

THE UNIVERSITY OF CHICAGO

Repairing Chicago's Communities: A First Look at Chicago's Calls for Service and Criminality in 2016

By:

Kevin J. Magnan

August 2017

A paper submitted in partial fulfillment of the requirements for the
Master of Arts degree in the Master of Arts Program in the Social
Sciences

Faculty Advisor: Dr. Forrest Stuart

Preceptor: Dr. Theresa Anasti

Repairing Chicago's Communities: A First Look at Chicago's Calls for Service and Criminality in 2016

This paper sets out to explore the complexities of 311 and 911 call rates in the city of Chicago during its highest year of violence and homicides since the mid-1990s crack epidemic. This study seeks to investigate the association between 311 and 911 calls for local government services and 2016 crime rates. Utilizing this data, I examine how calls for service rates and violent crimes, property crimes, and socioeconomic factors are spatially distributed and associated. The initial analysis resulted in insignificant results for both 311 and 911 models, while the second analysis utilizing GIS tools produced a highly statistically significant model. I end this analysis with limitations and implications of my findings and justification for future studies.

I. Introduction

Public safety in the United States is at a considerable turning point. Recent high profile police shootings of minority men followed subsequently by nationwide protests and prominent criminal indictments and trials have propagated the issues of police uses of force and police and community relations into the forefront of public discourse. At the same time, large metropolitan cities, like New York, Chicago and Los Angeles, are experiencing higher levels of violence and homicides when compared to national rates and historic trends. In contrast, the Federal Bureau of Investigation's (FBI) yearly Uniform Crime Report continues to show consistent crime reduction since the mid-1990s (FBI, 2015). In light of these recent trends, police departments, including Chicago, have drastically scaled back strict CompStat law enforcement strategies focusing on aggressive police stops and seizures and have quickly begun implementing and ramping up community policing strategies.

For Chicago, 2016 was the most deadly year since the mid-1990's crack epidemic. To put this in perspective, Chicago's yearly homicide rates between 2010 and 2015 averaged anywhere from 416 and 506 deaths. From year end of 2015 to 2016, that number jumped 58%, resulting in an unprecedented 764 individuals killed in Chicago. These homicides were not spread out across the city; instead, they were heavily segregated within Chicago's primarily

Repairing Chicago's Communities: A First Look at Chicago's Calls for Service and Criminality in 2016

African American, Hispanic and low income communities which already experience disproportionate amounts of violent crimes. In these minority areas for 2016, homicide rates rose from the city's average of 25 to more than 150 homicides per 100,000 residents (Gun Violence in Chicago, University of Chicago Crime Lab, 2016).

Further evidence suggests that Chicago is one of the most highly segregated regions in the United States, both racially and economically. The Metropolitan Planning Council's (MPC) Cost of Segregation study found that Chicago ranked 5th in terms of combined racial and economic segregation among the 100 largest metropolitan areas in the United States and 8th and 9th in Latino-White and African American-White segregation, respectively. MPC's report presented findings that the cost to Chicago's levels of segregation resulted in approximately 86,000 fewer bachelor's degrees, \$4.4 billion lost in African American potential income, and 30% more homicides than if the city was at the median level of U.S. segregation (Metropolitan Planning Council, 2017). At the very least, a conservative interpretation of these results indicates that the issues of socioeconomic and racial segregation are not only impacting the safety of Chicago but also many other significant factors including educational attainment and financial stability. Even more troubling, a growing body of research into segregated minority communities and police behaviors suggests that communities wrought with historic disinvestment and high criminal activity have low trust or are cynical of their government and police departments leading to reductions of participation within their community.

The goal of this study is to examine the spatial relationship between Chicago's unprecedentedly high 2016 crime rates and community engagement with local government reporting systems, formally recognized as 311 and 911 calls for services requests. I hypothesize that 311 and 911 calls for local government services in the city of Chicago are heavily impacted

Repairing Chicago's Communities: A First Look at Chicago's Calls for Service and Criminality in 2016

by crime rates and neighborhood demographics. This study seeks to investigate how varying crime rates, both property and violent, impact how often residents request government services for victimization, emergencies, and quality of life issues. Drawing on Chicago Police Department crime statistics, city of Chicago 911 calls for services, and United States Census Bureau American Community Survey data, this study utilizes crime rates and census demographics to develop a picture of Chicago's communities and examine the impacts on service request calls. This study proceeds as follows. I begin by examining the existing body of research on the relationship between 311 and 911 calls for services with community level crime and socioeconomic variables. Afterwards, I present my data sources and my statistical and spatial methodology utilized to examine Chicago's call rates, crime rates, and neighborhood demographics. Next, I test my theoretical argument in a framework that investigates whether 311 and 911 call rates are associated with community level crime rates and demographics. Finally, results, discussion, and limitations are presented as well as opportunity for future work.

II. Literature Review

Studies within criminology have varied widely in their measurements of crime through spatial units (national, state and local), crime types (e.g. calls for service and crime rates), and crime severity (e.g. violent and non-violent) (Weisburd, 2015). While there is no accepted standard for evaluating crime incidents through UCR crime incident reports, National Crime Victimization Surveys, or 911 emergency calls for services, many researchers use one or more of these methods in their evaluation of criminal behavior to either confirm one another or compare and contrast crime frequency. While these differing types of measures are used frequently, researcher Eric Baumer (2002) has asserted "few studies have examined the impacts of

Repairing Chicago's Communities: A First Look at Chicago's Calls for Service and Criminality in 2016

neighborhood characteristics on the likelihood that victims of violence notify police of their victimization" (i.e. 911 emergency calls for service). Furthermore, relatively little is known about the existence, direction, and strength of neighborhood effects on victim crime reporting (Baumer, 2002).

Criminology researchers have investigated whether 911 calls for police services could be a more reliable and accurate measure of crime rates. The concept presented by these earlier researchers was that 911 emergency calls omitted biases believed to negatively affect crime rates drawn from police incident reports on 911 calls for service. They hoped that drawing crime rates from a source which omitted these biases would create a more precise picture of the actual crime rates in their communities. Some of these biases included citizen call inaccuracy, dispatcher bias, citizen errors in reporting, misleading or false reports, police officer bias and discretion, and citizen misunderstanding of the law (Klinger & Bridges, 1997).

In 1997, researchers Klinger and Bridges found substantial error in substituting 911 calls for services as a measure of crime rates. They found vast discrepancies in crime categories, resulting in under reporting for assaults and over reporting for burglaries as examples. Klinger and Bridges findings strongly indicate that even after adjusting and interpreting 911 calls for services, they are not an improved measure of crime rates. However, their findings uncovered potential benefits of using crime rates and 911 calls for services together. First, their analysis provided strong associations between crime rates and 911 calls for services such that other methods of crime reporting, such as citizen reporting in police stations and officer observed crimes, were not significant sources of crime incidents and did not impact their analysis. Furthermore, they determined that neighborhoods with low education attainment, high residential

Repairing Chicago's Communities: A First Look at Chicago's Calls for Service and Criminality in 2016

stability, and low levels of fears of crime have higher 911 calls for service rates than neighborhoods with different characteristics (Klinger & Bridges, 1997).

Socioeconomic factors have also been found to affect 911 calls for service at differing rates and for differing types of calls. Residents of neighborhoods with high levels of socioeconomic disadvantage are substantially less likely than residents of advantaged neighborhoods to seek out the assistance of the police through calling 911, as well as other means, when they experience violent victimization. The effect of residents seeking out the police after victimization of a crime impacts community crime rates as well as 911 calls for service rates, both of which impact assumptions by police departments and local government administrators on the safety of each neighborhood. More specifically, the observable differences between high crime and low crime neighborhoods do not reflect the actual differences between these areas nor do they show a full picture of the victimization if these two measures are looked at independent of each other as well as other factors. What these observable differences in crime rates may suggest may not so much be criminality in the area but differences in disproportionate 911 call rates (Baumer, 2002).

