

*How Did the COVID-19 Pandemic  
Affect Crime in Chicago?*  
A Data Analysis Approach to Crime  
Data Correlations

Azal Alhadidi, Rekha  
Bhupatiraju, Holland Hysmith



THE UNIVERSITY OF  
**TENNESSEE**  
KNOXVILLE



# Outline

---

Introduction

Investigation I: Analyzing Rate of Arrests

Investigation II: Understanding Trends of Domestic Cases

Investigation III: Correlating Crime to Districts

Final Thoughts

# Introduction

---

**Primary goal:** Understand how the pandemic changed reported crime, hypothesizing that statistics for Chicago can be generalized.

**Importance:** Improve government response to adverse conditions, and find lessons that can be applied when things are normal.

# The Dataset: [kaggle.com/chicago/chicago-crime](https://kaggle.com/chicago/chicago-crime)

---

Daily updates of crime reports from 2001 to 7 days ago from Chicago Police Department's CLEAR database.

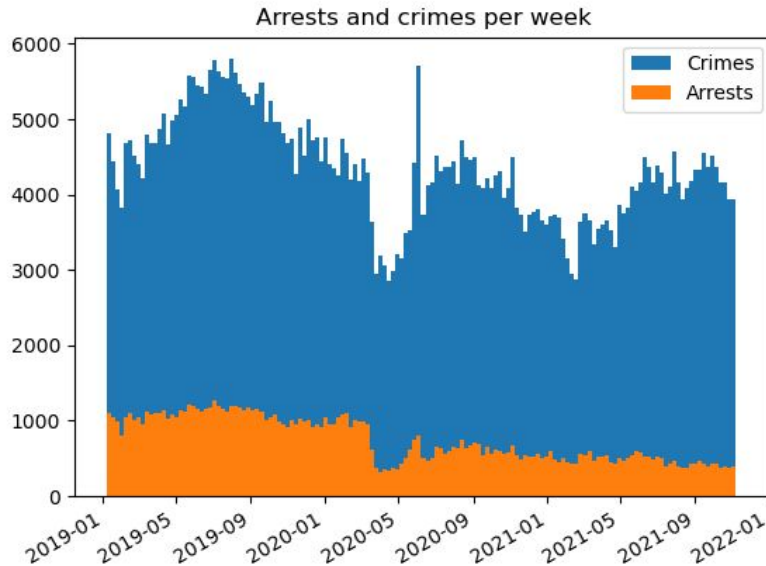
We selected data from January 1, 2015 until November 6, 2021.

We selected `unique_key`, `date`, `block`, `iucr`, `primary_type`, `description`, `location_description`, `arrest`, `domestic`, `fbi_code`, `year`, `district`.

Data was sorted by modification date, so functionally unordered.

# Investigation I: Analyzing Rate of Arrests

---

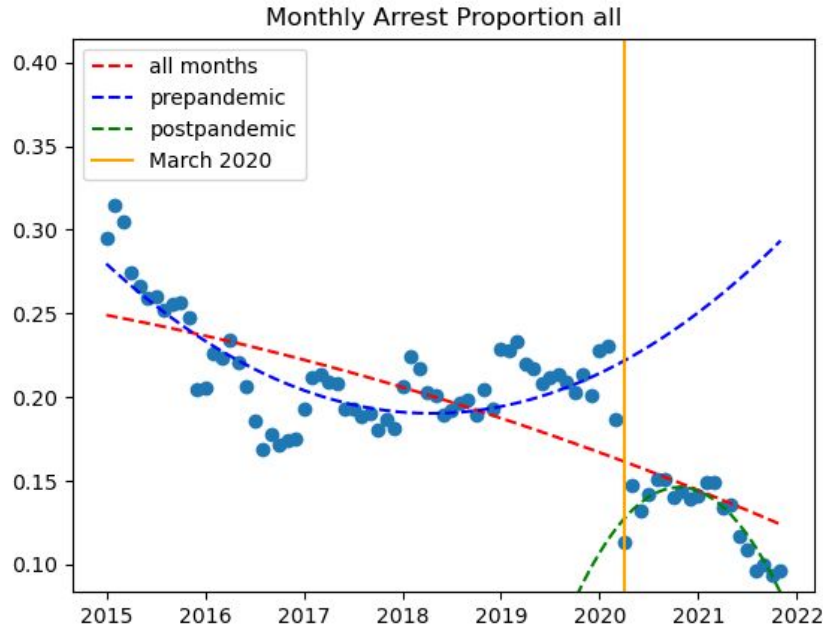


Questions:

Did the pandemic change the rate of arrests?

