The COVID-19 Impact on NYC Crime

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Description

New York City was an early epicenter of COVID-19 in the United States. From March to May in 2020, approximately 203,000 confirmed COVID-19 cases were reported with a 9.2% overall fatality rate and a 32.1% fatality rate among hospitalized patients[1]. As of March 15, 2020, there were 30,000 confirmed deaths in New York City and 626,400 lost jobs, with private sector employment falling 15%[2]. Unemployment has left many residents struggling to pay rent, buy food and cover medical bills. The city also witnessed widespread social unrest, sparked by the killing of George Flloyd and the rise of the Black Lives Matter movement.

Pandemics have the potential to increase the risk of crime. Prior research on pandemics found that isolation from quarantine can result in mental distress, loneliness, depression, PTSD, anger, sleep disorders and substance abuse, all factors that increase the risk of violence[3]. Research has also shown that rising unemployment can lead to an increase in property crimes[4]. This project seeks to investigate the impact of the pandemic on crime in New York City by analyzing NYPD crime data.

Hypotheses

Our research will investigate the following hypotheses:

1. We expect overall crime to decline in 2020 versus 2019 as a result of lock-downs due to the pandemic.
2. We expect an increase in theft and property related crimes in 2020 versus 2019 as a result of economic hardship caused by the pandemic.
3. We expect an increase in hate crimes against Asian citizens in 2020 versus 2019 due to an increase in anti-China rhetoric during the pandemic.

The Data

The NYPD data used in this analysis contains every criminal complaint in NYC since 2006; this amounts to over 7 million crimes. Our analysis will focus primarily on crimes that occurred between 2019 and 2020. Some of the key variables used in the analysis are: date of offense, borough, location description, offense description, and racial bias motive.

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[1] https://www.cdc.gov/mmwr/volumes/69/wr/mm6946a2.htm
[2]https://www.wsj.com/story/the-numbers-are-in-how-a-year-of-the-covid-19-pandemic-changed-new-york-city-60251164
[3] https://bmcmedicine.biomedcentral.com/articles/10.1186/s12916-020-01897-z
[4] http://jhr.uwpress.org/content/43/2/413.abstract

The raw data is accessible in .csv format from https://opendata.cityofnewyork.us/:

Data type	Data files
Complaint	● NYPD_Complaint_Data_Historic.csv ● NYPD_Complaint_Data_Current_Year_To_Date.csv
Hate Crimes	● NYPD_Hate_Crimes.csv
COVID	● COVID-19_Daily_Counts_of_Cases__Hospitalizations__and_Deaths.csv
Supplemental	● NYPD_Complaint_Incident_Level_Data_Footnotes.pdf ● NYPD_Complaint_Historic_DataDictionary.xlsx

Data Inspection & Cleaning

(a) Complaint Data

- The Complaint data comes in two files, *NYPD_Complaint_Data_Historic.csv ("Historic")* and *NYPD_Complaint_Data_Current_Year_To_Date.csv ("Current")*. The difference is that *Current* has an extra column for geodata.
- 24% of the combined data had missing data. However, most of the null values belonged to variables that wouldn't necessarily apply to every crime (ex: name of park where crime occured). For this reason, we did not filter out data with missing values.
- 819 crimes did not have dates of occurrence ("CMPLNT_FR_DT"). Since we decided to use this variable in our analysis for the date of the offenses, we populated the null values with other date fields. For example, if a crime had a reported end date ("CMPLNT_FR_TM"), we used that value to replace the null value. Otherwise, we used the report date ("'RPT_DT"). These steps eliminated all null values from the date column.
- Filtered out crimes which occurred before 2019 to facilitate a year-over-year comparison with 2020, and filtered out crimes before 2017 to observe longer trends

(b) Hate Crimes Data

- Data set came relatively clean with additional variables that were dropped for readability
- Because complaint_year_number provided the year that the hate crime occurred, we dropped all other date-related variables
- For easier processing, all column headers were transformed into strings joined with underscores rather than periods and spaces
- For instances where a racial/religious sexual orientation group had zero hate crimes in given year, we transformed NaN values to = 0
- We chose to leave in all offense categories for all targeted victims (race/color, sexual orientation, religion/ religious practice) to understand if trends were specific to race or general to all recorded hate crimes

