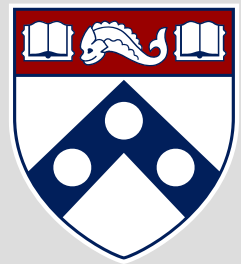
Avoid Chasing the Noise

09-25



Andrew Wheeler, PhD
andrew.wheeler@crimede-coder.com

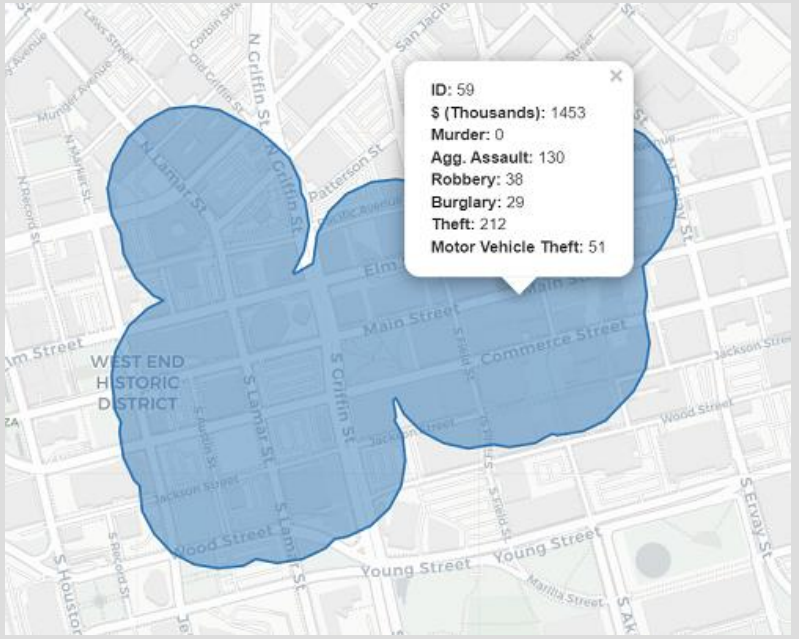
CRIME De-Coder

My Background

CRIME De-Coder

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)

Andrew Wheeler, PhD

andrew.wheeler@crimede-coder.com

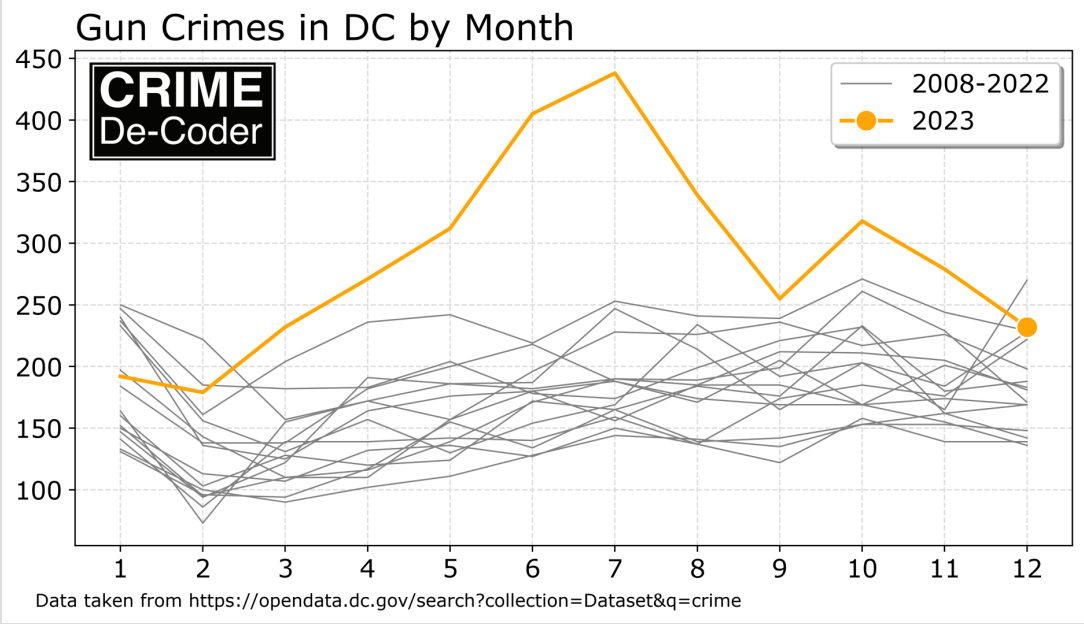
Motivation & Outline

Motivation

- Don’t be fooled by randomness
- Monitoring regular patterns
- See if intervention working

Outline

- Avoid Percent Change
- Charts are better than tables
- Compared to Control Area (WDD)



Andrew Wheeler, PhD

andrew.wheeler@crimede-coder.com

Percent Change is Bad

CRIME De-Coder

If you had 16 events this month, and 9 last month, is that a large increase?

It is a 78% increase!

Andrew Wheeler, PhD

andrew.wheeler@crimede-coder.com

Use this metric instead of % change

CRIME De-Coder

- **I have made a new metric, the *Poisson Z-score***
  - $Z = 2 \cdot (\sqrt{\text{Current}} - \sqrt{\text{Past}})$
  - **Example: 16 current, 9 past**
  - **Z = 2*(sqrt(16) – sqrt(9)) = 2*(4 – 3) = 2**
  - **Going from 9 to 16 is typical**
- **If Z is 3+ or more, increasing**
- **If Z is -3 or less, decreasing**

Andrew Wheeler, PhD

andrew.wheeler@crimede-coder.com

CompStat Example

CRIME De-Coder

Dallas PD Year-to-Date (5/6/2024)