Was this a short or long term change?

# Investigation I: Analyzing Rate of Arrests



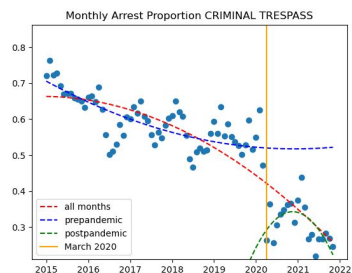
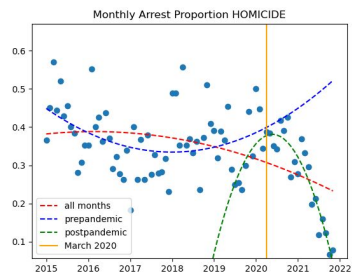
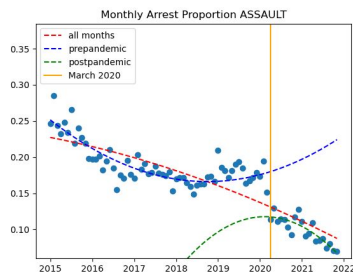
Month-by-month arrest rate.

Curve fitting with scipy (least squares regression).

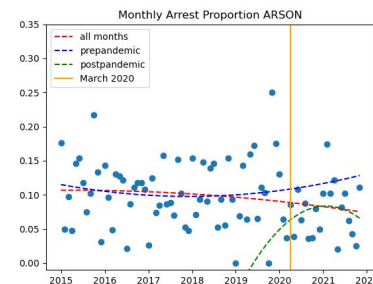
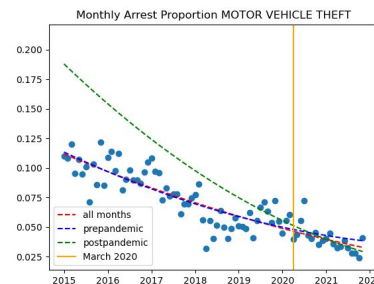
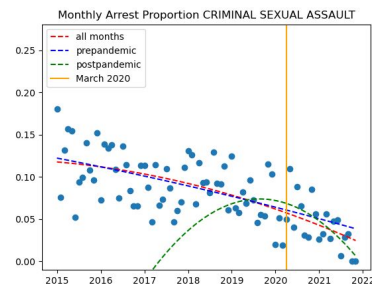
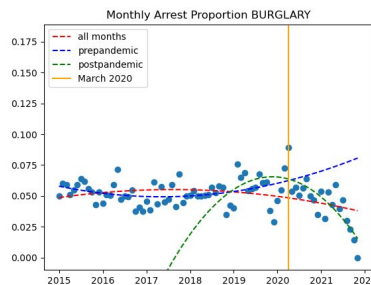
How dramatically has the long term trend been changed?

# Investigation I: Analyzing Categories of Arrests

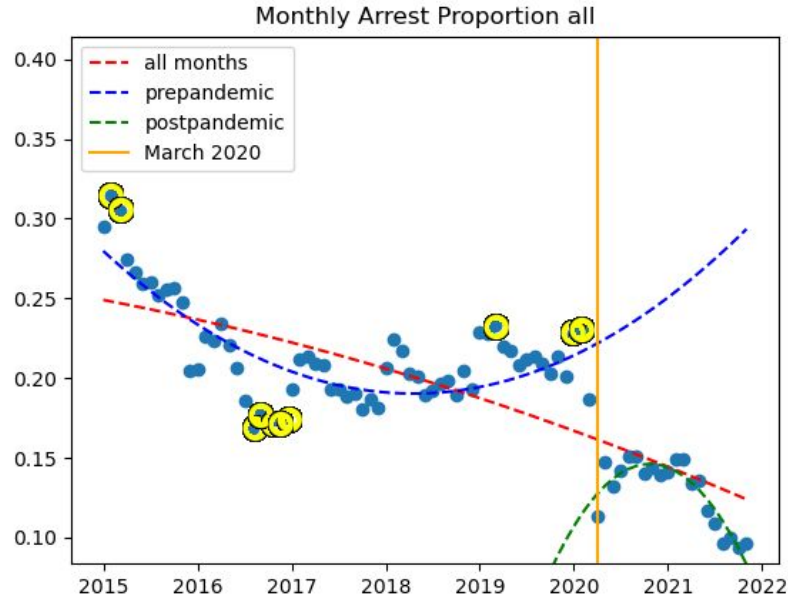
Categories with clear change:



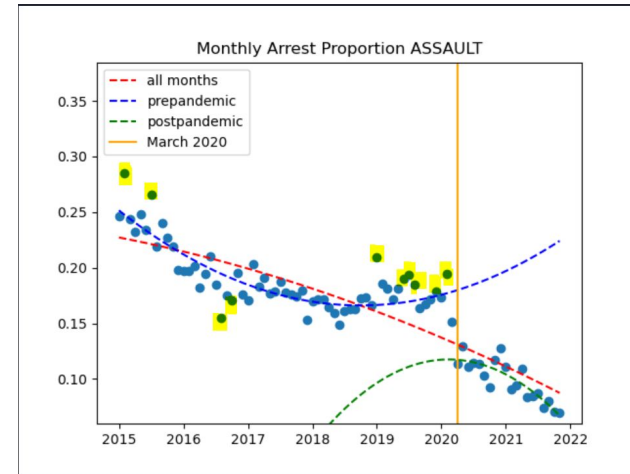
Categories with less change:



# Investigation I: Analyzing Rate of Arrests



Find outliers to the overall trend -  
are they in the early lockdown  
months?





# Investigation I: So many questions...

---

**Conclusion: Fewer arrests as a proportion of crimes.**

What caused the change - are crimes harder to solve, or did the nature of the crimes change?

What factors determine the variance we saw with crime type?

Why did the change persist?

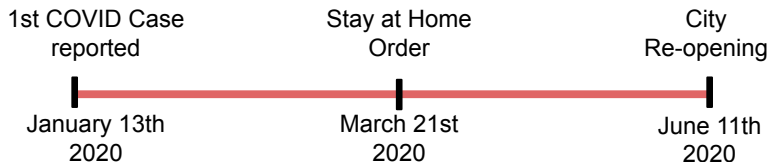
It's important to work with experts!

# Investigation II: Understanding Trends of Domestic Cases

## Why is this important?

Statistics from 2019:

- There were 10,095 domestic related arrests made by the Chicago Police Department [1].
- There were 193,800 domestic related calls made to the Chicago Police Department and 24,400 calls made to the Illinois Domestic Hotline [2].
- On average only 47% of domestic cases are reported to the police [3].



## Recommendations



Policies and services need to address the systemic inequalities impacting survivors including race/ethnicity and socio-economic status.



Services for survivors must be improved including individualized service models, the implementation of harm reduction models such as firearm removal, and ensuring that survivors have a voice throughout court proceedings.



Service providers must receive continuous, and often increased, levels of funding and collaborative prevention efforts must be formed if we wish to see an end to domestic violence.

## Goals for the Investigation:

- How did the pandemic affect domestic cases and what can this predict about future world events?
- How many cases were domestic and of those cases how many arrests took place?
- What was the distribution of domestic cases across Chicago districts for years prior to the pandemic and during 2020?

[1, 2] <https://the-network.org/wp-content/uploads/2020/07/Data-Report-State-of-Domestic-Violence-in-Illinois.pdf>  
[3] <https://newhopeofmcclowell.org/blog/why-do-so-many-domestic-violence-cases-go-unreported>

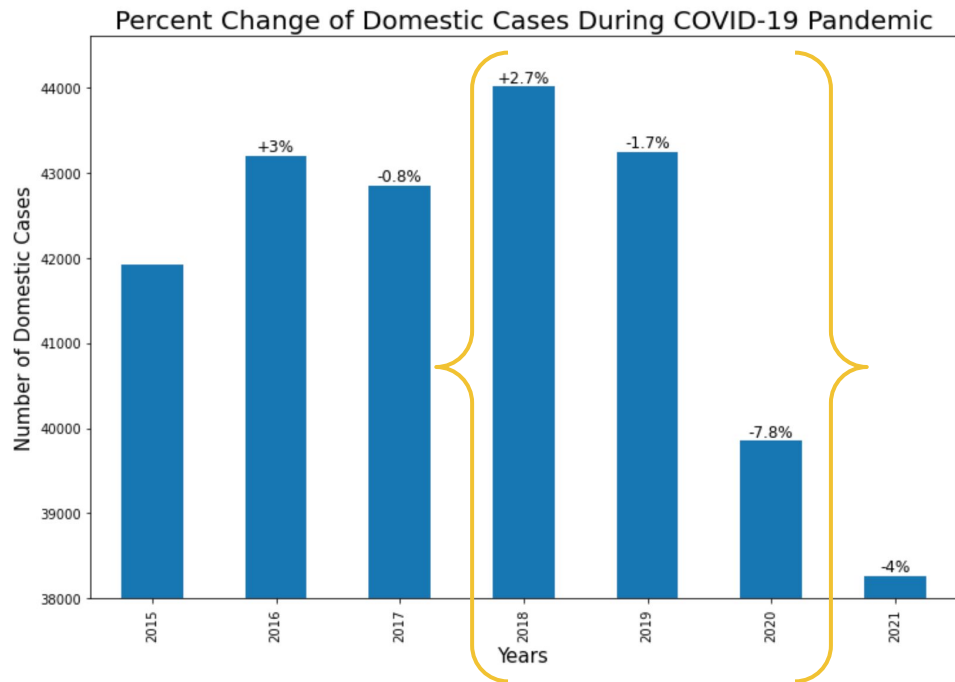
# Investigation II: Understanding Trends of Domestic Cases