While socioeconomic factors have been found to impact 911 calls for services, Baumer found that socioeconomic disadvantage was uncorrelated with crime reporting for serious crimes such as robbery and aggravated assault. Furthermore, while one would expect some variation in 911 call rates relative to crime rates, no significantly negative relationships were found between neighborhood disadvantage and 911 calls for service rates. More surprisingly, some of the lowest 911 call rates for crimes including simple assaults were found in the most advantaged socioeconomic neighborhoods as opposed to the disadvantaged neighborhoods. In light of this study utilizing both 311 and 911 call rates, results suggest that opposite to 311 calls, which are

Repairing Chicago's Communities: A First Look at Chicago's Calls for Service and Criminality in 2016

non-emergency related calls, 911 calls for service from citizens in the aftermath of serious victimization may use exercise discretion in general, regardless of factors including trust in the police and government or attachment to one's neighborhood. Citizens may feel compelled to make police notifications in the hope that legal remedies and retribution would result and such calls would reduce chance for repeat victimization, something 311 calls for service do not offer (Baumer, 2002).

The previous work regarding 911 calls for service rates and crime rates suggests that 911 call rates remain closely aligned with crime rates irrespective of neighborhood socioeconomic differences and due to the legal consequences or threat of consequences of victimization by the criminal justice system. This study will test the spatial relationship between 911 calls for service and crime rates for year 2016 in Chicago. I hypothesize that

Hypothesis 1: There will be a strong positive relationship between 911 calls for service and ward level violent and property crime rates within the city of Chicago.

While the relationship between 911 calls for service and crime has been studied in a variety of work (Baumer, 2002; Desmond, Papachristos, & Kirk, 2016; Kirk & Papachristos, 2011; Klinger & Bridges, 1997; R. Sampson, 2012; T. O. M. R. Tyler, 2004; T. R. Tyler & Fagan, 2008; Weitzer, 2002), more recent scholars have begun utilizing government service mechanisms for non-emergency 311 calls. Research investigating 311 call data as a proxy for citizen demand for order maintenance policing found that 311 call rates are not as strongly associated with crime as 911 call rates. They found that the largest factor influencing 311 call rates and police services were police administrators or upper levels of city management (Laniyonu, 2017). Survey research has also found that citizens are widely aware of and satisfied

Repairing Chicago's Communities: A First Look at Chicago's Calls for Service and Criminality in 2016

with 311 call services, particularly in large cities like New York. Therefore, it is logical to conclude that the familiarity of citizens with their local 311 calling system is not implicated in its variations of call rates. 311 calling not only allows citizens to make their problems aware of with their local authorities, but it also allows them a role in personally reporting issues which aid them in playing a problem solving role of neighborhood issues (Johnson, 2010).

In 2014, Lerman and Weaver argued that concentrations of police stops are associated with higher levels of community engagement via 311 calls for service. However, they also found that police stops, which included searches and uses of force, had a “chilling” effect on 311 calls for services. They found that when the police are seen as fair, this perception was applied to the political and government body as a whole, encouraging civic engagement through 311 calling. When the police are seen as hostile and unfair during events such as unjustified “stops and frisks” and uses of force, it leads community members to feel alienated from their local government and discourages civic engagement through 311 calling (Lerman & Weaver, 2014).

Disadvantaged and high crime areas are known to incur higher amounts of police patrols, uses of force, and officer misconduct (Fagan & Davies, 2000; Kane, 2002; Smith, 1986; Terrill & Reisig, 2003). Even worse, disadvantaged policing behaviors are seen to result in less than optimal results. In Chicago, these results were exemplified with the city's Police Accountability Task Force report. The report, utilizing Chicago Police Department's own data, revealed that the department used force more often in African American communities and conducted traffic, pedestrian, and investigatory stops on a disproportionate amount of African Americans and Hispanics relative to the population. From these traffic stops, the report determined that African Americans and Hispanics were stopped and searched up to 4 times more likely than whites, yet whites were found to have contraband twice as often as African Americans and Hispanics (Police

Repairing Chicago's Communities: A First Look at Chicago's Calls for Service and Criminality in 2016

Accountability Task Force, 2016). These types of interactions have much longer and significant impacts on citizens reporting than do positive interactions. Negative interactions of police experiences have been attributed to four to fourteen times as large of a negative impact than positive police interactions (Skogan, 2006).

Further complicating 311 calls for service and police interactions, Lerman and Weaver's study found a positive relationship between per capita police stops and the use of 311 calling. Conversely, when police stops involve uses of force or searches which do not result in an arrest, they found that 311 calls in that area decreased. While there existed a positive relationship between per capita police stops and per capita 311 calls, the significance is substantially reduced in lower-income and minority neighborhoods. City blocks which experienced above the mean police stops that resulted in no criminal or legal action had a negative impact on 311 calling while blocks at or below the mean experienced a range of impacts. Some neighborhoods duplicated the negative impact experienced by lower-income and minority neighborhoods while others had little to no negative impact on 311 calling. Overall, Lerman and Weaver determined that more police stops resulted in more 311 calls for service, yet this finding was nullified and actually reduced when those stops involved searches and uses of force which resulted in no further police action (Lerman & Weaver, 2014).

Similarities between 311 and 911 calling are not straightforward; while they both occupy the same behavior (e.g. using a phone to call a government reporting system), we have seen that 911 emergency calls for service incorporate greater victimization and greater legal and criminal ramifications. 311 calls for service are also more driven by more fickle motivation (Lerman & Weaver, 2014), whereas I expect 911 calls to more closely align with crime rates due to their

emergency nature and legal motivation (Baumer, 2002; Klinger & Bridges, 1997). Thus, I hypothesize:

Hypothesis 2: The relationship between 911 calls for service rates and crime rates will be more significant than 311 calls for service rates and crime rates.

III. Data & Methodology

In order to test my hypotheses, I collected a wide range of data from the city of Chicago and the United States Census Bureau. Utilizing the city of Chicago's data portal, which provides publicly accessible datasets, I first accessed the "Crimes – 2001 to present" dataset and filtered it for the year 2016 as my measure of crime rates. The crime dataset contained 22 variables including type of crime, district, ward, community area, zip code, and FBI code. The second dataset gathered from Chicago's data portal were an aggregation of all publicly available 311 calls for services for the year 2016, comprised of abandoned vehicles, all street lights out, single street light out, alley lights out, garbage carts, graffiti removal, potholes, rodent bait traps, sanitation, tree debris, tree trims, and vacant buildings. Similar to the crimes dataset, the 311 calls for service files contained a number of variables including types of service calls and spatial location identifiers.

The next dataset to acquire was 911 calls for service. Due to the nature of 911 calls for service, this dataset was not openly available to the public via the data portal. A Freedom of Information Act (FOIA) was filed and fulfilled for this data through the city of Chicago's Office of Emergency Management (OEMC). In order for the 911 calls for service dataset to be released, the OEMC desensitized the dataset to remove any and all identifying information. As a

Repairing Chicago's Communities: A First Look at Chicago's Calls for Service and Criminality in 2016

result of this process, the file contained only the following variables: event ID, entry date, closed date, event type, disposition, police district, ward, and zip code. Consequently, the 911 dataset limited any spatial analysis I could conduct at a level below police district, ward, or zip code. The final dataset required for this study was community census demographic data. I gathered this data from the United States Census Bureau's American Community Survey (ACS) for 2011-2015. At the time of this study, data from the Census Bureau for 2016 was unavailable. ACS data was gathered at the census tract level for population, gender, age, race, educational attainment, dropout status, aggregate household income, unemployment status, poverty status, and tenure status.

Social and Urban researchers have historically favored examining the city of Chicago's 77 community areas as the spatial unit of analysis. In this study, however, I am limited by the 911 calls for service data acquired by the OEMC FOIA. Therefore, I must focus this analysis on Chicago's 50 political wards. The results section will discuss an alternative analysis utilizing geographical analysis conducted in ArcGIS which attempts to solve the limitations of the 911 data and ward boundaries. Based on previous research, this study incorporates similar census demographics and crime rates in used in previous calls for service and crime analysis (Carr, Napolitano, & Keating, 2007; Desmond et al., 2016; Kirk & Matsuda, 2011; Lerman & Weaver, 2014; T. R. Tyler & Fagan, 2008). This analysis is by no means exhaustive, but is rather an exploratory analysis with the data that is available.

