Spatial Patterns and Socioeconomic Correlates of Domestic and Non-Domestic Violent Crime in Chicago

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Abstract

While significant work has been done on the prevalence of domestic violence and socioeconomic factors associated with violent crimes in general, little has been done comparing violent crime rates between strangers to domestic violent crime rates This paper aims to do that, using 2017 crime data for the city Chicago. A cluster and outlier analysis found that while general spatial patterns of domestic assault and battery are similar to non-domestic assault and battery, there are some noteworthy differences in the spatial distribution of the two types of crime rates. Regression analysis conducted to test the correlation between socioeconomic factors and crime rates found that there are statistically significant differences in the explanatory variables of domestic and non-domestic crime rates in Chicago.

Introduction

For most of modern history, domestic violence was not considered a social problem (Erez, 1986; Fradella and Fischer, 2010). The topic was so taboo, that *The Journal of Marriage and Family*, the premier scientific journal on Family Studies and one of the top sociology journals, did not publish a single article with the word "violence" in the title until 1971 (O'Brien, 1971). It was that decade, the 1970s, that domestic violence shifted from being considered a private matter and a behavior that was generally accepted (Star, 1980; Hartman & Belknap, 2003) to a serious public problem worthy of attention and research (Erez).

Foundational research on the prevalence of domestic violence in America – most notably qualitative work done by Richard Gelles (1972), and quantitative work done by Murray Straus (1977) that found assault rates are higher among married couples than between strangers – led to

a coining of the term “a marriage license is a hitting license.” Research co-authored by Gelles and Straus in the same decade reiterated the extent of America’s domestic violence problem, saying, “[violence] may be more common to the institution of family than is love” (1979, p. 550).

More recent studies by Alhabib et al. (2009) and Garcia-Moreno et al. (2006) have shown that domestic violence is prevalent in many areas of the world, but there is significant variation within and between different societies. Some of this variation in prevalence can be explained by socioeconomic factors thought to influence violent crime rates, in general, which includes domestic violence. For example, some researchers have shown that unemployment rates are strong correlates of violent crime (Brownfield, 1986; Nordin and Almen, 2017). Others have shown that income inequality (Fajnzylber et al. 2002), low education levels (Kyriacou et al., 1999), and collective efficacy (Sampson et al. 1997) are strong correlates of violent crime. The first two being positively correlated, while the third is negatively correlated.

While significant work has been done on the prevalence of domestic violence and socioeconomic factors associated with violent crimes in general, little has been done comparing violent crime rates between strangers to domestic violent crime rates. This paper aims to do that, using violent crime data for Chicago from 2017 to compare differences in the spatial distribution and socioeconomic factors that affect non-domestic violent crime rates and domestic violent crime rates at the neighborhood level.

The first research question focuses on the spatial distribution of crime rates in Chicago and asks whether spatial patterns of domestic violence and non-domestic violence differ. In relation to this question, I hypothesize that neighborhoods with the highest rates of non-domestic violence will also have the highest rates of domestic violence (H1). Similarly, I hypothesize that

any clusters and outliers that exist for non-domestic violence will also exist for domestic violence (H2).

The second research question focuses on the explanatory variables of violence and asks what factors explain violent crime rates in Chicago, and are those factors equally explanatory for domestic violent crime rates as they are for non-domestic violent crime rates. My hypothesis here is that a regression analysis for domestic violence will yield different results than a regression analysis for non-domestic violence that tests the same independent variables (H3).

By testing these hypotheses and answering these questions, differences in the spatial patterns and explanatory variables of domestic violence and violent crime between strangers can be uncovered. Understanding where these two categories of crime overlap and diverge is critical in developing effective community outreach and violence prevention programs.

