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Alcohol Outlets, Social Disorganization, and Robberies: Accounting for Neighborhood Characteristics and Alcohol Outlet Types

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Abstract

We estimated spatially lagged regression and spatial regime models to determine if the variation in total, on-premise, and off-premise alcohol outlet¹ density is related to robbery density, while controlling for direct and moderating effects of social disorganization.² Results suggest that the relationship between alcohol outlet density and robbery density is sensitive to the measurement of social disorganization levels. Total alcohol outlet density and off-premise alcohol outlet density were significantly associated with robbery density when social disorganization variables were included separately in the models. However, when social disorganization levels were captured as a four item index, only the association between off-premise alcohol outlets and robbery density remained significant. More work is warranted in identifying the role of off-premise alcohol outlets and their characteristics in robbery incidents.

Keywords

Robbery, Alcohol outlet density, Social disorganization, GIS

1. Introduction

Robbery is a serious violent crime that involves “the taking or attempting to take valuable commodities from a person by force or with a threat of force” (United States Department of Justice, 2010). Although the average financial loss in robbery victimizations is relatively insignificant \$877.00 (United States Department of Justice, 2010), robbery is a serious violent crime due to the unexpected encounter between the offender and the victim. Prior literature suggests that high availability of alcohol outlets and greater social disorganization contribute to higher concentrations of robbery (e.g., Bernasco and Block, 2011, Bernasco et al., 2013, Brantingham and Brantingham, 1995, Smith et al., 2000). However, the research in this area has left two areas that need further exploration.

The first relates to the alcohol outlet typology. Broadly defined, alcohol outlets are places that are licensed to sell alcohol beverages. Alcohol outlets are commonly disaggregated into on-premise (i.e., places that sell alcohol beverages that are meant for consumption while visiting the place, such as a bar or restaurant) and off-premise (i.e., places like liquor and convenience stores that sell alcohol beverages that are meant for consumption elsewhere). Only two studies have examined the association between different types of alcohol outlets (on-premise, such as bars and restaurants, and off-premise, such as liquor stores) and robberies. These studies have suggested that different types of alcohol outlets have different association with robberies (Bernasco and Block, 2011, Bernasco et al., 2013). Understanding the associations that different outlets have with robberies is essential to determining appropriate policy responses.

The second relates to the issue of measurement of social disorganization. The concept of social disorganization captures neighborhood level characteristics, such as ethnic heterogeneity, poverty, residential instability, and single-headed households, which taken together reduce social cohesion in the area and the ability of community residents to realize common goals (Shaw and McKay, 1942). A few studies measured social disorganization as an index comprised of several variables, while the majority of prior studies have examined the association between individual social disorganization variables estimated separately. The issue of measurement is important because prior studies in this area have produced different findings depending on which measure they utilized, making it difficult to fully understand the relationship between social disorganization and robberies. Therefore, this study further explores the association between different alcohol outlets and robberies in the city of Milwaukee, WI, and examines how different measures of social disorganization affect the findings.

1.1. Theoretical perspectives

Two broad types of social ecological theories, place-based and social integration (Gorman et al., 2013), can explain spatial distribution of robberies. First, place-based theories (such as routine activities or crime potential theory) suggest that some neighborhoods may be attractive to motivated offenders because they bring about a flow of vulnerable victims who are suitable targets for robbery and have ineffective or absent guardianship (Cohen and Felson, 1979). Motivated offenders travel from one place to another during the course of their daily routine and assess opportunities for robberies within their awareness space (Brantingham and Brantingham, 1993). As they take note of opportunities to victimize vulnerable victims, they are cautious about the opportunities upon which they act. If they act upon opportunities that are within their neighborhoods, they risk the possibility of being recognized by their victims. If they act upon opportunities outside of their neighborhood, they risk the possibility of appearing to be out of place (Brantingham and Brantingham, 1993). Some offenders choose to act upon opportunities that exist along edges between different parts of the city (e.g., wealthy and poor, white and minority), where they are less likely to stand out. Accordingly, robberies may occur on the edges

between wealthy and poor neighborhoods where there is an opportunity for victimization of vulnerable victims and where there are absent guardians. Additionally, robberies may occur in neighborhoods with high availability of alcohol outlets, which serve as social attractors (Parker, 1993). Alcohol outlets can either attract crime by bringing a flow of unguarded vulnerable victims or generate crime by providing public places that are easily accessible to the public (e.g., places that are located on main street, or near public transportation stations) and lack place managers (Brantingham and Brantingham, 1995, Eck, 1995). For example, neighborhoods with high availability of bars produce intoxicated patrons who are vulnerable victims at closing time, while liquor stores lack effective guardianship once the patron leaves the premise and becomes vulnerable. Liquor stores themselves also may be suitable targets when only one store clerk is present but may be unsuitable for robbery when customers or multiple store clerks are present. Alcohol outlets may also contribute to robbery by being part of an environmental landscape that already provides situational opportunities for victimization. For example, a majority of commercial robberies have occurred in convenience stores that were located near major transportation route, on a lightly traveled street, and in an area with retail activity (Duffala, 1976).