(c) COVID Data

- The dataset contains 2020 data, from February 29th until December 3rd
- The dataset contains data for NYC as a whole, as well as a breakdown by borough
- Dataset contains 274 rows, one for each day during the report timeframe
- Checked for correlations between the different variables in purpose of reducing dimensionality
- Due to high positive correlation (>0.8) between newly reported covid cases, new hospitalizations and new deaths, we decided to leave only the “CASE_COUNT” metric and drop the rest of the data columns
- No null values identified
- Converted dates column to datetime and aggregated the data by month (sum)

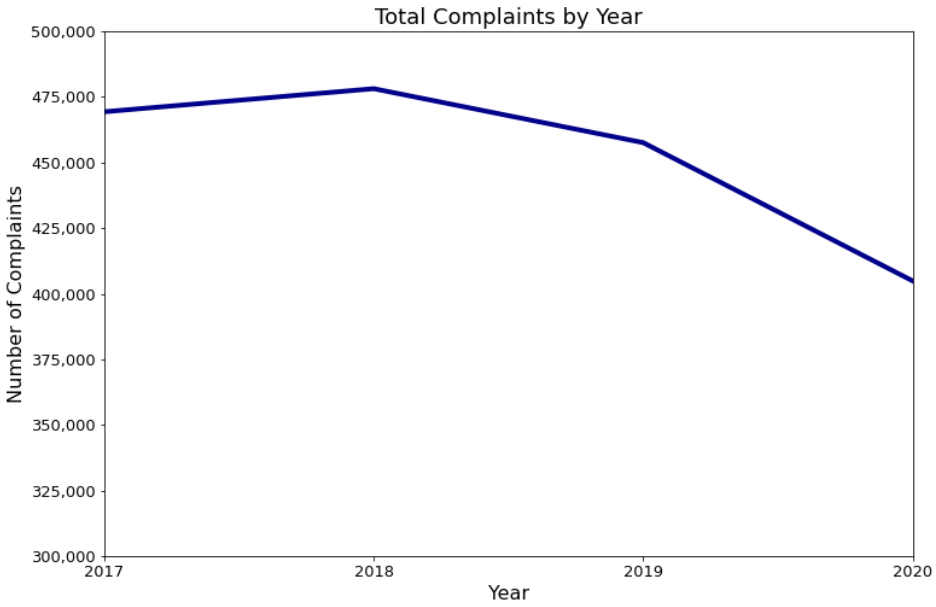
(d) Supplemental Data

- Certain drug, trespassing, theft of service, prostitution offences and other mala prohibita offenses do not require a complaint report and therefore may not be represented accurately, or at all, in this dataset. These incidents are tracked with other forms.

Data Analysis

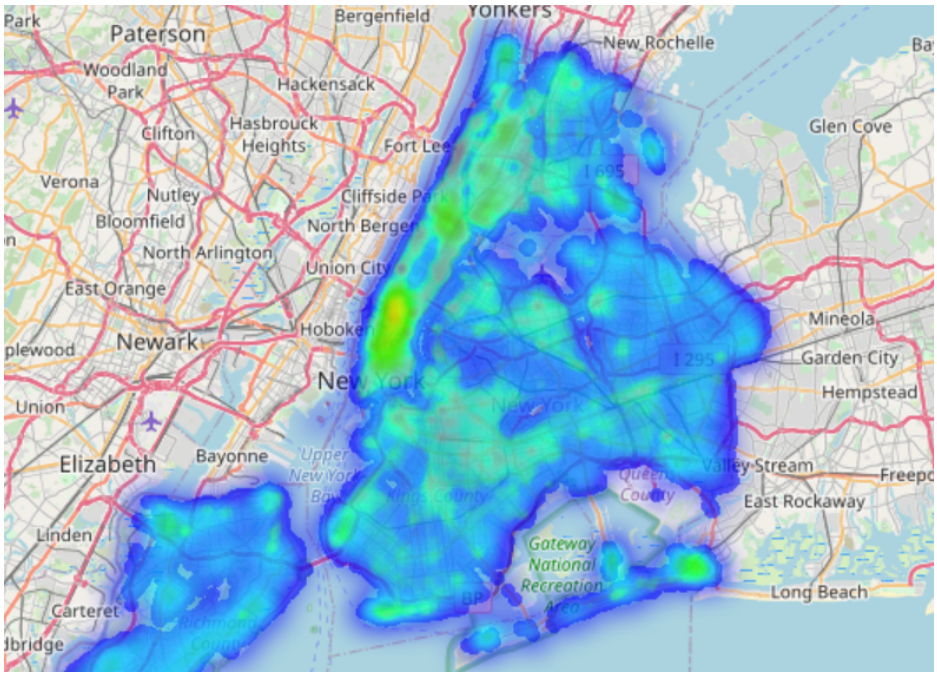
The data in **Figure 1** shows that crime rose slightly from 2017 to 2018 and then declined in 2019. The number of reported crimes dropped even further in 2020. The decline could be a continuation of the prior year’s trend, or the pandemic, or both. It is also possible that crimes were under-reported in 2020 due to lockdowns and people wanting to avoid social interactions.

