

## Crime in Chicago: Red Light Violations and its Association with Violent Crime

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## Abstract

This paper examines red light camera traffic violations and violent crime, specifically assault and battery, in the city of Chicago, IL. Using cluster analysis, a data mining technique that identifies groups within a dataset, and crime data from the Chicago Data Portal, we searched for crime correlations among different police districts in Chicago. The results found here could give Chicago crime-fighters and government officials insight into the occurrences of overall crime as they work to prevent it.

## Introduction

Why do people commit crimes? It is a question that has beleaguered society for generations and one our group has pondered in recent years. Living as students in Chicago, historically one of the most violent cities in the United States (Bosman, J., and Smith, M., (2016)), we are hyper-aware of crime both because of its frequency in the news and its effects on our own safety. Crime impacts our day to day decisions, influencing how, where and what times of the day we travel in the city. In fact, we have been told by numerous local residents which areas are safe and which areas to avoid.

Their advice sparked further questions among our group. We began to wonder why some areas in Chicago are safe and others are not. Why do some people commit violent crimes in some parts of the city, but not in others? Additionally, are there any other types of crime, perhaps even traffic-related, that seem to be highly correlated with region?

The combination of these questions led us to the City of Chicago Data Portal, a hub of data covering various topics related to Chicago. Exploring the site, we discovered a dataset involving red-light traffic violations, captured by red-light cameras. The dataset revealed that a spike in red-light violations had occurred in the area surrounding the Chicago Midway International Airport. Intuitively, we deduced the violations were due to travelers rushing through red-lights to catch their flight. Considering the greater context of Chicago, we consolidated all of our prior musings about violent crime with our new information about the red light violations to formulate our research question: *does surrounding violent crime, specifically assault and battery, have an influence on red light violations?* It's a question that may lead to interesting implications about whether drivers run red lights out of a situational need—as displayed near the airport—or from a general lack of respect for the law.

The findings of this study can serve as a starting point for broader questions about crime as a whole. Namely, whether a general attitude of disrespect for the law could be an underlying cause of both violent crime and traffic-related crime.

We hope our research can be applied by lawmakers in Chicago, who are committed to reducing crime of all kinds. The goal of our research is to offer them more information about crime that can add to their understanding and assist them in making Chicago a safer city for all its citizens.