The first step of my analysis was to aggregate census tract demographic data up to the ward level, the lowest spatial unit possible for this analysis. Through the tools available in ArcGIS, I aggregated up census tract data to the ward level based on the amount of area each census tract represented in a ward. The tools in ArcGIS allowed for a holistic picture of each

Repairing Chicago's Communities: A First Look at Chicago's Calls for Service and Criminality in 2016

Chicago ward to be created for 311 and 911 calls for service, crime rates, and ward demographics. Additionally, 2016 crimes were separated into violent crimes (homicide, sexual assault, robbery, aggravated assault, and aggravated battery) and property crimes (burglary, larceny, motor vehicle theft, and arson) as defined by the FBI UCR (FBI, 2017).

After data collection and manipulation, what follows is a spatial exploratory analysis of Chicago's wards followed by ordinary least squares regressions models exploring the relationship between 311 and 911 calls for services and violent and property crimes. The regression models aim to test my two hypothesis involving 311 and 911 calls for service and crime rates. Finally, utilizing tools available in ArcGIS, I will attempt to solve the spatial unit of analysis problem created by the limitations of the 911 calls for service dataset by separating the city into an equal grid of analysis.

IV. Results and Discussion

As recent studies of segregation and concentration of violence in the city of Chicago have found (Kapustin et al., 2016; Metropolitan Planning Council, 2017), Chicago wards are highly heterogeneous, with concentrations of residents by socioeconomic factors including race, income, and educational attainment. These ward disparities can be seen in Table 1 and subsequent maps of census demographics. Chicago's wards exhibit large discrepancies across all demographic variables. For example, for Chicago's racial makeup, there are very large standard deviations, well above 25% for each of the three races I included in this study. Additionally, average household income provides evidence on the vast wealth discrepancies plaguing the city. Average household income is heavily skewed to the right and the standard

Repairing Chicago's Communities: A First Look at Chicago's Calls for Service and Criminality in 2016

deviation is nearly \$6,000 less than the lowest ward average income. Educational attainment is another discouraging variable in this analysis. In some areas of Chicago, 47% of the population are without a high school education, while in other areas bachelor degree attainment is 48%.

Finally, employment rates are a common topic in the political and economic climate and Chicago is no exception. Some wards in the city face unemployment rates of as much as .29 while other wards are well below the national average of .04.

The population of Chicago is almost evenly split into thirds for Whites, African Americans, and Hispanics (Metropolitan Planning Council, 2017). However, this even distribution is not seen throughout in the city; instead, Chicago is highly segregated neighborhoods in the north, west and south regions. The racial disparities seen below carry with them socioeconomic disparities in the form of educational attainment, employment, income and poverty. The maps shown below visualize how white neighborhoods enjoy higher educational attainment, incomes, and low rates of unemployment and poverty while these socioeconomic indicators are much worse for minority communities.

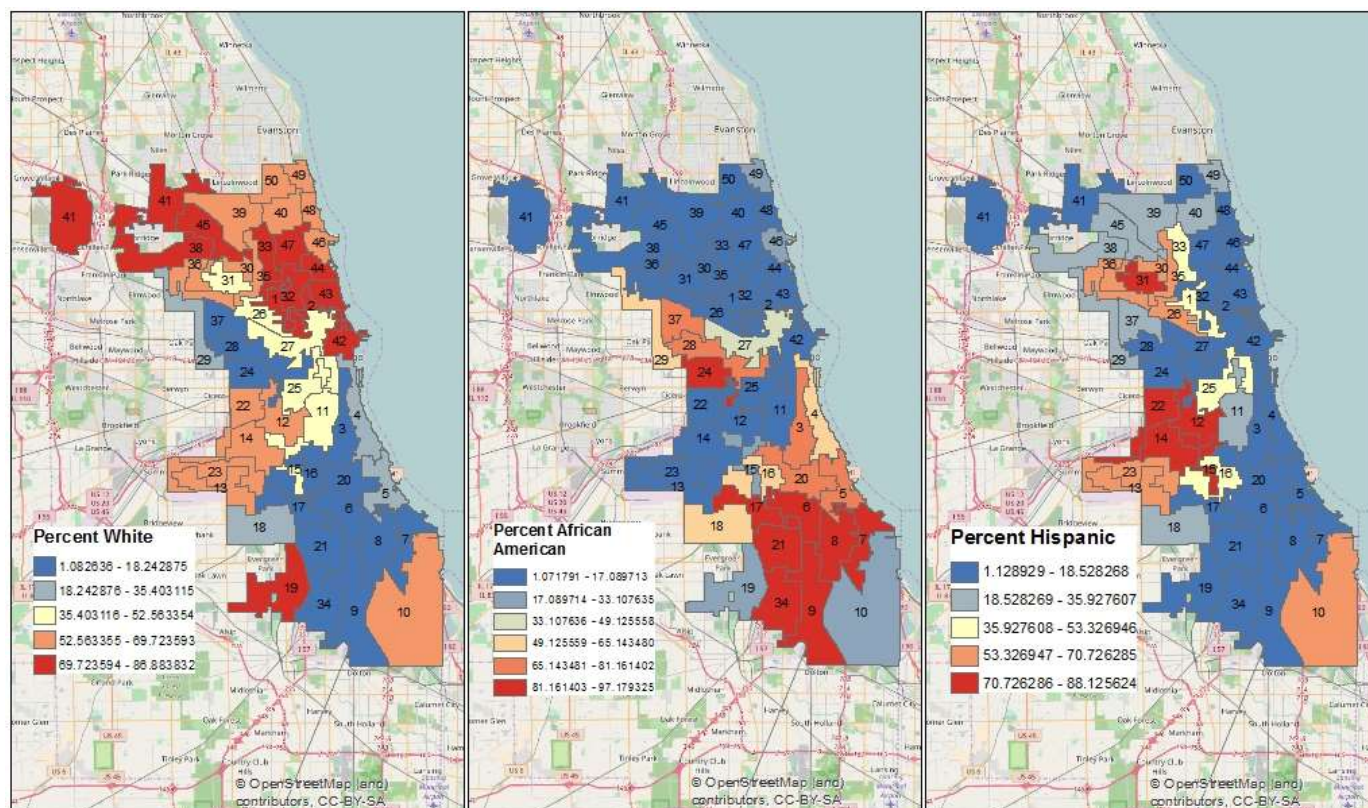
Repairing Chicago's Communities: A First Look at Chicago's Calls for Service and Criminality in 2016