## How did the Pandemic Affect Domestic Case Trends?

- Case counts were filtered via domestic related incidents on a yearly basis from 2015-2021.
- Largest count of domestic cases were filed in year 2018.
  - 44,009 total cases
- Percent change of domestic cases were calculated each year.
  - Largest increase in cases from 2017-2018.
  - Largest decrease from 2018-2020 (-9.4%).

## Potential Connections:

- In 2018, VOCA expanded services to victims with \$1 million dollar grant for the city of Chicago [1].
  - Assistance for medical and social services.
- In 2020, more than 30,000 domestic calls were received by the Illinois hotline (+16% from 2019) [2].



# Investigation II: Understanding Trends of Domestic Cases

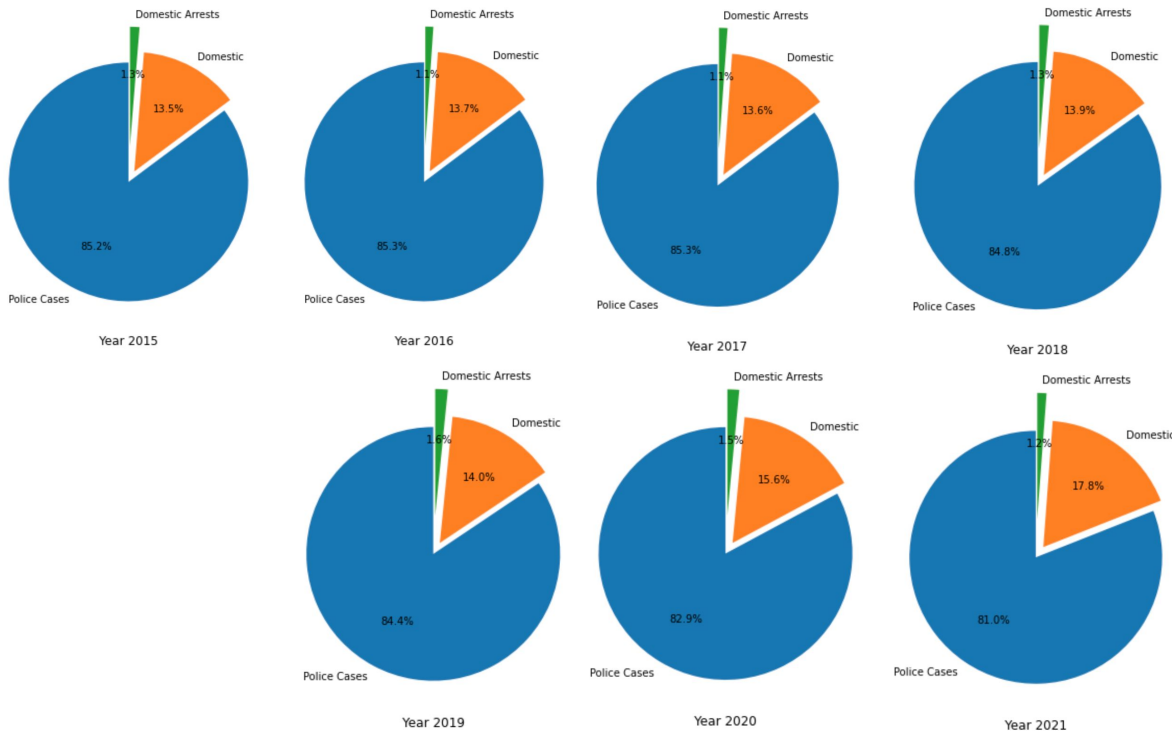
## How many cases were domestic how many arrests took place?

