

Final Project: Chicago Crime

Description

To identify crime hotspots in Chicago and provide insights to the city's police department about resource allocation, we analyzed a historical Chicago crime dataset from Kaggle. Because the original dataset had over 6 million entries, we used a subset of the data that consisted of a 1% random sample through the years of 2001 to 2016. The data contained useful information on recorded crimes such as the type of crime, where the crime was located, and whether or not authorities arrested the perpetrators.

As of 2016, the city of Chicago's violent crime rate, 903.8 violent crimes per 100,000 people, was considerably higher than the U.S. mid to large city average, 746.6 per 100,000 people.¹ In particular, crimes such as robbery and assault were more prevalent versus other top-10 U.S. cities. By identifying historical crime trends and hotspots around the city, our goal was to provide specific direction to the Chicago Police Department on how to better their resource allocation in order to more effectively combat crime. As a result of our insights, each Chicago police district may be better prepared to fight crime, thereby reducing the future overall crime rate in Chicago.

Exploratory Data Analysis

Our initial approach was to identify the areas where crimes were the most prevalent. The police department has divided the city into 25 police districts, each covering certain areas and neighborhoods in town. By tracking crime per district from 2002-2016 (missing data for 2001 and 2017), we were able to identify Districts 8, 11, and 25 as "hot spots" relative to the other areas in the city (*Figure 1*). In researching more specific areas within those districts that could be targets, we identified the Chicago Lawn neighborhood and Midway Airport in District 8, the East Garfield Park neighborhood in District 11, and the Austin neighborhood in District 25. It is notable that all of these areas attract a significant amount of foot traffic, increasing the potential for crime.

We also reviewed data on population per police district in the year 2010 and compared each district's percentage of the total population to the fraction of all crimes occurring that year in each district. From this data, we noted that District 8 housed the highest portion of the population and the highest fraction of crimes for that year, with District 25 following suit in both metrics (*Figure 2*). Unfortunately this population per police district data was only available for 2010. Finally, we identified the most common types of crime per district and plotted this on a map overlaying the Chicago Police

¹<https://ucr.fbi.gov/crime-in-the-u.s/2015/crime-in-the-u.s.-2015/offenses-known-to-law-enforcement/violent-crime>

Districts (*Figure 3*). Between all 25 districts, either battery, theft, or narcotics ranks in first place as the most common type of committed crime in that district.

In-Depth Data Analysis

District 8

Because District 8 had the highest number of crimes recorded when compared to all other districts, we isolated the data from this district first to identify what types of crimes were being committed and where specifically they were happening. Figure 2 shows that theft was the most common crime committed in this district. Furthermore, these thefts commonly occurred in three locations: on the streets, in a residence, or in a department store (*Figure 4*). The severity of these thefts varied, with 36.9% being thefts in value of \$500 and less while 21.8% were thefts over \$500 (*Figure 5*). Unfortunately since most of these thefts still qualify as “minor” crimes, criminals have historically been able to get away with it - with District 8 reporting low arrest rates relative to thefts reported (*Figure 6*). Other significant crimes that were commonly reported in District 8 include battery, criminal damage, burglary, and narcotics. More recently, yearly theft rates have seemed to decrease in District 8 relative to past years, while battery rates have been on the rise (*Figures 7 and 8*).

In trying to pinpoint the time and days of the week these thefts most often occurred, we found a low frequency between midnight and 4:00 AM, understandably since that is when most people are asleep. From Figure 9, we can see that theft peaked between the hours of 10:00 AM to 6:00 PM, taking place mostly on Wednesdays and Saturdays (*Figure 10*). It is also interesting to note that the months where most theft occurred happened to vary between June, July, and October (*Figure 11*). This may indicate a relationship between weather and crime rates, as in the warmer months more people may tend to be out in the streets than during a Chicago winter.

We were also able to identify “hot spots” in District 8, consisting of the Beats 823, 824, 832, and 831. These are specific areas within police District 8 where most of the crimes seemed to take place, and where police can increase their patrols throughout the day according to the specified times above.

District 11

District 11 had the next highest number of crimes, containing several neighborhoods that comprise the “West Side” of Chicago. According to the Chicago Tribune, the “West Side” has historically been known as a poor and crime-ridden part of the city². With this in mind, we were interested in determining if poverty status was related to the severity of crimes

² http://articles.chicagotribune.com/2005-05-19/news/0505190155_1_north-side-west-side-east-side

committed in the district. In identifying the most common type of crimes committed in District 11, the category of "Narcotics" ranked first. Specifically, in the 1% dataset we were able to identify 251 counts of "Possession of Heroin", 219 counts of "Possession of Cannabis, 30 grams or less", and 181 counts of "Possession of Crack". These incidents suggest that there may potentially be heavy narcotics operations within the district, as District 11 had much higher numbers of narcotics-related incidents than other districts. With a combined 73% of narcotic incidents in District 11 happening on either sidewalks or the street, the police should increase their presence around District 11 during 10:00 AM to 8:00 PM (*Figure 12 and 13*).

We also considered that perhaps also associated with heavy drugs would be the increased chance for violence. In checking for such crimes, District 11 recorded 383 incidents of simple domestic battery, 206 incidents of "simple battery", and 181 counts of theft. In contrast to battery related incidents seeing a recent upsurge in District 11 (*Figure 7*), narcotics related crimes have actually seen a decrease over time. The rates in District 11 have even steadily decreased recently (*Figure 14*), possibly due to the police starting to turn their focus away from marijuana possessions. In addition, former Chicago Police captain John Roberts described in 2016 a rise in the police attitude that they can't "arrest their way out of the drug problem"³. With sentiment shifting towards rehabilitation rather than felony charges, it's possible that this decrease in narcotics criminal records has resulted from the police force putting their time into resolving crimes that impose a greater danger to the public.

