Simple Stats for Evaluating Crime Reductions

04-25

VCAN Virginia Crime Analysis Network

Andrew Wheeler, PhD
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CRIME De-Coder

My Background

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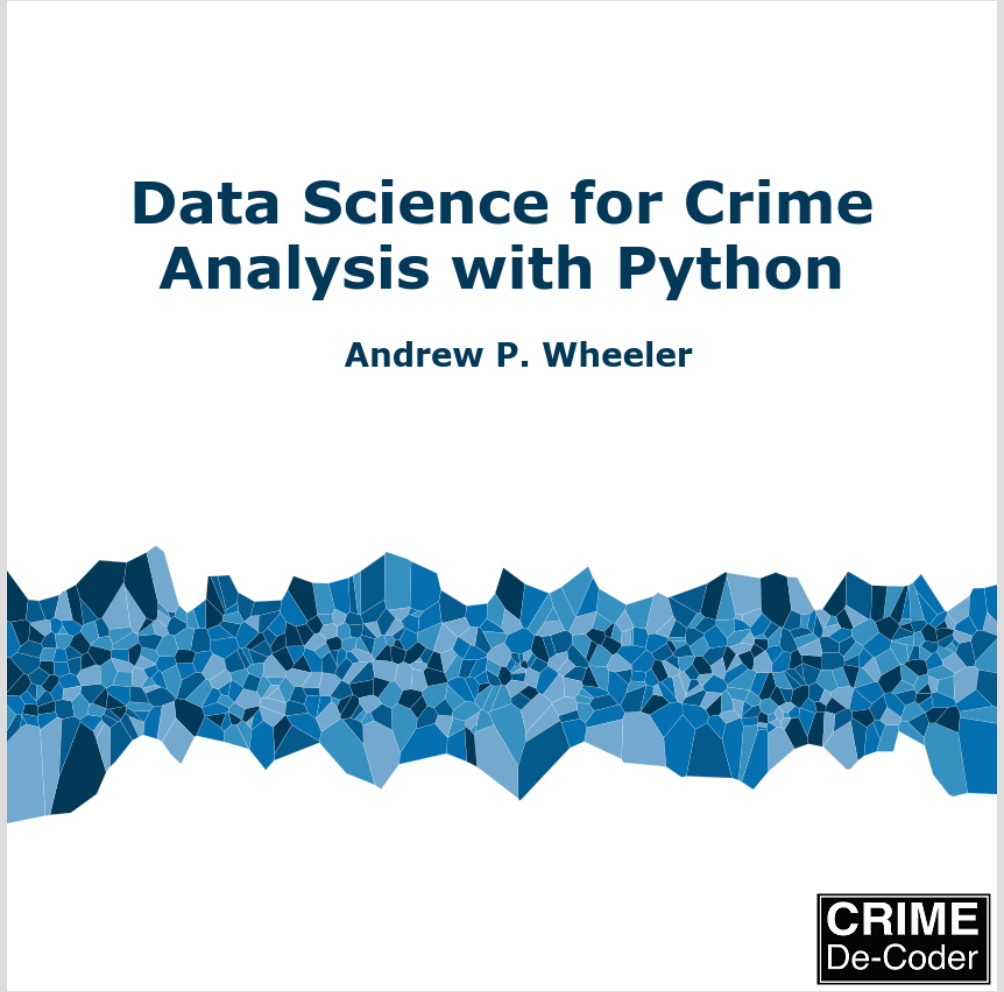
PhD Criminal Justice

- Statistical Analysis
- Operations Research
- Predictive Modelling
- Policy Analysis

Examples of Prior Work

- Optimal patrol beats with workload equality (Wheeler, 2019)
- Cost of crime hotspots (Wheeler & Reuter, 2021)
- Network algorithm to prioritize gang members (Wheeler et al., 2019)



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Paper

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Research | Open access | Published: 25 September 2018

A simple weighted displacement difference test to evaluate place based crime interventions

Andrew P. Wheeler ✉ & Jerry H. Ratcliffe

Crime Science **7**, Article number: 11 (2018) | Cite this article

What is the point?

