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Crime and the City:

How patterns in agency expenditures relate to crime in the City of New York

One of the most obvious ways that a government can measure a quality-of-life attribute in their locality is through the measurement of criminal activity. Crime is significant beyond just a criminal act in isolation. If businesses are impacted by crime, they are reluctant to operate or expand in a risky area. Citizens in a high crime area choose to move and impact the local tax base. Areas such as Baltimore, Detroit, or Camden have seen this type of long-term flight due to crime and worsening economic opportunities in time. The City of New York has a lot of opportunities to provide residents and businesses as a center of culture and commerce, so it is a good locality to measure crime. If crime grows, the future potential of the city can be negatively impacted like many other places. Cities are aware of the threat of heightening crime statistics and seek to curtail the issue through spending on different resources. For our project we sought to address the topic: Does higher expenditures by key New York agencies impact the level of crime in the city over time?

The first question we needed to answer is what measures do we need to use to measure both crime and expenditures by the City of New York? Both sets of data come from the city official reporting figures and are presented by the Independent Budget Office of New York. The most direct comparison measure is to use seven significant felonies as crime data. Felony data is constant as crimes such as murder and robbery as defined does not change over time. Also, as a choice, felony data does not fluctuate too much due to changes in the law. Misdemeanors can change in severity and some actions can become legal, such as marijuana possession that was a misdemeanor but is now a fineable offense and may be legalized. From receiving the seven serious felony data sets from 2000 to 2020, we needed to narrow it down further to focus on specific crimes to use in analysis. The most obvious statistics were

murder, robbery, and total felony offenses in order to get different measures of felonies and see how the total amount of felonies are changing over time.

To look at spending by the City of New York we wanted to view how specific agencies spend their budgets over the same period of time as the crime data. New York is a good place to view because it large, has high visibility, and has a large amount of data that is verified. The best agencies of interest are agencies that either provide public safety and protection or provide resources that make the lives of citizens better in the form of public services. Protection is best defined through NYPD spending, while spending on Social Services, Department of Education, City University Spending, and Youth and Community Services. Spending on services should help improve the life of the citizenry and make crime less likely. If children are more educated and are given positive guidance, he/she is less likely to commit crimes in the long run. NYPD, by comparison should reduce crime by removing criminals from society, but also to deter people from committing crimes.

The inferences explained above support a thesis we should see in the data: Does higher spending on these services lead to less crime in affected communities? The negative correlation is valuable to measure the success of such programs. If crime is higher or is flattened but spending is high, do the programs work well? If the programs were not there, would the data show worse outcomes potentially? The ramifications of these questions impact whether or not budgets should increase or decrease in future years.

The code written is split into statistics of interest in the fixed time period and graphics that show comparative line graphs between spending and crime levels. Descriptive statistics show what years had high spending or high crime and show statistics such as mean, min, max, and the quantiles of the data. This shows how the mean spending might compare to the max spending, is there a disparity between the year with the least amount of crime vs the most amount of crime? Overall, from running the data

we can see patterns that tell a story. Let's first look at descriptives of interest, specifically the statistic moments through graphics on each data set. Descriptives and graphs not represented here are included in the code portion that is also attached.
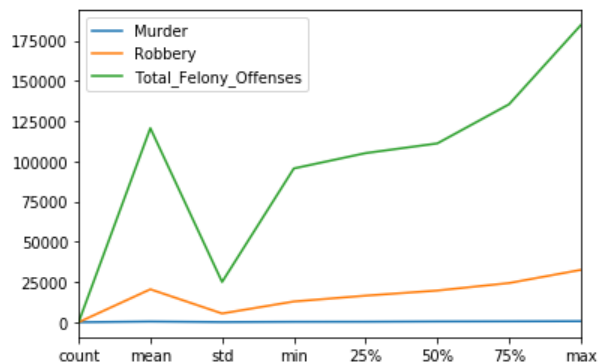
```
In [25]: Agency_Expenditures_NYC.describe().plot()
Out[25]: <matplotlib.axes._subplots.AxesSubplot at 0x24c1483bba8>
```
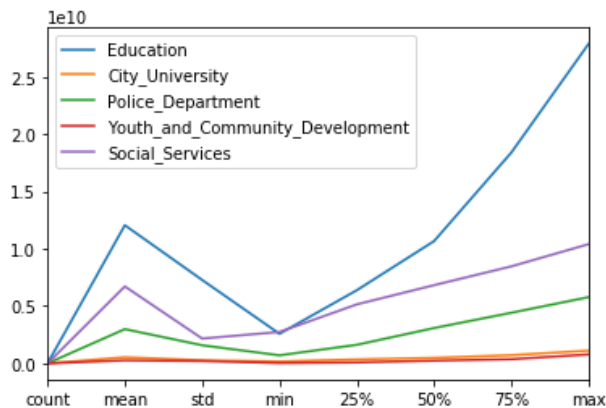


```
In [27]: Major_Felonies_NYC.describe().plot()
Out[27]: <matplotlib.axes._subplots.AxesSubplot at 0x24c148c9fd0>
```