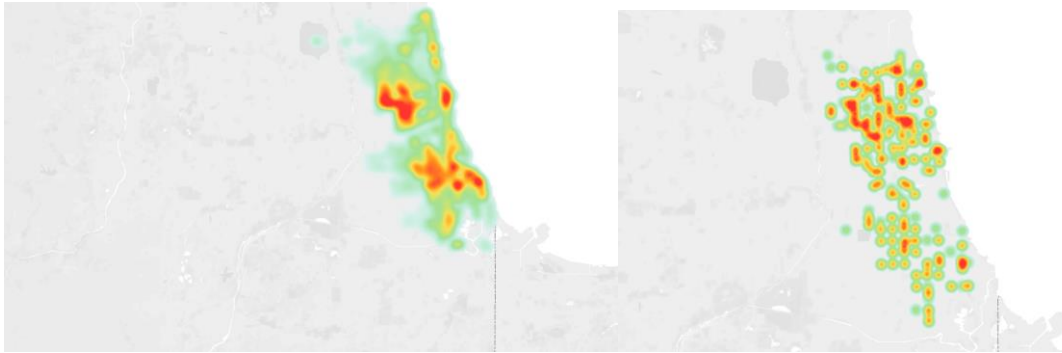
## **Literature Review**

To answer the question, we reviewed academic articles and studies related to the topic. Most studies addressed different questions. Some found that people tend to stop at intersections with cameras more often than the ones without cameras (Baratian-Ghorghi, Fatemeh, Zhou, Huaguo, and Franco-Watkins, Ana. (2017)), (*City of Seattle Traffic Safety Camera Pilot Project* Seattle, Washington. (2007)). We explain the potential impacts of that behavioral change in the literature review section of our case. Other studies, conducted in San Francisco and Israel, found evidence that young people are more sensitive to increases in fines from red light violations (Bar-Illan, A. and Sacerdote, B. (2004)). Another study suggested that red light cameras reduce red light violations and traffic accidents, but, according to the researchers, it is unclear whether the cameras affected violent crime (Ratcliffe, J.H., Taniguchi, T. & Taylor, R.B., (2009).) And finally, one study found a correlation between “high fines and high rates of violent crime,” (Smith, S., Gangopadhyay, K., Gill, S.S., McIntosh, S. (2018)). This source seemed to answer our question. But upon closer inspection, we noticed various external factors that, unaccounted for, skew the study’s results. For example, police bias and increased police presence—factors often involved in neighborhoods with high levels of crime—increase the likelihood of traffic violations (MacDonald, J., Fagan, J. and Geller, A. (2016)). We, unlike Smith’s study, narrow our focus to red light violations issued by an independent, bias-free camera and effectively eliminate these significant external factors.

## **Methodology**

To visualize the selected data, both datasets—assault and battery, and red light violations—were connected using the police district where the crime and violations occurred. After we identified the locations of the crimes for these specific violent offenses and red light violations, we transferred the locations of the different types of crime into a heatmap of Chicago, divided by zip code. We assigned each type of crime with a color to differentiate between the two kinds. The darker shades of each color represent a higher frequency of crime.

**Figure 1**



(Figure 1: Two heat maps of Chicago. Left: Assault and battery heat map. Right: Red light violations heat map)

The first dataset is titled “Red Light Camera Violations,” found on the Chicago Data Portal website. The dataset contains the number of red light violations captured by a specific camera each day and the block on which the camera is located. The second, also found on the city’s website, is crime data, covering all crime in Chicago Police Department’s jurisdiction. This particular data set records the type of crime, the date and time of occurrence, whether or not an arrest was made, and the block where the crime occurred. We will only use data from 2014 through the present.

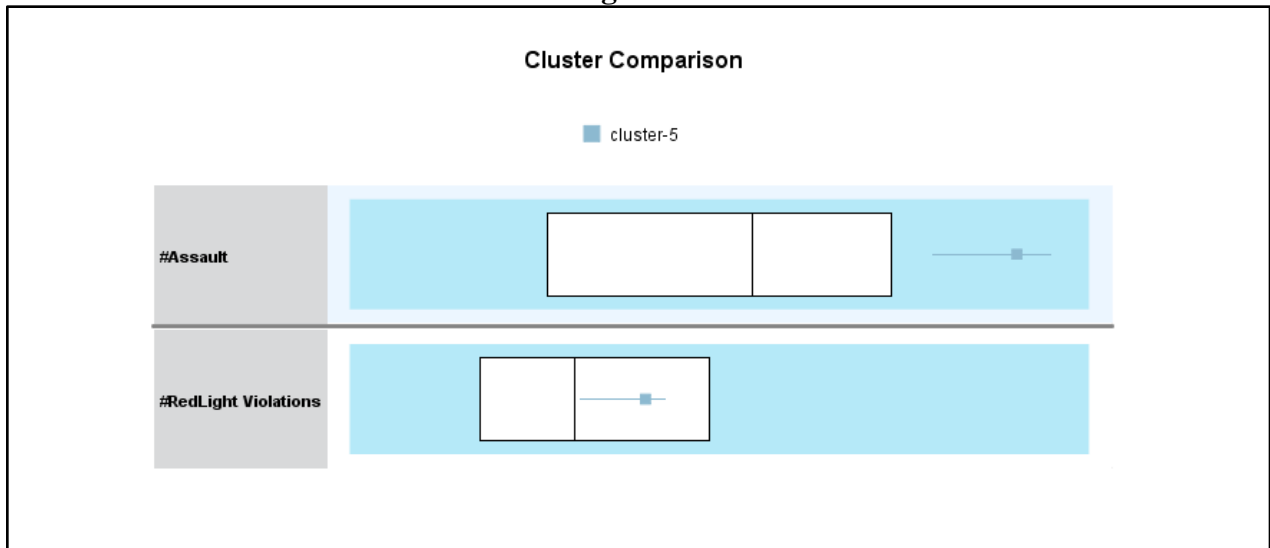
Although both datasets included the location of each crime by city block, they were not recorded in the same way, resulting in minor variations between the two datasets. To successfully connect the datasets, and avoid a mismatch, we discovered the police district where each red light violation occurred, thanks to a Chicago Police Department website that locates the districts in relation to each red light camera. The other dataset for battery and assault crimes did not require additional research because it included the police districts.