Address	2023	2024	Difference	Poisson-Z
MOTOR VEHICLE THEFT	9,963	10,996	1,033	10.1
DRUG/ NARCOTIC VIOLATIONS	2,306	2,762	456	9.1
TRESPASS OF REAL PROPERTY	276	425	149	8.0
FAMILY OFFENSES, NONVIOLENT	132	201	69	5.4
ROBBERY	726	803	77	2.8
FRAUD OFFENSES	598	664	66	2.6
LARCENY/ THEFT OFFENSES	9,968	10,152	184	1.8
BURGLARY/ BREAKING & ENTERING	2,012	2,093	81	1.8
STOLEN PROPERTY OFFENSES	132	150	18	1.5
ASSAULT OFFENSES	2,534	2,534	0	0.0
DESTRUCTION/ DAMAGE/ VANDALISM	3,157	3,080	-77	-1.4
WEAPON LAW VIOLATIONS	502	460	-42	-1.9
COUNTERFEITING / FORGERY	92	69	-23	-2.6
DRIVING UNDER THE INFLUENCE	483	361	-122	-6.0
TRAFFIC VIOLATION - HAZARDOUS	1,234	1,022	-212	-6.3

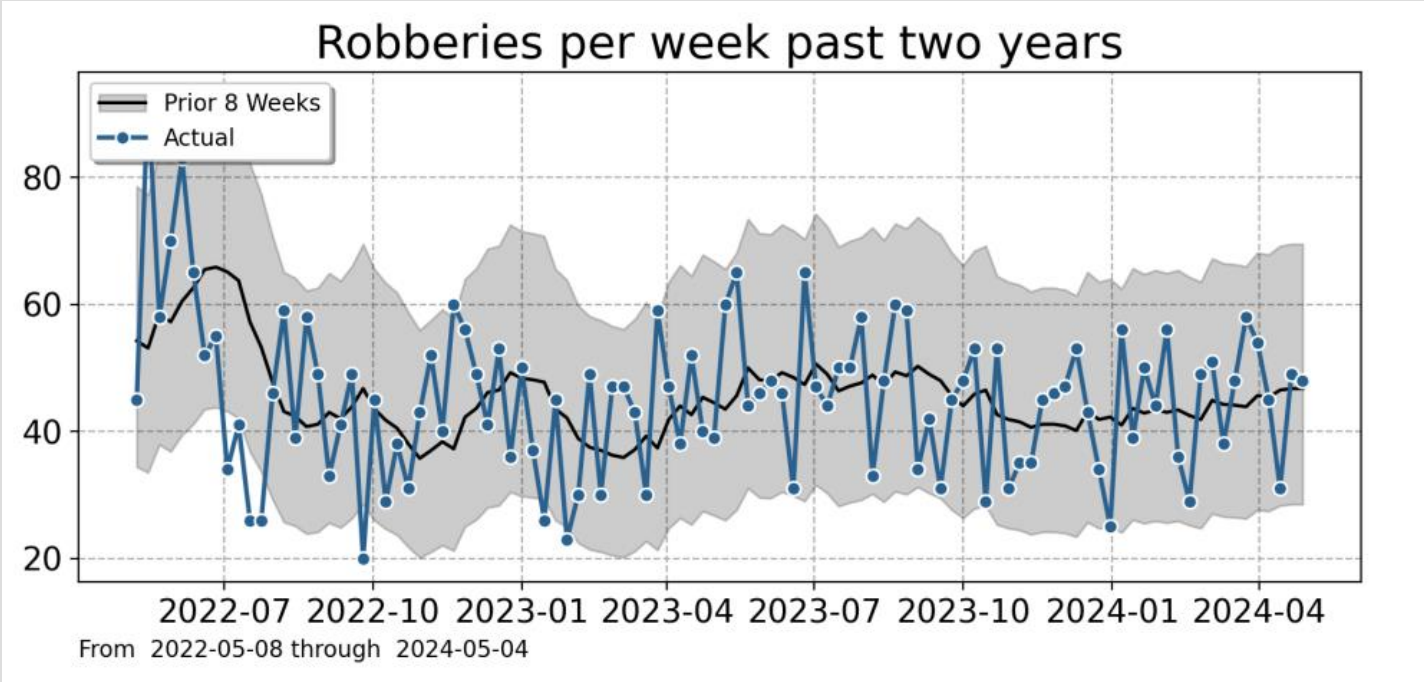
Andrew Wheeler, PhD

andrew.wheeler@crimede-coder.com

Weekly chart with upticks/trends

CRIME De-Coder

- **Prior = average over prior 8 periods**
- **Black line = prior mean**
- **Error bands based on same Poisson Z-score**