We can see above that for some expenditures and for total felony offenses there is a wide disparity between the mean value and the min or max values. Department of Education shows a high disparity between min and max points showing that a high rate of increase or decrease occurred at some point. The other expenditures show a gradual incline from mean or min to the max value, supporting a steady increase or decrease in time. Otherwise, total felony offenses have a significant

standard deviation with an almost exponential difference in min to max points. The other crimes are steadier in change. This supports that there are most likely felonies that are outside the scope of this analysis that have shown a significant change in occurrences over time. This is most likely a lower-level felony statistic because less severe felonies occur more often and have higher volatility due to the fact that these events would be more likely to occur on a normal basis. Our intuition is assault, for example, is most likely to be a spontaneous occurrence in a circumstance compared to executing a murder, which ha a much heavier criminal sentence involved. Next, we need to examine values that occur over the period of time. By looking at the max values of spending and crime occurrences, we can see if patterns occur and what part of the time series that this is occurring.

Max Values for Agency Expenditures:

```
In [8]: Agency_Expenditures_NYC.nlargest(5, ['Education'])
Out[8]:
```

Year	Education	City_University	Police_Department	Youth_and_Community_Development	Social_Services
2020	27903294638	1116522798	5785046467	783648904.00	10408734036
2019	26905467180	1114118133	5668823293	697619241.00	10188334878
2018	25026392457	1087244959	5480431760	620742309.00	9853246905
2017	23317602305	1067116800	5312163257	549820517.00	9501094797
2016	21973688201	955775205	5075080640	508135145.00	9345924176

```
In [10]: Agency_Expenditures_NYC.nlargest(5, ['City_University'])
Out[10]:
```

Year	Education	City_University	Police_Department	Youth_and_Community_Development	Social_Services
2020	27903294638	1116522798	5785046467	783648904.00	10408734036
2019	26905467180	1114118133	5668823293	697619241.00	10188334878
2018	25026392457	1087244959	5480431760	620742309.00	9853246905
2017	23317602305	1067116800	5312163257	549820517.00	9501094797
2016	21973688201	955775205	5075080640	508135145.00	9345924176

```
In [12]: Agency_Expenditures_NYC.nlargest(5, ['Police_Department'])
```
Out[12]:

Year	Education	City_University	Police_Department	Youth_and_Community_Development	Social_Services
2020	27903294638	1116522798	5785046467	783648904.00	10408734036
2019	26905467180	1114118133	5668823293	697619241.00	10188334878
2018	25026392457	1087244959	5480431760	620742309.00	9853246905
2017	23317602305	1067116800	5312163257	549820517.00	9501094797
2016	21973688201	955775205	5075080640	508135145.00	9345924176

```
In [14]: Agency_Expenditures_NYC.nlargest(5, ['Youth_and_Community_Development'])
```
Out[14]:

Year	Education	City_University	Police_Department	Youth_and_Community_Development	Social_Services
2020	27903294638	1116522798	5785046467	783648904.00	10408734036
2019	26905467180	1114118133	5668823293	697619241.00	10188334878
2018	25026392457	1087244959	5480431760	620742309.00	9853246905
2017	23317602305	1067116800	5312163257	549820517.00	9501094797
2016	21973688201	955775205	5075080640	508135145.00	9345924176

```
In [16]: Agency_Expenditures_NYC.nlargest(5, ['Social_Services'])
```
Out[16]:

Year	Education	City_University	Police_Department	Youth_and_Community_Development	Social_Services
2020	27903294638	1116522798	5785046467	783648904.00	10408734036
2019	26905467180	1114118133	5668823293	697619241.00	10188334878
2018	25026392457	1087244959	5480431760	620742309.00	9853246905
2015	20457511110	904050361	4896334549	419393769.00	9745753028
2017	23317602305	1067116800	5312163257	549820517.00	9501094797

These data sets show the years with the largest values of spending for the individual NY agencies. The five graphs show that the last five years of the data set reviewed all are the highest in spending on record. This shows the budgets are definitely increasing over the full time period.