Table 1: Independent Variables of Chicago Ward Demographics

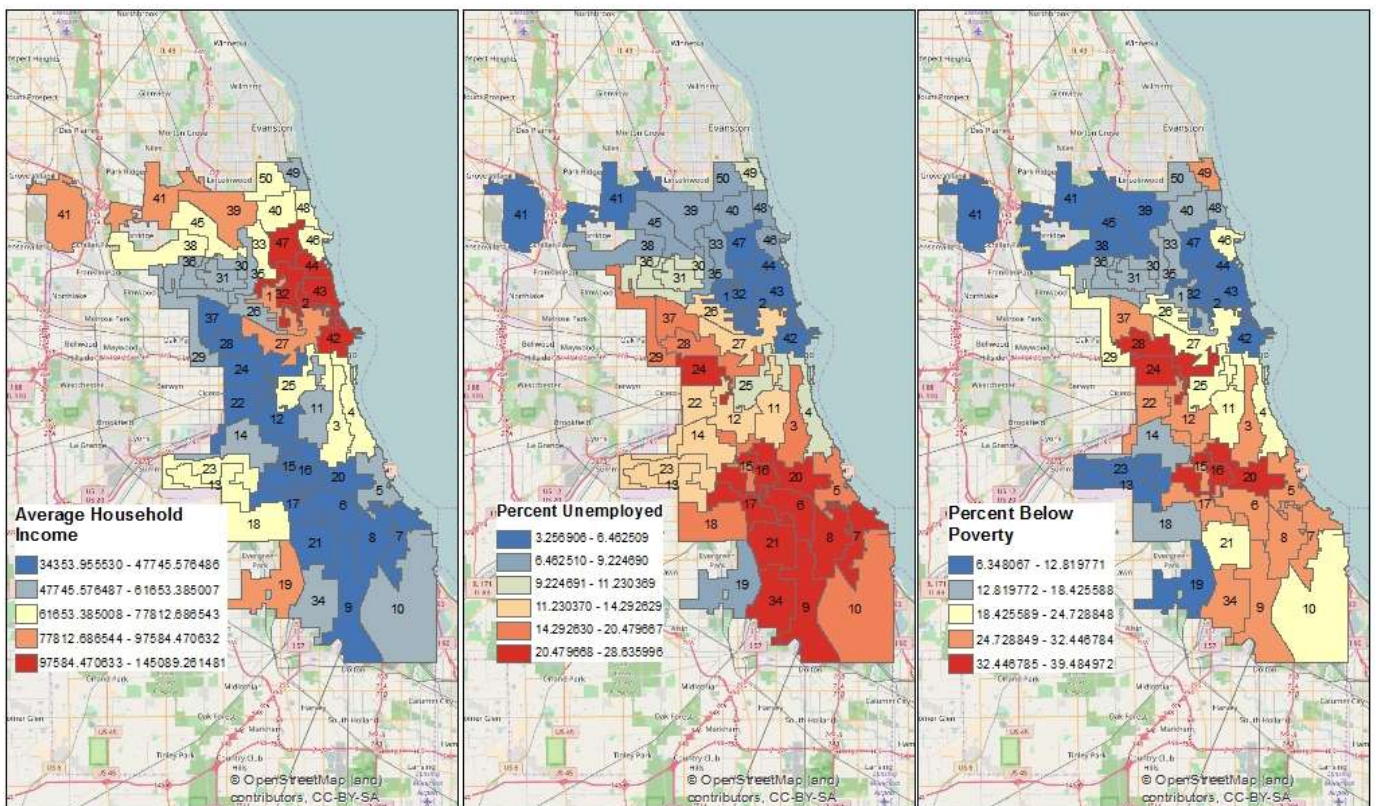
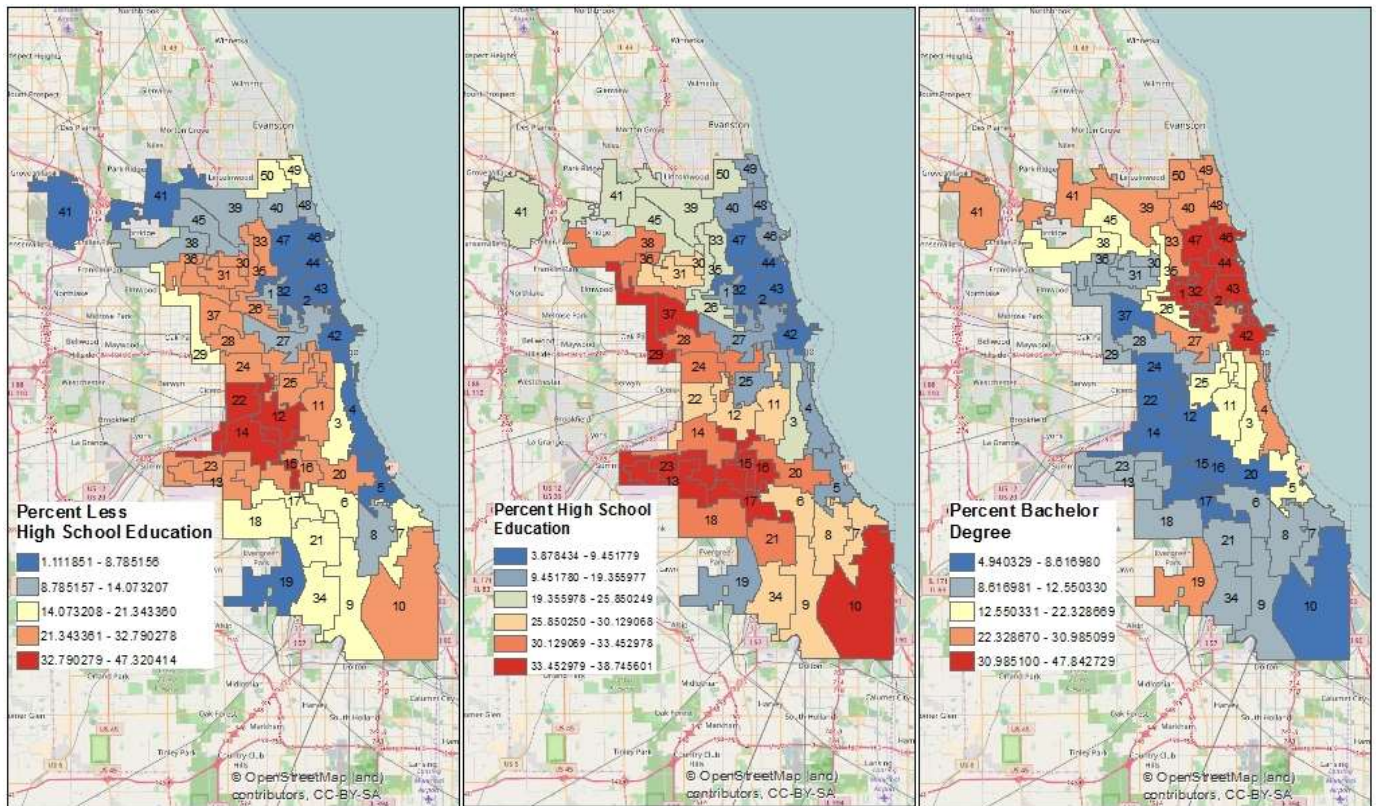
	Min	Max	Mean	Std. Deviation
Percent White	1.00	86.00	47.00	28.00
Percent African American	1.07	97.18	32.93	35.08
Percent Hispanic	1.13	88.13	29.22	26.38
Percent Less High School	1.00	47.00	19.00	11.00
Percent High School	4.00	39.00	24.00	9.00
Percent Bachelor	5.00	48.00	20.00	12.00
Percent Dropout	0.00	20.00	5.00	3.00
Percent Unemployed	3.00	29.00	13.00	7.00
Average Household Income	\$34353.00	\$145089.00	\$68049.07	\$28110.00
Percent Own	23.00	83.00	45.00	14.00
Percent Rent	17.00	77.00	55.00	14.00
Percent in Poverty	6.00	39.00	21.00	9.00

**Unemployment rate is calculated by dividing number of unemployed workers in an area by the total population of workers above the age of 16. Dropout rate is calculated by dividing the number of young adults between the ages of 16 and 19 from the total population of young adults between the ages of 16 and 19. Average Household Income is calculated by dividing the total income for the area by the number of households.*

Source: United States Census Bureau American Community Survey 2011-201



Repairing Chicago's Communities: A First Look at Chicago's Calls for Service and Criminality in 2016



Repairing Chicago's Communities: A First Look at Chicago's Calls for Service and Criminality in 2016

In Table 2, I present a list of descriptive characteristics for the crime variables used in this study. Expectedly, there is large variation with both call rates and criminality, which has been the narrative of local media, researchers, and city officials beginning with Chicago's crime surge. 911 calls for service rates were the most heavily heterogeneous variable with extremely large variability based on the scale 911 calls made each year. To aid in making sense of crime and call rates in a spatial context, I included maps below to illustrate the discrepancies between Chicago's calls per crime for each variable.

