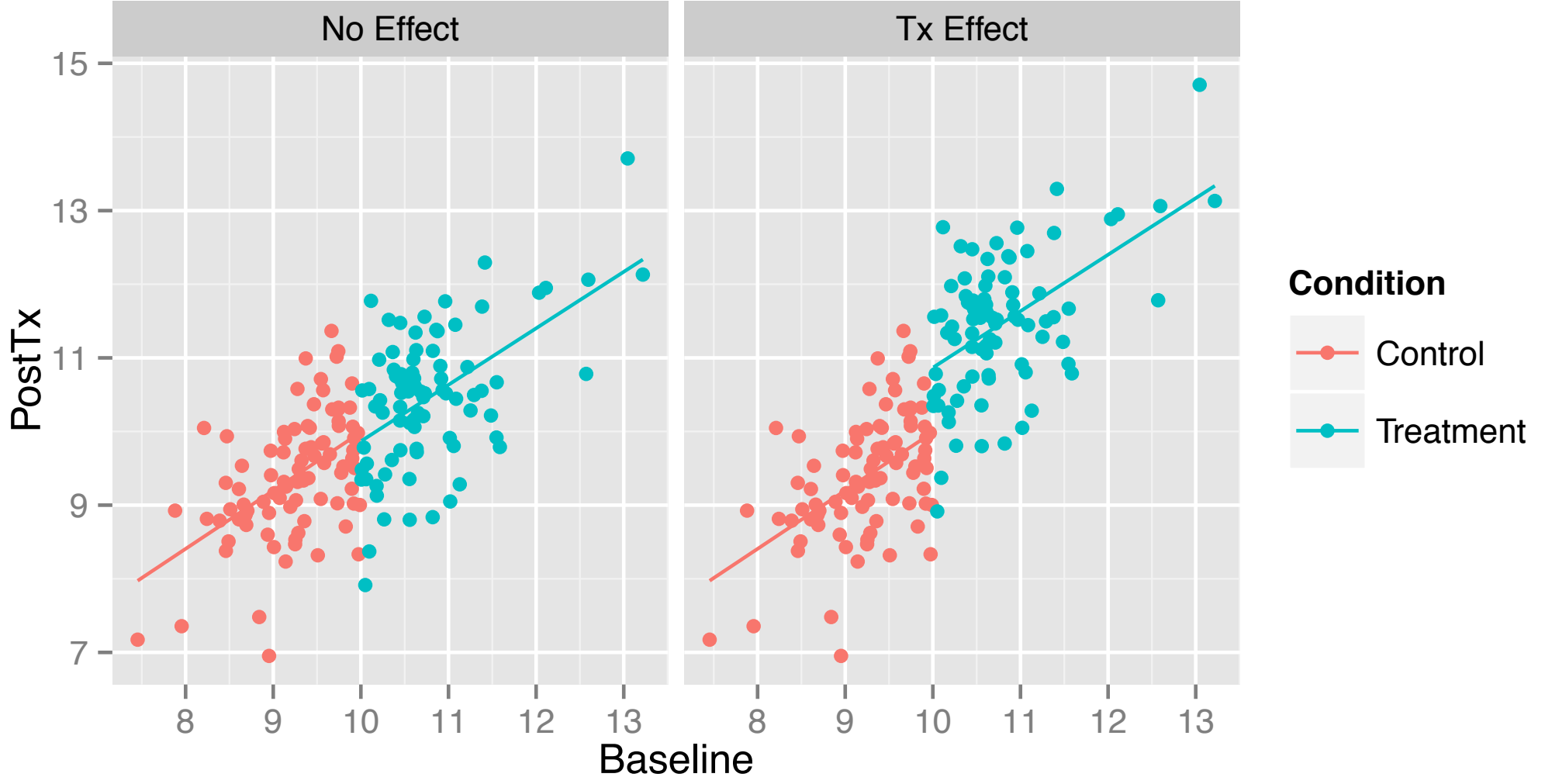


Interrupted Time Series

- Other alternatives
 - Remove Tx at a known time
 - Add and withdraw Tx
 - Give Tx to Control later on

Regression Discontinuity

- Assignment to Treatment or Control (or Alternative Treatment) based on a cut-off score
- Examine whether the regression of post-treatment value on the cut-off is discontinuous -- at the cut-off value