Data & Methods

Domestic violence is not a crime, rather, it is an umbrella term that describes the relationship of the people involved in a crime, but not the crime committed. For example, if someone assaults someone else, the crime is assault, regardless of the relationship between the someone and someone else. If those two people have an intimate relationship or are related to each other, the crime is still assault, but it is now under the category of domestic violence. This is important to note. Since domestic violence in itself is not a crime but rather a type of crime, some cities that have publicly available crime data do not publish data on the relationship between the perpetrator of a crime and the victim of a crime, meaning they do not publish domestic violence information. Chicago, however, does include this information in its crime

database. For that reason, and the interesting social and economic characteristics of the city, this project focuses on Chicago.

The crime data for this project is from the Chicago Crime Data Portal, published by the City of Chicago (2018). The data are point data and include the street address for each crime, with the house number redacted. The data include about 68,000 reports of assault or battery, with 28,000+ of those being cases where there was a relationship between the perpetrator and victim (domestic), and 39,000+ cases where there was no known relationship (non-domestic). The data were downloaded from the City of Chicago's website as two different .csv files, one containing all of the domestic cases and the other containing all of the non-domestic cases. The files were cleaned in Microsoft Excel to remove any irrelevant data and rename the fields to be GIS-compatible.

The socioeconomic data is from the United States Census Bureau (2010), and includes unemployment, poverty, population with less than a high school diploma/GED, population 18-24, single parent households, and vacant houses. The data is polygon data, at the census tract level, and was downloaded as a shapefile. Additional socioeconomic data from the Social Impact Research Center (2015) was used to update the 2010 census data with 2015 estimates. This data file was downloaded as an excel spreadsheet, converted to a .csv file, imported into ArcMap, and joined with the census 2010 shapefile based on the census tract number. That joined shapefile was then cleaned to remove any 2010 fields that had updated 2015 estimates, and any other irrelevant information. The cleaned shapefile was exported and saved as a new shapefile containing all of the socioeconomic information to be used for analysis.

Since the analysis of this project is for the neighborhood level, a centroid was calculated for each census tract and was spatially joined to the neighborhood boundaries shapefile. The

summed counts for each socioeconomic variable was then calculated as a rate or percentage by dividing the variable by the neighborhoods population and multiplying by 100. Maps of the socioeconomic variables are shown below, in Figure 1. For all six maps, the neighborhoods are classified by quantile.