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Motivation

- Know if some intervention *actually* reduced crime
- Estimate *how much* it reduced crime
- and whether the results are due to chance

Outline

- Planning and Evaluation
  - Why you need a control group
  - Making inferences
  - Choosing control
  - Length of treatment
  - Extensions (different temporal pre/post, normalize per area, harm weights, continuous monitoring)

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Why you need a control group

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Pre-crime = 100

Post-crime = 80

Was the intervention successful?

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Why you need a control group

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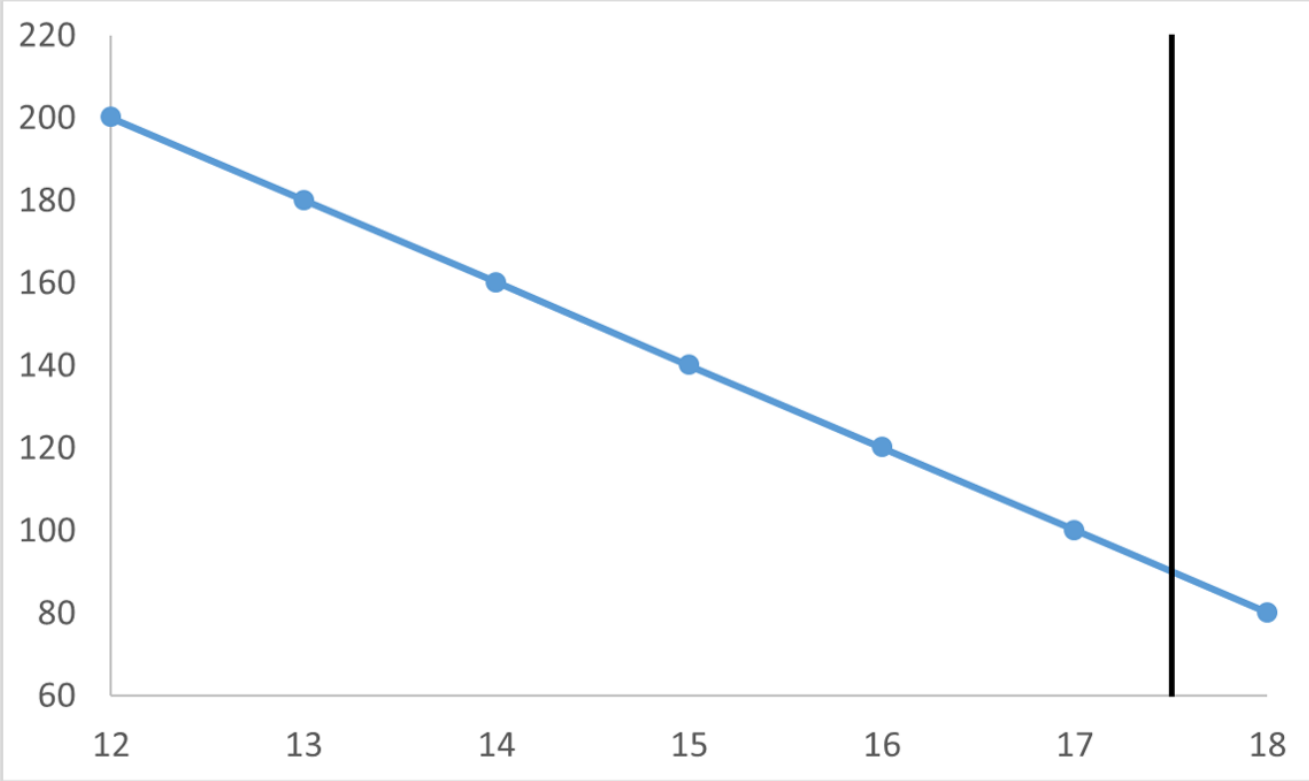
Pre-crime = 100

Post-crime = 80

Was the intervention successful?