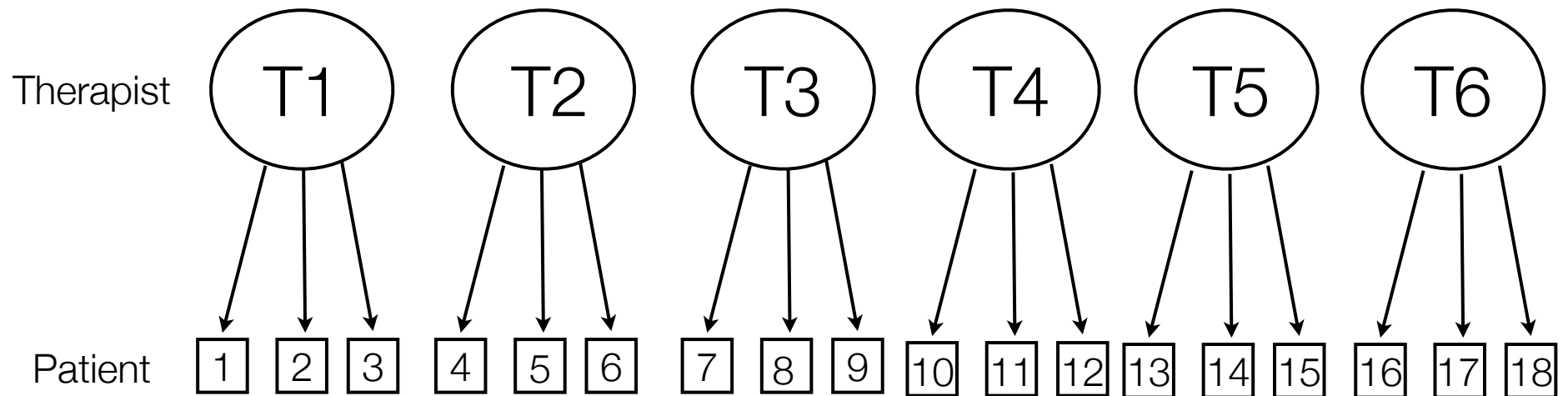
Regression Discontinuity

- Assignment based on cut-off has to be strict
- Need to know the relationship between assignment variable and outcome
 - outcome at pre-tx is often a good choice -- linear relationship

Psychometric Issues and Fidelity Assessments

Between-Within

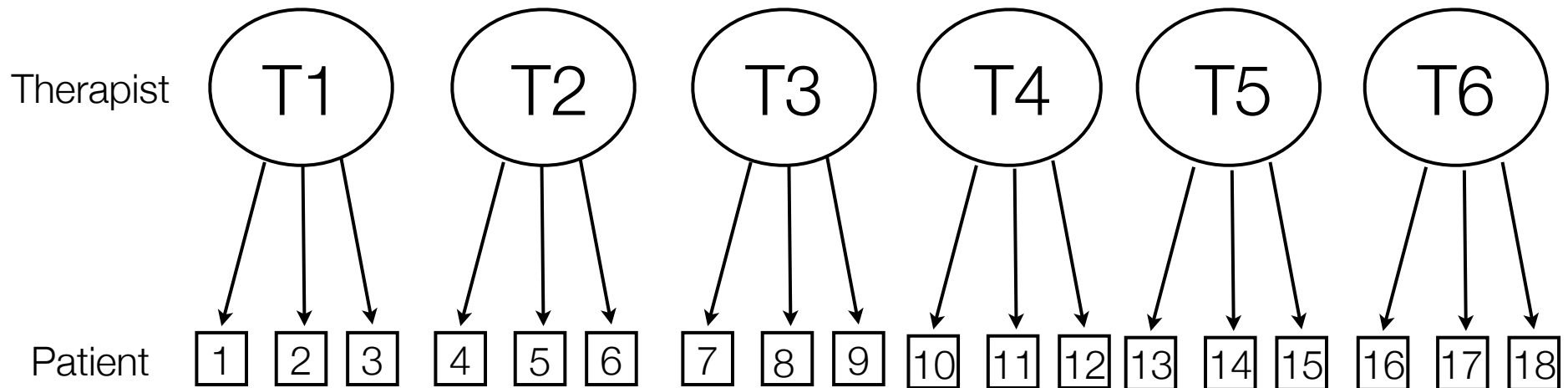
- Nested Data Are Interesting



- Fidelity? Therapist-level or Patient-level (or site-level)
- Fidelity? Between or Within Therapists?