Figure 1.



The heatmap in **Figure 2** provides a visual representation of the reported locations of offenses across the five boroughs.

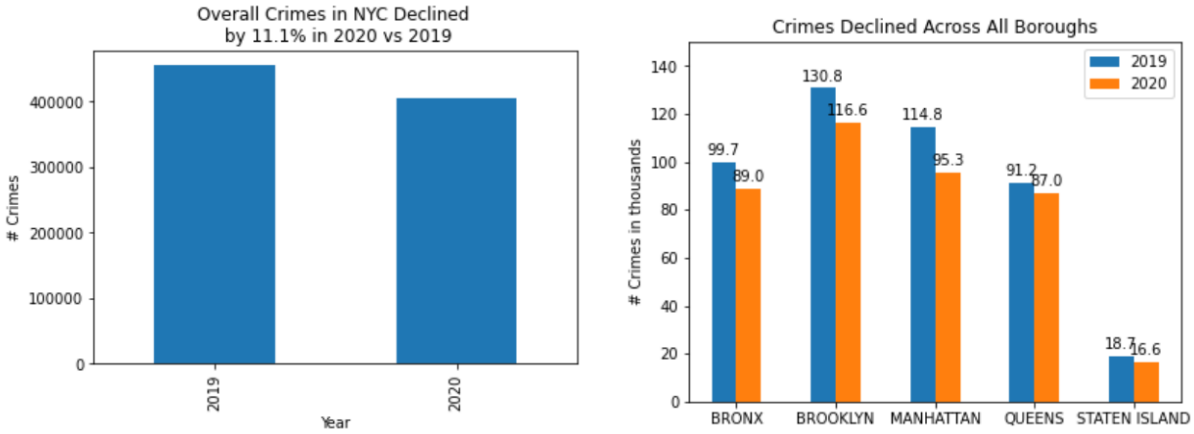
Figure 2.



Hypothesis #1: We expect overall crime to decline in 2020 versus 2019 as a result of lock-downs due to the pandemic.

A total 860,433 crimes occurred between 2019 and 2020. The data in **Figure 3** shows that overall crime in New York City declined by 11.1% in 2020 compared to 2019, which supports our first hypothesis. The declines were experienced across all five boroughs.

Figure 3.



The number of crimes that occurred inside a premise also declined, as shown in **Table 1**. This could be due to fewer indoor gatherings due to lockdowns, social distancing and closed businesses. Unsurprisingly, the number of crimes reported as occurring “outside” increased substantially, though from a much lower base.

Table 1.

YEAR	2019	2020	YoY Change	YoY Change (%)
LOC_OF_OCCUR_DESC				
FRONT OF	106730	110552	3822	+3.6%
INSIDE	248235	210472	-37763	-15.2%
OPPOSITE OF	10032	9970	-62	-0.6%
OUTSIDE	177	310	133	+75.1%
REAR OF	8345	8312	-33	-0.4%

Despite overall crime declining in 2020 relative to 2019, certain types of crimes increased. As shown in **Table 2**, burglaries, car theft and murders increased by +43.7%, +66.1% and +47.5%, respectively. Crimes involving rape declined by -28.9%, perhaps due to fewer social gatherings.