- Case counts were filtered via domestic related incidents and domestic related arrests on a yearly basis from 2015-2021.
- Proportionally, the larger amount of domestic cases took place in 2020.
  - 32,976 domestic cases / 211,388 total cases (only 3,170 arrests)
  - **Note:** 2021 has not concluded so may need to be revised.

## Potential Connections:

- Correlation between larger proportion of domestic cases expected due to at large stay-at-home order issued by the government.
- Arrests depend on multiple factors: preference of officer/victim, previous charges, and family unit [1].

Proportion of Domestic Cases and Arrests



[1] <https://www.ojo.gov/sites/g/files/xyckub241/files/media/document/222679.pdf>

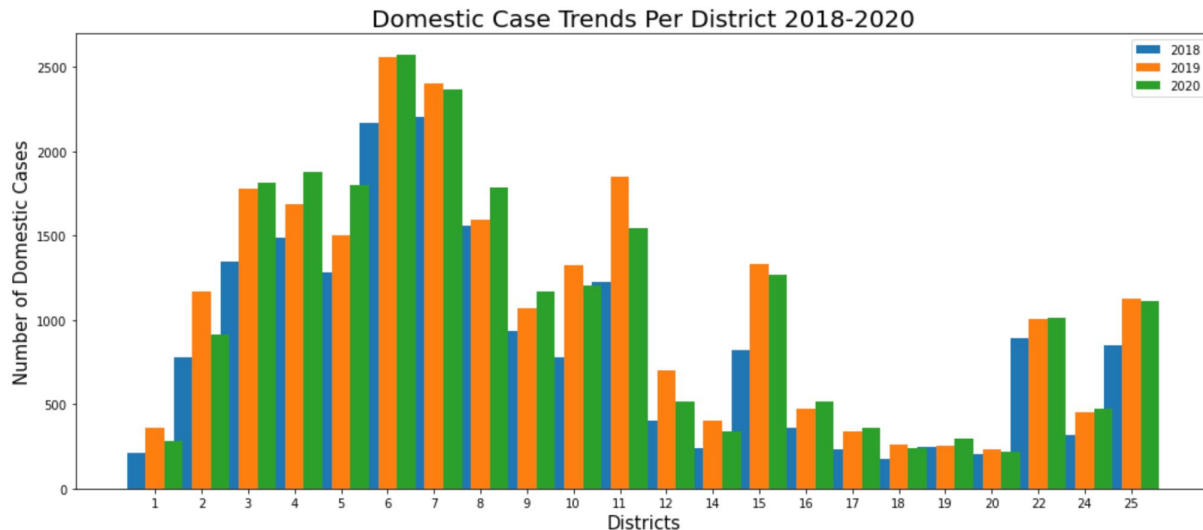
# Investigation II: Understanding Trends of Domestic Cases

## What was the distribution of domestic cases by district?

- Case counts were filtered via domestic related incidents and Chicago districts on a yearly basis from 2018-2020.
- The highest reports for cases across all years was in district 6.
  - 2018: 2,168 domestic cases
  - 2019: 2,558 domestic cases
  - 2020: 2,569 domestic cases
- Lowest counts of cases reported in district 18-20.

## Potential Connections:

- District 6 is Gresham area of Chicago, 6,731 crimes per 100k people reported in 2020 [1].
- Districts 18-20 are downtown metropolitan areas (less residential) [2].



# Investigation II: Understanding Trends of Domestic Cases

## Overall Takeaways

- Reports of domestic related crime decreased significantly from 2019-2020 (-7.8%).
  - Although crime reports decreased, likely more crime happened (+16% hotline calls). Unlikely to proceed to further authority intervention due to being trapped at home.
- Proportionally, 2020 had more domestic related incidents than previous years (15.6% of all reported cases).
  - Not an unexpected finding due to stay-at-home orders instituted nationwide in 2020.
  - Continuing trend of small arrest rates (~1%) due to variety of factors during police intervention.
- Statistically District 6 of Chicago consistently reports higher numbers of domestic cases, Districts 18-20 remain the lowest regardless of pandemic.
  - District 6 has one of the highest rates of criminal activity in Chicago and is a large residential area.
  - Domestic occurrences less likely in downtown metropolitan areas due to tourism and lack of housing.