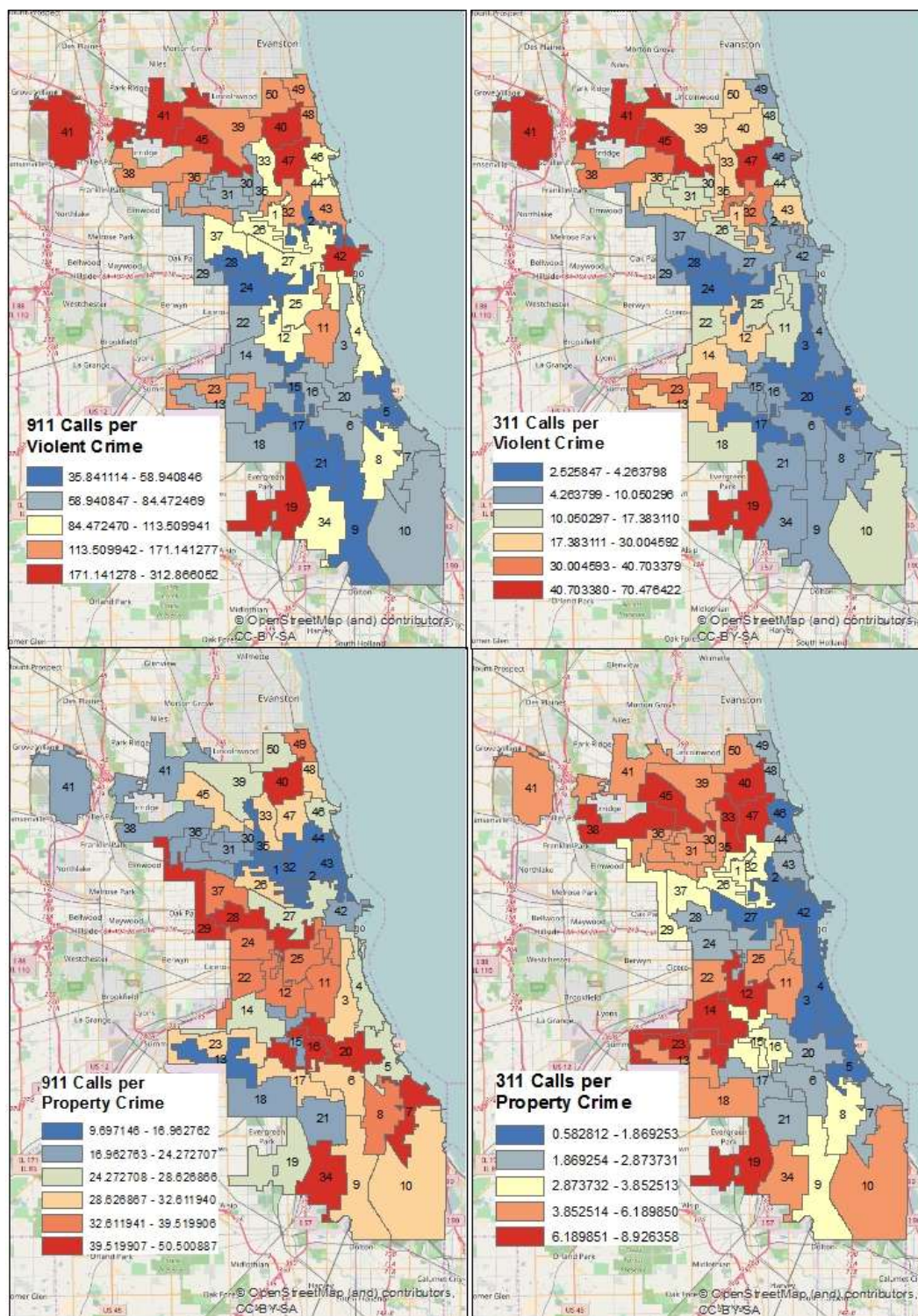
Table 2: Chicago Ward Crime Rates (2016)

Variables	Min	Max	Mean	Std. Deviation
311 Call Rate	7482	3.26E+04	2.02E+04	5969.9
911 Call Rate	55835.5	4.00E+05	1.75E+05	105188.86
Violent Crime Rate	247.06	7.24E+03	2.17E+03	1824.7
Property Crime Rate	2809.2	1.20E+04	6.01E+03	2934.56

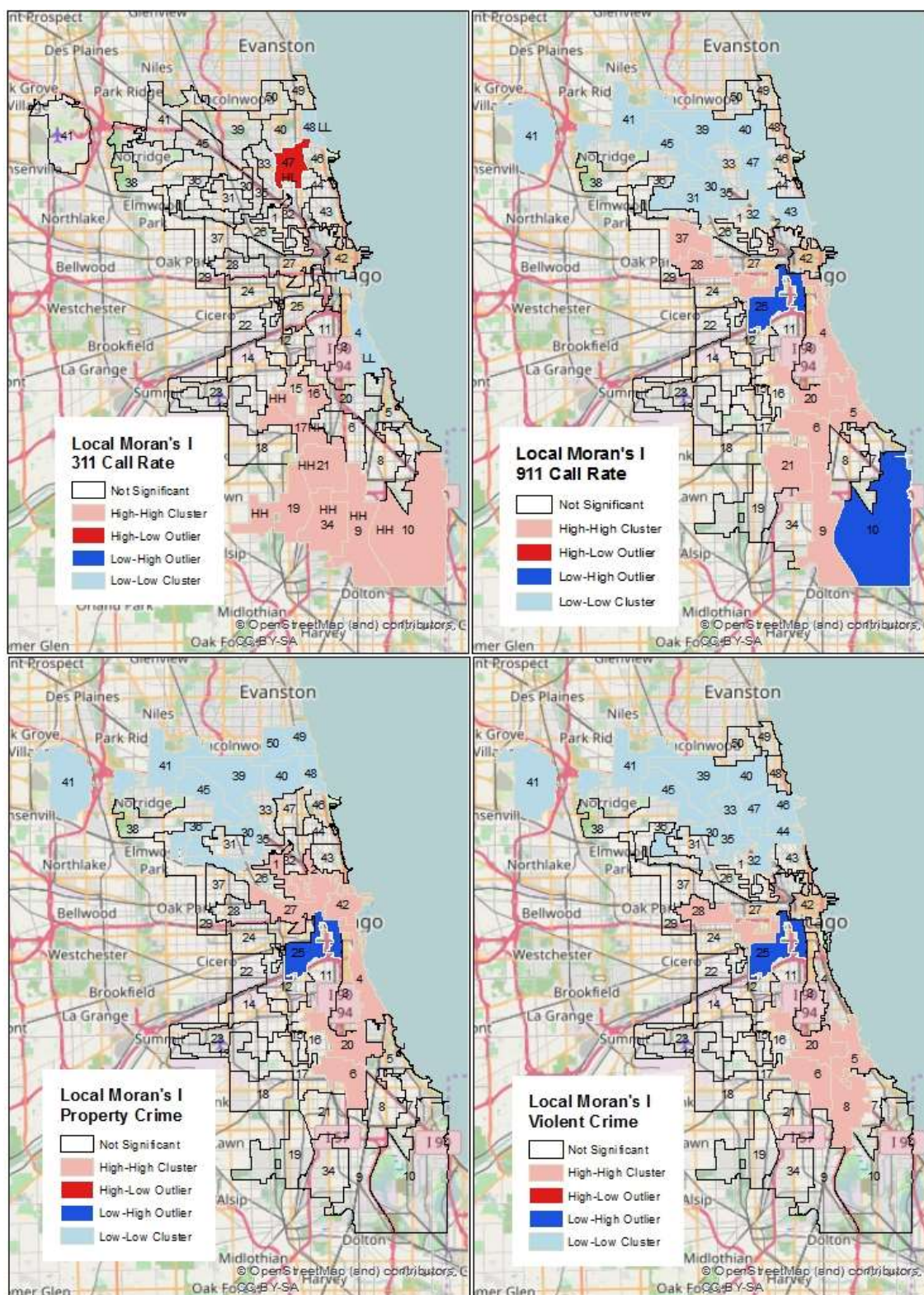
Crime Rates for 2016 per 100,000 residents across 50 wards

To examine the spatial variability of my dependent variables, 311 and 911 call rates, crime indicators, violent and property crimes, and ward demographics, I utilized spatial statistical tools within ArcGIS and GeoDa applications to test for global and local autocorrelation and hot spot clustering. These tests determine if values cluster on a global scale (throughout the city of Chicago) and on a local scale (within each ward and its immediate neighbors). The global spatial autocorrelation test, Moran's I, returned statistically significant, highly clustered values for 311 and 911 call rates and violent and property crimes. These test tell us that throughout all wards in Chicago, these variables are highly clustered and there is less than a 1% chance that this clustering is due to random chance. Furthermore, the maps below explore local spatial autocorrelation through Local Moran's I analysis. These maps determine the locations of high and low clustering of values and outliers for calls for service and criminal activity cluster within the city. The coloring schemes of these maps represent clustering and outliers of each variable in

Repairing Chicago's Communities: A First Look at Chicago's Calls for Service and Criminality in 2016



Repairing Chicago's Communities: A First Look at Chicago's Calls for Service and Criminality in 2016



relation to its contiguous neighbor. These clusters and outliers constitute statistical significance with an alpha level of 0.05 or lower. Based on these maps, there are large amounts of low-low clustering values in the northern area of the city. These clusters suggest that low values for each respective variable are clustering together; specifically, 911 call rates, property crime rates, and violent crime rates identified as low values based on neighboring rates are clustering together. Similarly, high-high clustering appears to be more common on the south side and parts of the west side, especially for violent crimes and 911 call rates.