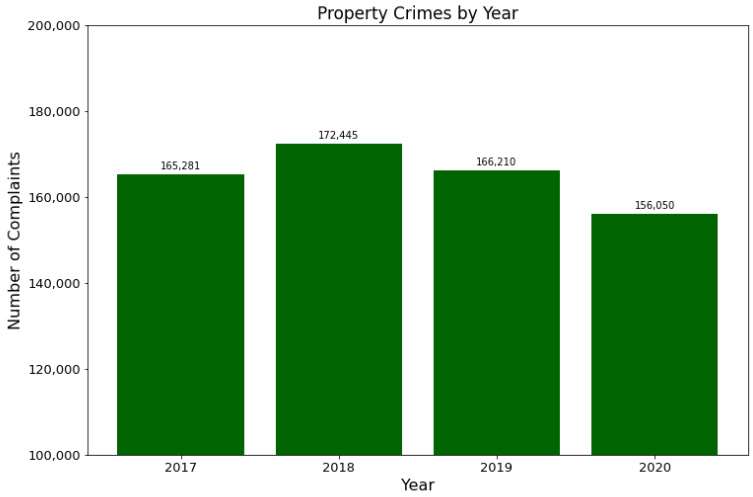
Table 2.

YEAR	2019	2020	YoY Change	YoY Change (%)
OFNS_CUSTOM				
BURGLARY	10701	15378	4677	+43.7%
FELONY ASSAULT	20525	20452	-73	-0.4%
GRAND LARCENY	42359	33752	-8607	-20.3%
GRAND LARCENY AUTO	5402	8974	3572	+66.1%
MURDER	299	441	142	+47.5%
OTHER	272680	231165	-41515	-15.2%
PETIT LARCENY	88794	80619	-8175	-9.2%
RAPE	1455	1035	-420	-28.9%
ROBERRY	13309	13080	-229	-1.7%

Hypothesis #2: We expect an increase in theft and property related crimes in 2020 versus 2019 as a result of economic hardship caused by the pandemic.

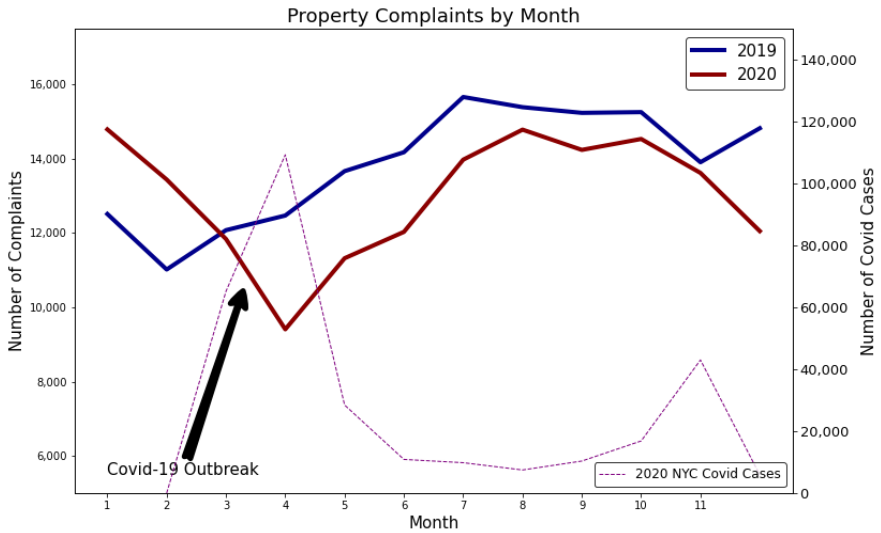
The data also supports our second hypothesis. As shown in **Figure 4,** property crimes, which include theft, larceny, burglary, robbery, arson, and trespassing, declined 6.1% in 2020 versus 2019, continuing the trend from the previous year[5].

Figure 4.



The data in **Figure 5** suggests the outbreak of COVID in March played a strong role in the decline in property crimes from March to April, a time that normally sees an increase. Lockdowns and “shelter-in-place” orders forced many to stay at home, even criminals! By April, the *rate* of complaints returned to normal despite the overall *level* being down.

Figure 5.



[5] Property crimes as defined by Bureau of Justice Statistics (BJS), https://www.bjs.gov/index.cfm?ty=tp&tid=323

Despite overall property offenses declining in 2020 relative to 2019, certain types of property offences increased. The data in **Table 3** shows that offenses involving motor vehicles increased the most, followed by burglary and arson. Criminal trespassing, grand larceny and possession of stolen property crimes declined the most.

Table 3.