## Recommendations

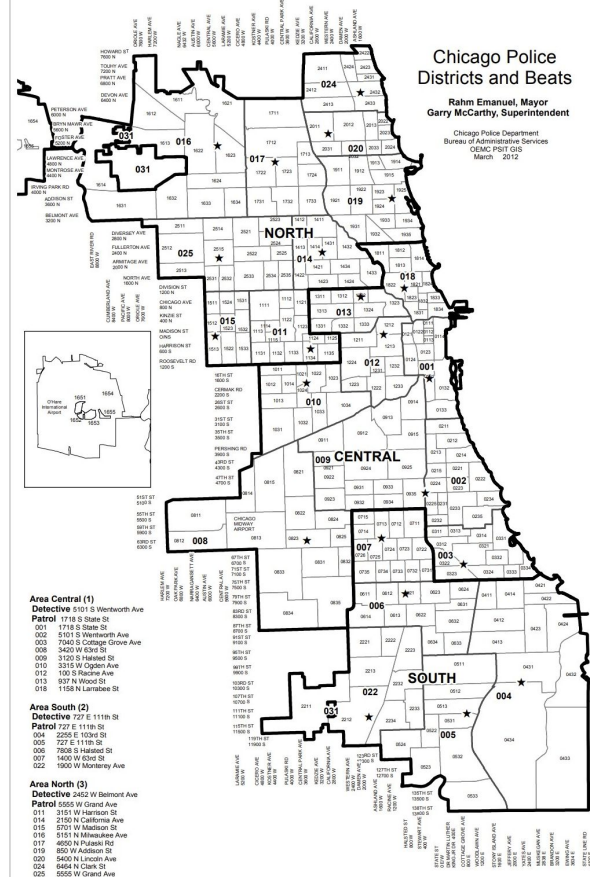
- Creating a better system for domestic reporting due to over half of the incidents not being reported.
  - Difficult to predict when/where domestic incidents can occur.
- Creating access to domestic victims specifically in districts where case counts are the highest.

## Investigation III: Correlating Crimes to Districts

## Key Information

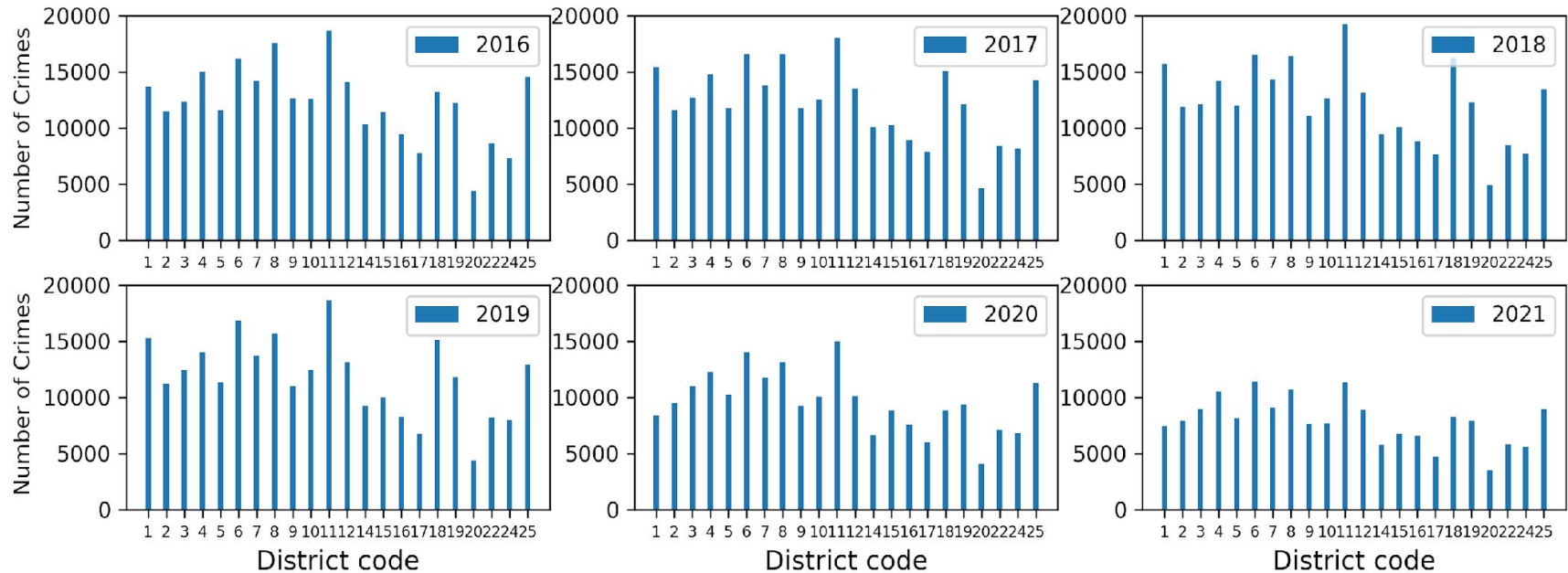
- Utilized features:
  - Primary types (crimes)
  - District (22 district)
  - Area (Central, North and South)