To examine the relationship between 911 calls for service and crime and 311 calls for service and crime, I created two ordinary least square (OLS) regression models to test my hypotheses presented earlier. Based on previous research utilizing ordinary least squares regressions with crime rates, neighborhood demographics, and calls for service, I determined the relevant demographic covariates to include were percent African American, percent Hispanic, percent with less than a high school education, percent who obtained a bachelors degree, average household income, percent below poverty, and renting tenure (Carr et al., 2007; Desmond et al., 2016; Kirk & Matsuda, 2011; R. J. Sampson, Raudenbush, & Earls, 1997; T. R. Tyler & Fagan, 2008). The OLS regression is estimated by the following models:

$$\textbf{Model 1: } EC = \beta_0 + \beta_1 VC + \beta_2 PC + \beta_3 WD + \varepsilon$$

$$\textbf{Model 2: } NEC = \beta_0 + \beta_1 VC + \beta_2 PC + \beta_3 WD + \varepsilon$$

where

EC = Emergency calls or 911 calls for service

NEC = Non-emergency calls or 311 calls for service

VC = Violent Crime Rates

PC = Property Crime Rates

WD = Ward Census Demographics

Table 3 presents the findings of my first round of ordinary least squares regression results. Neither model indicates strong statistical significance or good fit. In model 1, which tested my hypothesis of a strong positive relationship between 911 calls for service and ward level crime rates, the results successfully rejected the null hypothesis for property crime rates but failed to reject the null hypothesis for violent crime rates. The results for model 1 suggest property crime rates are positively associated with 911 calls for service ($b = 17.8$, $p < 0.01$), indicating that property crime rates were seen to increase with 911 call rates. However, the coefficient value for property crime rates is insignificant when considering the magnitude of property crime 911 calls are made in the city (referencing Table 2, the mean property crime rate per ward was 6,010 per 100,000 residents for 2016). Not only did I fail to reject the null hypothesis for violent crimes, but the violent crime coefficient was also negatively associated with 911 calls in the model ($b = -2.56$). The ward demographic covariates in the model did not provide any statistical significance, aside from a marginally significant negatively associated percent Hispanic variable ($b = -1679.51$, $p < 0.08$).

In model 2, which sought to test if 911 calls for service and crime rates were more significantly associated than 311 calls for service and crime rates, the results show neither violent or property crime rates were statistically significant for 311 calls. The violent crime rate coefficient was positively associated with 311 calls for service ($b = 0.14$) while the property crime rate coefficient was negatively associated with 311 calls ($b = -0.18$), however both variables indicated insignificantly small values. Also, results for the R-Squared and Adjusted R-Squared values suggest model 1 explained more of the variation within 911 calls for service than model 2. Consequently, model 1 and 2 results suggest I can reject the null hypothesis and

Repairing Chicago's Communities: A First Look at Chicago's Calls for Service and Criminality in 2016

conclude that 911 call rates were more significantly related than 311 call rates since model 1's property crime rate coefficient was the only statistically significant crime rate variable and its R-Squared was much stronger than model 2.

Table 3. OLS Regressions

<i>N</i> = 50	Model 1	Probability	Model 2	Probability
Intercept/Constant	24460.1	0.71	1447.1	0.07†
Violent Crime Rate	-2.56	0.79	0.14	0.91
Property Crime Rate	17.8	0.00**	-0.18	0.73
Percent African American	435.0	0.43	166.04	0.02*
Percent Hispanic	-1679.51	0.08†	124.4	0.28
Percent Less High School	2732.4	0.28	34.71	0.91
Percent Dropout	1455.54	0.47	605.05	0.02*
Average Household Income	-0.24	0.67	0.06	0.37
Percent Below Poverty	3333.83	0.21	-218.5	0.5
Percent Renting	-494.87	0.50	-110.99	0.21
R-Squared	0.89		0.51	
Adjusted R-Squared	0.86		0.39	

* $p < .05$, † $p < .10$

The results from my first round of analysis were far from convincing. While some aspects of my hypothesis were able to reject the null hypothesis, these results should be taken with caution since my previous analysis revealed statistically significant levels of spatial autocorrelation and dependence within the dataset and Chicago's wards. Furthermore, the limitation of my study utilizing Chicago's 50 wards severely limits the likelihood of finding meaningful results using OLS regression tests. Nonetheless, the results from my initial analysis appears to be somewhat in line with previous studies. At the very least, obtaining significance

Repairing Chicago's Communities: A First Look at Chicago's Calls for Service and Criminality in 2016

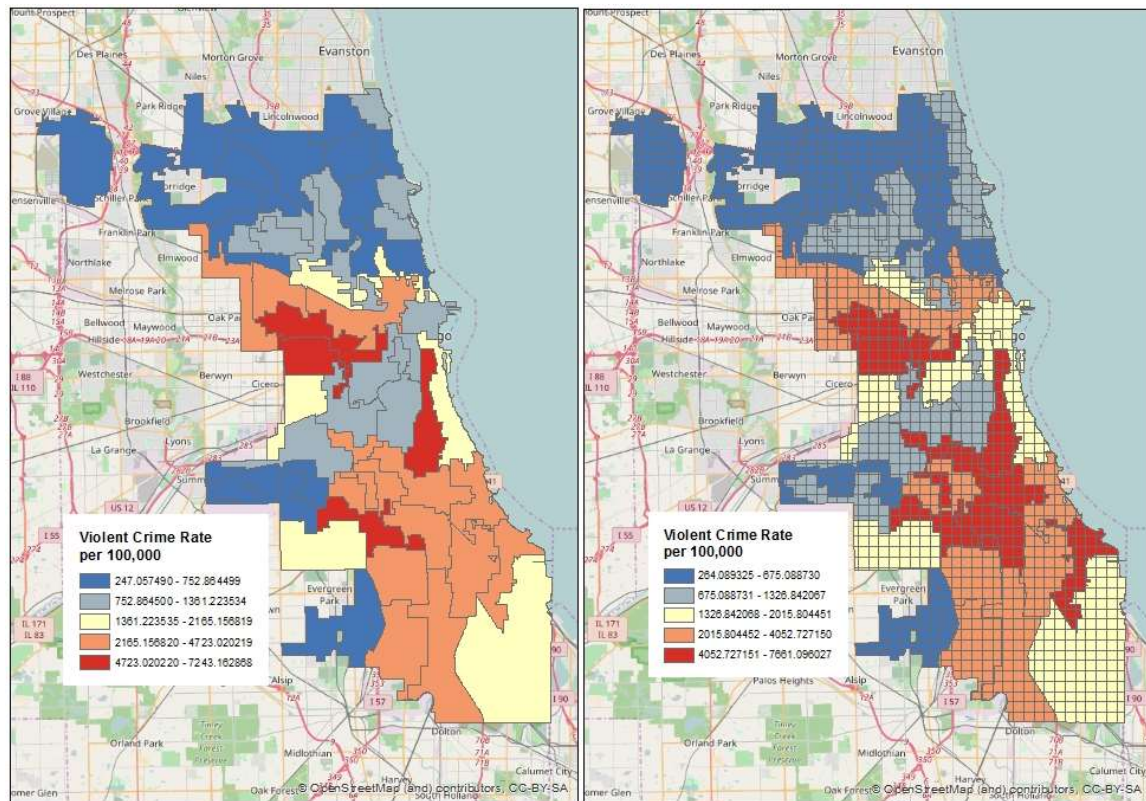
for property crimes in model 1 and having a R-Squared explain almost 90% of the variation in 911 calls for service support the notion that 911 calls for service and crime rates are strongly and positively related while 311 calls for service do not share the same relationship with criminality.