District 25

Next, we investigated District 25, which had the third highest number of crimes recorded in our data set. Similar to District 11, District 25 also resides in the "West Side" of Chicago - so we expected a similar level of poverty in the makeup of the minority population. The most common types of crime in District 25 were battery and theft. Specifically for battery, most of these incidents were reported as taking place at apartments, residences, streets, or sidewalks (*Figure 15*). Assigning additional patrol to the streets of this district could potentially help to reduce conflicts before they escalate. On the other hand, the top three locations for theft were on the street, in a department store, or in a residence (*Figure 16*).

Furthermore, we wanted to identify particular times for which additional patrol would be beneficial. From the data, thefts were common between 9:00 AM and 8:00 PM (*Figure 17*) with small variability between days of the week (*Figure 18*). On the other hand, battery related incidents seemed to occur more on Saturdays (*Figure 18*), so additional street patrol would be warranted for those days between the times of 2:00 PM to 9:00 PM (*Figure 17*).

³<http://chicago.suntimes.com/chicago-politics/chicago-on-pace-to-have-fewest-drug-arrests-since-nixon-era/>

In comparison to the overall decline in theft for all districts since 2010, with the exception of a recent upsurge, District 25 has seen little improvement in theft rates (*Figure 8*). However, unlike in Districts 8 and 11, battery rates for District 25 have seemingly been decreasing since 2016 (*Figure 7*). District 25 may therefore benefit from police efforts focusing on reducing theft. Securing department stores with more security measures would help reduce the amount of thefts, saving businesses more money and keeping citizens safe.

Solutions and Insights

Although the recommendations following this analysis might seem obvious (send more patrol officers to District 8 to crack down on theft or allocate more resources towards anti-narcotics operations in District 11), the demographics of the districts and the Chicago Police Department's recent history would create implementation problems.

The hotspots identified in our analysis (Districts 8, 11, and 25) include the Chicago Lawn, East Garfield Park, and Austin community areas, three large minority districts. Demographic data shows that roughly 93.3% of East Garfield Park is Black⁴, 86.1% of Austin community is Black⁵, and 95% of Chicago Lawn is either Black or Hispanic⁶. A simple crackdown by a 45% White police department plagued with a history of civil rights violations and damning Department of Justice abuse of force investigations, would be counterproductive.

We recommend that Chicago PD recommit to its CAPS (Chicago Alternative Policing Strategy) initiative, increase its funding to \$12 million, and focus the program's reimplementation to Districts 8, 11, and 25. Started in 1993, CAPS was founded as community policing strategy and contributed to a large drop in violent crime in Chicago throughout the 90's⁷. However, due to recent budget cuts, CAPS is no longer a spending priority and has a budget of less than a third from its peak leading some commentators to proclaim "the fall of community policing"⁸.

By engaging with the communities in these districts through CAPS and increasing the program's funding to \$12 million (where funding was in the late 90's), we expect two main outcomes to occur. First, an increased police presence at peak times of crime should result in decreased crime counts. Second, we may see a more sustainable relationship between police and community, resulting in the a population that serves as an impediment rather than a promoter of crime.

⁴ <http://statisticalatlas.com/neighborhood/Illinois/Chicago/East-Garfield-Park/Race-and-Ethnicity>

⁵ <http://statisticalatlas.com/neighborhood/Illinois/Chicago/Austin/Race-and-Ethnicity>

⁶ <http://statisticalatlas.com/neighborhood/Illinois/Chicago/Chicago-Lawn/Race-and-Ethnicity>

⁷ http://articles.chicagotribune.com/2002-02-20/news/0202190316_1_police-districts-city-agencies-police-and-other-city

⁸ <https://www.chicagoreader.com/chicago/caps-cpd-community-policing-analysis/Content?oid=23635982>

Appendix

Figure 1.