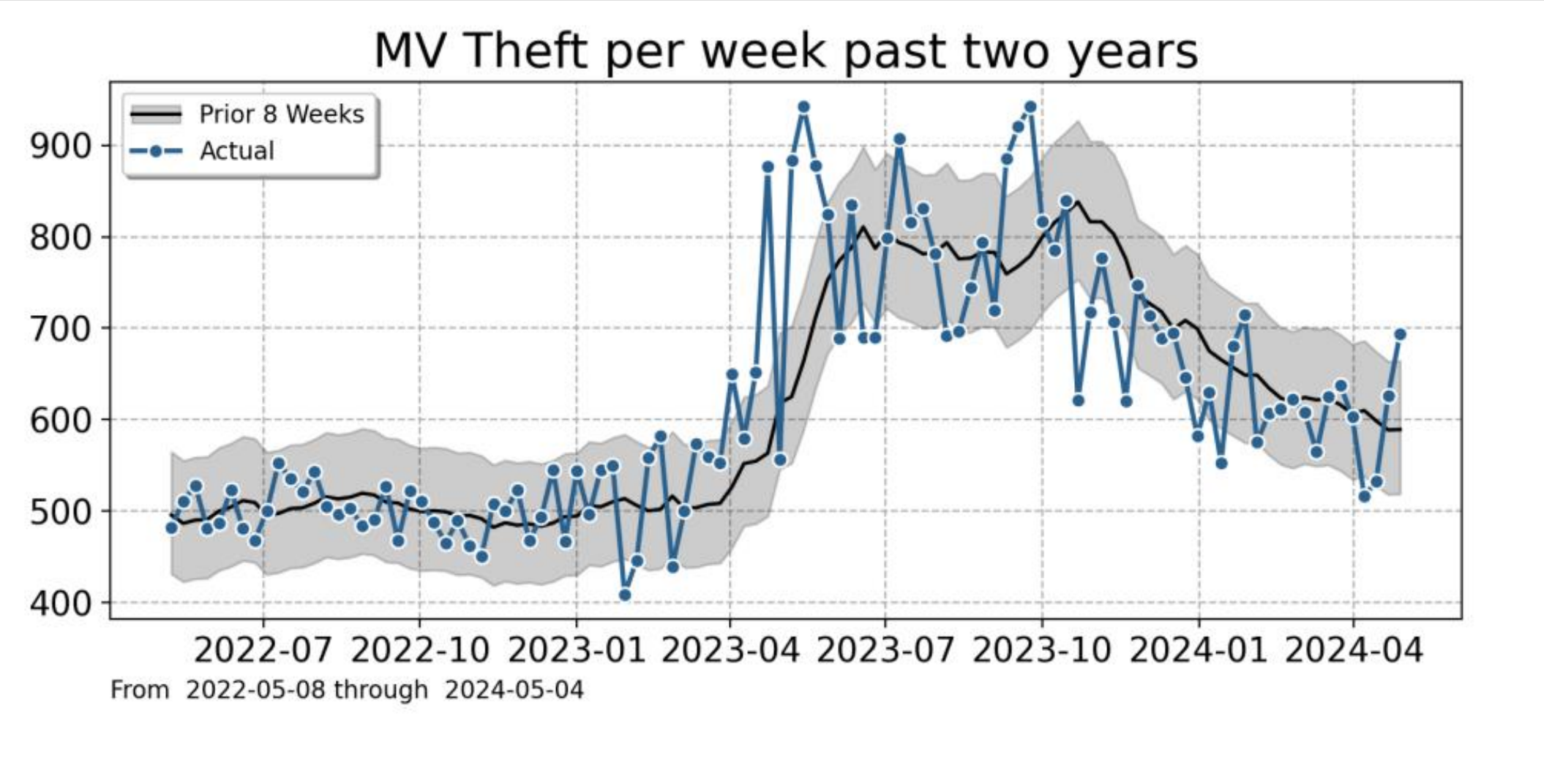


Andrew Wheeler, PhD

andrew.wheeler@crimede-coder.com

Weekly chart with upticks/trends

CRIME De-Coder



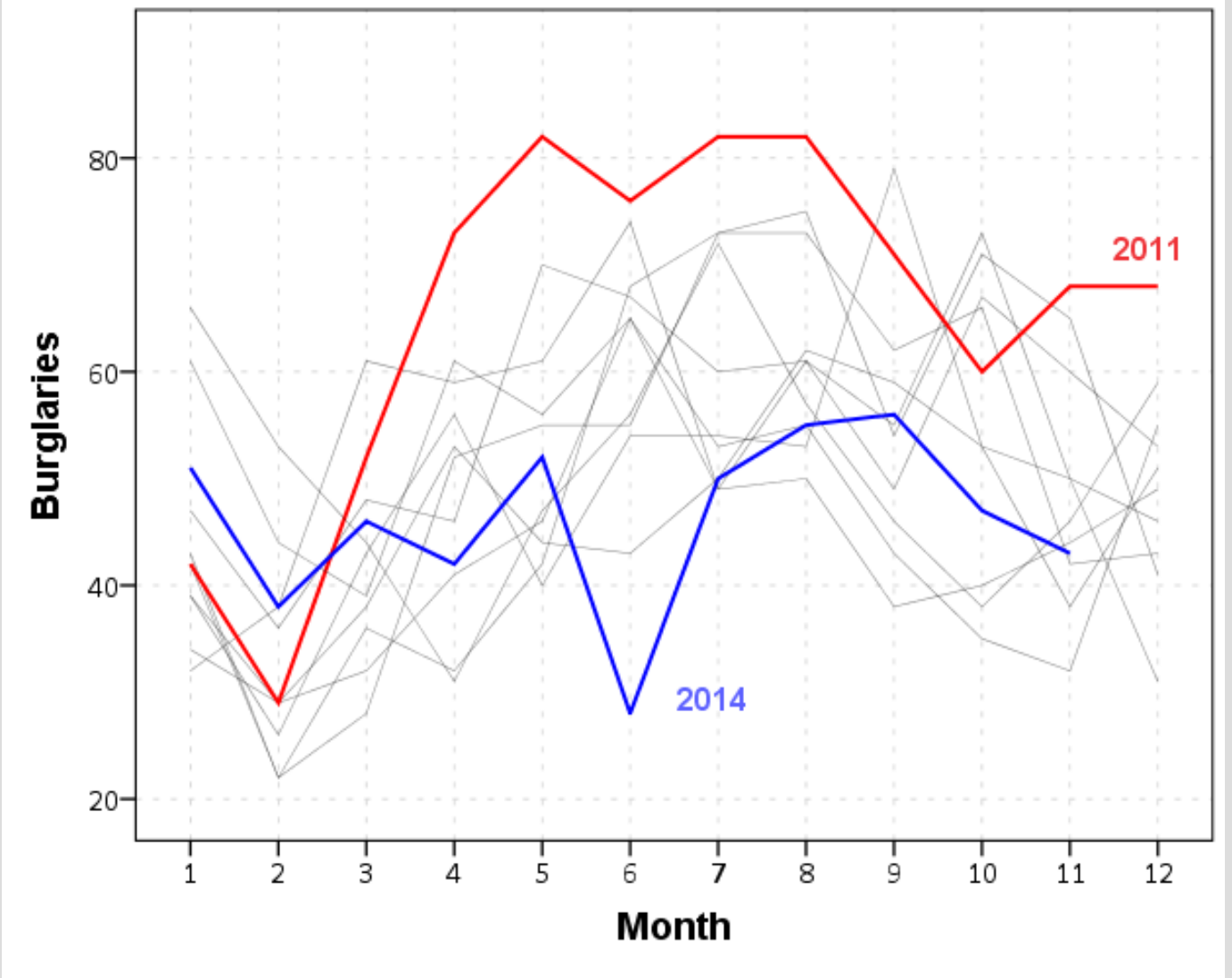
Andrew Wheeler, PhD

andrew.wheeler@crimede-coder.com

Seasonal Chart

CRIME De-Coder

- Count per month (make sure to include 0s!)
- Older years light grey, highlight current year
- If partial reporting, can normalize to per day