Reliability/Dependability

$$\text{Reliability}_t = \frac{\tau^2}{\tau^2 + \frac{\sigma^2}{m}}$$

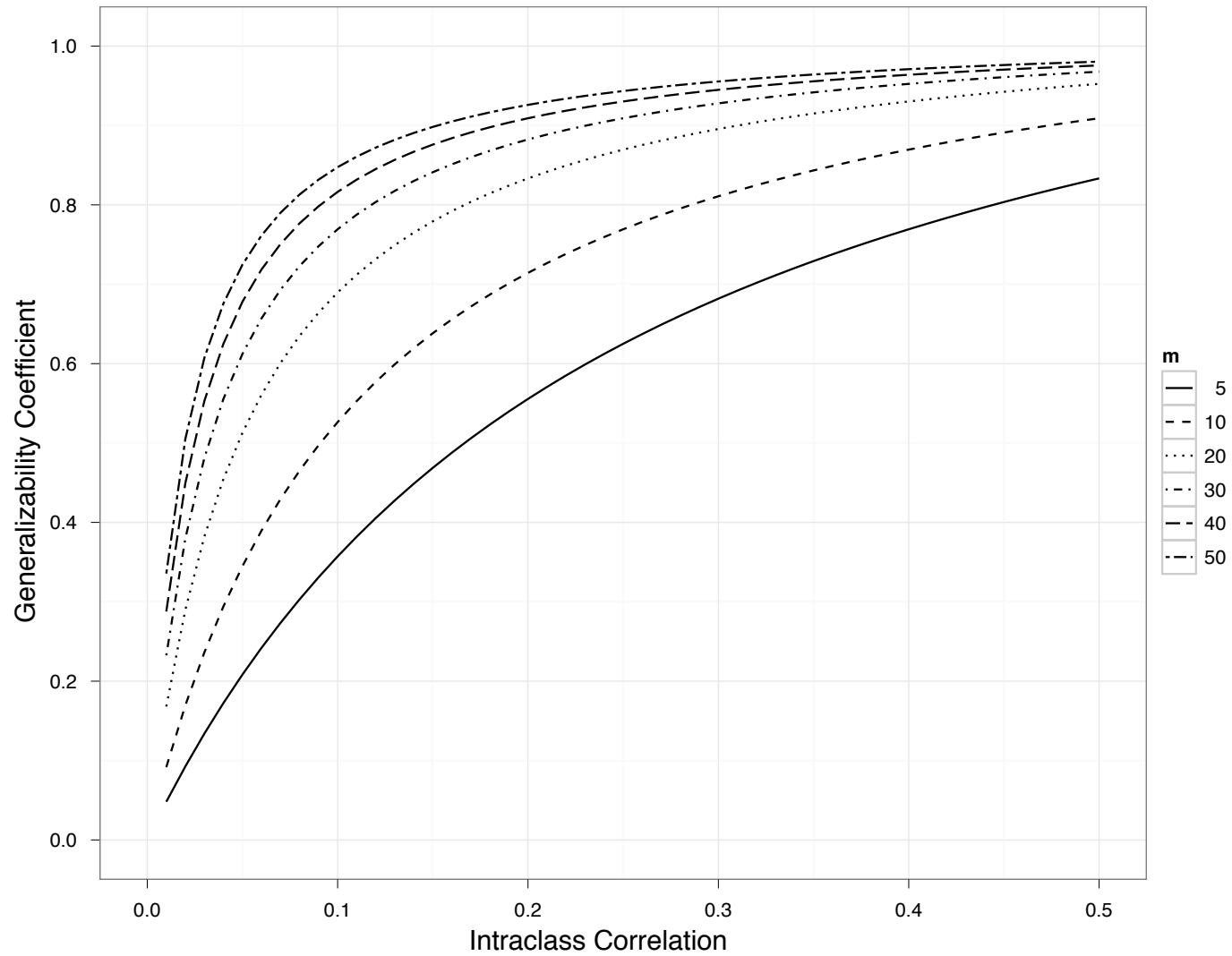


Reliability

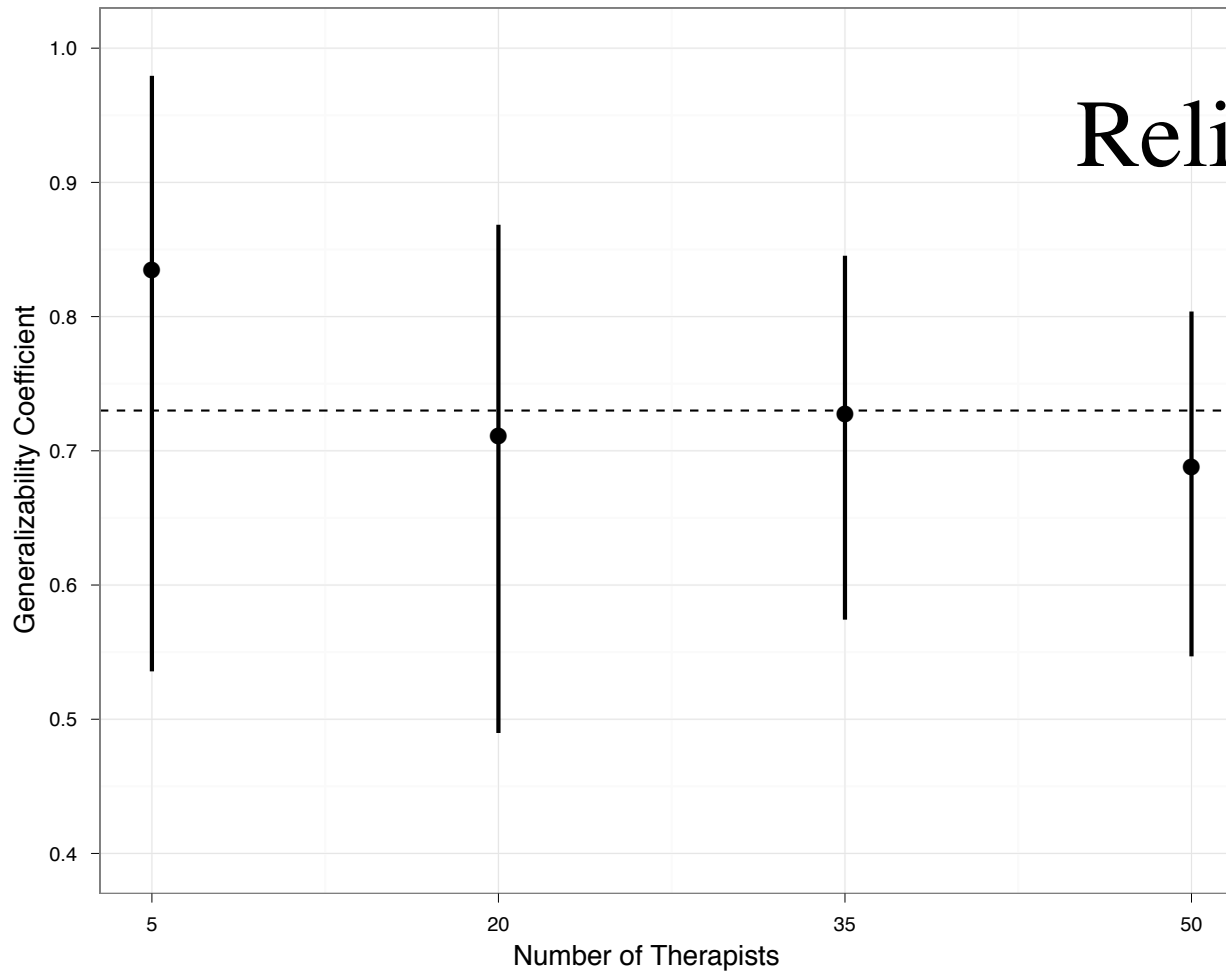
$$\text{Reliability}_t = \frac{\tau^2}{\tau^2 + \frac{\sigma^2}{m}} \quad \rho_t = \frac{\tau^2}{\tau^2 + \sigma^2}$$

- How many patients?
- How much do therapists differ?