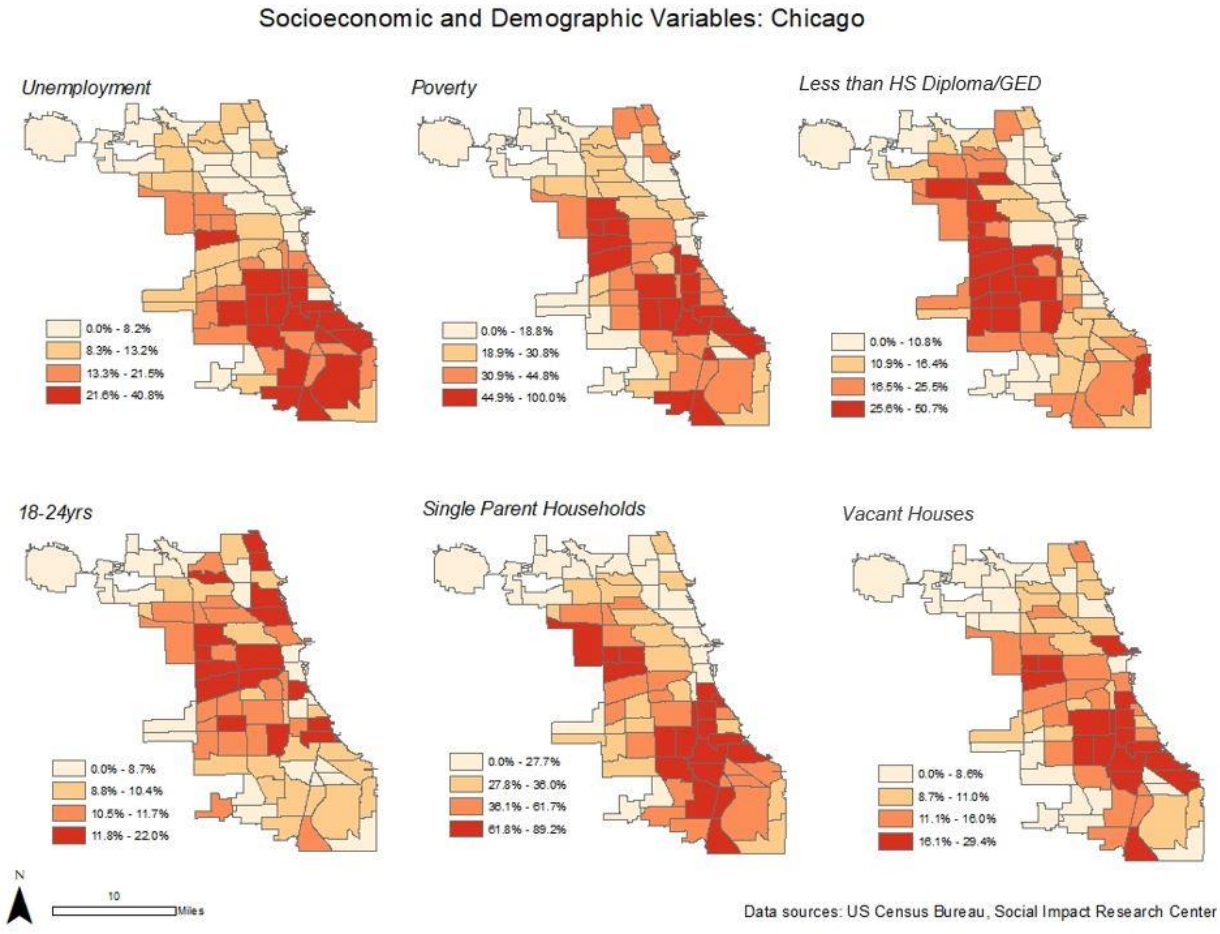

Figure 1

To test the first hypothesis, domestic crime data and non-domestic crime data were imported into ArcMap, geocoded, and spatially joined to the neighborhood shapefile containing the relevant socioeconomic data. This generated two new fields, a count of domestic crimes per neighborhood and a count of non-domestic crimes per neighborhood. The counts were

normalized by dividing them by the neighborhood population and put into new fields, domestic crime rate and non-domestic crime rate. The results were then visualized, using a quantile classification method to in order to determine crime rates relative to other neighborhoods in Chicago.

To test the second hypothesis, a Local Moran's I, or cluster and outlier analysis, was performed in ArcMap for the domestic crime rate and non-domestic crime rate. The shapefile was properly projected, and for both runs the conceptualization of spatial relationships was set to contiguity edges corners.

Before testing the third hypothesis, a global Moran's I was run for each socioeconomic variable, domestic crime rate, and non-domestic crime rate to test for spatial autocorrelation. This is a necessary step, since the existence of spatial autocorrelation can inflate the significance of independent variables in a regression analysis if the spatial autocorrelation is not accounted for and corrected in the regression. For each run the conceptualization of spatial relationships was set to contiguity edges corner and the standardization was set to row. Unsurprisingly, every variable showed spatial autocorrelation. The specific Moran's Index, z-score, and p-value for each variable are shown in Table 1, below.

Table 1

ATTRIBUTE	MI INDEX	Z SCORE	P VALUE
Unemployment Rate	0.461685	10.937850	0.00000**
Poverty	0.357112	8.539857	0.00000**
Less than GED	0.361365	8.611200	0.00000**
% population 18-24	0.122546	3.204397	0.00135**

% single parent HH	0.457439	10.754779	0.00000**
% Vacant Houses	0.300596	7.226981	0.00000**
Domestic Crime Rate	0.563062	8.010769	0.00000**
Non-Domestic Crime Rate	0.535170	7.639832	0.00000**

After testing for spatial autocorrelation, the shapefile was imported into GeoDa, a weights file was created, and a regression analysis run. The weights file histogram is shown below, in Figure 2. For both domestic crime and non-domestic crime, a spatial error model was used.