If it looks like this, probably not



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Why you need a control group

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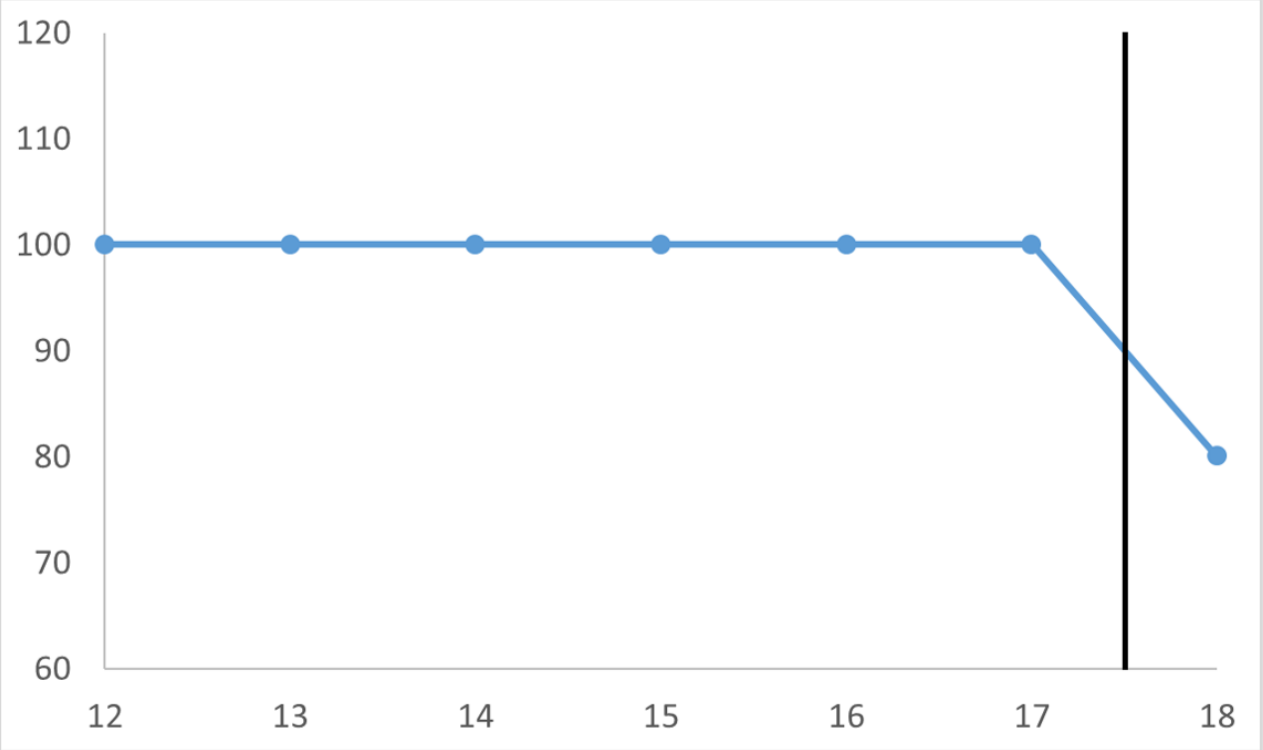
Pre-crime = 100

Post-crime = 80

Was the intervention successful?

This is better evidence



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A control group lets you infer trends