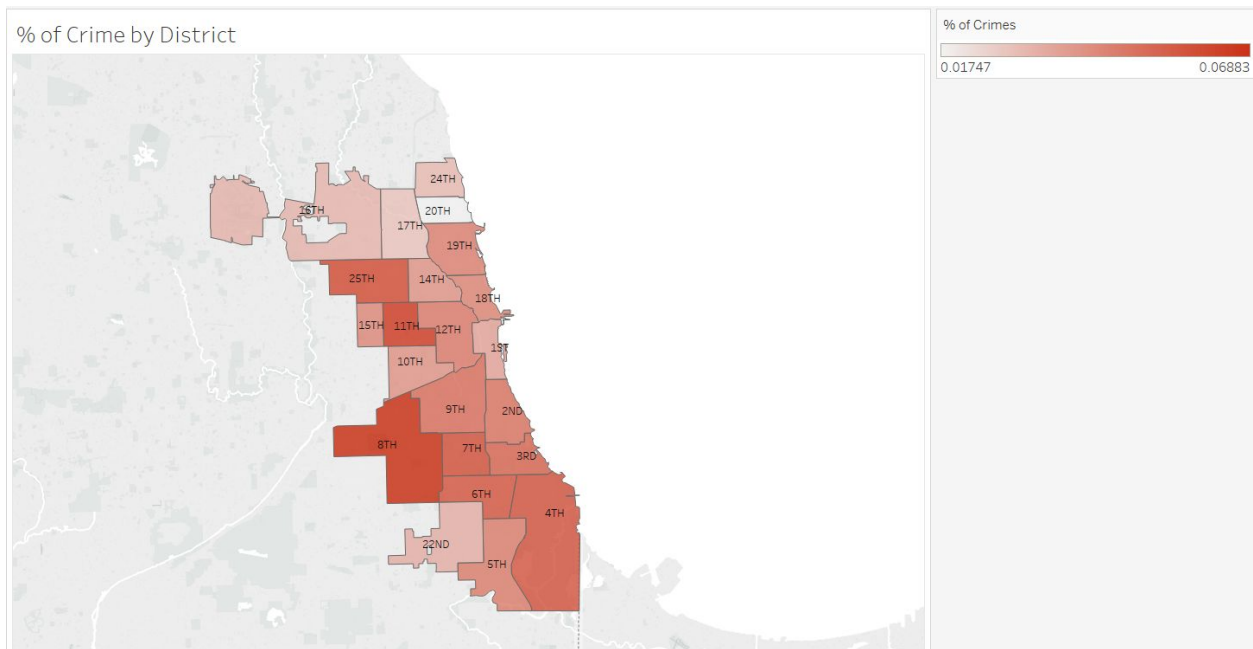


Figure 2.

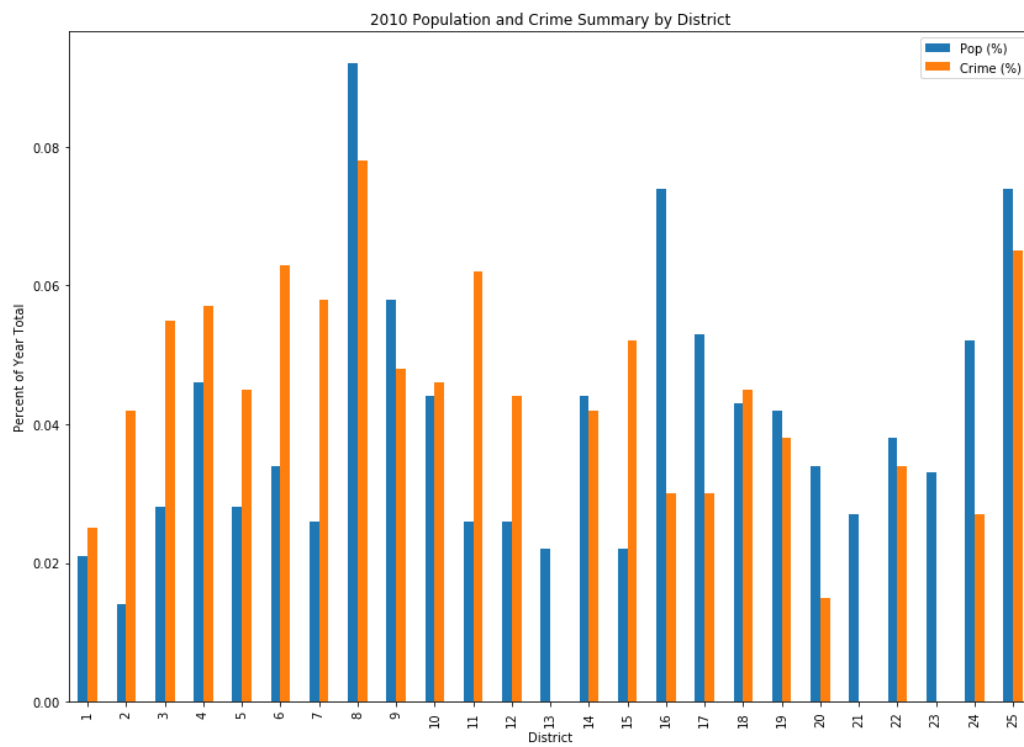


Figure 3.