[Map of Chicago Police Districts and Beats.pdf \(wttw.com\)](#)



# Investigation III: Correlating Crimes to Districts

Number of Crimes Per Districts of Chicago city USA From 2016 to 2021

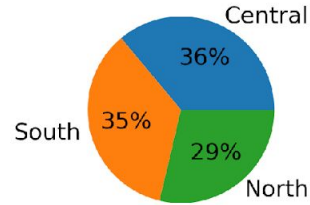


Through the years 2016, 2017, 2018 and 2019, the trend of crimes in most of districts have not faced a big change. Unlikely, the other figures (for years 2020 and 2021) show a noticeable decrease in the level of crimes in all districts, particularly in the areas coded 1, 8, 11 and 18 with the largest-scale of criminal activities that are dropped to about 10000 crimes or less in 2021.

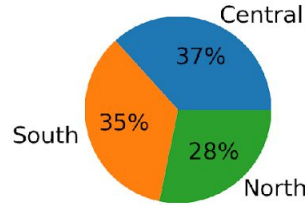


# Investigation III: Correlating Crimes to Districts

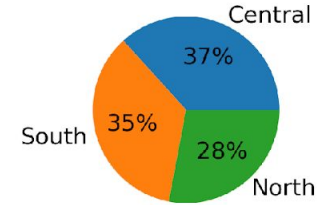
Crime distribution per region in Chicago city