In our search for the proper analytical model, we initially considered three kinds of association models: Apriori Node, Sequence Node, and CARMA Node. Because we were only looking for a correlation between the two datasets, we thought association models were fitting for their ability to “find patterns in your data where one or more entities (such as events, purchases, or attributes) are associated with one or more other entities,” (IBM’s knowledge center). However, after further consideration, we changed our approach. Finding a correlation was only part of our goal. Ultimately, to help lawmakers prevent crime, we wanted to discover a causation, the reason that’s responsible for any correlation. Additionally, in the context of Chicago, where some areas account for drastically different amounts of crime, we needed a model that could factor another component: location. Cluster analysis, a method that groups data with similarities, enabled our team to study a cluster in Chicago composed of three police districts, locations included, with a high correlation of red light violations and violent crime. By inspecting the cluster, and searching for commonalities between the three police districts, we inched toward uncovering the cause of the correlation.

## Conclusion

After running a cluster analysis, a method that identified groups of police districts with similar rates of violent crime and red light violations in our dataset, one cluster in particular drew our attention. Cluster 5, containing police districts 4, 11 and 25, had the strongest correlation between the two kinds of crime, with 25,102 assaults and 139,130 red light violations. This is reflected in Figure 2. To discover why both kinds of crime were spawning in high frequency, we searched for commonalities among the three districts in cluster 5 and found a few potential causes.