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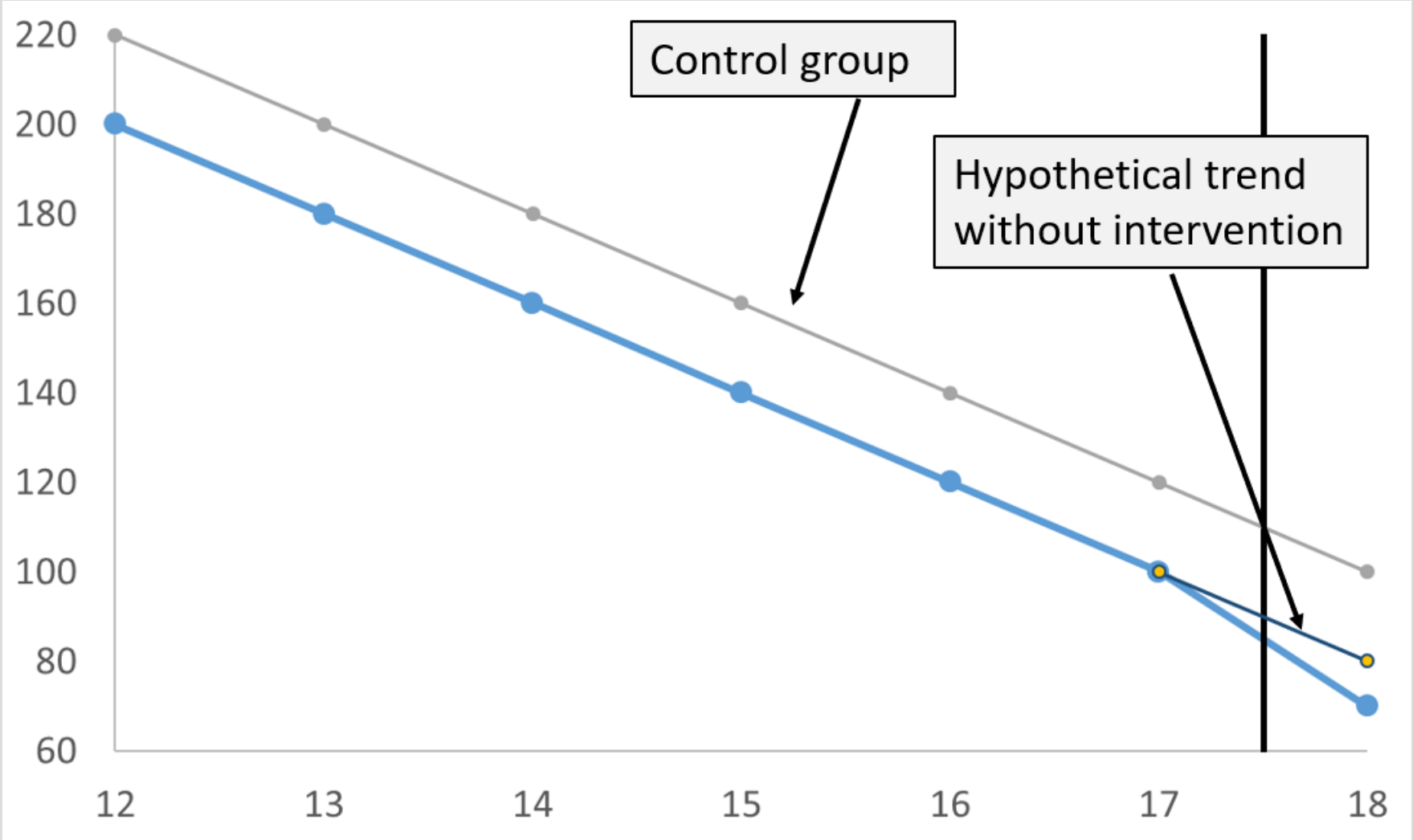

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Example Use Case

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- **Treated: Pre=80, Post=85, Difference = 5**
- **Control: Pre=80, Post=100, Difference = 20**
- **Estimate: 5 – 20 = -15 (19)**
- **95% Confidence Interval: -51 to 21**
- **Uses Poisson distribution to make metrics easier**

- **See the online calculator**

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Example Use Case

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Weighted Displacement Difference Calculator

This is a demonstration of how **CRIME** De-Coder can provide your agency with simple tools to conduct rigorous crime analysis.

This tool calculates the *Weighted Displacement Difference*, an estimate of the total number of crimes reduced given an input treated area vs control areas. See Wheeler and Ratcliffe (2018) for an empirical reference on the method and for advice on applying the method.

For brief instructions, calculate crime counts in your treated and control areas pre and post your intervention. (If you do not have displacement areas, you can insert 0's into those input fields.) Hit the Calculate button, and you will be presented with estimates of the total crime reduction, along with estimates of the standard error and a confidence interval for that crime reduction.

Input Metrics

Unit Type	Pre	Post
Treated	120	100
Control Treated	130	150
Displacement	40	25
Control Displacement	30	25

Calculate

Results

Weighted Displacement Difference Results (Standard Error)

WDD: -50 (25)