The second broad type of social ecological theory, social integration theory, argues that some neighborhoods may be conducive to robberies because they are socially disorganized (Shaw and McKay, 1942). Such neighborhoods are marked by poverty, ethnic heterogeneity, and population turnover all of which reduce social cohesion of the area. Socially disorganized neighborhoods lack collective efficacy necessary to exert influence over the behavior of community members or events in their community (Sampson and Groves, 1989, Sampson et al., 1997, Sampson et al., 2002). As such, those neighborhoods may be unable to control the behavior of their community members and may also lack political influence to control and limit opening of alcohol outlets in their communities. Additionally, socially disorganized neighborhoods are often in close proximity to central downtown business district, and the proximity to downtown is associated with crime rates (Park and Burgess, 1924, Shaw and McKay, 1942).

1.2. Literature review

1.2.1. Alcohol outlets and robberies

Research on alcohol availability and resulting alcohol related problems is rich within epidemiological and public health literature. Within this rich body of literature, alcohol outlets are commonly disaggregated into on-premise (i.e., places that sell alcohol beverages that are meant for consumption while visiting the place, such as a bar or restaurant) and off-premise (i.e., places like liquor and convenience stores that sell alcohol beverages that are meant for consumption elsewhere) (e.g., Ornstein and Hanssens, 1985). The epidemiological and public health literature suggests that alcohol availability plays an important role in negative health and social outcomes. First, alcohol outlets contribute to alcohol consumption, alcoholism, and related health problems. For example, per capita on-premise alcohol license was positively and significantly associated with consumption of distilled spirits and of beer across the nation (Ornstein and Hanssens, 1985). Additionally, the number of on-premise alcohol outlets per 100,000 persons was associated with per capita consumption and alcoholism rate, independent of level of urbanism, per capita income, and per capita restrictions on the number of alcohol outlets (Harford et al., 1979, Parker et al., 1978). Per capita alcohol outlet availability was associated with liver cirrhosis mortality, even after controlling for neighborhood characteristics such as race/ethnicity and wealth (Rabow and Watts, 1982).

Alcohol outlet availability can also have negative social consequences, such as crime and interpersonal violence. For example, density of on-premise and of off-premise alcohol outlets was associated with assaultive violence (i.e., criminal homicide, forcible rape, robbery, and aggravated assault) (Scribner et al., 1995), alcohol-related motor vehicle crashes (Scribner et al., 1994), and felony drunk driving arrest rates (Rabow and Watts, 1982), independent of neighborhood sociodemographic characteristics such as median income, unemployment, racial/ethnic composition, and female headed households. Indeed, even recent empirical epidemiological and

criminological studies acknowledged the role that the availability of different alcohol outlet types in a given neighborhood have on violence (e.g., Gruenewald and Remer, 2006, Lipton et al., 2013, Livingston, 2008a, Livingston, 2008b, Pridemore and Grubestic, 2013, Roman et al., 2008, Snowden and Pridemore, 2013, Zhu et al., 2004). For example, Lipton et al. (2013) found that alcohol outlets were related to violent crimes at the local block group level and to violent crimes in neighboring block groups.