Top Crime Type per District

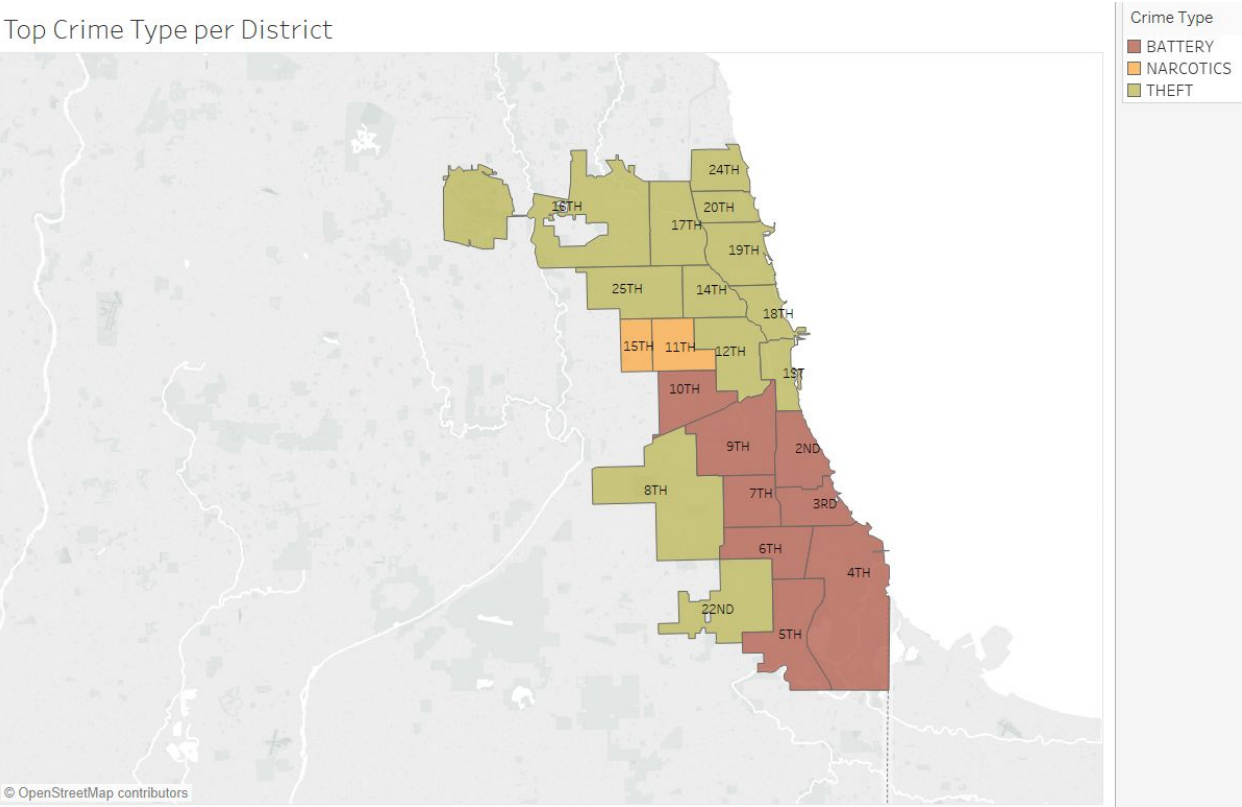


Figure 4.

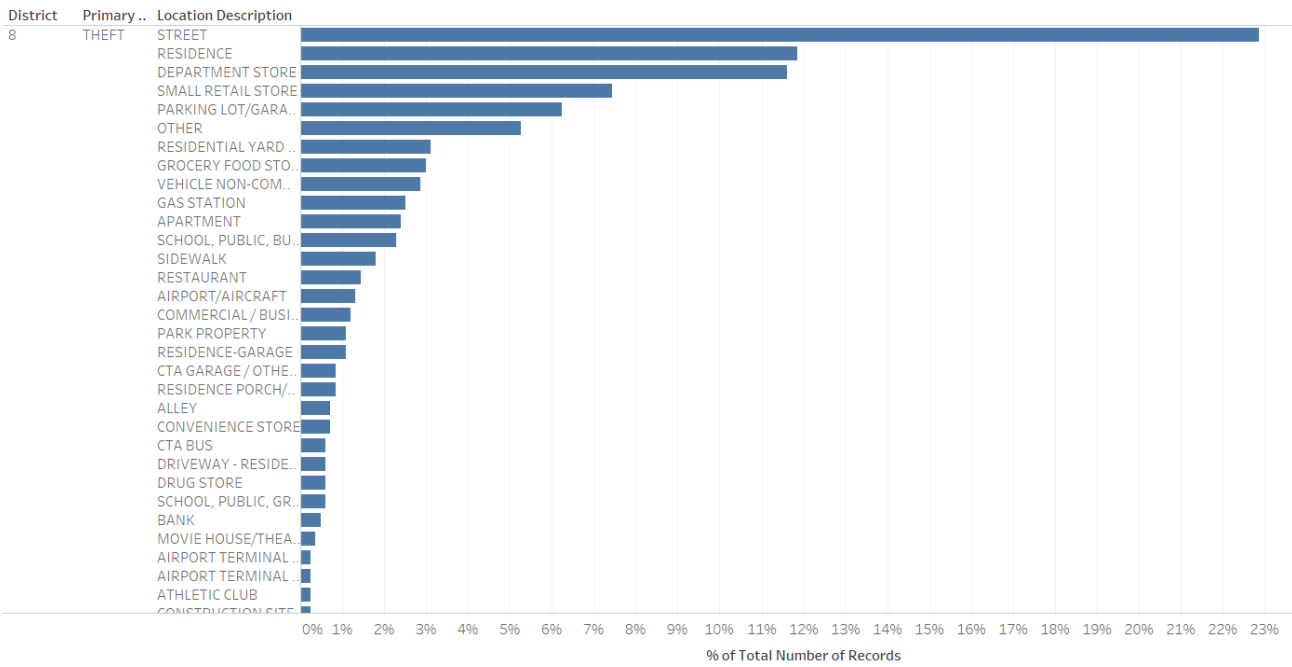


Figure 5.

District	Primary Type	Description	
8	THEFT	\$500 AND UNDER	36.89%
		OVER \$500	21.80%
		RETAIL THEFT	18.80%
		FROM BUILDING	14.01%
		FINANCIAL ID THEFT: OVER \$300	3.35%
		PURSE-SNATCHING	1.44%
		FINANCIAL ID THEFT:\$300 &UNDER	1.32%
		POCKET-PICKING	1.08%
		ATTEMPT THEFT	0.72%
		AGG: FINANCIAL ID THEFT	0.24%
		ATTEMPT FINANCIAL IDENTITY THE..	0.24%
		DELIVERY CONTAINER THEFT	0.12%

Figure 6.