Figure 2

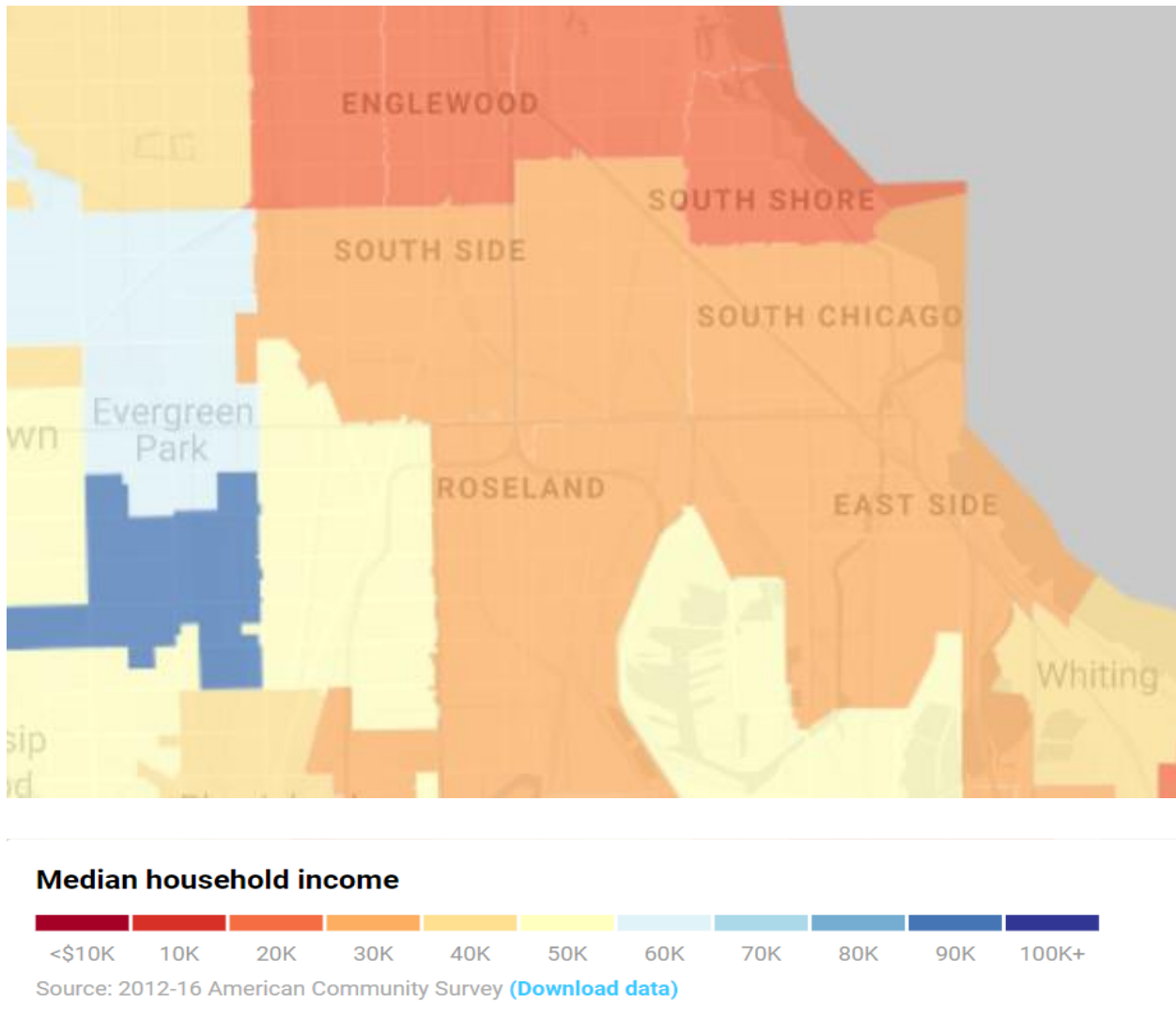


(Figure 2: Cluster 5 had a high frequency of assaults and red light violations.)

First, each police district within the cluster had a median household income of \$40,000 or lower, according to Chris Persaud, a research specialist who created a map of median household income in the United States titled "Rich Blocks Poor Blocks." In West Garfield Park, a neighborhood in district 11, the median household income was \$20,000, well below the poverty line, which is \$25,750 in Illinois, according to *Business Insider* (Hoffower, H., and McDowell, E. (2019)). Districts 4 and 25 were slightly better, posting a \$30,000 median income for the local neighborhoods. Low levels of income may contribute to high levels of violent crime as residents of the districts resort to unlawful activities for more money. In fact, after examining additional crimes using the Chicago Police Department's Crime Incidents Map, we noticed that larceny, a form of theft, was ubiquitous among the districts. Although the map only includes snapshots of crime recorded outside the time zone of our dataset, week per week in 2020, its revelations appear consistent: theft is prevalent. Theft, moreover, is likely purposeful. A person who steals probably needs something of monetary value. And in districts with extensive poverty, perhaps most of the crimes, even violent ones, occur out of a sense of necessity, due to a lack of basic resources, rather than out of disrespect for the law. However, it's unclear why poverty would

also correlate with red light violations, a crime that occurred alongside violent crime in cluster 5. Perhaps laws of any kind become burdensome to obey when more fundamental financial needs go unmet.

**Figure 3**



(Figure 3: Median household income for the South Chicago neighborhood, part of the 4th police district. Data courtesy of Rich Blocks Poor Blocks.)

Second, Chicago districts with the highest murder rates have traditionally been staffed with the youngest officers, averaging 10 years on the force with over a third of these officers accumulating only five years of experience. To put it in perspective, Chicago's entire patrol fleet averages 15 years on the force. A nonprofit journal on criminal justice titled *The Marshall Project* highlights this issue in the 11th district, claiming this discrepancy can be credited to transfer procedures followed by Chicago's police department: senior officers are given higher

priority when requesting transfers (Fan, A. (2016)). As a consequence, experienced officers have fled to traditionally low crime neighborhoods and rookie officers are forced to fill the gaps in high crime neighborhoods. This has affected the Chicago police community for many years. According to the 2013 police superintendent Garry McCarthy, rookie cops were being sent to South Side Chicago to “give the new cops a taste of life on the street.” The lack of experience has led to a large division between the community and the police departments. According to a study from 2008, younger officers are more likely to use deadly force. Chicago does not escape this trend; according to the Chicago Tribune, the average experience of an officer using deadly force was nine years on the force (Gorner, J. (2013)). The frequent change in the constitution of these police departments may hinder the departments’ ability to form a trusting relationship with the community and therefore increase instances of deadly force and consequent disrespect from the community. The general lack of experience and appropriate enforcement of the police in these districts could be a reason why citizens tend to run more red lights. If authority is not realized or felt by citizens in the area, perhaps the citizens believe they can commit these violations despite the presence of cameras.