Recently, criminologists have shown substantial interest in place-based investigations of causes and correlates of crime and in examinations of routine activities and environmental criminological theory. This place-based endeavor has focused on the role of various micro-places within neighborhoods in crime causation. Broadly defined, micro-places are various types of places that operate within neighborhoods, such as alcohol outlets, half-way houses and laundromats. Alcohol outlets, in particular, appear to be deviant places (Stark, 1987) and are associated with crime at various distance thresholds (Grubestic and Pridemore, 2011, Grubestic et al., 2011). Grubestic and Pridemore (2011) used sophisticated proximity analyses and spatial cluster detection to identify clusters of alcohol outlets and assess spatial distribution of violent crimes around those clusters. They identified six statistically significant agglomerations of alcohol outlets. Within each one of those alcohol outlet agglomerations, violent crimes clustered within a particular distance from the alcohol outlet agglomerations. For example, for the first statistically significant agglomeration of alcohol outlets, simple assaults clustered within three distance ranges: between 575 and 659 feet from the alcohol outlet agglomeration, between 1500 and 1613 feet from the alcohol outlet agglomeration, and between 2637 and 3061 feet from the alcohol outlet agglomeration (Grubestic and Pridemore, 2011). Additionally, Groff and Lockwood (2014) found that bars were associated with violent, property, and disorder crimes within 400 feet of the street segment that contained bars, as well as within 800 feet and 1200 feet away from the street segments that contained bars. Most of these prior studies, however, have grouped all crimes (e.g., Britt et al., 2005) or all violent crimes (e.g., Gorman et al., 2001, Zhu et al., 2004) into one broad category. Less is known about the role of alcohol outlets, including different alcohol outlet types, on robberies.

Place-based theories of crime causation have found support in empirical literature that examined robberies. In line with routine activities theory, it appears that places such as beer establishments bring about a flow of people to and from the establishment, some of whom are inebriated and vulnerable (Haberman et al., 2013). Haberman et al. (2013) found that beer establishments were significantly associated with robbery counts, and that an increase in each additional beer establishment increased expected robbery counts by 71%. Brantingham and Brantingham's (1995) ideas about micro-places being the generators or attractors of crime have also found empirical support. For example, Bernasco et al. (2013) found that census blocks with retail activity were most likely to be selected for robbery and that the odds were greatest for blocks with liquor stores and relatively high for blocks with bars and clubs. Additionally, liquor stores were the greatest crime attractors for robbery, relative to other types of legitimate retail businesses (e.g., pawn shops, laundromats, etc.), increasing the expected number of robberies by 67% (Bernasco and Block, 2011).

1.2.2. Social disorganization and robberies

Social integration theory, such as social disorganization, has also found support in empirical studies that examined robberies. However, prior studies that examined neighborhood-level robberies differ in their approach for assessing the association between social disorganization and robbery levels. Some studies created an index to measure social disorganization levels (e.g., Bernasco and Block, 2009, Nielsen and Martinez, 2003, Nielsen et al., 2005, Warner, 2007) and controlled for either (1) neighborhood collective efficacy levels (Bernasco and Block, 2009), (2) disadvantage index (Warner, 2007), or (3) disadvantage index and residential instability index (Nielsen and Martinez, 2003, Nielsen et al., 2005). For example, Nielsen and Martinez (2003) found a significant association between neighborhood disadvantage index (comprised of percent non-Latino Blacks, percent female headed households, percent male joblessness, and percent living in poverty) and

robbery. Additionally, Warner (2007) found that neighborhood disadvantage index (comprised of percent living below poverty, percent female headed households, percent receiving public assistance, and percent Black) was significantly associated with gun-related robberies. Importantly, Pridemore and Grubestic (2012) found that not only does social organization index have a negative and a significant effect on violent crimes in a large urban city, but also that the effect of alcohol outlets on violent crimes is more detrimental in neighborhoods with low levels of social organization (i.e., they were socially disorganized).

Instead of utilizing an index in their models, other studies examined the individual variables often used in creating social disorganization indices to estimate neighborhood robbery levels (e.g., Bernasco and Block, 2011, Smith et al., 2000). For example, Smith et al. (2000) regressed street robbery on six individual variables used to measure social disorganization levels (i.e., number of single-parent households, distance from the center of city, number of African Americans, racial heterogeneity, percent of buildings in low quartile of value, and average value of buildings). They found that the number of single-parent households, distance from center of city, and racial heterogeneity were significantly associated with street robbery, although the number of African Americans and percent of buildings in low quartile of value were not. However, Bernasco and Block (2011) recently found that percentage below poverty level, percentage African American, and ethnic heterogeneity were all significantly associated with street robbery.