% of Theft Arrests in District 8

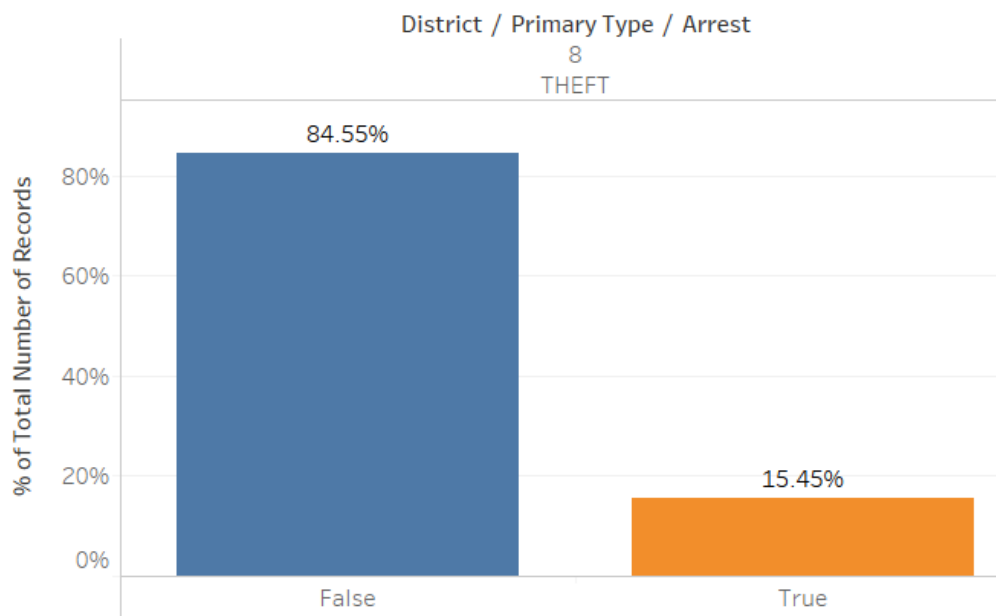
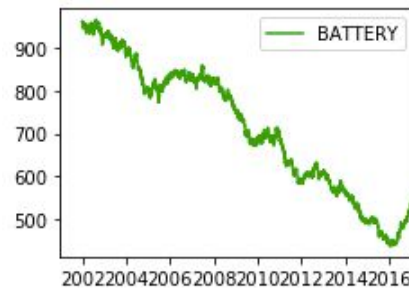
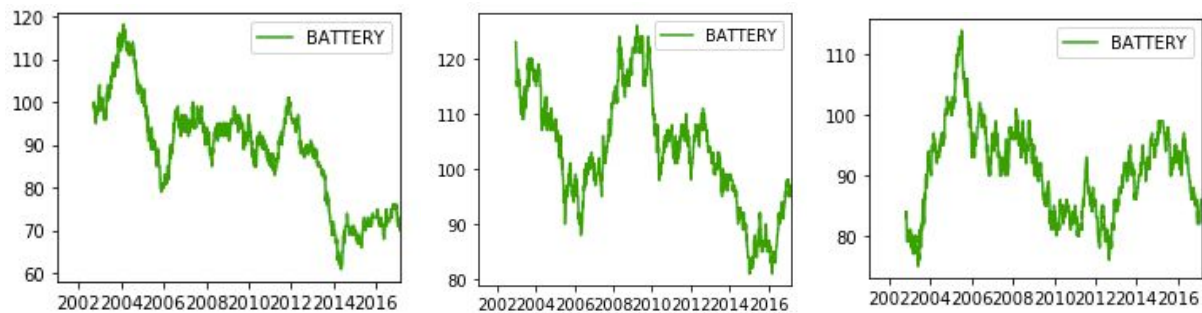


Figure 7.

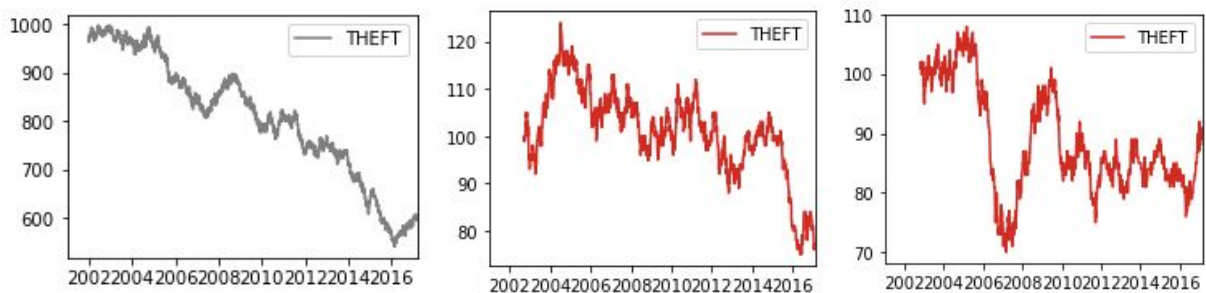


Rolling 365-day sum of criminal battery counts in all districts.



Rolling 365-day sum of criminal battery counts in Districts 8, 11, and 25 (from left to right).

Figure 8.



Rolling 365-day sums of criminal theft counts in all districts (left), District 8 (middle), and District 25 (right).

Figure 9.