Reliability



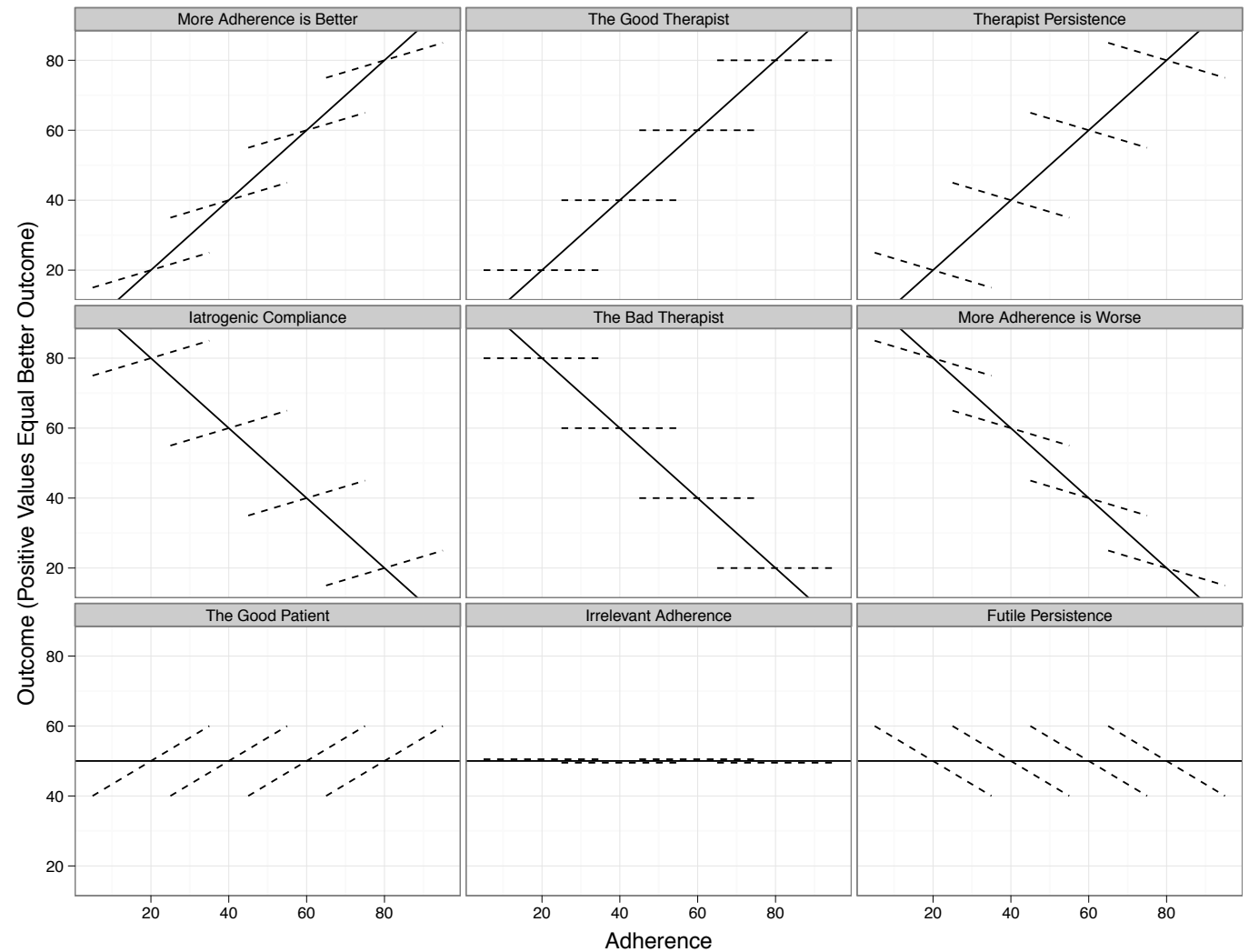
Reliability - Number of therapists?



$$\text{Reliability}_t = \frac{\tau^2}{\tau^2 + \frac{\sigma^2}{m}}$$

Untangling Correlations

- Correlation between Fidelity and Outcome (or any other variable) has 2 parts
 - Between and Within



References

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 - Murray, D. M. (1998). *Design and analysis of group-randomized trials*. New York: Oxford University Press.
 - Baldwin, S. A., Murray, D. M., & Shadish, W. R. (2005). Empirically supported treatments or Type I errors? Problems with the analysis of data from group-administered treatments. *Journal of Consulting and Clinical Psychology, 73*, 924-935.
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Thanks

- Questions or Comments?