1.2.3. Current study and hypotheses

Given this theoretical and empirical review, this study aims to advance our understanding of the role of alcohol outlets in robbery incidents. We do so by disaggregating alcohol outlet types into those where alcohol is purchased and consumed while visiting the outlet (i.e., on-premise, such as bars and restaurants) and those where alcohol is purchased and consumed elsewhere (i.e., off-premise, such as liquor or convenience stores). We follow analytical approaches utilized in prior empirical studies and examine the influence of modeling social disorganization variables as an index (as discussed in detail below) (e.g., Nielsen and Martinez, 2003, Warner, 2007) verses including the four social disorganization variables (proportion African American, proportion single parent households, proportion renter occupied housing units, and proportion living in poverty) separately into the models (e.g., Bernasco and Block, 2011, Smith et al., 2000). Given the multiple approaches used in prior studies to assess the relationship between neighborhood characteristics, social disorganization levels, and robberies, we examine whether and how findings of the relationship between alcohol outlets and robbery are influenced by the measurement of the social disorganization levels. The issue of measurement is important both theoretically and practically. Theoretically, because prior studies in this area have produced different findings depending on which measure of social disorganization they utilized, it is difficult to know just how broadly the covariates of robberies (i.e., neighborhood characteristics or social disorganization) can be generalized. This is also important practically, as the appropriateness of policies and interventions in reducing robberies may vary by type of alcohol outlet. In line with prior studies, all of our models control for the role of routine activity theory variables (i.e., population density that provides greater guardianship, and proportion of young individuals that provides greater availability of unsupervised motivated offenders). Additionally, we include a variable that measured the distance of block group centroids from city center. This variable is included as a general measure of social disorganization as done in the classic work of Shaw and McKay (1942) and in more recent work by Smith et al. (2000) that examined the association between social disorganization, routine activities, and robbery diffusion. Lastly, in line with prior research that found social organization to moderate the relationship between alcohol outlets and violent crimes in a large urban city (Pridemore and Grubestic, 2012), we create three interaction variables to allow us to assess the moderating effect of social disorganization on the relationship between various alcohol outlet types and robberies.

We test the hypothesis that (1) the density of total alcohol outlets will be associated with robbery density in an urban setting. Additionally, we test whether (2) the association exists for different alcohol outlet types (i.e., on-

premise and off-premise). There are theoretical reasons to believe that different outlet types may have a different influence on robbery. For example, off-premise alcohol outlets are places where informal social control ends the moment the patron leaves the premise. As such, these places may be more likely to contribute to more frequent occurrences of robberies relative to on-premise outlets. In the case of on-premise alcohol outlets (e.g., restaurants and bars), on the other hand, during the regular business hours there are other patrons or trained staff who may act quickly in cases of problematic or suspicious behavior occurring in the vicinity of the outlet. However, on-premise alcohol outlets may contribute to robberies at closing hours, when some patrons leave the premise inebriated and thus become vulnerable to victimization. Lastly, we test for a (3) direct and moderating effect of the social disorganization index on the association between alcohol outlet density, including on-premise and off-premise alcohol outlet density, and robbery. The influence of social disorganization may result in a direct association with robbery or it may aggravate conditions within neighborhoods (Pridemore and Grubestic, 2012). If it aggravates conditions, socially disorganized neighborhoods may be unable to create limits on alcohol outlets that are licensed to operate within their areas, resulting in a differential effect of those outlets on robbery across neighborhoods with various levels of disorganization (Pridemore and Grubestic, 2012).

2. Materials and methods

2.1. Research site and units of analysis

Milwaukee, Wisconsin, is the largest city in the state, covering land area of about 96 square miles with an estimated population of 598,916 individuals (US Census Bureau, 2014). Relative to the rest of the state, Milwaukee is an exceptionally diverse city, with 44.8% of White residents, 40% of African American residents, 17.3% of Hispanic or Latino residents, and 3.5% of Asian residents (US Census Bureau, 2014). Within the state of Wisconsin, on the other hand, 86.2% residents are White, 6.3% are African American, 5.9% are Hispanic or Latino, and 2.3% are Asian (US Census Bureau, 2014). Homeownership rate in this diverse city is lower relative to the rest of the state (44.5% in Milwaukee versus 68.6% in the state) (US Census Bureau, 2014). The median household income between 2008 and 2012 for Milwaukee was also lower relative to the rest of the state, with the income being \$35,823 for Milwaukee and \$52,627 for the state. About 28% of Milwaukee residents live below poverty levels, while the percentage of residents who live below poverty levels for the state of Wisconsin is much lower at 12.5% (US Census Bureau, 2014). Milwaukee is also an interesting research site because it is nationally known for its historical ties with alcohol production, as it used to be a home for several large beer brewing companies (e.g., Pabst and Schlitz), and alcohol producers abound even presently (e.g., Historic Pabst Brewery, Big Bay Brewing Company, Lakefront Brewery, Sprecher Brewery, Milwaukee Brewing Co., MillerCoors, Milwaukee Distillery, etc.).