Max Values for Crime:

```
In [18]: Major_Felonies_NYC.nlargest(5, ['Murder'])
```

Out[18]:

Year	Murder	Robbery	Total_Felony_Offenses
2000	673	32562	184652
2001	649	28202	162908
2003	597	25989	147069
2006	596	23739	128682
2002	587	27229	154809

```
In [20]: Major_Felonies_NYC.nlargest(5, ['Robbery'])
```

Out[20]:

| Year	Murder	Robbery	Total_Felony_Offenses
2000	673	32562	184652
2001	649	28202	162908
2002	587	27229	154809
2003	597	25989	147069
2005	539	24722	135475

```
In [22]: Major_Felonies_NYC.nlargest(5, ['Total_Felony_Offenses'])
```

Out[22]:

Year	Murder	Robbery	Total_Felony_Offenses
2000	673	32562	184652
2001	649	28202	162908
2002	587	27229	154809
2003	597	25989	147069
2004	570	24373	142093

These three data sets show a similar pattern as the agency expenditures, but shows the highest levels of crimes in the early part of the fixe time period. This supports that crime is most likely on the downward decline over the time period. Further analysis show support if there are relationships between the two data sets and where the rates of growth or decline may occur most acutely.

In the next process we have comparative graphs comparing the relationships between spending and crime levels. To cut redundancy we will show a few graphs here that illustrate patterns, with the complete number of graphs in the presentation and the code.

