Chapter 6 - Causation and Research Design

Cause and Effect

What do we mean by causation?

$$X -> Y$$

$$\text{Cause} -> \text{Effect}$$

Cause and Effect

What do we mean by causation?

A Causal effect is when **variation** in one phenomena (*the independent variable*) leads to **variation** in another phenomena (*the dependent variable*).

Cause and Effect

5 Criteria for Causality

- **Association**
- **Time Order** or **Temporal Relationships**
- **Non-spuriousness** or **Controlling for Confounders**

- **Mechanism**
- **Context**

Why Experiments?

Let's make sure we understand the difference between some concepts

Let's check out some visual applications and clarify some concepts!

Random sampling is different than **random assignment**.

But both are important to the **Central Limit Theorem**.

Why Experiments?

Back to Causality

We use experiments because they are the most powerful design for causal hypothesis testing.

True experiments have 3 features!

- Two or more comparison groups
- Random Assignment
- Assessment of change in Y *after* X (experimental condition) has been applied

Why Experiments?

Let's run an experiment!

Does prison classification affect inmate behavior?

(images: Wikipedia & Wall Street Journal)

Why Experiments?

Field Experiments

Check out Pager (2003)

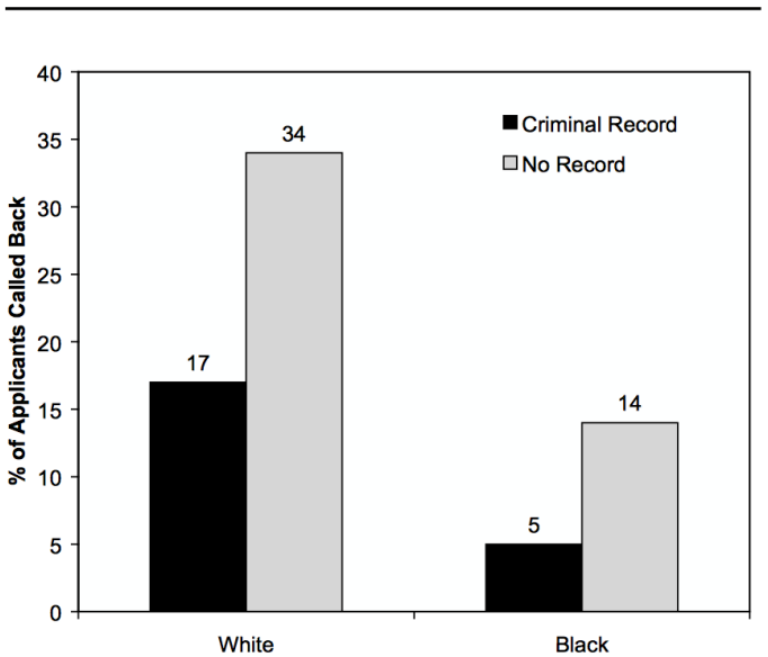


Figure 2. The effect of a criminal record in the Milwaukee audit sample.

(image: the Sociologist)

Recap

- **Cause-> Effect**
- **5 Criteria for Causality**
- **Why do use experimental design?**
- **What is the difference between random assignment and random sampling?**

What if a True Experiment isn't Possible?

Quasi-Experimental Designs

Non-equivalent Control Group Designs

1.) Individual Matching

2.) Aggregate Matching

What if a True Experiment isn't Possible?