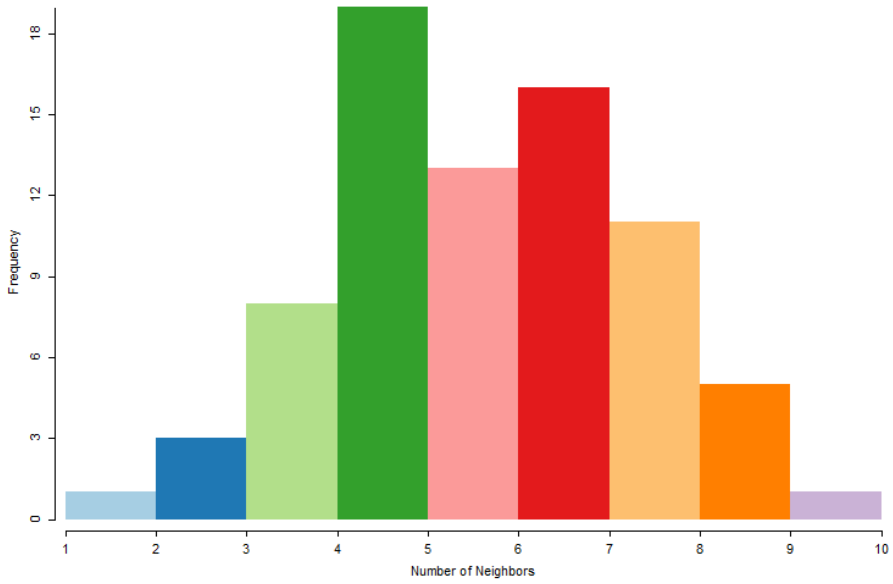

Figure 2

Results

The results from the crime rate comparison are shown in Figure 3. For both domestic violence and non-domestic violent crime, the southside and southwest side of Chicago are

disproportionately affected. Most of the neighborhoods on the northside of the city are in the lowest or second-lowest quantile for domestic assault and battery reports per 1,000 residents. For non-domestic assault and battery reports, a few of these northside neighborhoods, particularly those along the shore of Lake Michigan, jump up into the second or third quantile.

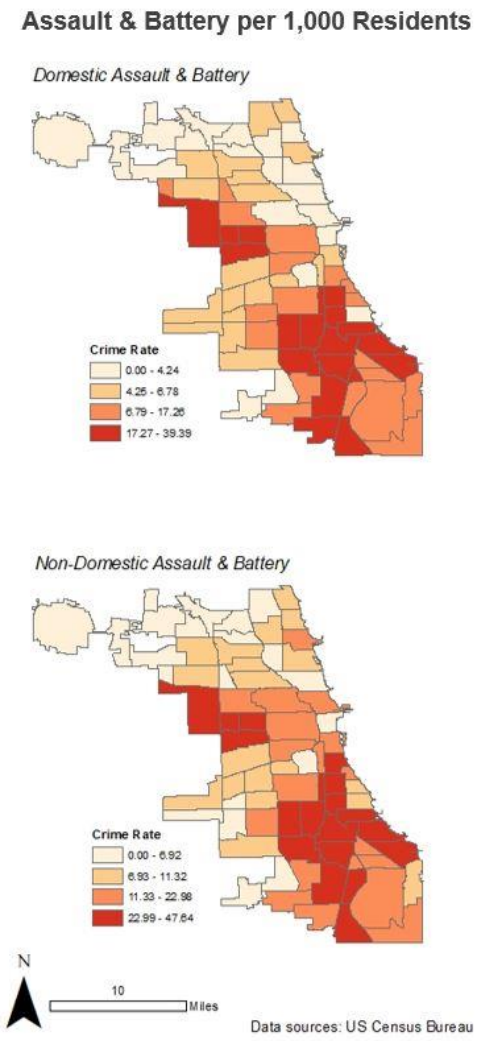

Figure 3

The results from the Anselin Local Moran's I/Cluster and Outlier Analysis are shown below, in Figure 4. Light red areas are high-high clusters, light blue areas are low-low clusters, dark red areas are high-low outliers, and dark blue areas are low-high outliers. While the two

maps show a similar overall pattern, there are significant differences in the size of the low-low cluster on the northside of the city and the high-high clusters on the westside and southside of the city.