% of Theft in District 8 by Hour

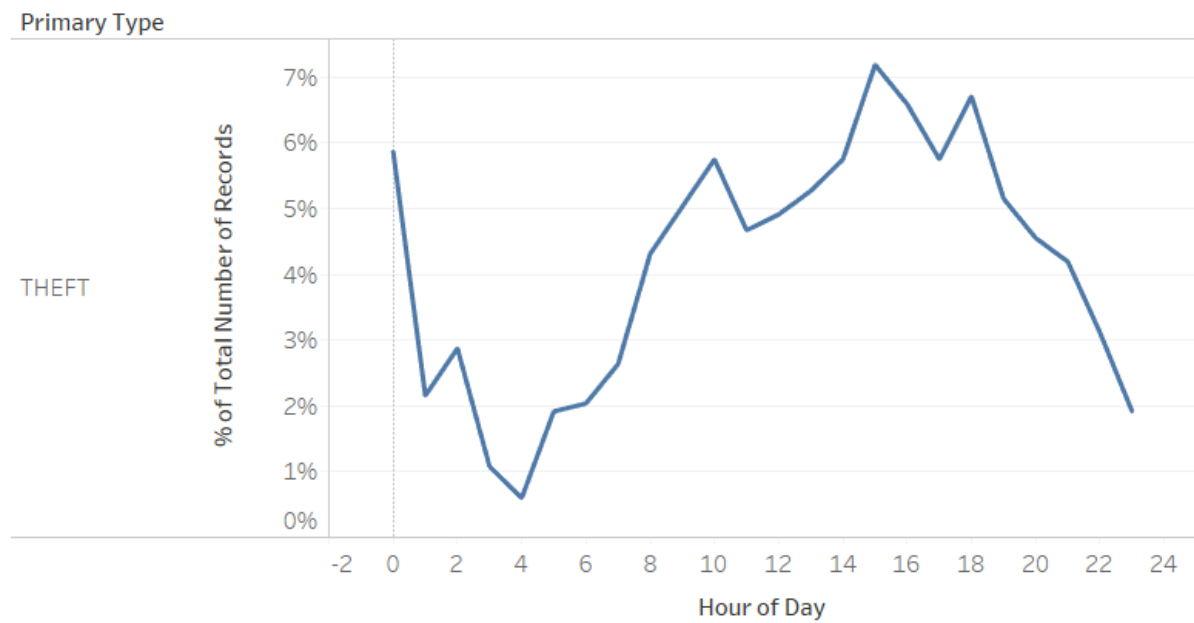


Figure 10.

% of Theft in District 8 by Weekday

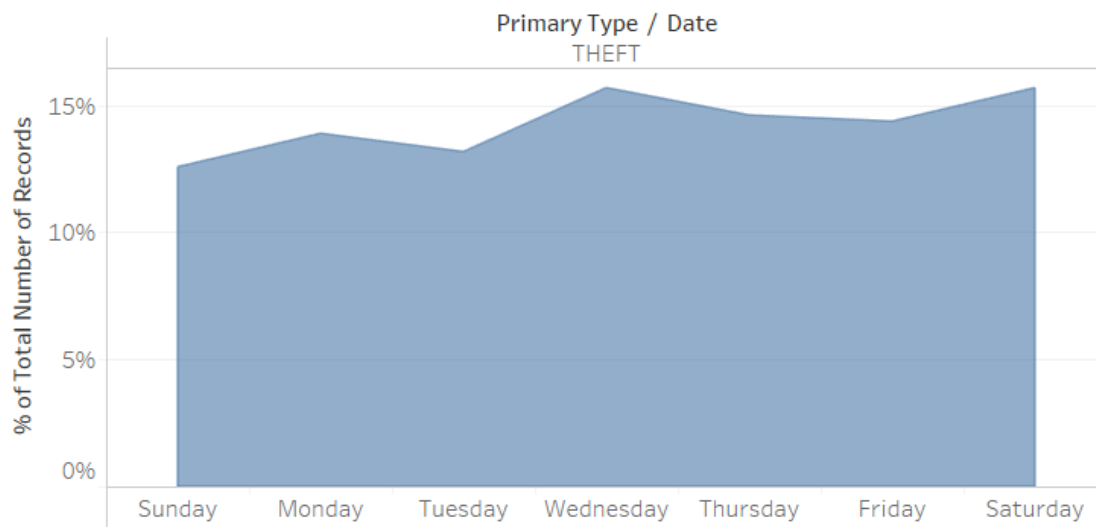


Figure 11.

% of Theft in District 8 by Month

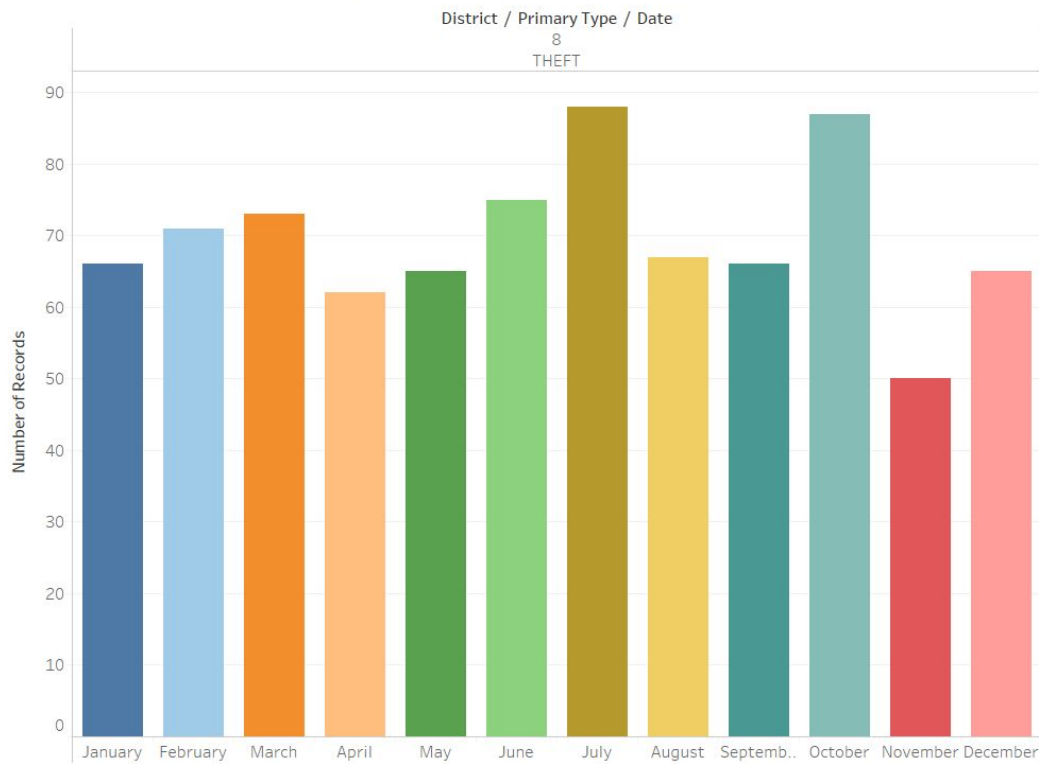


Figure 12.