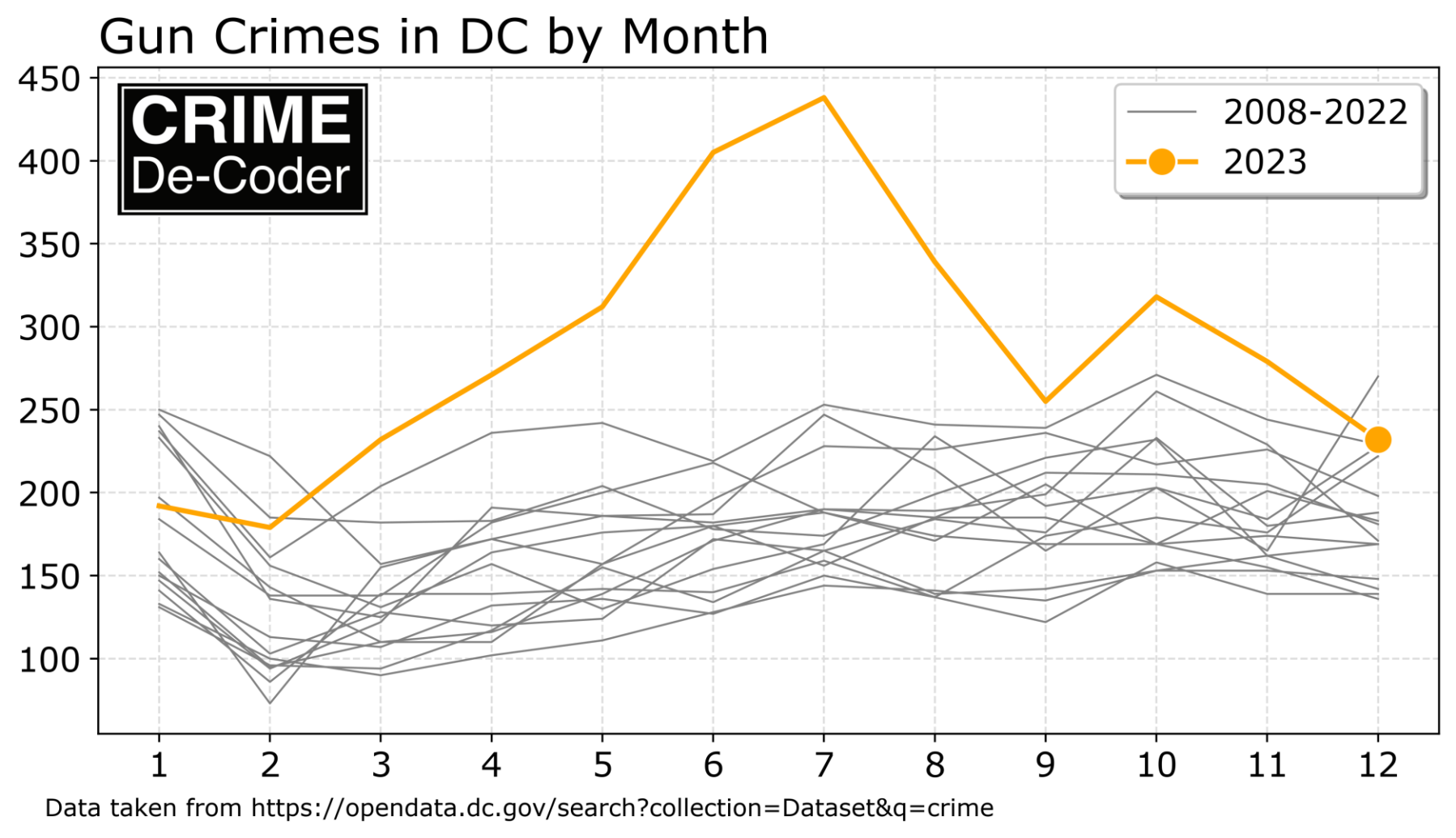


Andrew Wheeler, PhD

andrew.wheeler@crimede-coder.com

Seasonal Chart

CRIME De-Coder



Andrew Wheeler, PhD

andrew.wheeler@crimede-coder.com

Weighted Displacement Diff test

CRIME De-Coder

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

Why you need a control group

CRIME De-Coder

Pre-crime = 100

Post-crime = 80

Was the intervention successful?

