How did COVID-19 affect the crime rates in Chicago in 2020 compared to 2019

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Abstract

The purpose of this paper is to identify the differences in crime rates in Chicago between March 2019 and March 2020 using the dataset in Chicago Data Portal. It was found that the crime rates have significantly decreased after the COVID pandemic hit North America, compared to the previous year. Four types of crime (narcotics, theft, battery, deceptive practice) were found to have statistically significant decrease during pandemic controlling for other factors. Narcotics daily crime rate had decreased 2.7 times.

Introduction

COVID-19 pandemic is associated with series of lockdowns, staying at home and working from home. These restictions affect how people work and interact with others. These lifestyle changes would affect all aspects of life including crime. It is expected that with people staying at home, having less interaction with each other, being exposed less frequenty to dangerous situations, the crime rates will decline. The daily crime rates depend on various other factors like day of the week, month of the year, etc. that should be accounted for in the analysis.

The most accurate information about crime comes from police department. Chicago Police is known for tracking crime rate since 2001 and have information publicly available. Crimes-2019 dataset includes all the crime occurred in City of Chicago from 2001 to current year. This data is collected by the Chicago Police Department CLEAR (Citizen Law Enforcement Analysis and Reporting) System.

Data

I examined the 2019 and 2020 crimes datasets provided by Chicago Police Department which includes the reported crime in Chicago. The data is available since 2001 and is constantly being updated. The crime data for 2019 and 2020 was downloaded as CSV files from the following locations:

https://data.cityofchicago.org/Public-Safety/Crimes-2019/w98m-zvie

https://data.cityofchicago.org/Public-Safety/Crimes-2020/qzdf-xmn8

I primarily focused on the crime type and the number of reported crimes in order to investigate the difference in numbers and categories of crimes.

In order to properly categorize the types of crimes, I had to clean some types of crimes from the dataset. I also cleaned the categories that has low frequency and grouped it into “other offense”. Additional variables were created to reflect the month, day of the week, and first of month indicator. I expect that seasonality exists in some types of crime and crime rates vary by day of the week. I removed months of January and February as there was no COVID in 2020 until 1-Mar-2020.

The combined dataset contains 376844 crime events in both years, 222433 in 2019 and 154411 in 2020. The following types of crime are most prevalent in Chicago: Theft (82603), battery (74322), criminal damage (42747), assault (31764).

Table 1. Top 10 most frequent crimetypes in Chicago in 2019-2020

Crime Type	Frequency
THEFT	82603
BATTERY	74322
CRIMINAL DAMAGE	42747
ASSAULT	31764
DECEPTIVE PRACTICE	26666
OTHER OFFENSE	22683
NARCOTICS	16631
MOTOR VEHICLE THEFT	15271
BURGLARY	14963
ROBBERY	12763

Table 2. Daily crime rates for year 2019 and 2020 by crime type

Crime Type	Daily rate 2019	Daily rate 2020
ARSON	1.06	1.78
ASSAULT	58.15	51.19
BATTERY	139.77	115.66
BURGLARY	26.78	24.80
CONCEALED CARRY LICENSE VIOLATION	0.63	0.41
CRIMINAL DAMAGE	75.96	71.46
CRIMINAL SEXUAL ASSAULT	4.42	3.01
CRIMINAL TRESPASS	18.88	10.17
DECEPTIVE PRACTICE	51.30	40.21
GAMBLING	0.45	0.08
HOMICIDE	1.50	2.40
HUMAN TRAFFICKING	0.04	0.01
INTERFERENCE WITH PUBLIC OFFICER	4.40	1.37
INTIMIDATION	0.44	0.49
KIDNAPPING	0.49	0.33
LIQUOR LAW VIOLATION	0.66	0.36
MOTOR VEHICLE THEFT	24.98	27.93
NARCOTICS	40.82	15.26
OBSCENITY	0.17	0.14
OFFENSE INVOLVING CHILDREN	6.37	4.66
OTHER OFFENSE	45.61	32.01
PROSTITUTION	1.90	0.76
PUBLIC INDECENCY	0.04	0.03
PUBLIC PEACE VIOLATION	4.34	3.75
ROBBERY	22.41	21.64
SEX OFFENSE	3.65	2.40
STALKING	0.60	0.54
THEFT	175.39	106.24
WEAPONS VIOLATION	18.08	24.47

In the above table, I observed a decrease in the following four crime types: battery, theft, deceptive practice and narcotics. For example, narcotics daily rates decreased from 40.82 in 2019 to 15.26 in 2020, a decline of 63%.