% of Narcotic Crimes in District 11 by Location

District	Primary Type	Location Description	
11	NARCOTICS	SIDEWALK	39.24%
		STREET	32.77%
		ALLEY	5.63%
		VEHICLE NON-COM..	3.36%
		POLICE FACILITY/VE..	2.44%
		OTHER	2.02%
		VACANT LOT/LAND	1.76%
		RESIDENCE PORCH/..	1.68%
		RESIDENCE	1.51%
		PARKING LOT/GARA..	1.26%
		APARTMENT	1.09%
		CHA PARKING LOT/G..	1.01%

Figure 13.

% of Narcotics in District 11 by Hour

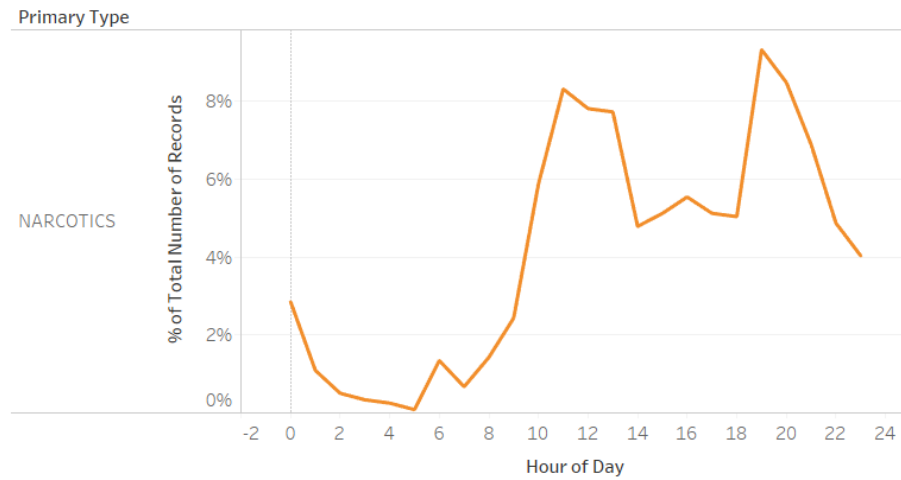
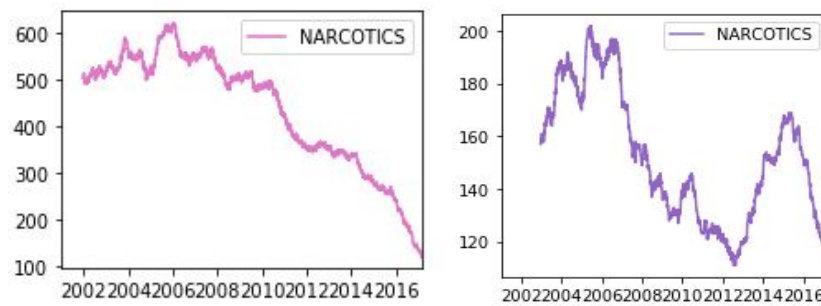


Figure 14.



Rolling 365-day sums of narcotics crime counts in all districts (left), and in District 11 (right).

Figure 15.

% of Battery Crimes in District 25 by Location

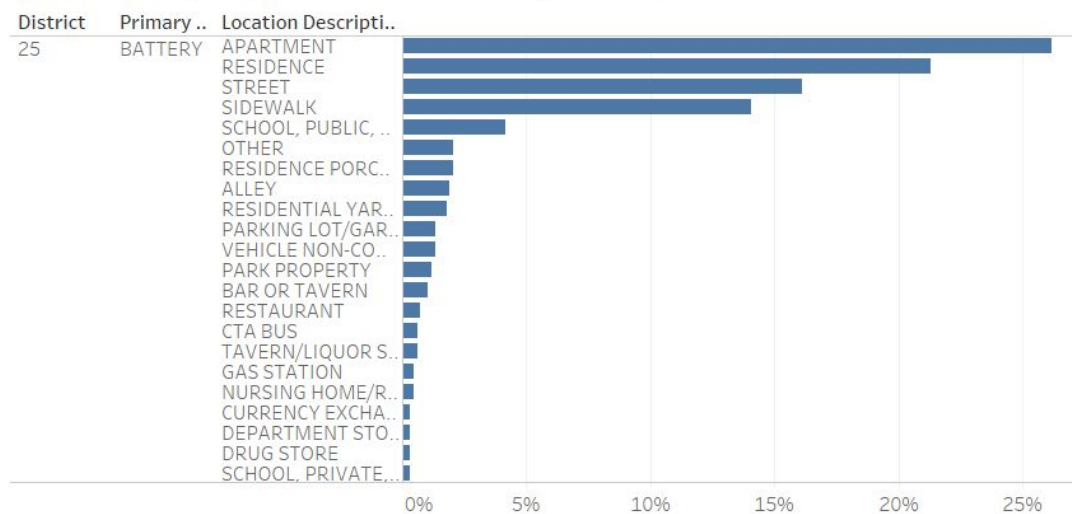


Figure 16.