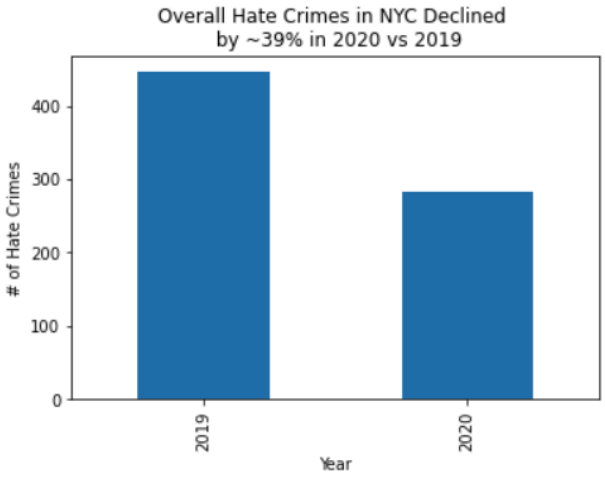
CMPLNT_FR_DT Property Crimes	2019	2020	YoY Change	YoY Change (%)
ARSON	695	809	114	+16.4%
BURGLARY	10729	15378	4649	+43.3%
CRIMINAL TRESPASS	3041	2123	-918	-30.2%
GRAND LARCENY	42503	33752	-8751	-20.6%
GRAND LARCENY OF MOTOR VEHICLE	5415	8974	3559	+65.7%
PETIT LARCENY	88997	80619	-8378	-9.4%
PETIT LARCENY OF MOTOR VEHICLE	85	163	78	+91.8%
POSSESSION OF STOLEN PROPERTY	1403	1152	-251	-17.9%
ROBBERY	13342	13080	-262	-2.0%
Total	166210	156050	-10160	-6.1%

The rise in motor vehicle theft during the pandemic could be a reflection of fewer people using their cars and more people out of jobs. Motor vehicle theft is also considered to be a low risk crime with high potential reward. The rise in burglaries could also be due to people leaving the city and abandoning their properties, therefore leaving an opening for potential criminals. Trespassing and larceny crimes, which declined in 2020, were likely much harder to commit during the pandemic since people were mostly home.

Hypothesis #3: We expect an increase in hate crimes against Asian citizens in 2020 versus 2019 due to an increase in anti-China rhetoric during the pandemic.

Though we expected that the pandemic would likely reduce overall crime rates in New York City, we likewise hypothesized that anti-Asian hate crimes would *increase* compared to the year prior due to anti-Asian rhetoric and a divisive political atmosphere. The data supports this hypothesis. As shown in **Figure 6**, there were a total of 446 hate crimes reported in NYC in 2019; in 2020, this number was nearly halved to 282 hate crimes. This follows the trend that we observed in hypothesis #1, that the overall rate of crime would decline with a city enduring a pandemic and shelter-in-place orders.

Figure 6



Next, we examined how the totals for hate crimes changed year-over-year relative to their "offense category", a means of distinguishing whether the victims were targeted on the basis of race, religious affiliation, or sexual orientation.

Table 4.

complaint_year_number offense_category	2019	2020	YoY Change	YoY Change (%)
Age	0.0	1.0	1.0	+inf%
Disability	1.0	0.0	-1.0	-100.0%
Ethnicity/National Origin/Ancestry	22.0	7.0	-15.0	-68.2%
Gender	13.0	17.0	4.0	+30.8%
Other	0.0	3.0	3.0	+inf%
Race/Color	66.0	81.0	15.0	+22.7%
Religion/Religious Practice	277.0	138.0	-139.0	-50.2%
Sexual Orientation	64.0	35.0	-29.0	-45.3%
Unclassified	3.0	0.0	-3.0	-100.0%
Total	446.0	282.0	-164.0	-36.8%

As shown in **Table 4**, there was a marked decline in all categories *except* for hate crimes related to Race/Color and Gender.

And while the number of Gender-related crimes increased from 13 to 17, Race/Color-related crimes increased by 15, the greatest overall growth of any category.

The racial bias driving the increase was overwhelmingly anti-Asian. As shown in **Table 5**, 2020 witnessed a 2900% increase in anti-Asian hate crimes, dwarfing the increases of any other targeted group.