Model

The primary analysis is performed to determine if daily crime rates have decreased significantly during the pandemic. Linear regression model was built for each type of crime with dependent variable being daily frequency of crime. Models include the following predictors: - Pandemic = binary indicator with 0 = year 2019 (pre-pandemic) and 1 = year 2020 (during pandemic) - Month = categorical variable with March being chosen as reference category - Day of the week = categorical variable with SUnday being selected as reference category - First day of the money = binary indicator with 0 = not first day of the month and 1 = first day of the month

Linear regression model equation can be written as following:

$$[DailyCrimeRate] = \beta_0 + \beta_1[Pandemic] + \beta_2[Apr] + ... + \beta_{10}[Dec] + \beta_{11}[Mon] + ... + \beta_{16}[Sat] + \beta_{17}[FirstDayOfMonth]$$

Data was reorganized so each row represents a particualar day and crime type. Each row has a count of how many crimes of this type were reported to police, with zero indicating no crime being reported that day. The sample below shows first 10 records in this re-organized file.

```
data1[1:10,]
```

```
##          Date                       PrimaryType Pandemic Month DayOfWeek
## 1  2019-03-01                            ARSON        0 March    Friday
## 2  2019-03-01                          ASSAULT        0 March    Friday
## 3  2019-03-01                          BATTERY        0 March    Friday
## 4  2019-03-01                         BURGLARY        0 March    Friday
## 5  2019-03-01 CONCEALED CARRY LICENSE VIOLATION        0 March    Friday
## 6  2019-03-01                  CRIMINAL DAMAGE        0 March    Friday
## 7  2019-03-01           CRIMINAL SEXUAL ASSAULT        0 March    Friday
## 8  2019-03-01                CRIMINAL TRESPASS        0 March    Friday
## 9  2019-03-01               DECEPTIVE PRACTICE        0 March    Friday
## 10 2019-03-01                         GAMBLING        0 March    Friday
##    FirstDayOfMonth NumOfEvents
## 1                1           1
## 2                1          47
## 3                1          97
## 4                1          23
## 5                1           1
## 6                1          63
## 7                1           5
## 8                1          12
## 9                1         105
## 10               1           0
```

Results

Four regression models were constructed for the following crime types: narcotics, theft, battery and deceptive practice.

NARCOTICS crime

Model overall is statistically significant ($p < .001$) with R-square being 0.7503. The model explains 75.03% of variability in daily narcotics crime rates. During the COVID pandemic, daily narcotics crime has decreased

significantly by 26.1058 events ($p < .001$), controlling for other factors. The lowest daily rates are reported in December (12.2975 lower than March). Friday appears to have significantly higher daily rates compared to Sunday, 9.4954 higher.

THEFT crime

Model overall is statistically significant ($p < .001$) with R-square being 0.7965. The model explains 79.65% of variability in daily theft crime rates. During the COVID pandemic, daily theft crime has decreased significantly by 68.739 events ($p < .001$), controlling for other factors. The lowest daily rates are reported in April (10.230 lower than March), while the highest are in August (32.555 higher than March). Friday appears to have significantly higher daily rates compared to Sunday, 26.730 higher. First day of the month is associated with 14.631 more thefts compared to other days of the month.