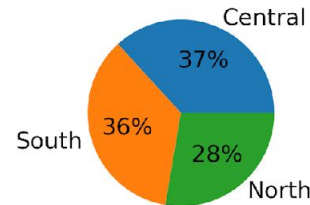
2016



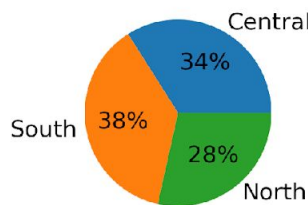
2017



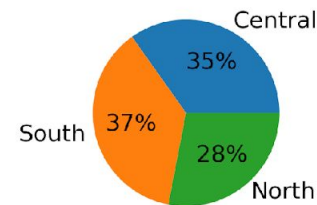
2018



2019



2020



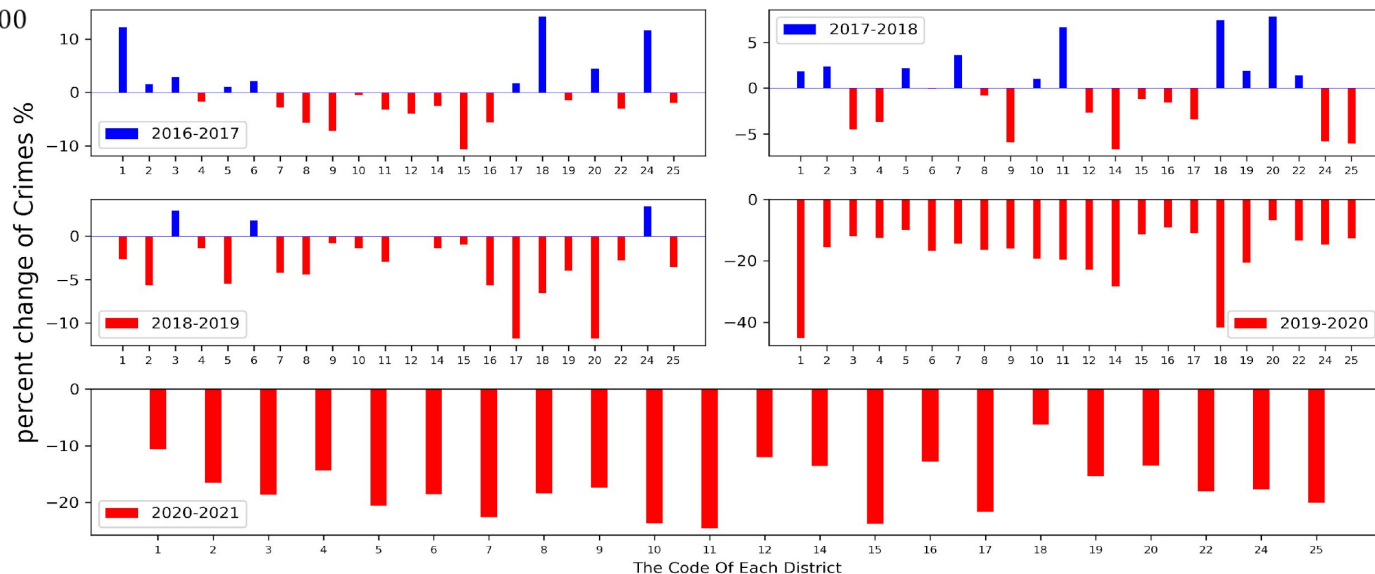
2021

**There is no change in the crime trend distribution before covid19 pandemic with the central Chicago region with the highest crime. However, The south region of Chicago becomes the highest crime rate during the Covid19.**

# Investigation III: Correlating Crimes to Districts

$$\text{Percent Change}^* = \frac{x_i - x_{i-1}}{x_{i-1}} * 100$$

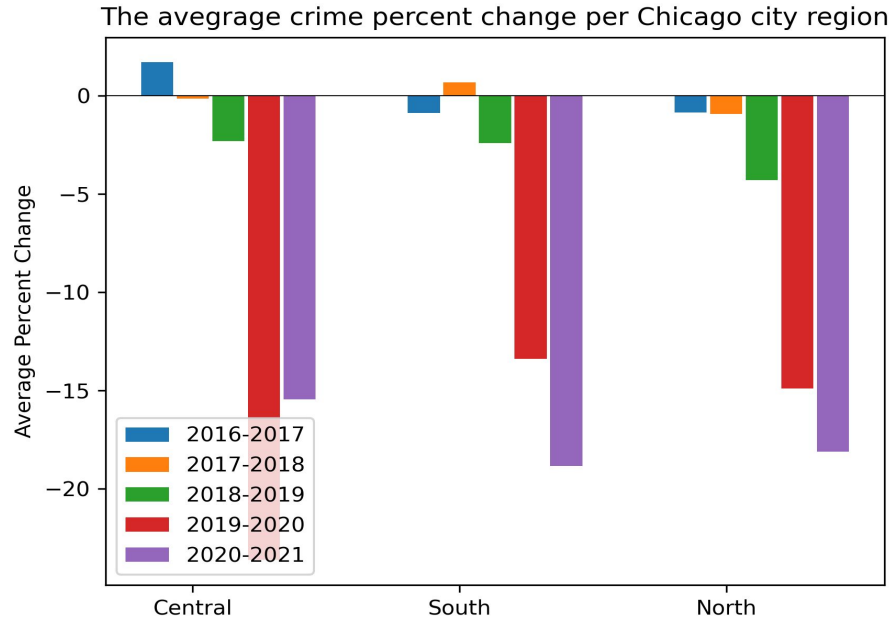
The Percent Change of Crimes Per District in Chicago city, USA from 2016 to 2021  
The change is computed between each two successive years.



The first three figures, which represent the duration almost before Covid19, show a crime percent change range (about 10% to -10%). However, we observe a noticeable decrease in crime percent change during Covid19, which reach down to 40% decrease in 2020.

\*<https://www.percentage-change-calculator.com/calculate.php>

# Investigation III: Correlating Crimes to Districts



## Observations:

- The crimes at the city districts and areas decrease during the pandemic.

The average crime percent change, computed per regions in Chicago, has massively decreased during the pandemic, particularly for the Central Chicago region for the 2019-2020 (about 25%). For the 2020-2021 period, the South and North regions have the highest crime percent decrease with about 18% each.

# Final Thoughts

---

- Overall the arrest rate has decreased in a lasting way, but in a way that varies depending on the nature of the crime.
- Domestic cases decreased during the pandemic, but higher reports of hotline calls were made. Proportionally higher reports of domestic cases were filed. Greater accessibility is needed for domestic victims.
- Criminal activities at the districts and Chicago areas decreased during the Covid19 pandemic.

**Questions?**