Table 5.

complaint_year_number bias_motive_description	2019	2020	YoY Change	YoY Change (%)
50 YEARS OLD OR MORE	0.0	1.0	1.0	+inf%
ANTI-ARAB	5.0	1.0	-4.0	-80.0%
ANTI-ASIAN	1.0	30.0	29.0	+2900.0%
ANTI-BLACK	36.0	39.0	3.0	+8.3%
ANTI-BUDDHIST	2.0	0.0	-2.0	-100.0%
ANTI-CATHOLIC	6.0	9.0	3.0	+50.0%
ANTI-FEMALE	0.0	11.0	11.0	+inf%
ANTI-FEMALE HOMOSEXUAL(GAY)	6.0	5.0	-1.0	-16.7%
ANTI-GENDER NON CONFORMING	0.0	2.0	2.0	+inf%
ANTI-HINDU	0.0	2.0	2.0	+inf%
ANTI-HISPANIC	8.0	1.0	-7.0	-87.5%
ANTI-ISLAMIC(MUSLIM)	15.0	5.0	-10.0	-66.7%
ANTI-JEHOVAS WITNESS	1.0	0.0	-1.0	-100.0%
ANTI-JEWISH	251.0	120.0	-131.0	-52.2%
ANTI-LGBT(MIXED GROUP)	7.0	3.0	-4.0	-57.1%
ANTI-MALE HOMOSEXUAL(GAY)	51.0	27.0	-24.0	-47.1%
ANTI-MULTI RACIAL GROUPS	1.0	2.0	1.0	+100.0%
ANTI-OTHER ETHNICITY	9.0	5.0	-4.0	-44.4%
ANTI-OTHER RELIGION	2.0	0.0	-2.0	-100.0%
ANTI-PHYSICAL DISABILITY	1.0	0.0	-1.0	-100.0%
ANTI-RELIGIOUS PRACTICE GENERALLY	0.0	2.0	2.0	+inf%
ANTI-TRANSGENDER	13.0	4.0	-9.0	-69.2%
ANTI-WHITE	28.0	10.0	-18.0	-64.3%
OTHER	0.0	3.0	3.0	+inf%

We postulate that this increase in hate crimes targeting Asian Americans correlates with political rhetoric claiming that COVID originated in China, describing COVID as “The China Virus”, and other inflammatory commentary circulated in 2020.

Though New York City is one of many major metropolitan centers in the United States, it is in many ways a microcosm for the United States. It is both incredibly diverse and incredibly segregated- a place where cultures collide and occasionally crash.

Key Limitations

Although the data supports our hypotheses, there are limitations.

- ***Risk of unreported crimes:*** Not all crimes are reported to the police, and some individuals or groups may be more likely to report crimes than others. Certain groups, such as undocumented foreign born individuals and victims of domestic abuse, may be less likely to report these crimes. In addition, certain *mala prohibita* crimes may not be reflected in the data because the NYPD uses other forms to track them.
- ***Risk of misclassification:*** For a hate crime to be entered into the NYPD database, the investigating police officer must identify a bias motivation. It is possible that some hate crimes may not be classified as a hate crime, if the investigating officer is not aware of the bias even if it was present.

- ***Risk of multiple motives:*** Our current data sets identify a singular bias or motive for committing hate crimes. It's possible that a multiplicity of beliefs, biases, and prejudice motivate these crimes meaning data may be skewed.

Conclusion

The NYPD crime data provided strong evidence in support of our hypotheses that 1) overall crime would decline in 2020 due to the pandemic, 2) theft and property crimes would increase as a result of economic hardship and 3) crimes against Asian Americans would increase in 2020 due to anti-China rhetoric. The data also yielded some unexpected insights.

Some of the key takeaways from the analysis:

- Overall crime in New York City declined by 11.1% in 2020 during the pandemic compared to 2019
- The number of crimes that occurred inside a premise declined 15.2% in 2020 compared to 2019, possibly due to fewer people gathering indoors during the pandemic
- Burglaries, car theft and murders increased by +43.7%, +66.1% and +47.5%, respectively, despite overall crimes declining.
- Property crimes decreased in 2020, aligned with the overall decrease in crime in 2020. however, within the property crimes category, there were mixed trends between the different crime types- crimes that relate to property and vehicles increased, probably due to them being abandoned during the pandemic
- Property crimes dropped during the initial Covid-19 outbreak in NYC, but rapidly started increasing again when the first wave of Covid-19 started declining
- Hate crimes targeting Asian people dramatically increased during the COVID-19 outbreak, even as other targeted groups saw steep declines in victimization. Though the cause of this increase is speculative, the staggering acceleration of hate crimes committed is concrete.
- Though hate crimes orbiting religion and religious practices make up the majority of hate crimes in NYC, religion-centric hate crimes decreased substantially during the COVID-19 outbreak