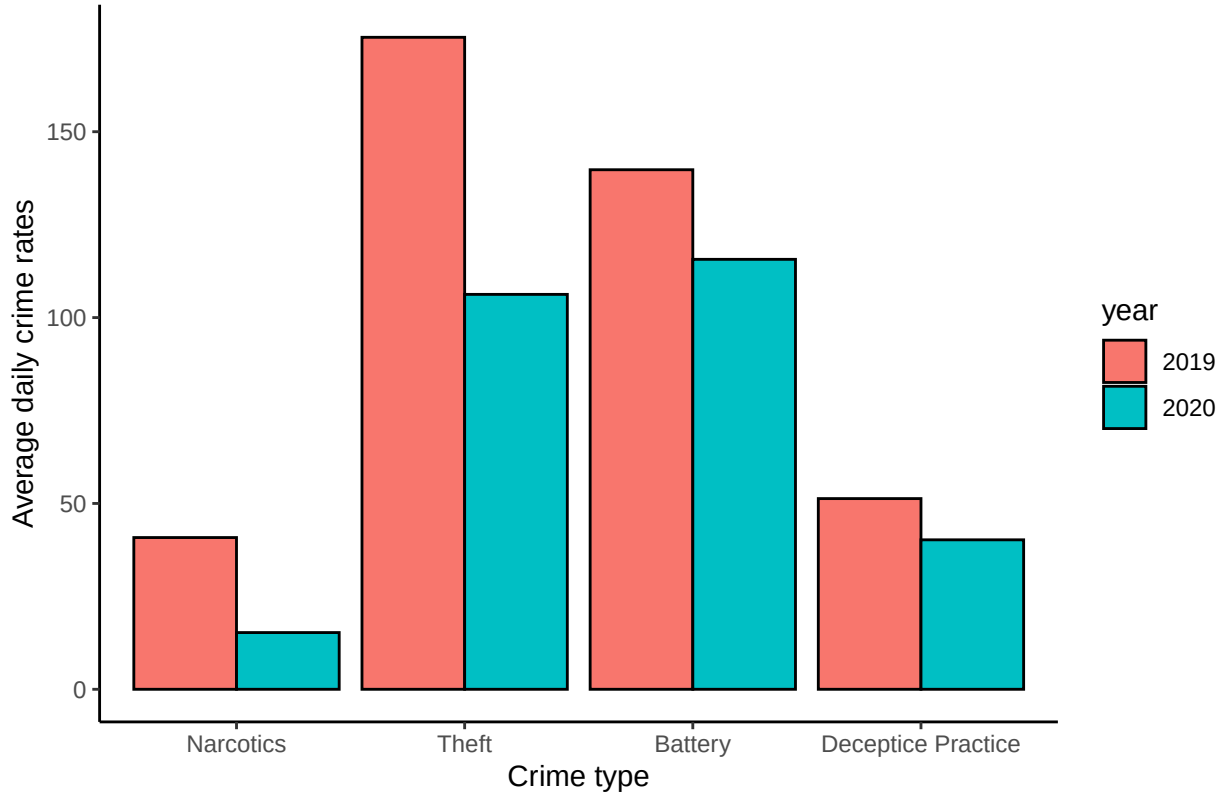
BATTERY crime

Model overall is statistically significant ($p < .001$) with R-square being 0.6271. The model explains 62.71% of variability in daily battery crime rates. During the COVID pandemic, daily battery crime has decreased significantly by 25.919 events ($p < .001$), controlling for other factors. The lowest daily rates are reported in December (12.117 lower than March), while the highest are in July (24.191 higher than March). Sunday has the highest daily rates of battery crime compared to all other days of the week, the lost rate are in Tuesday and Wednesday.

DECEPTIVE PRACTICE

Model overall is statistically significant ($p < .001$) with R-square being 0.5143. The model explains 51.43% of variability in daily deceptive practice crime rates. During the COVID pandemic, daily deceptive practice crime has decreased significantly by 11.29961 events ($p < .001$), controlling for other factors. The highest daily rates are reported in October (11.67277 higher than March). Friday has the highest daily rates of deceptive practice compared to Sunday (19.00006 higher). First day of the month is associated with 31.51421 higher number of deceptive practice crimes.

Figure 1. Change in daily crime rates before and during pandemic



The figure 1 (above) shows how four crime types examined in this research had changed from 2019 (pre-COVID) to 2020 (during COVID pandemic). All four crime types decreased significantly in 2020.

Discussion

The COVID-19 Pandemic that struct the world in 2020 led to many changes in peopleâ€™s lives. Since more people are working and staying home most of the time, the crime rate has significantly declined. The dataset based on different crime reported to the police department of city of Chicago also display the differences between 2019 and 2020 crime rates.

Since there are drastic decline in physical crimes, there will be less report in the police department. However, potentially there is a chance that there are more online, cybercrimes and scam calls.

The police in Chicago can be redeployed and re-allocated to other types of crimes such as fraud or online crime. The government can also consider reducing the police budget and re-allocating funds.

The results discovered in this study might not apply to other US cities, states or countries since it is specifically focused on Chicago.

The more accurate model can be built if I apply geospatial information about the location of the crime. This particular model focuses on four types of crimes which are narcotics, theft, deceptive practice and battery. However, there might be other types of crimes that will show different result. Since the downtown of Chicago is mostly office buildings and commercial, with the lockdown, it makes sense that there are less crimes.

One of the weaknesses of this paper is that the data only includes crime events that are reported to the police department. There is also a potential misclassification of crime types in the database.

In the future, I can look into data from other police departments, examine other types of crime and include geospatial information.

References

Chicago Police Department. Crimes-2019. Chicago Data Portal, 21 Dec. 2020, data.cityofchicago.org/Public-Safety/Crimes-2019/w98m-zvie.

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