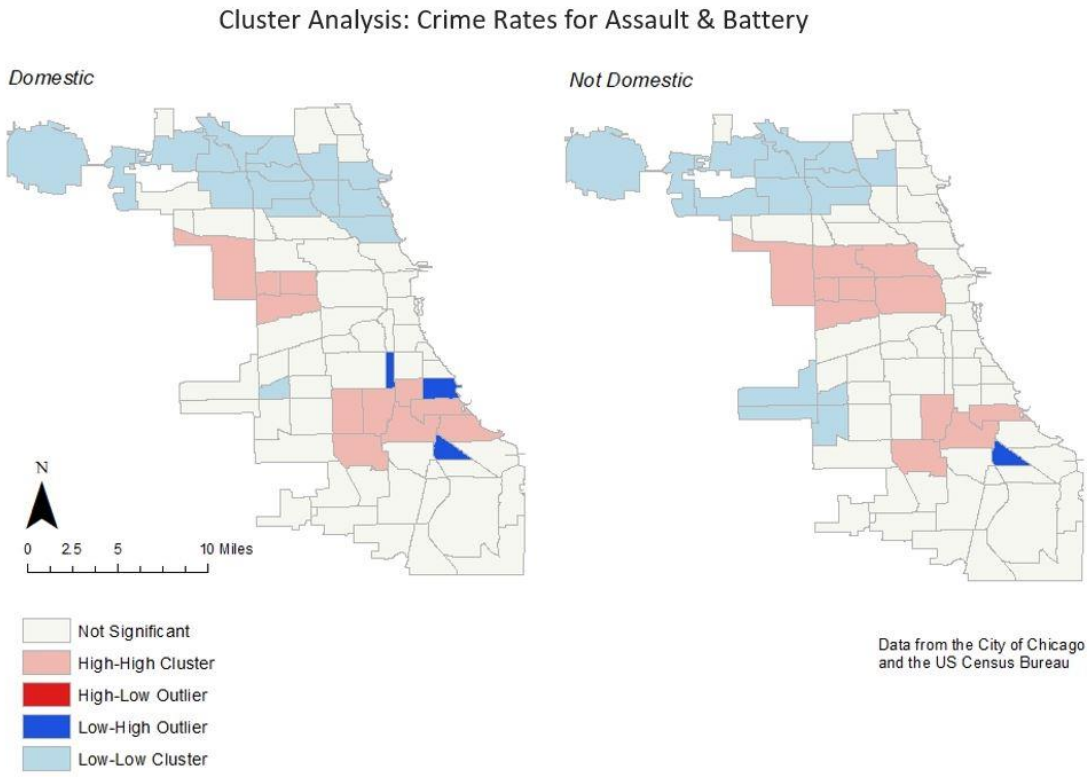

Figure 4

The regression analysis results are shown below, with the domestic assault and battery results in Table 2 and the non-domestic assault and battery rates in Table 3. For domestic assault and battery rates by neighborhood, all six socioeconomic variables tested were statistically significant. Percent unemployed, vacant houses, single parent households, and poverty were positive coefficients, while percent population with no high school diploma/GED and population 18-24 years old yielded negative coefficients. For non-domestic assault and battery, percent unemployed, vacant houses, single parent households, and population with no high school

diploma/GED produced similar statistical results as they did in the domestic assault and battery table, but two independent variables – percent of the population in poverty and percent of the population age 18-24 – are not statistically significant.