Andrew Wheeler, PhD

andrew.wheeler@crimede-coder.com

Why you need a control group

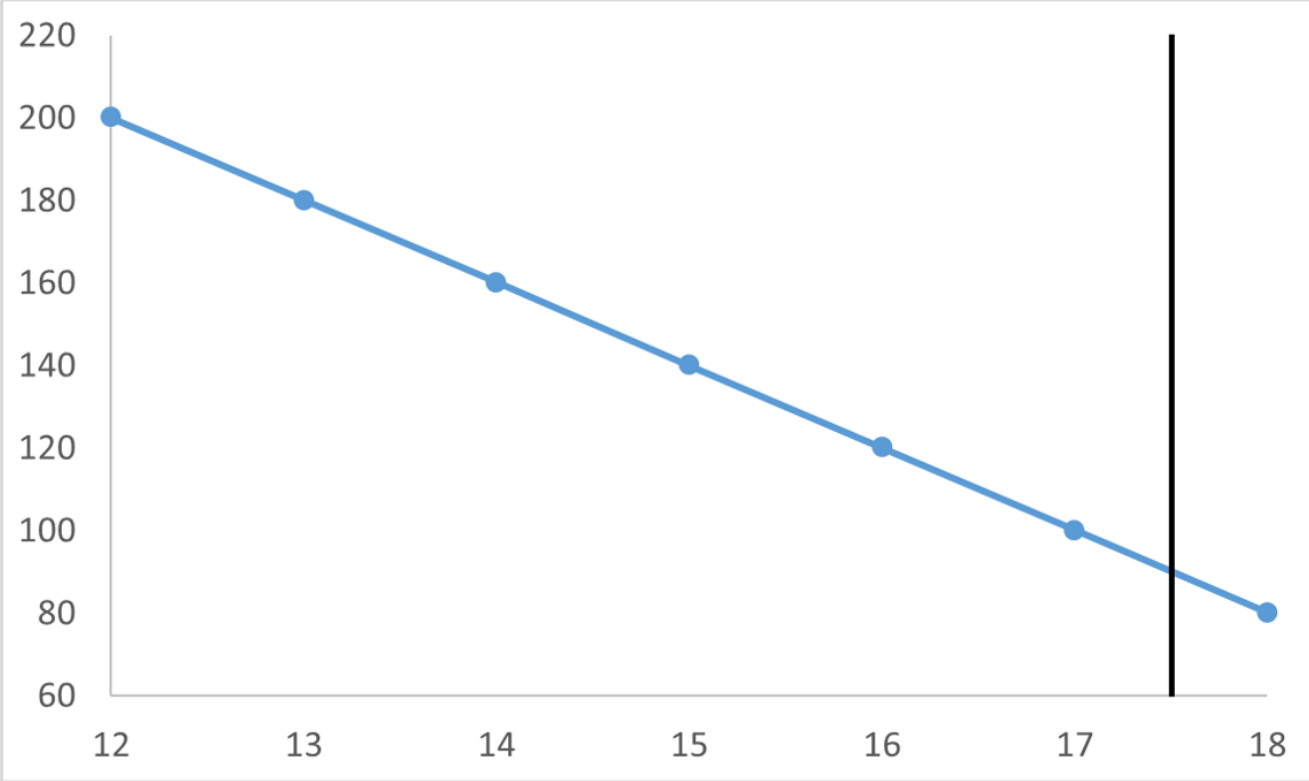
CRIME De-Coder

Pre-crime = 100

Post-crime = 80

Was the intervention successful?

If it looks like this, probably not



Andrew Wheeler, PhD

andrew.wheeler@crimede-coder.com

Why you need a control group

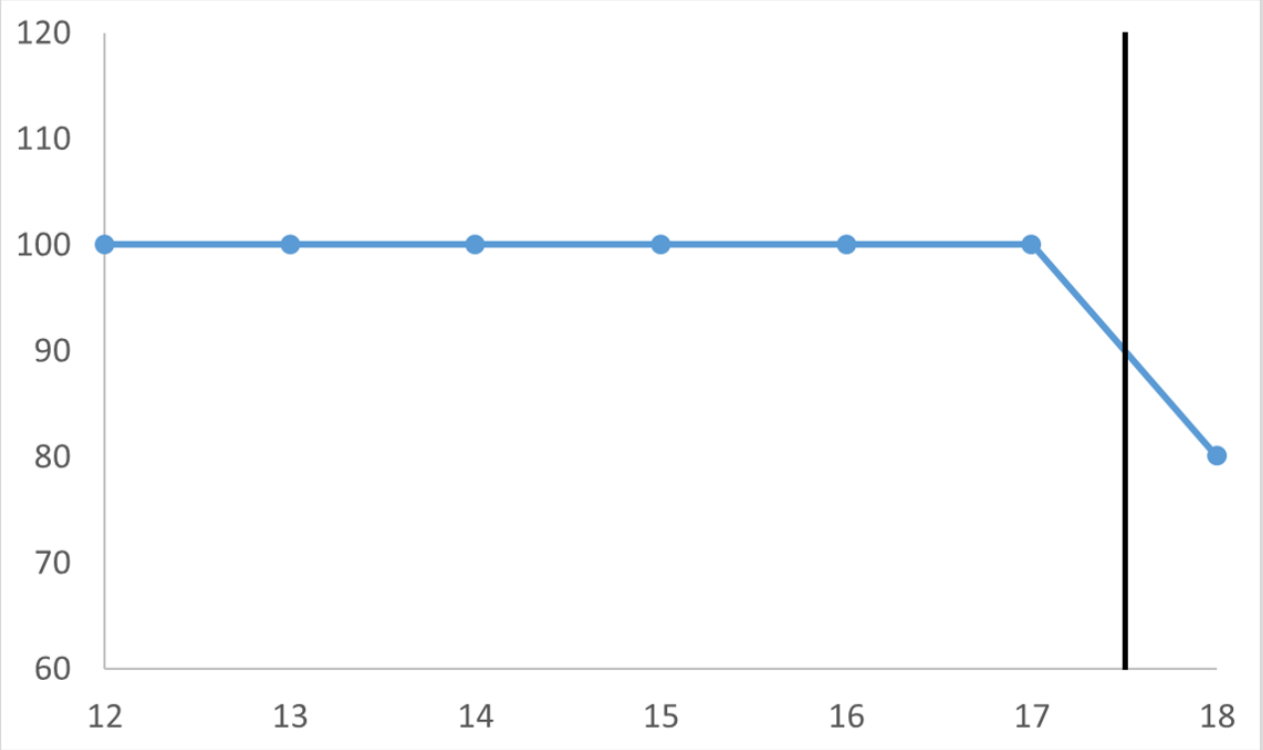
CRIME De-Coder

Pre-crime = 100

Post-crime = 80

Was the intervention successful?