95% Confidence Interval: -99 to -1

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Control Groups

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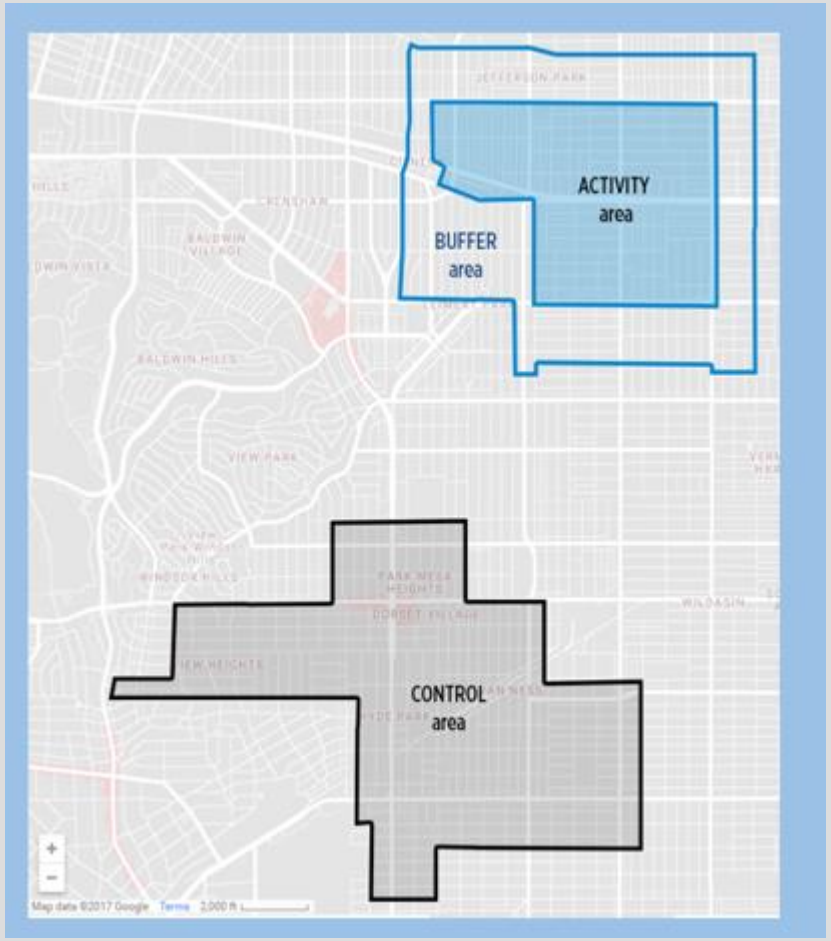
- How do you choose a control group?
  - Not subject to displacement
  - Similar Trends
- Advice
  - Aim for similar baseline counts
  - It is ok if control area is bigger (can use rest of city)
  - Can use a neighboring jurisdiction
  - Choose Only based on pre-trends