% of Theft Crimes in District 25 by Location

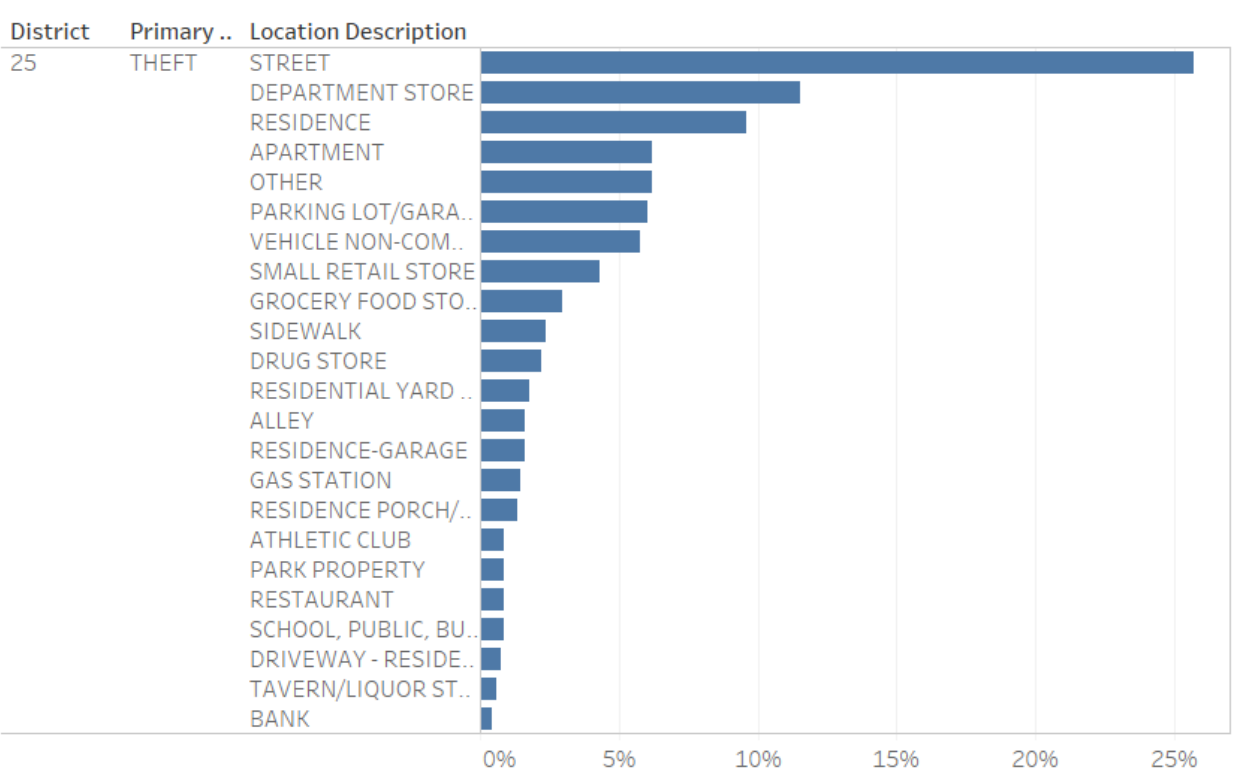


Figure 17.

% of Battery and Theft in District 25 by Hour

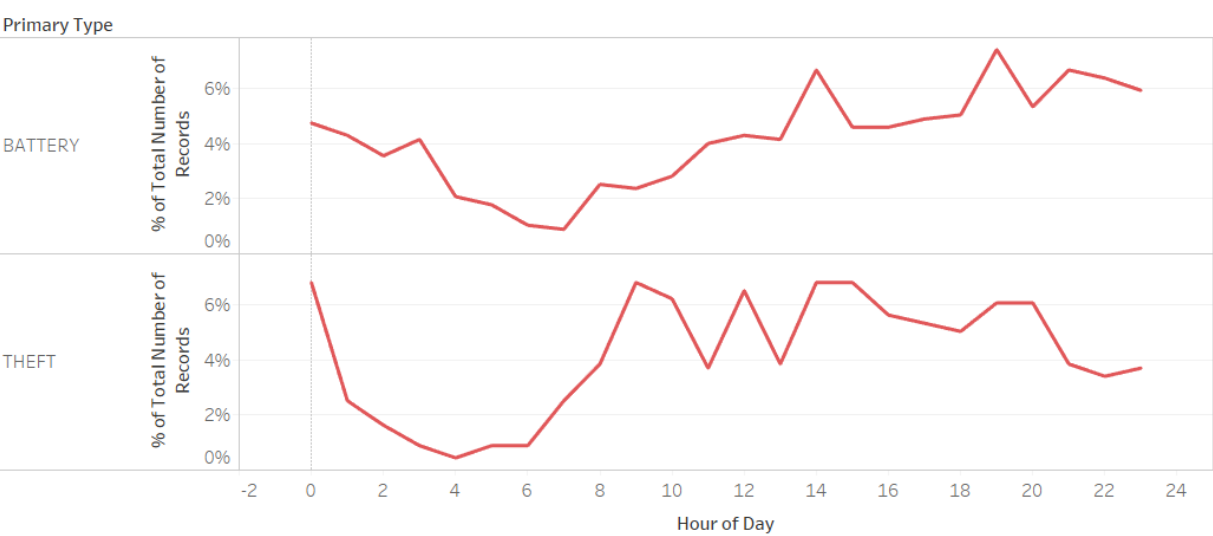


Figure 18.

Theft and Battery Crimes in District 25 by Weekday