This is better evidence

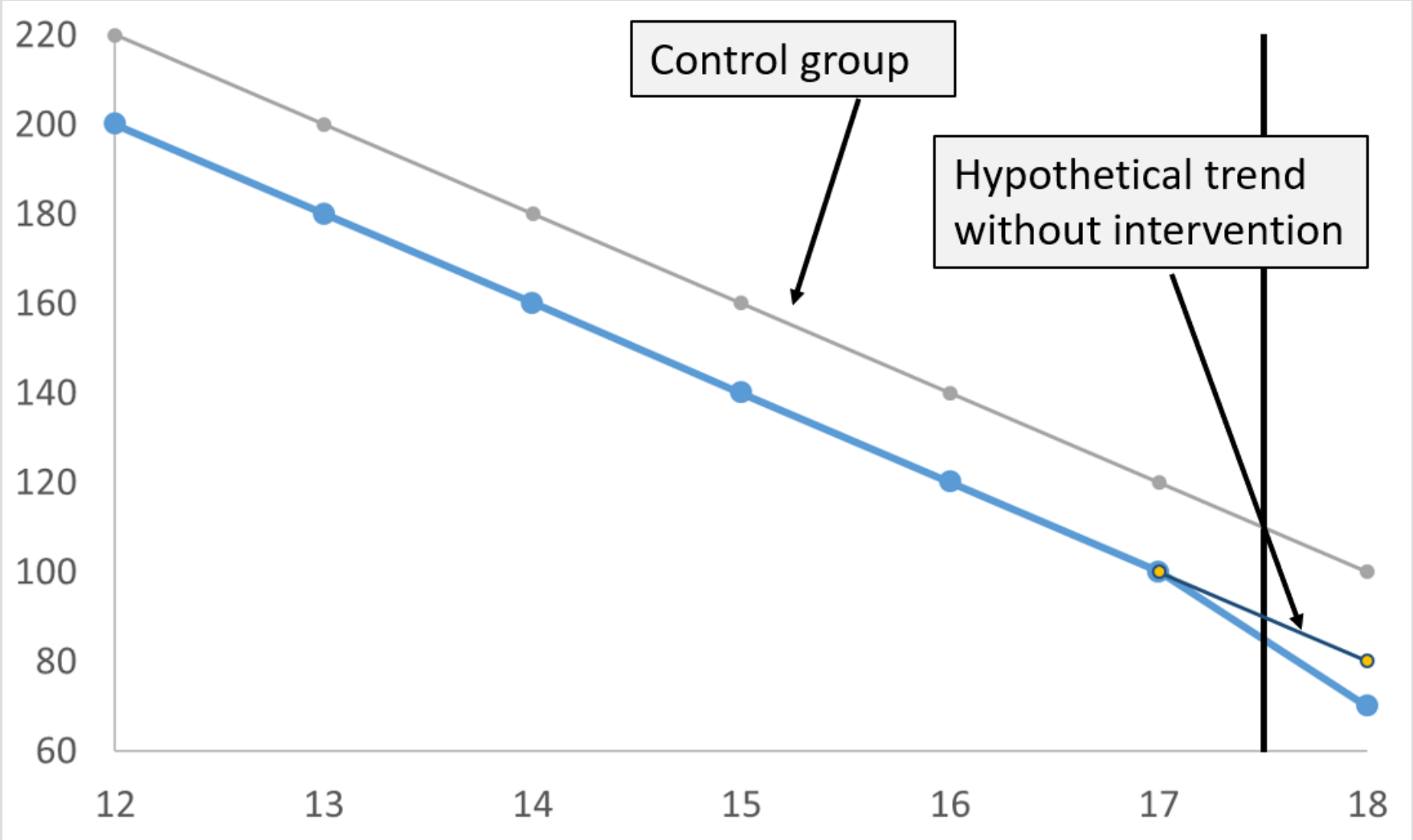


Andrew Wheeler, PhD

andrew.wheeler@crimede-coder.com

A control group lets you infer trends

CRIME De-Coder



Andrew Wheeler, PhD

andrew.wheeler@crimede-coder.com

Example Use Case

CRIME De-Coder

- **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**

Andrew Wheeler, PhD

andrew.wheeler@crimede-coder.com

Example Use Case

CRIME De-Coder

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)