The last section of this analysis will be an attempt to solve what spatial statistics calls the modifiable areal unit problem (MAUP). The modifiable areal unit problem refers to the sociological and urban ways in which data are aggregated to a particular set of arbitrary or man-made districts, boundaries, or spaces. Data aggregated in this way creates high levels of spatial autocorrelation, clustering like groups into spaces or boundaries (Waller & Gotway, 2004). While there is no accepted approach to solving the modifiable areal unit problem, the method I employ in this study superimposes a random, uniform grid over the city and splits the ward level data into each grid based on the proportion of its shape area are contained in each grid. For example, if one uniform grid is split between the 22nd and 24th ward 60/40 respectively, I took the area of the grid in the 22nd and 24th ward, divided it by the area of the entire ward, and multiplied that proportion to the values for that ward data, resulting in an appropriately apportioned amount of data for each grid relative to the amount of area of each ward it contained. While this is a somewhat crude method with many validity issues (chief among them correctly appropriating the variables to their respective grids), the results should be illuminating nonetheless.

Within ArcGIS are tools which I used to solve my study's modifiable areal unit problem. I created a random uniform grid of square boundaries and apportioned the ward level data into each respective grid with the method described above. This produced a map study area with an *N* of 2063 as opposed to a map study area with an *N* of 50 wards in my previous method. The maps below were used as a sanity check to see how violent crime rates were impacted moving

Repairing Chicago's Communities: A First Look at Chicago's Calls for Service and Criminality in 2016

from ward boundaries to grids. While not perfectly identical, I believe the variation to be within an acceptable margin for this type of analysis.



After evaluating my sanity check as successful, I conducted my analysis a second time for both models utilizing the new grid map data. Table 4 presents the findings from my second round of ordinary least squares regressions utilizing my grid spatial area unit. Overall and compared with my previous analysis, this method resulted in both models having strong statistical significance, indicating my method for solving the MAUP was at least somewhat successful. Model 1's test of 911 call rates and crime rates indicate that violent crime rates ($b = -8.16$, $p < 0.01$) and property crime rates ($b = 17.66$, $p < 0.01$) were strongly associated with 911 call rates. Violent and property crime rate coefficient signs remained the same as they were in the previous analysis, leading me to fail to reject the null hypothesis for violent crime rates and

Repairing Chicago's Communities: A First Look at Chicago's Calls for Service and Criminality in 2016

reject the null hypothesis for property crime rates. In other words, the results suggest that during the 2016 crime spike in Chicago, violent crime was negatively related to 911 calls for service while property crimes were positively related. Also, these values remained as statistically insignificant as the previous analysis suggesting the impacts on 911 call rates may not have been felt strongly. Census demographics for this model were statistically significant and provided further depth to the analysis. Percent African American ($b = 637.94$, $p < 0.01$), percent with less than high school education ($b = 2749.29$, $p < 0.01$), percent high school dropouts ($b = 2052.5$, $p < 0.01$), and percent below poverty income ($b = 2999.54$, $p < 0.01$) were all positively associated with 911 calls for service and indicating much larger impacts on call rates than violent and property crimes based on their coefficients. Alternatively, percent Hispanic ($b = -1624.75$, $p < 0.01$), average household income ($b = -0.31$, $p < 0.01$) and percent renting ($b = -216.90$, $p < 0.05$) were negatively associated with 911 calls for service. Finally, model 1's R-Squared (0.89) and Adjusted R-Squared (0.89) in this analysis show the model explains much of the variability in 911 call rates.

Model 2's test of 311 call rates and crime rates also indicate a strong yet negative relationship between 311 call rates and property crime rates ($b = -0.26$, $p < 0.01$). Violent crime rates, alternatively, were not statistically significant for the second time in my overall analysis for 311 call rates. For hypothesis 2, the results from model 1 and 2 strongly align with my hypothesis and reject the null. My second analysis suggests that 911 calls for service and crime rates present a strong statistically significant relationship while 311 call rates present no relationship for violent crime and a negative relationship with property crime rates with a coefficient close to 0. In model 2, percent African American ($b = 171.24$, $p < 0.01$), percent Hispanic ($b = 161.18$, $p < 0.01$), percent high school dropout ($b = 453.73$, $p < 0.01$), and average

Repairing Chicago's Communities: A First Look at Chicago's Calls for Service and Criminality in 2016

household income ($b = 0.08$, $p < 0.01$) had a positive and statistically significant relationship to 311 calls for service. Negative statistically significant relationships were found in percent below poverty income ($b = -180.92$, $p < 0.01$) and percent renting ($b = -96.9$, $p < 0.01$).

Table 4. OLS Regression (MAUP)

<i>N</i> = 2063	Model 1	Probability	Model 2	Probability
Intercept/Constant	20924.8	0.02*	12244.8	0.00**
Violent Crime Rate	-8.16	0.00**	0.18	0.19
Property Crime Rate	17.66	0.00**	-0.26	0.00**
Percent African American	637.94	0.00**	171.24	0.00**
Percent Hispanic	-1624.75	0.00**	161.18	0.00**
Percent Less High School	2749.29	0.00**	-10.96	0.75
Percent Dropout	2052.5	0.00**	453.73	0.00**
Average Household Income	-0.31	0.00**	0.08	0.00**
Percent Below Poverty	2999.54	0.00**	-180.92	0.00**
Percent Renting	-216.90	0.02*	-96.9	0.00**
R-Squared	0.89		0.51	
Adjusted R-Squared	0.89		0.51	

* $p < .05$, ** $p < .01$

Utilizing data from the city of Chicago's 311 and 911 calls for service systems, city crime rates, and census demographics, my main objective was to investigate the relationship between local government reporting mechanisms and violent and property crime rates during one of the most violent years in the city's recent history. Research on 911 calls for service and crime rates suggests that 911 call rates, while not an effective replacement measure for crime overall, are strongly associated with crime rates. Furthermore, I expected educational attainment and residential instability to be related to 911 call rates (Klinger & Bridges, 1997). However, I

Repairing Chicago's Communities: A First Look at Chicago's Calls for Service and Criminality in 2016

expected calls for serious crimes, namely FBI UCR part I and II crimes, to be unaffected by socioeconomic factors and a strong relationship between 911 calls for service and crime rates to be present in Chicago.

Evidence for associations between 311 call rates and crime rates are far less supported by research and have been far less studied. Baumer suggests that 911 calls will have a much stronger association than 311 calls to crime since the nature of 911 calls are emergencies which do not always allow for individual bias to impact whether or not a call is made. Additionally, 911 calls for service provide the caller(s) with legal ramifications and retribution for crimes and victimization while 311 calls often only provide an altruistic feeling of helping the community (Baumer, 2002). Many other factors have been found to be more influential in 311 calls than crime rates or census demographics. Especially for Chicago, research suggests CPD's policing strategies, specifically searches and uses of force which do not lead to legal action in the south and west areas of the city, should impact 311 call rates negatively for the city overall (Johnson, 2010).

My second round of analysis results align strongly with my hypotheses and previous studies. In model 1, my results indicate strong associations between 911 call rates and crime rates and strong statistical significance throughout the model as well as an extremely high R-Squared value, while there were negative relationships between violent crime and some demographics. My results also found further evidence to Klinger and Bridges' argument that residential instability, or percentage of individuals who rent, are negatively associated with 911 call rates. At the same time, my results disagree with Klinger and Bridges' assertion that low educational attainment is negatively related to 911 calls for service. As mentioned before, my R-Squared value in model 2 confirms my second hypothesis that 911 calls for service have a

stronger relationship to crime than 311 calls for service. Violent and property crime rates and census demographics within Chicago were only able to account for 50% of the variability within 311 call rates, suggesting other factors like police behavior, citizen satisfaction with the 311 call system, and city resources may have impacted 311 call rates more significantly.

V. Limitations

This study aimed to be an exploration of the relationship between 311 and 911 call rates, violent and property crime rates, and ward demographics. Initially, this analysis was made difficult by the OEMC's limited geographic identifiers for the 911 calls for service dataset. The tools and methods I utilized within ArcGIS allowed for advanced data manipulation but also ran the risk of improper data manipulation and aggregation. For example, while the uniform grids utilized in my second round of analysis were able to separate the data into a smaller unit of analysis, the grids were still made up of the initial large scale ward data. Additionally, there are many limitations when utilizing 311 and 911 calls for service rates. Calling 311 and 911 services are voluntary human behaviors which are difficult to predict. The systems themselves could have errors in data recording, labeling, and reporting. Calls for service are also not restricted by where residents live, so that commuters and tourists could be the source of the calls instead of residents, leading to a skewed spatial analysis of where these calls are originating from within the community.