Third, the districts in cluster 5 included low-performing high schools, according to data from a map by Chicago Public Schools, with below average SAT scores and “weak” safety ratings among students and teachers. For example, Bowen High School, a public school located in the 4th police district with 236 students, records an average SAT score of 809. A standardized test that measures reading, writing and math skills, the SAT is taken by students across the country, who cumulatively scored a national average of 1059 in 2019, according to the *Washington Post* (Anderson, N. (2019)). Bowen falls well short of that average. On the City of Chicago’s school progress report for the 2018-2019 school year, Bowen was given a “far below expectations” rating for student attainment, which measures how well the school performed on standardized tests at a given point in time. Even for those who take the SAT at Bowen, only 58.1% graduate, according to the Chicago Public Schools website. They also reported a “weak” safety rating, measured from the perspective of students and teachers. Crane Medical High School, a public school that specializes in health science programs, sits between the West Loop and East Garfield Park, near the 11th district. Although students scored an average of 916 at Crane Medical, more than 100 points higher than Bowen, they performed worse than the national average and also reported a “weak” safety rating and “below expectations” student attainment rating. Likewise, students at the public Orr High School, which abuts Humboldt Park in the 25th police district, posted a “weak” safety rating and a “far below expectations” student attainment rating. Only 42.9% graduate from Orr, where students average a 774 on the SAT.

Struggling to compete with national benchmarks, the three schools in cluster 5, which educate hundreds of young people in each district, are not providing students with a path to success. For those who graduate, access to a quality university may be unattainable, considering each school’s low SAT scores. Many, however, don’t even graduate, eliminating the chance to attend a university—a degree of education widely regarded as a stepping stone to higher income levels.

With few opportunities, perhaps violence, theft and a life of crime is inevitable for young people, the only way to survive. A poor education may contribute to red light violations as well. For a person living in poverty, without hope for a future job that pays the bills, perhaps laws, even red lights, lose meaning. However, the actual cause of the correlation is beyond the scope of our research. We included our speculations above, based on commonalities between the districts.

In summary, our research discovered a strong correlation between red light violations and violent crime in certain police districts in Chicago. The impact of low incomes, an inexperienced police force and poorly performing schools on the number of reported violent crimes and red light photo violations is worth considering, but our research does not address these factors specifically, and we make no claims that they are in fact related. Rather, our findings are meant to serve as a starting point for further research into the factors that may contribute to a high level of violent crime and red light photo violations.

### **Recommendations for future research**

Although we found correlations between red-light violations and violent crime in some areas of Chicago, we could not find data revealing a causation. We have a hypothesis for the cause—the same people who assault innocent bystanders are not concerned about traffic laws—but further research is required to examine the validity of our speculations. To find an answer uncovering the source of the correlation, researchers should study the people within each district who are breaking the law. In our reasoning about the source of the correlation, we assume violent offenders are the ones also running red lights. However, it's possible that two different groups of people account for each crime within each police district, resulting in a correlation but not necessarily a spirit of disrespect for the law that cuts across crime categories. Future researchers should study the criminal history of violent offenders to discover if they also tend to break traffic laws. The answer may shed more light on the reasons people break laws. Additionally, future researchers should study other cities to determine if the results of this study are applicable broadly or limited to Chicago only.



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Map of Chicago Schools, provided by Chicago Public Schools:

<https://schoolinfo.cps.edu/schoollocator/index.html>

Chicago Public Schools website: <https://cps.edu/Pages/home.aspx>

IBM's Knowledge Center:

[https://www.ibm.com/support/knowledgecenter/en/SS3RA7\\_15.0.0/com.ibm.spss.modeler.help/nodes\\_associationrules.htm](https://www.ibm.com/support/knowledgecenter/en/SS3RA7_15.0.0/com.ibm.spss.modeler.help/nodes_associationrules.htm)

Chicago Police Department Clear Map, Crime Incidents:

<http://gis.chicagopolice.org/website/ClearMap/viewer.htm?POLICEDIST=011>