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Control Groups

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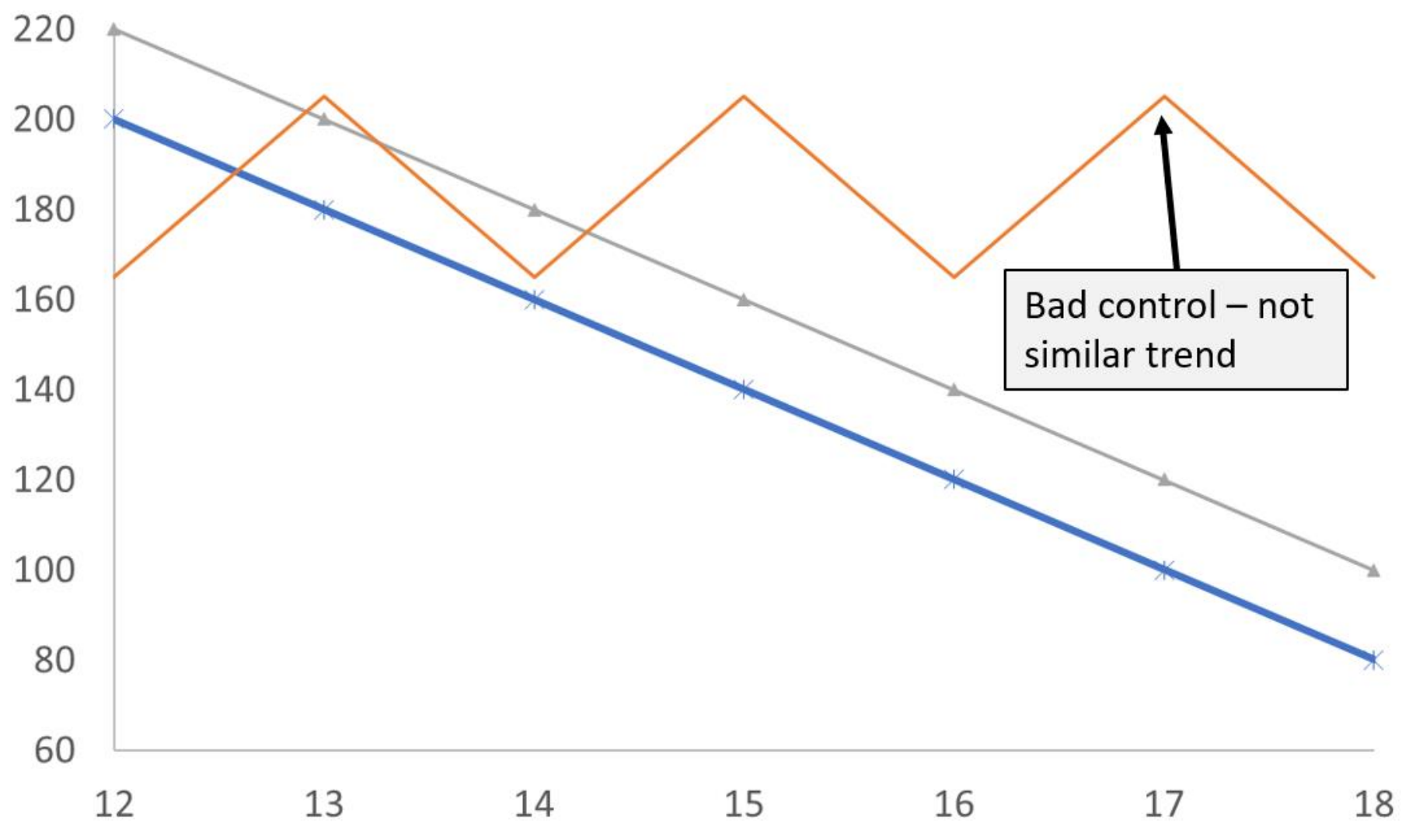