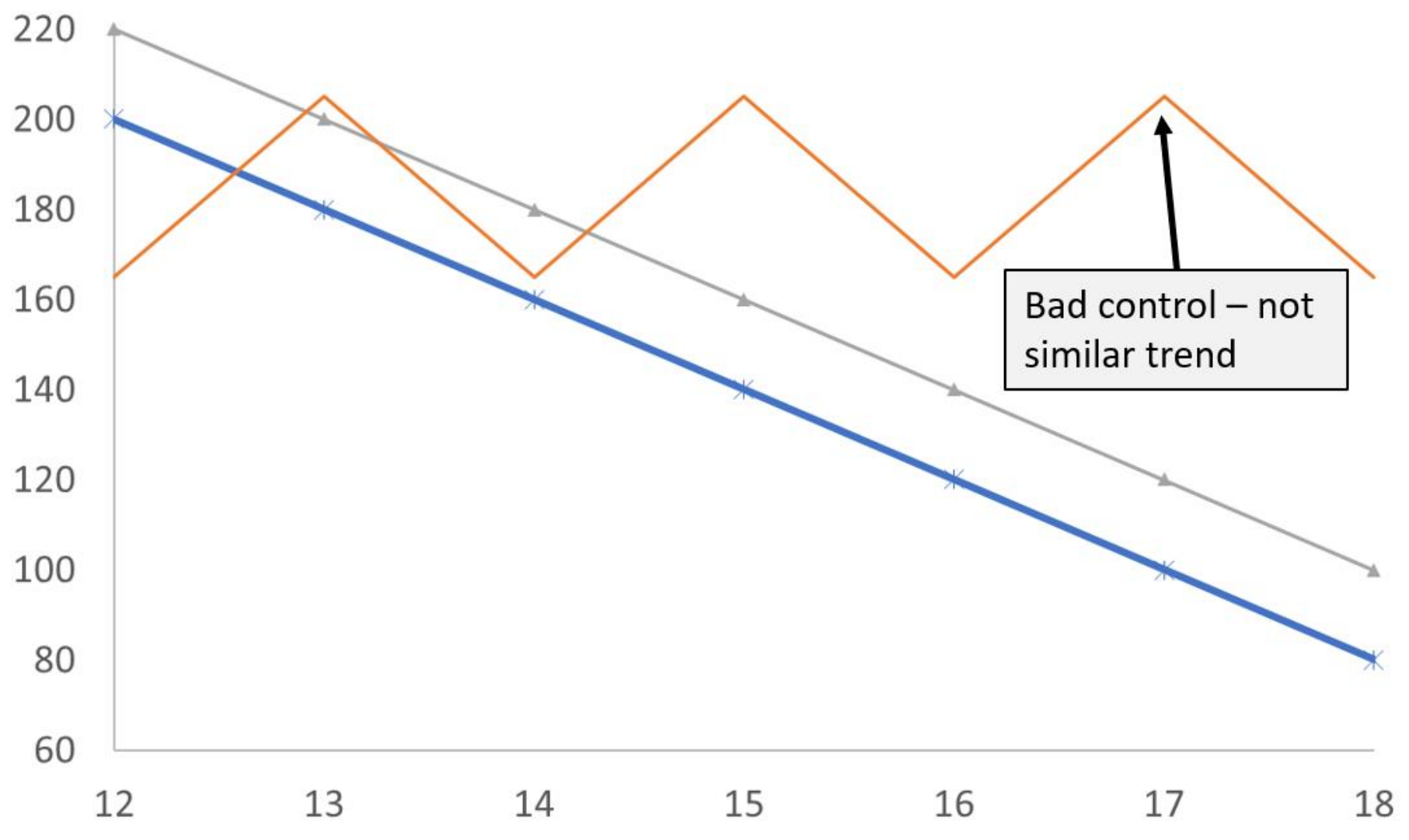
95% Confidence Interval: -99 to -1

Andrew Wheeler, PhD

andrew.wheeler@crimede-coder.com

Control Groups

CRIME De-Coder

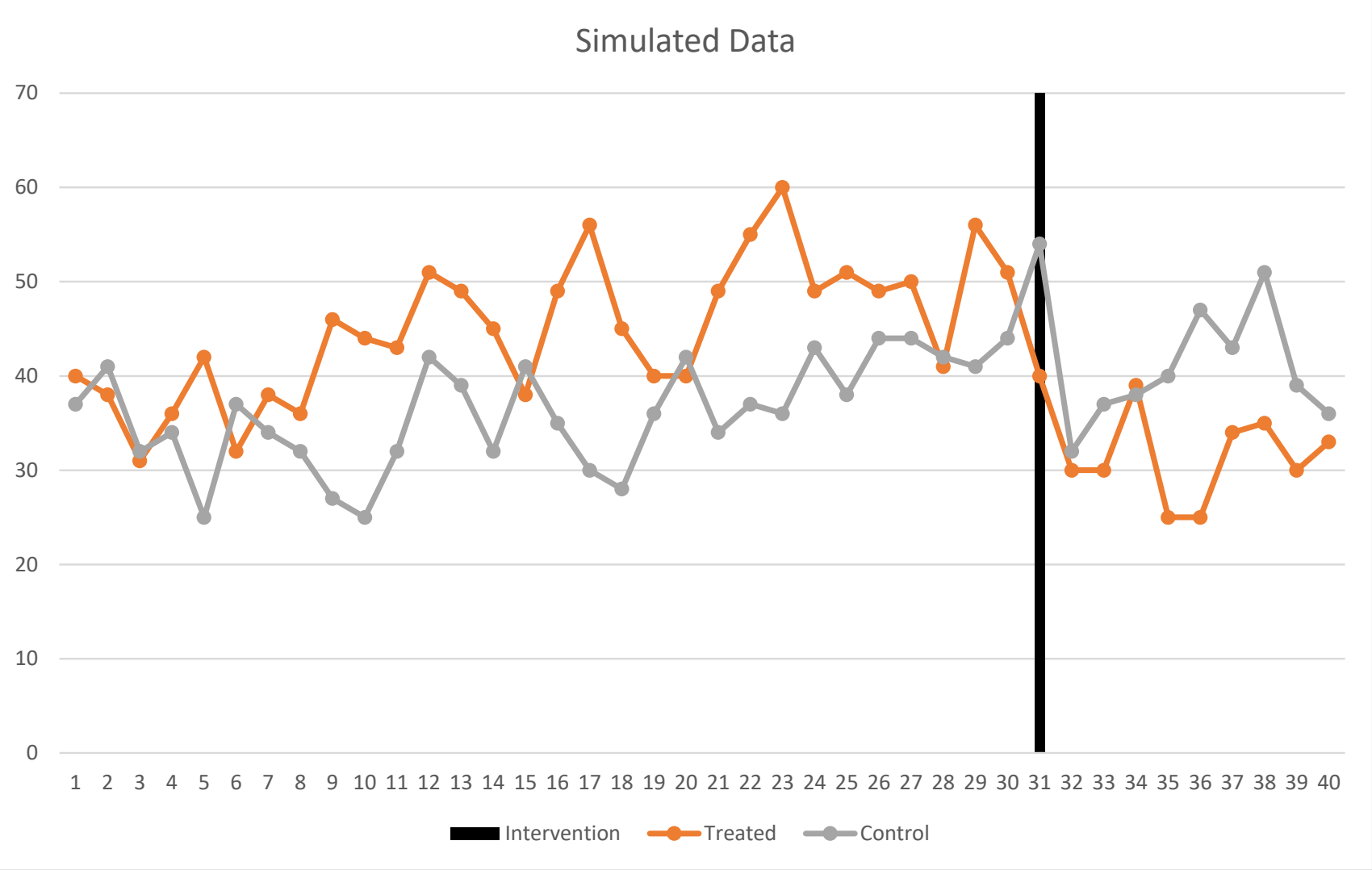


Andrew Wheeler, PhD

andrew.wheeler@crimede-coder.com

Control Groups

CRIME De-Coder



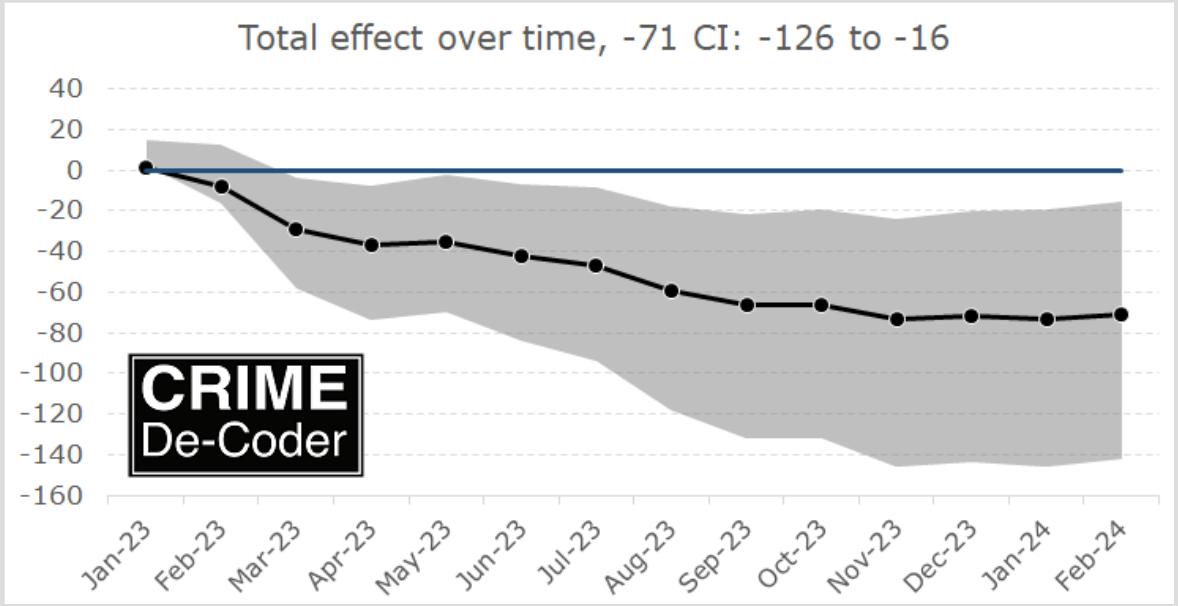
Andrew Wheeler, PhD

andrew.wheeler@crimede-coder.com

Other Resources

Resources

- Materials to replicate these charts in Excel and Tableau