Quasi-Experimental Designs

Case Study: The Effectiveness of Drug Courts

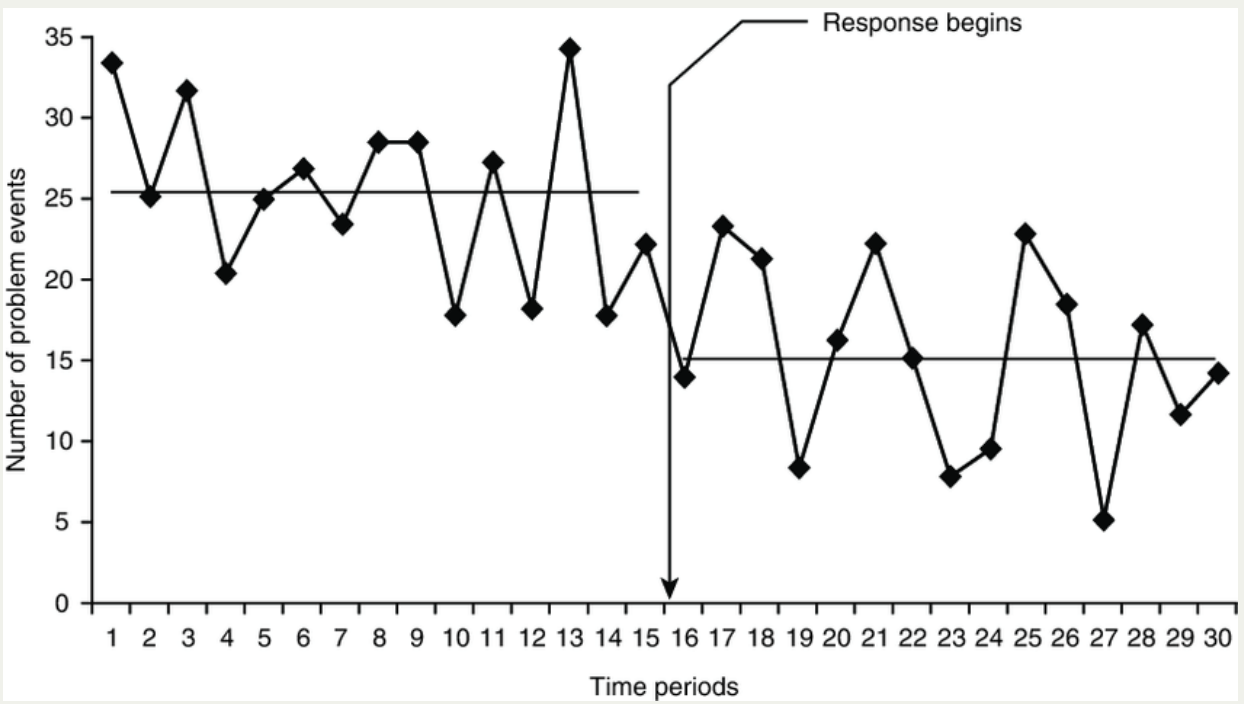
What if a True Experiment isn't Possible?

Before and After Designs

A design that has a pretest and postest but no comparison group.

What if a True Experiment isn't Possible?

Time Series Designs



(image: researchgate)

Threats to Validity

Causal Validity aka Internal Validity

Threats to Validity

Generalizability

The need for generalizable findings is the "Achilles Heel" of true experimental design.

The trade off for causal validity is:

- **Sample Generalizabilty**
- **Cross-Population Generalizabilty**

Threats to Validity

Interaction of Testing and Treatment

Solution to the external valdity problem - **Solomon four-group design**

Treatment Group A	Pretest	Treatment	Posttest
Comparison Group A	Pretest		Posttest
Treatment Group B		Treatment	Posttest
Comparison Group B			Posttest

(image: Justin Nix's Lecture)

The Element of Time in Research

Fixed Sample Panel Design

Data collected at 2 or more time points from the same sample.