Education vs Robbery
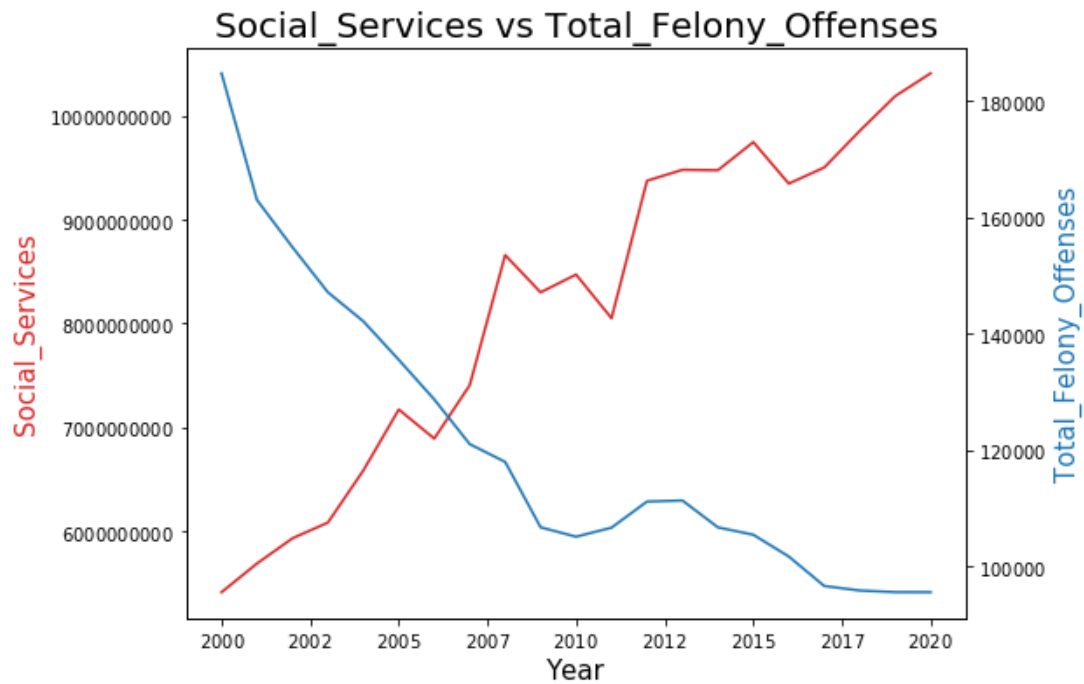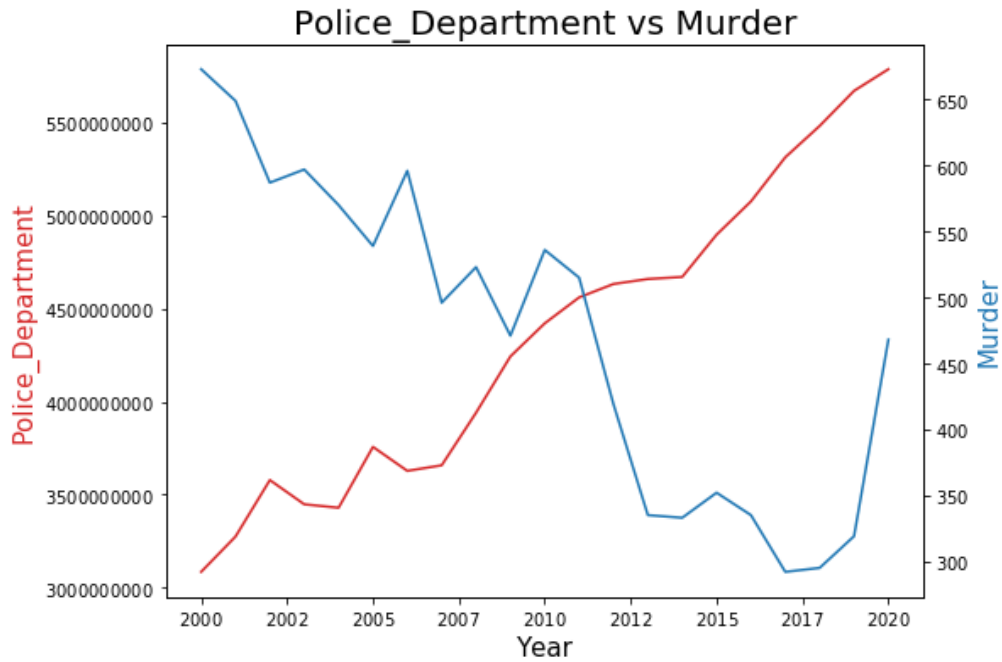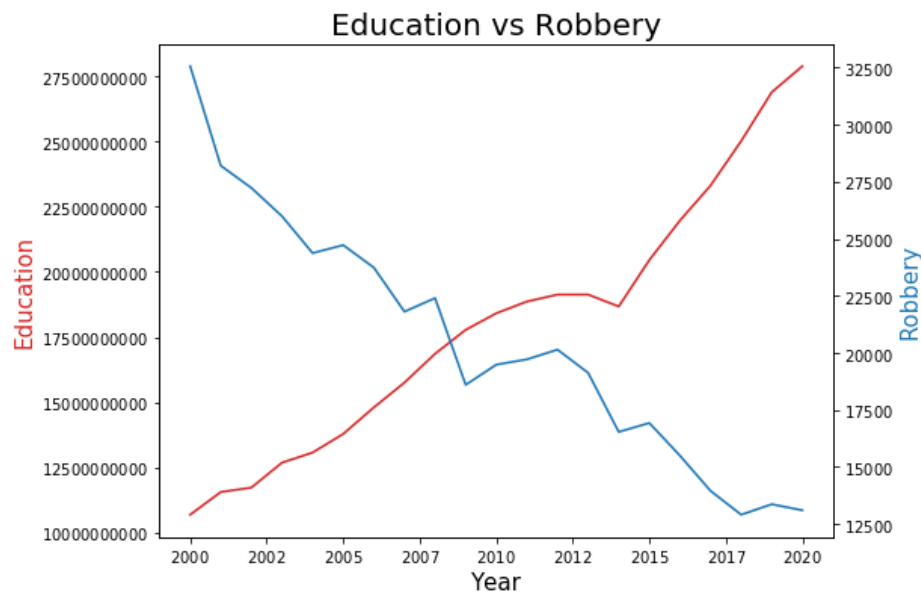
The three graphs above show a good mix of comparisons between spending levels and their corresponding agency spending in the time period. We can see education spending growing at almost a linear rate, reflecting either expanded funding for education or higher costs to conduct education. Comparatively we see a linear decline in murders but with a notable increase around 2019-2020. This is due to reduced police activity to monitor and reduce crime. In addition, there was a higher level of criminal activity in this time period in the production and selling of drugs, which invites rivalry leading to violence. This is supported by news article at the time and current articles highlighting the notable increase.