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Control Groups

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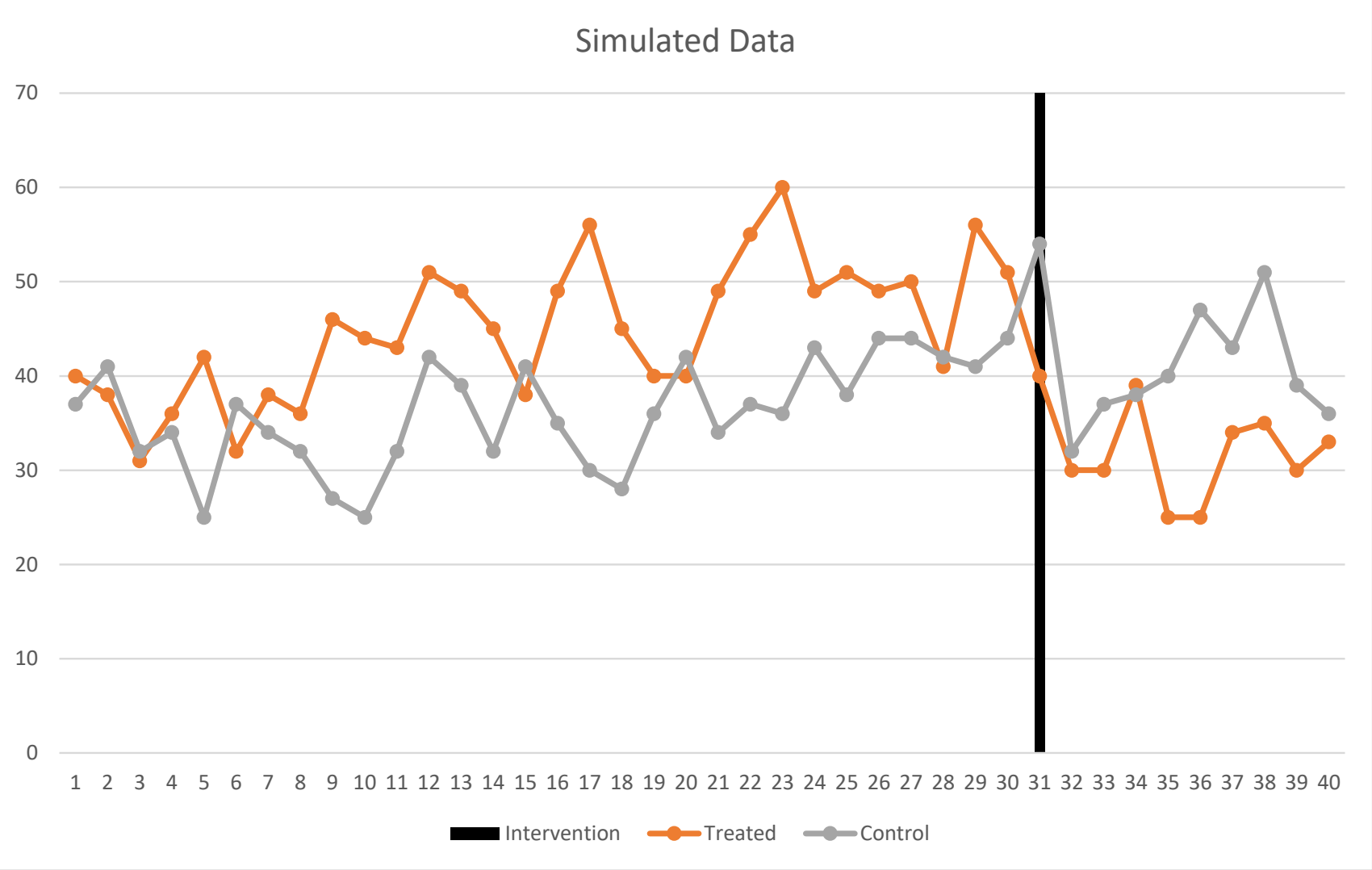