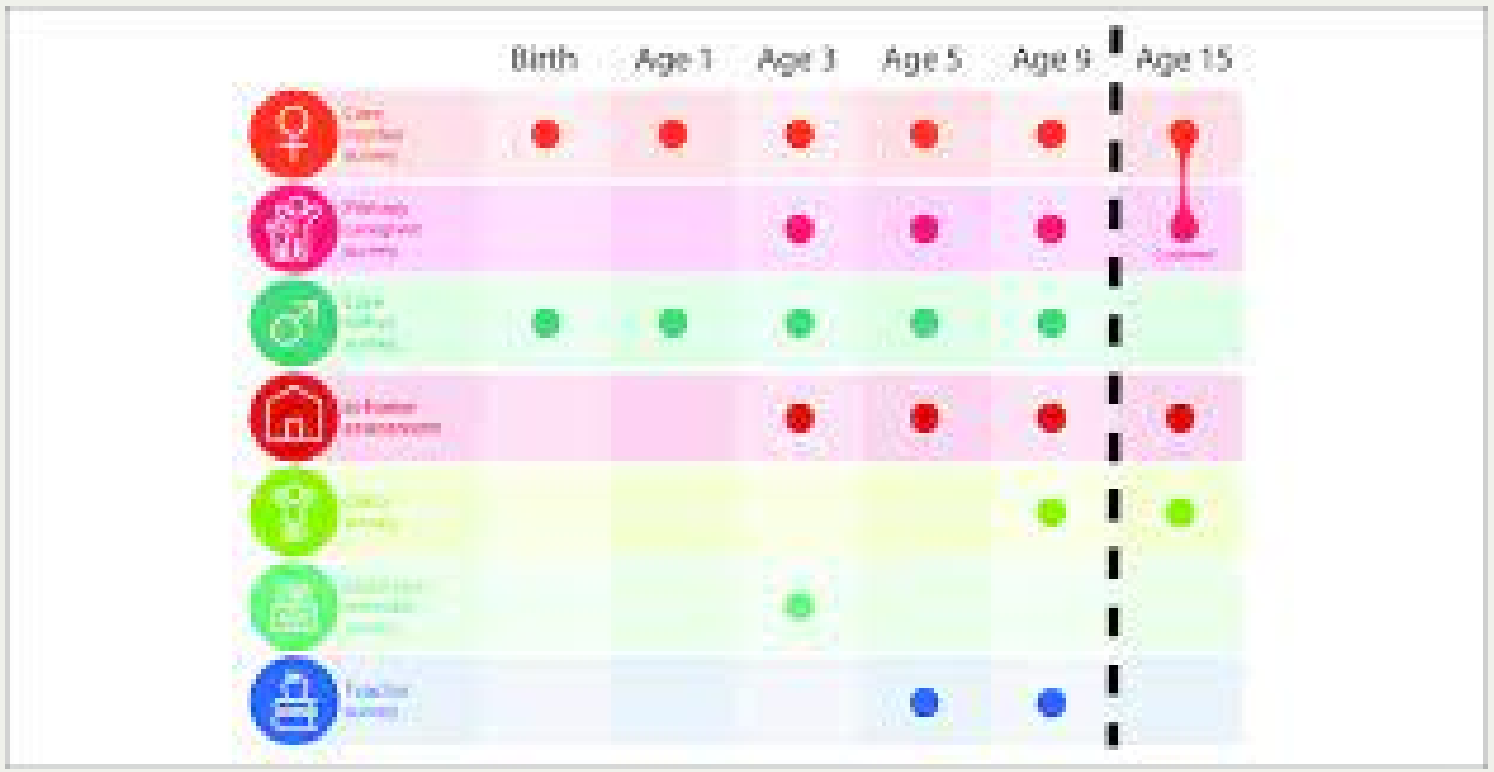
Although, susceptible to some problems

- Expense and attrition
- Subject fatigue

The Element of Time in Research

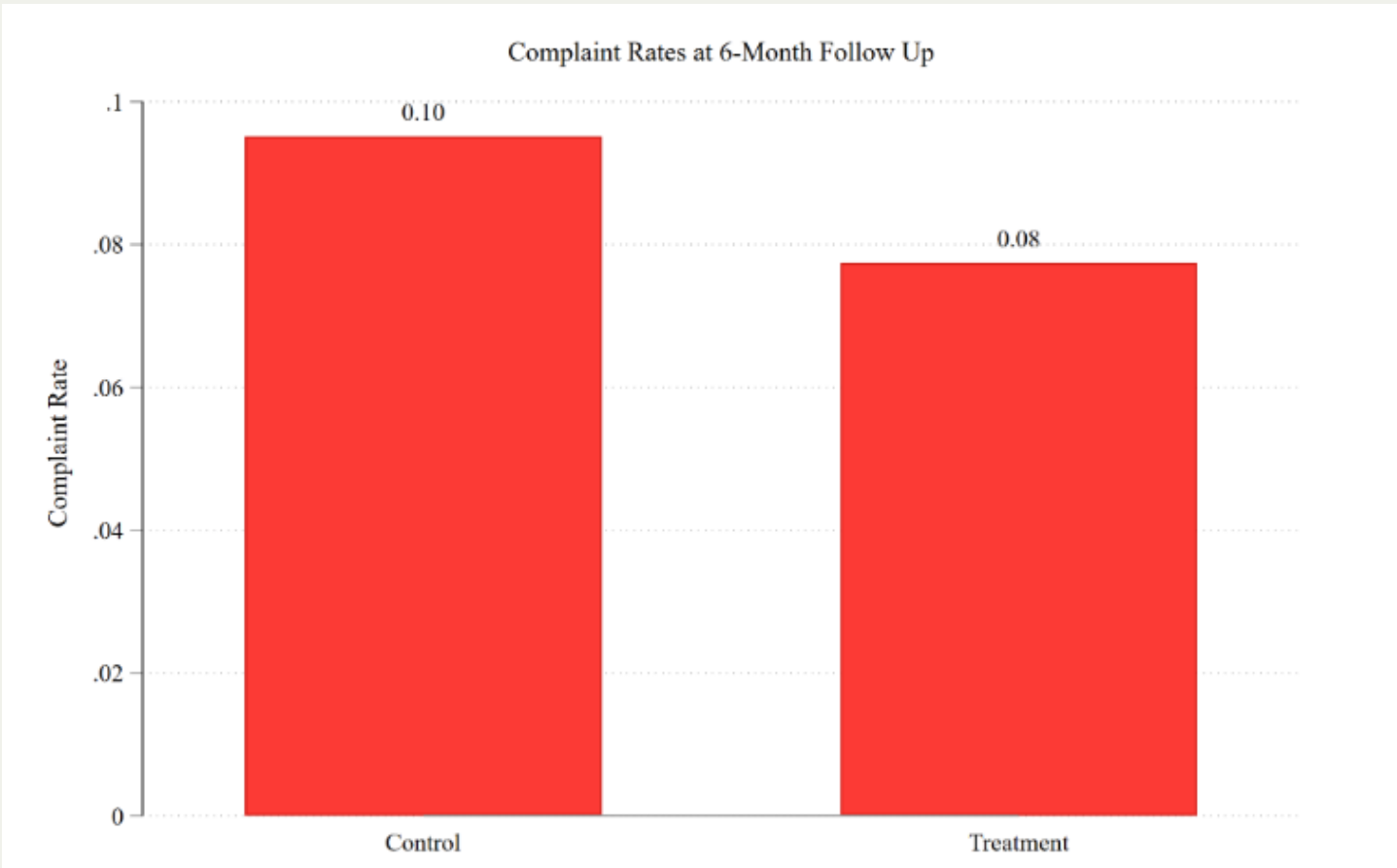
Event-Based Designs

Follow up samples are selected from the same cohort, people who experienced a similar event on a common starting point.



Causality in Nonexperimental Designs

To reduce the risk **spuriousness**, researchers use statistical controls.