Next, we compare total felony offenses and social services spending as social services should reduce different types of crime if social work helps alleviate problems that could occur on a day-to-day basis and overtime. So many crimes including robbery and assault will be less likely if people are not exposed to domestic violence, drugs, or an unstable home life. We can see from the graph that total crimes have fallen almost exponentially in this time period, while a general linear pattern of social

services spending has grown upward. This shows that tackling more crime at its source is ideal to reduce current and future crime when the state and the city monitor these issues in the community.

The final graph in the set reviews crime that generally impacts younger people and corresponding government spending for the young. Education (K-12) spending is completely focused on young people and guiding them to lead better futures as best as possible. Robbery activities are usually committed by people under 25 as a means of making money. Young people have the strength and speed to carry out these activities, so if education spending is effective, we should see a sizable reduction in robbery as people at risk will choose other lifestyle decisions. In the graph we see almost an exact inverse relationship between the two line charts, where education spending is upward, robbery is sloped downward. This supports the conclusion that over time, when children are growing up between 2000 and 2020, we see much less robbery when education spending grows. The correlation here could be related to other factors, but it is significant that one has fallen around the same rate as the other has grown.

In the proceeding graphs below we see the rate of change for each pairing of variables. Each graph matches the corresponding graphs above that show the comparative change in count of a crime vs agency expenditures over time. If a line graph is falling, the variable is decreasing at a specific rate and vice versa. Looking at patterns, we can see below that the police department spending has wide dispersion in change over time, while the rate change in murder has a tight oscillation with only one sharp change in 2017 to 2020. This relates to the spike in murder counts we saw in the prior graph. Murder has fallen quickly, while police spending is growing at a fast rate.

Next, we see divergence in behavior in this time period between social services spending and total felony offenses. There is some overlap between the variables but the change between 2010 and 2016 show a heavy difference in the behavior of each metric. Total felony offenses fell sharply in this

time period while social services spending had a spike in its rate. The same pattern occurred in 2019-2020 to a lesser degree. This adds to the belief that when social service spending grew quickly, the same period showed an inverse behavior in offenses. The last graph has robbery vs education spending rate of change plotted. This graph has a more obscured conclusion as both rates of changes have oscillated almost randomly without showing clear patterns. This could be due to the fact that spending on education only has a knock-on effect later in time as the child grows into a more well-educated person. This hypothesis would be good to explore in a future analysis.