- Other WDD methods & Excel
- R library (ptools) python library (crimepy)
- Data Science for Crime Analysis with Python book
- Follow Crime De-Coder on LinkedIn for updates on my work



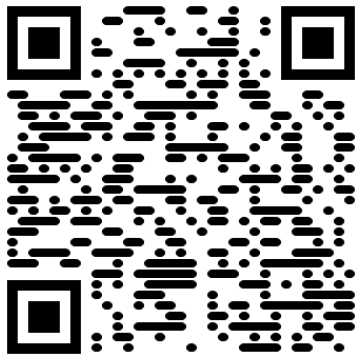
Andrew Wheeler, PhD

andrew.wheeler@crimede-coder.com

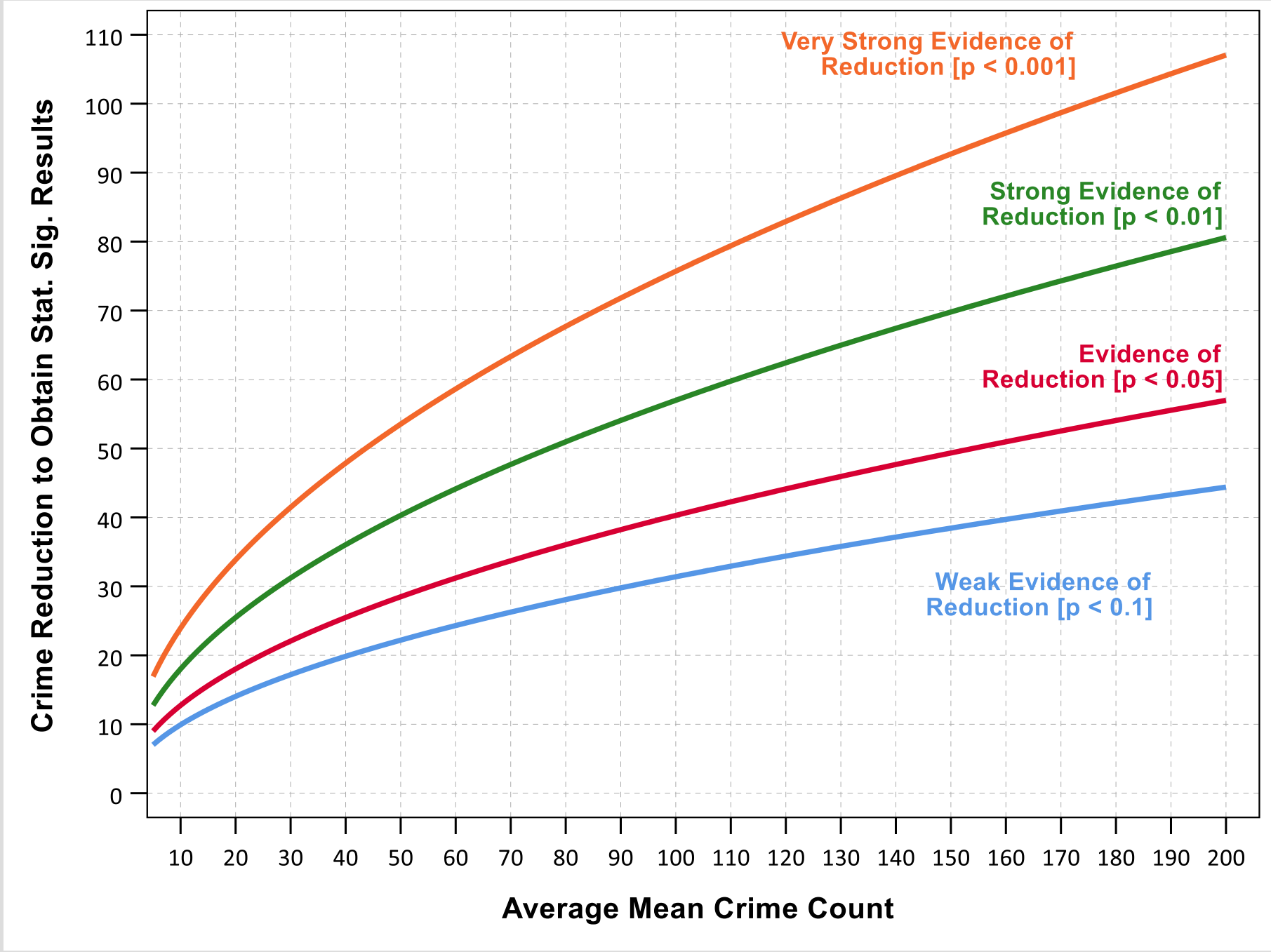
Avoid Chasing the Noise

09-25

Contact: andrew.wheeler@crimede-coder.com
Website: crimede-coder.com



CRIME De-Coder



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