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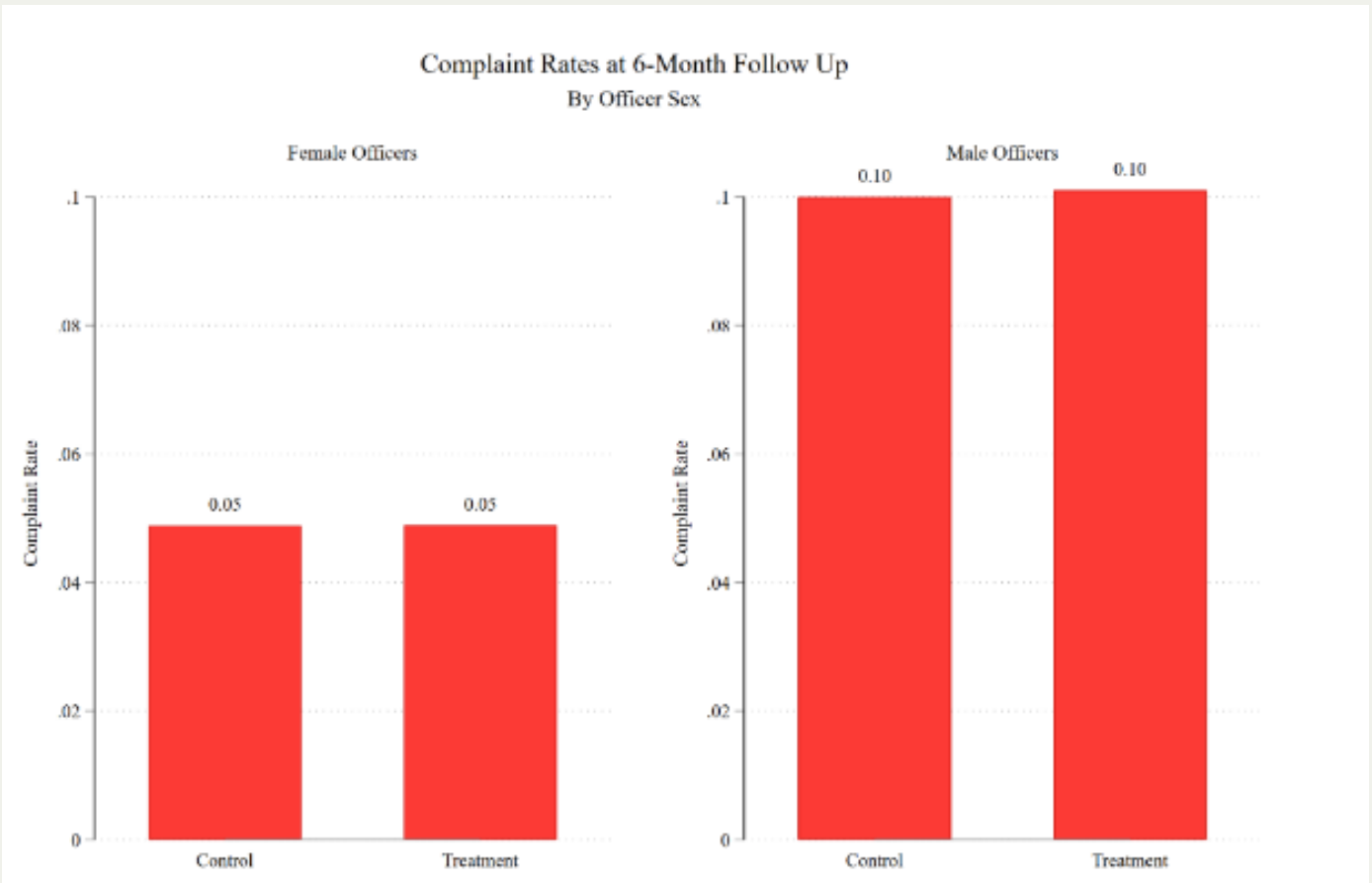