While a large amount of the research surrounding police and community relations discusses legitimacy and satisfaction with the police and local government as impacting willingness to cooperate with government reporting systems, this study was not able to incorporate such data. In addition, I did not consider any differences in policing strategies or

personnel differences by wards. It is a plausible argument that wards on the south and west side with higher crimes or call rates have drastically different policing resources devoted to them than areas on the north side or downtown and I would expect allocation of police resources to impact crime rates as well as call rates and police and government responses to crime.

The solution used by this study to solve the MAUP increased my N as well as removed the effects of arbitrary political ward boundaries on my data. However, after running new spatial autocorrelation analyses, my new models still resulted in very high values for spatial autocorrelation. Furthermore, both models presented statistically significant tests for multicollinearity and heteroscedasticity. Therefore, the results of the new models should be taken with caution. Future studies should prioritize obtaining the smallest spatial unit level of data from the city of Chicago to avoid the limitations of this study. Additionally, future studies should include citizen surveys of public perception of police and surveys of public awareness and satisfaction of both the 311 and 911 reporting systems. Officer allocation related to criminal activity or boundaries such as beats and precincts would another useful variable in this type of analysis.

VI. Conclusion

This study sought to aid in developing some kind of understand of the crime spike Chicago experienced in 2016 and, by all accounts, is still experiencing in the early part of 2017. By comparing 311 and 911 call rates to violent and property crimes and ward level demographics, I hypothesized that 911 call rates would be closely related to crime rates while 311 call rates would exhibit much less of strong relationship to crime rates. This study initially found null results, aside from a relationship between ward level property crime rates and 911 call

Repairing Chicago's Communities: A First Look at Chicago's Calls for Service and Criminality in 2016

rates. However, after correcting for spatial limitations presented by data obtained from the city of Chicago, my second round of analysis provided much stronger and statistically significant models for both 311 and 911 call rates. As a result, I concluded that 911 calls for service and property crime rates are strongly related and the relationship between 911 calls for service and crime is much more significant than 311 calls for service and crime.

While the limitations of this study are significant and prevent me from making any strong claims from my results, I believe this exploratory analysis gives further credence to studying the impacts of crime rates and demographics on call rates. Specifically for Chicago, this study's descriptive data and maps present a compelling narrative that the city is segregated by violent crime, property crime, and call rates in addition to race and socioeconomic factors. Additionally, the results of my regression analyses indicate strong associations between 911 call rates and crime rates and weaker associations between 311 call rates and crime rates. If these results for 2016 are any indication of the safety and future of Chicago's residents, agencies seeking to address the rising violence should be pursuing research into the types of factors affecting citizens abilities and predilection to contact the police for help against victimization as well as helping the police in fighting and solving crime and community issues.

REFERENCES

- Baumer, E. P. (2002). Neighborhood Disadvantage and Police Notification By Victims of Violence. *Criminology*, 40(3), 579–616. <https://doi.org/10.1111/j.1745-9125.2002.tb00967.x>
- Carr, P. J., Napolitano, L., & Keating, J. (2007). We never call the cops and here is why: A qualitative examination of legal cynicism in three Philadelphia neighborhoods. *Criminology*, 45(2), 445–480. <https://doi.org/10.1111/j.1745-9125.2007.00084.x>
- Desmond, M., Papachristos, A. V., & Kirk, D. S. (2016). Police Violence and Citizen Crime Reporting in the Black Community. *American Sociological Review*, 81(5), 857–876. <https://doi.org/10.1177/0003122416663494>
- Fagan, J., & Davies, G. (2000). Street Stops and Broken Windows: Terry, Race and Disorder in New York City. *Fordham Urban Law Journal*, 28, 457–504.
- FBI. (2015). Crime in the United States. Retrieved February 1, 2017, from <https://ucr.fbi.gov/crime-in-the-u.s/2015/crime-in-the-u.s.-2015/tables/table-1>
- FBI. (2017). Uniform Crime Reporting Offense Definitions. Retrieved March 16, 2017, from <https://www.ucrdatatool.gov/offenses.cfm>
- Johnson, S. (2010). What a Hundred Million Calls to 311 Reveal About New York. *Wired*.
- Kane, R. (2002). The Social Ecology of Police Misconduct. *Criminology*, 40(4), 867–896.

Repairing Chicago's Communities: A First Look at Chicago's Calls for Service and Criminality in 2016

- Kapustin, M., Ludwig, J., Punkay, M., Smith, K., Spiegel, L., & Welgus, D. (2016). Gun Violence In Chicago. Retrieved from <http://urbanlabs.uchicago.edu/attachments/store/2435a5d4658e2ca19f4f225b810ce0dbdb9231cbdb8d702e784087469ee3/UChicagoCrimeLab+Gun+Violence+in+Chicago+2016.pdf>
- Kirk, D. S., & Matsuda, M. (2011). Legal Cynicism, Collective Efficacy, And The Ecology Of Arrest. *Criminology*, 49(2), 443–472. <https://doi.org/10.1111/j.1745-9125.2011.00226.x>
- Kirk, D. S., & Papachristos, A. V. (2011). Cultural Mechanisms and the Persistence of Neighborhood Violence. *American Journal of Sociology*, 116(4), 1190–1233. <https://doi.org/https://doi.org/10.1086/655754>
- Klinger, D. A., & Bridges, G. S. (1997). Measurement Error in Calls-For-Service as an Indicator of Crime. *Criminology*, 35(4), 705–726. <https://doi.org/10.1111/j.1745-9125.1997.tb01236.x>
- Laniyonu, A. (2017). Coffee Shops and Street Stops : Policing Practices in Gentrifying Neighborhoods. *Urban Affairs Review*, 1–33. <https://doi.org/10.1177/1078087416689728>
- Lerman, A. E., & Weaver, V. M. (2014). Staying out of Sight? Concentrated Policing and Local Political Action. *The ANNALS of the American Academy of Political and Social Science*, 651(1), 202–219. <https://doi.org/10.1177/0002716213503085>
- Metropolitan Planning Council. (2017). *The Cost of Segregation*. Retrieved from <https://www.metroplanning.org/uploads/cms/documents/cost-of-segregation.pdf>

Repairing Chicago's Communities: A First Look at Chicago's Calls for Service and Criminality in 2016

Police Accountability Task Force. (2016). *Recommendations for Reform: Restoring Trust Between the Chicago Police and the Communities They Serve*. Chicago, IL.

<https://doi.org/10.1353/jod.2001.0036>

Sampson, R. (2012). *Great American City: Chicago and the Enduring Neighborhood Effect*. Chicago: The University of Chicago Press.

Sampson, R. J., Raudenbush, S. W., & Earls, F. (1997). Neighborhoods and Violent Crime: A Multilevel Study of Collective Efficacy. *Science*, 277(5328), 918–924.

<https://doi.org/10.1126/science.277.5328.918>

Skogan, W. G. (2006). Asymmetry in the Impact of Encounters with Police. *Policing and Society*, 16(2), 99–126.

Smith, D. (1986). *The Neighborhood Context of Police Behavior*. (M. Tonry & N. Morris, Eds.) (8th ed.). Chicago, IL: University of Chicago Press.

Terrill, W., & Reisig, M. (2003). Neighborhood Context and Police Use of Force. *Journal of Research in Crime and Delinquency*, 40(3), 291–321.

Tyler, T. O. M. R. (2004). Police Legitimacy, (May), 84–99.

<https://doi.org/10.1177/0002716203262627>

Tyler, T. R., & Fagan, J. (2008). Legitimacy and Cooperation: Why Do People Help the Police Fight Crime in Their Communities. *Ohio State Journal of Criminal Law*, 6. Retrieved from <http://heinonline.org/HOL/Page?handle=hein.journals/osjcl6&id=233&div=11&collection=journals>

Waller, L. A., & Gotway, C. A. (2004). *Applied Spatial Statistics for Public Health Data*. Wiley.

Repairing Chicago's Communities: A First Look at Chicago's Calls for Service and Criminality in 2016

Weisburd, D. (2015). The Law of Crime Concentration and the Criminology of Place.

Criminology, 53(2), 133–157. <https://doi.org/10.1111/1745-9125.12070>

Weitzer, R. (2002). Incidents of Police Misconduct and Public Opinion. *Journal of Criminal*

Justice, 30(5), 397–408.