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Length of Treatment

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- If low crime to begin with, impossible to know if worked
- If too low of power, combine areas or evaluate longer time span
- Baseline 20 crimes, need to reduce 15
- Baseline 100 crimes, need to reduce 30

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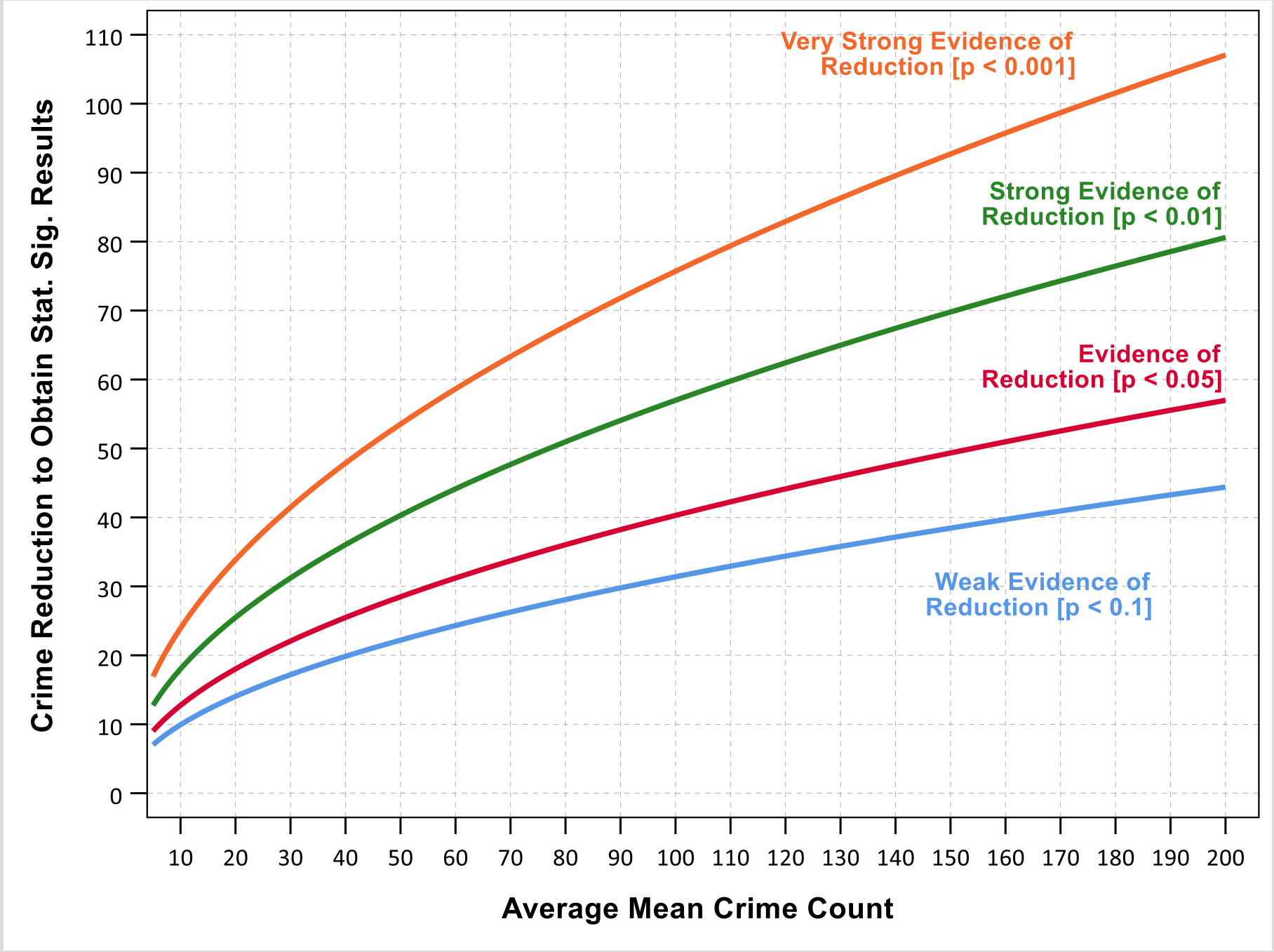
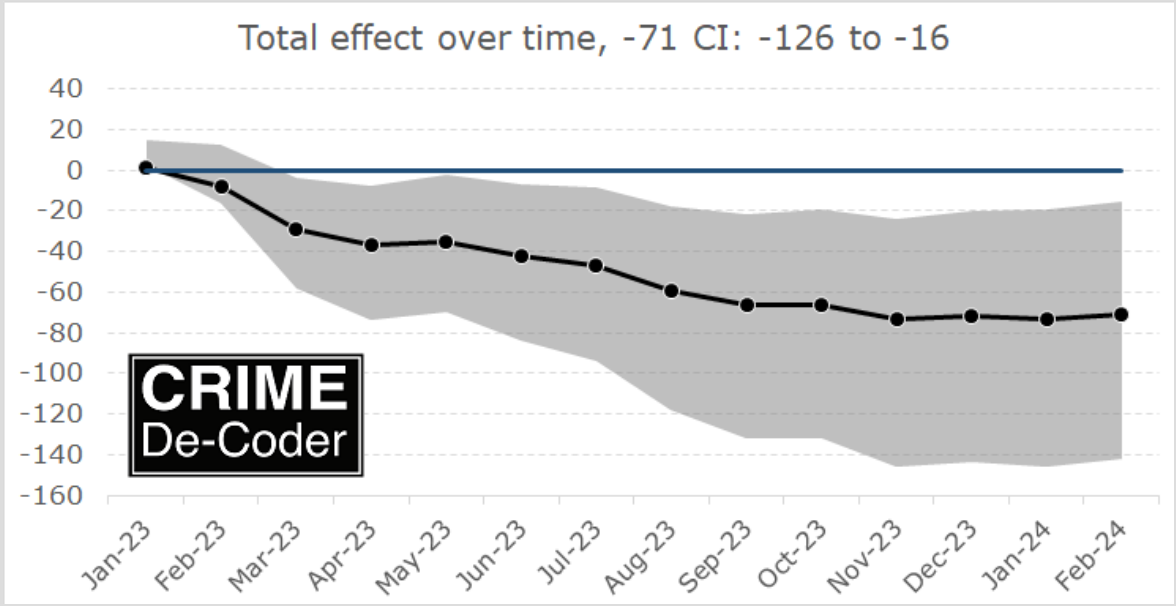


The standard error of the test statistic given average number of crimes per each period and within each area.

Other Resources

Resources

- Original paper with Jerry Ratcliffe
- Spreadsheet with additional examples (harm weights, area normalization, different temporal periods, continuous monitoring)
- R package, ptools, has these implemented
- Weighted Displacement Difference online tool



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