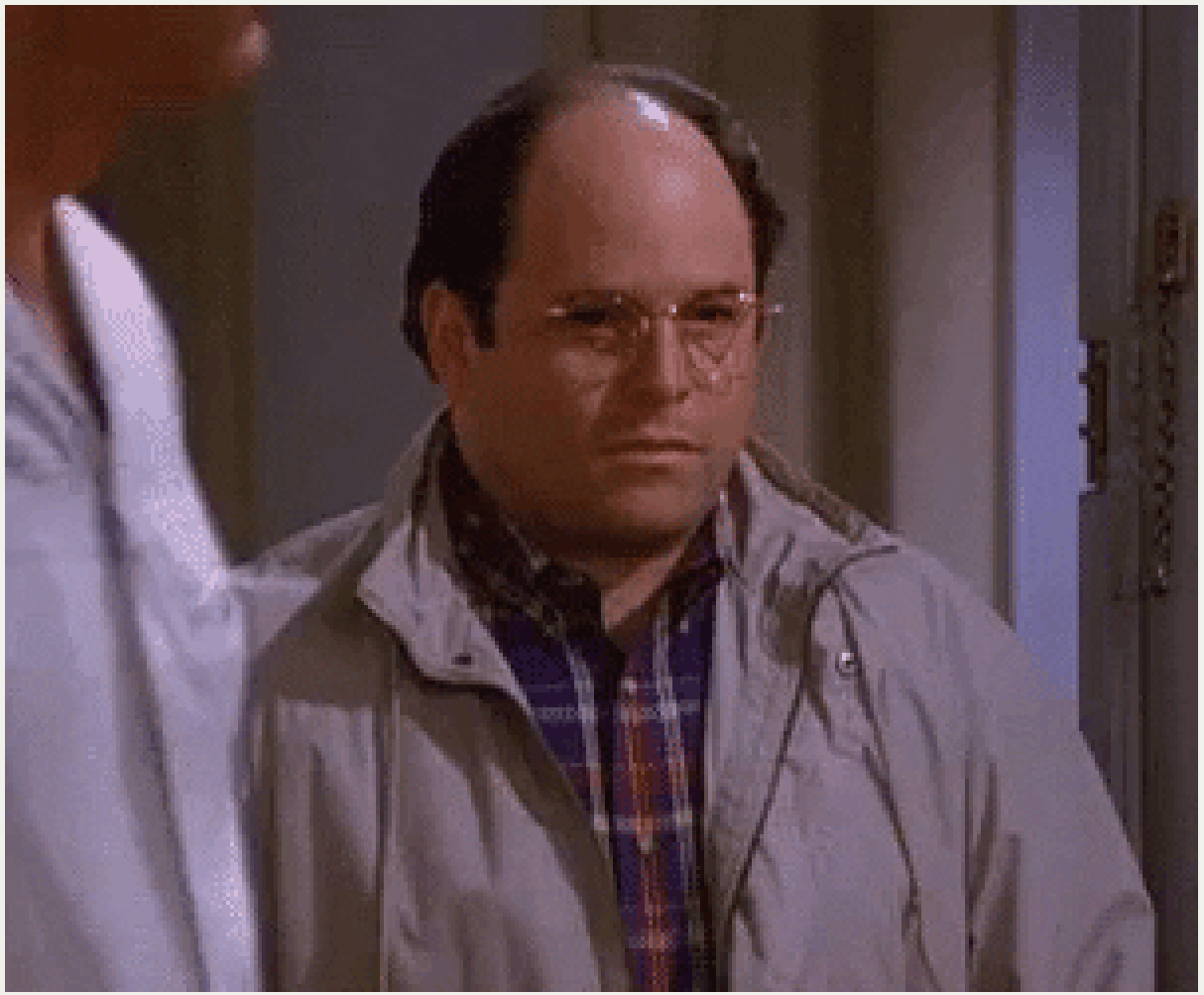


Have a great day!!



(image: giphy.com)