Education vs Robbery
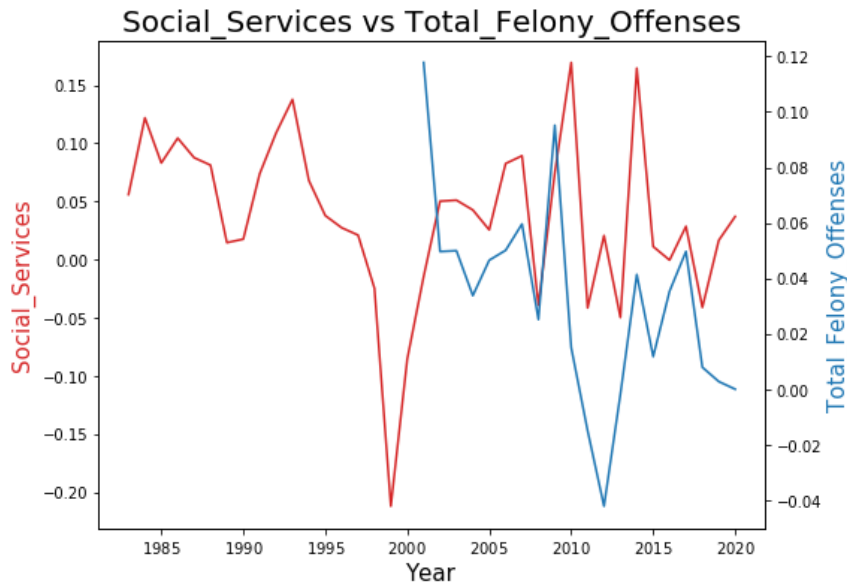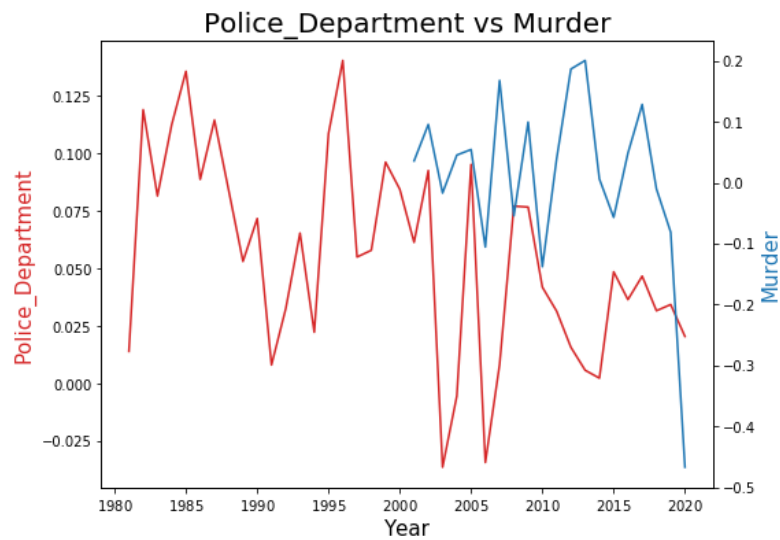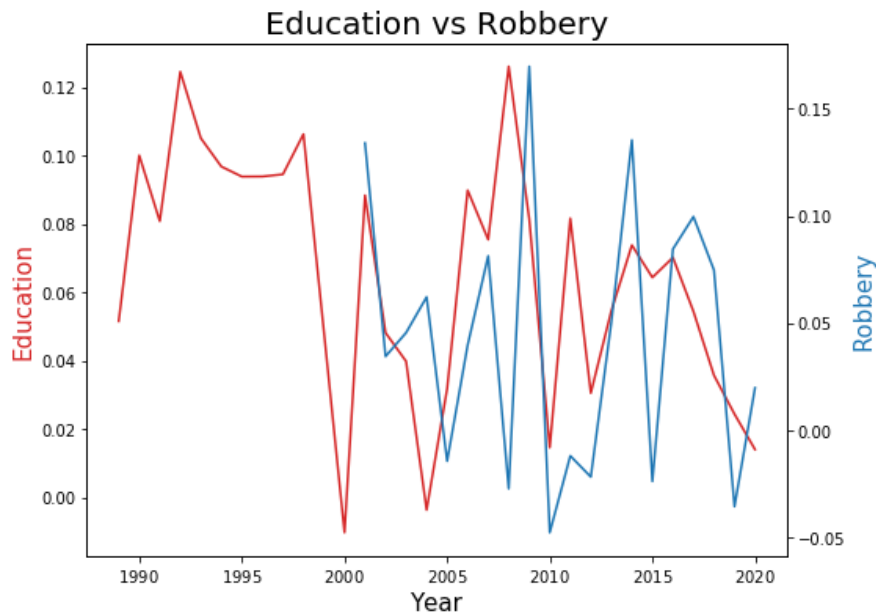
Conclusions drawn in this report reflect correlations not causations, but even still there is clear support that higher spending in different areas of interest has led to fall in different types of crime. With few exceptions, there has been clear reductions in crime levels. Crime has certainly fallen between 2000 and 2020, with the hope that it falls further. Spending conducted by the city have definitely risen over time. The limitation of the analysis is that is difficult to isolate specific solutions as being successful over other options as crime is a multifaceted issue. A further analysis can explore if a set group, say a large group of young children in the 1990s has had a large change in crime compared to other time period. This method controls for when people are young and developing, and then later how the people turn out as adults. Otherwise, a practitioner could examine other factors such as spending on misdemeanor crime or other types of spending on levels of crime.

Sources:

Agency Expenditure Data:

https://comptroller.nyc.gov/wp-content/uploads/2020/10/7-General-and-Capital-Fund-Detailed-Schedules-of-Revenues-and-Expenditures-2020.pdf

Crime Data:

STATISTICAL NOTES
1. 2000-2005 Data Source-Historical Comfinal data inclw-Up data. Compiled from aggregated monthly tapes 2000 thru 2005.
2. 2006-2016 Data Source-CDW Omniform System anmplaint Follow Up) data by record create date.
3. Murder & Non-Negligent Manslaughter data source: Comfinal Data, 2006-2016 Shooting & Homicide Database.
4. 2000-2009 data as of 12/8/2010. 2010 data as of 1s of 1/18/2012. 2012 data as of 1/15/2013. 2013 data as of 1/17/2014. 2014 data as of 1/16/2015. 2015 data as of 1/18/2016. 2016 data as of 1/16/2017. 2017 data as of 1/17/2018. 2018 data as of 1/14/2019. 2019 data as of 1/15/2020. 2020 data as of 1/15/2021.