Table 2 shows the regression results for domestic assault and battery rates, $R^2 = 0.9434$

Domestic Assault & Batter Rates – Spatial Error Regression Model				
Variable	**Coefficient**	**Standard Error**	**Z-value**	**P-value**
Unemployment	34.18	9.99	-3.42	0.0032**
Vacant houses	55.51	10.17	5.46	0.0000**
Single parent households	17.21	4.27	4.03	0.0000**
No GED/HS diploma	-13.84	4.26	-3.25	0.0012**
18-24yrs	-30.37	12.05	-2.52	0.0117**
poverty	11.63	4.49	2.59	0.0097**

Table 3 shows the regression results for non-domestic assault and battery rates, $R^r = 0.9076$

Non-Domestic Assault & Battery Rates – Spatial Error Regression Model				
Variable	**Coefficient**	**Standard Error**	**Z-value**	**P-value**
Unemployment	29.31	13.14	2.23	0.0257*
Vacant houses	67.45	13.89	4.86	0.0000**
Single parent households	48.53	5.70	3.25	0.0012**
No GED/HS diploma	-20.13	5.43	-3.71	0.0002**
18-24yrs	-15.02	16.77	-0.90	0.3705
poverty	11.76	6.07	1.93	0.0527

Discussion

The results of the crime rate comparison in Figure 3 show that there is a difference between the spatial distribution of domestic crime rates and non-domestic violent crime rates in Chicago. While the crimes are the same – assault and battery – it is clear that the rates of these crimes differ by neighborhood, depending on the relationship between the perpetrator and victim (domestic vs. strangers). One possible explanation for the difference in relative crime rates for the northside neighborhoods of Chicago could be mobility. Some of the northside neighborhoods that jump up a quantile in crime rates from domestic to non-domestic violent crime are Lakeview/Wrigleyville, Uptown, and West Town – neighborhoods that are less residential but attract a lot of people from outside the neighborhood and outside the city for professional sports games, concerts, and bars. This influx of people provides a potential explanation for the increase in non-domestic assault and battery rates, relative to domestic assault and battery rates.

Because there is a difference between the spatial distribution of domestic crime rates and non-domestic crime rates, there is also a difference in the Anselin Local Moran's I cluster and outlier analysis results. The low-low cluster that exists on the north side of the city of is larger in the map of domestic violence than non-domestic violence, because the neighborhoods along Lake Michigan have higher relative rates of non-domestic crime than domestic crime.

The regression analysis results are especially interesting. For domestic assault and battery rates, the positive and statistically significant results for unemployment rate, poverty, single parent households, and vacant houses are all expected, based on findings from previous studies on violent crime. The statistically significant and negative relationship between percentage of the population age 18-24 and percent of the population with no high school diploma/GED was not expected.

A potential explanation for the negative correlation between low education and domestic violence rates could be due to a lack of reporting, not a lack of crime. If you look back at the maps of the independent variables, Figure 1, the neighborhoods that have the highest rates of low education levels are concentrated on the west side of Chicago. Maybe in these west side neighborhoods with high levels of low education, victims are more reliant on their partners and family members for support than those who have higher levels of education. This could make the personal cost of reporting domestic violence much more significant for those victims than victims with higher levels of education, agency, and independence. Another potential explanation for the negative and statistically significant correlation between low levels of education and domestic violence reports could be that domestic violence is more culturally acceptable in these neighborhoods. The west side neighborhoods in Chicago that have the highest levels of low education also have the highest levels of immigrant populations, and some researchers have shown that different cultures accept domestic violence more than others (Flood and Pease, 2009).

The difference between the regression results for domestic violence and non-domestic violence show that there is a statistically significant difference between the socioeconomic correlates of domestic assault and battery and the socioeconomic correlates of assault and battery between strangers. The most interesting difference is that poverty is not a statistically significant correlate of non-domestic assault and battery. This is an interesting result that I do not have an explanation for, and it certainly warrants future research and discussion.

Conclusion

The results of this project show that while general spatial patterns of domestic assault and battery are *similar* to non-domestic assault and battery, there are some noteworthy differences in the spatial distribution of the two types of crime rates. The results of the regression analysis support previous research that socioeconomic correlates like unemployment rates are strong correlates of violent crime, whether domestic or not. The regression analysis for domestic and non-domestic crime rates suggests that while the actual crime is the same – assault and/or battery – the influence of socioeconomic factors is different depending on the relationship between perpetrator and victim.

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