The units of analysis for this study are 571 census block groups that lie within the city of Milwaukee boundaries. The population of these census block groups ranged between 288 and 3391, with a mean of 1045.46 (US Census Bureau, 2010). The size of these 571 census block groups ranged from 0.03 square miles to 3.7 square miles, with a mean of 0.17 square miles (US Census Bureau, 2010).

2.2. Outcome variable

Data on robberies were obtained from the City of Milwaukee Community Mapping and Analysis for Safety Strategies public applications website. Data on robberies were based on incidents that occurred between January 1, 2013 and August 31, 2013 in the city of Milwaukee. The data included incident number, date, time, and location of the incident, which was geocoded using ArcMap 10 and the 2013 Census TIGER street centerlines as a reference layer with a 99.7% successful match. Using successfully matched data, we calculated robbery density per square mile for each block group. We standardized the robbery data by the census block group land area (i.e., per square mile), rather than by the population of a census block group (i.e., per 1000 residents). If we standardized the data on robberies with a traditional, population-based rate, the resulting

metric would take into account only the population that lives in each block group, and thus fail to account for victims and offenders traveling to other block groups as they go about their daily activities, including purchasing alcoholic beverages, drinking, and becoming robbery victims and offenders. Because the distribution of robbery density was skewed, the scores were calculated using square root transformation.

2.3. Main predictor variables

Data on all active alcohol outlet licenses as of summer 2013 were obtained from the Wisconsin Department of Revenue. The data included license address, which was geocoded using ArcMap 10 with 99.7% successful match, and license type (e.g., on-premise, such as bars and restaurants, or off-premise, such as liquor and convenience stores). Unfortunately, the nature of the license type data did not allow us to further disaggregate the two broad license types (i.e., on-premise into bars, restaurants, or similar, or off-premise into convenience, liquor, grocery store). Using successfully matched data, we calculated total alcohol outlet density as the number of all outlets per square mile for each block group. We disaggregated all alcohol outlets into two broad types (i.e., on-premise and off-premise). As with robbery density, we calculated on-premise alcohol outlet density based on the number of on-premise outlets per square mile for each block group, and off-premise alcohol outlet density as the number of off-premise outlets per square mile for each block group. Because the distribution of alcohol outlet density, including different alcohol outlet types, was skewed the scores were calculated using square root transformation.

2.4. Control variables

We controlled for several variables that are theoretically important for robbery. Specifically, we controlled for routine activities theory variables, including (1) population density, which we calculated based on the number of individuals residing in a census block group per square mile; and (2) proportion young individuals residing in a census block group, calculated based on the number of individuals who were 15–24 years of age relative to the total block group population; and four social disorganization variables, including (3) proportion African American residents residing in a census block group; (4) proportion single parent households; (5) proportion renters, calculated based on the number of renter-occupied housing units relative to the total number of housing units, and (6) poverty, calculated based on the number of individuals with income below poverty level, relative to total number of individuals. Similar to previous research on the influence of social disorganization on robberies (e.g., Nielsen et al., 2005, Warner, 2007) we also created a variable to directly measure social disorganization levels in census block groups. This social disorganization variable was operationalized as an index consisting of four traditional measures of social disorganization at the block group level: ethnic heterogeneity, which was calculated using Lieberman Diversity Index (Lieberman, 1969), poverty, residential instability, and single-headed households. This index was calculated as a summed standardized score of these four variables and divided by four. Also similar to prior research (i.e., Smith et al., 2000), we controlled for the distance (in miles) between census block group centroids and the city center. The data for these variables were obtained from the US Census Bureau.

2.5. Statistical analyses

We used ArcMap 10 software to clean, geocode, and manage data. Potential errors in geocoding related to positional accuracy with the use of TIGER street centerlines (Bichler and Balchak, 2007, Grubestic and Murray, 2004, Ratcliffe, 2001, Ratcliffe, 2004) were considered. The high rate of successful geocoding of crime and outlet data was obtained by carefully cleaning the address data and manually matching instances in which ArcGIS was unable to find a successful match. Personal familiarity of the authors with the research site helped in this case, and the process included selecting a random sample of geocoded addresses and visually and physically verifying the accuracy of geocodes. We subsequently employed GeoDa and GeoDaSpace softwares (Anselin et al., 2006) to estimate all models with first order queen contiguity weight matrix to specify adjacencies. Thus, all models

included the spatial lag term (*Rho*) that measured the average influence of robberies in neighboring block groups on the block group of interest. First, we estimated global models using GeoDa; the models were specified as spatially lagged autoregressive models with maximum likelihood estimation and first order queen contiguity spatial weight matrix. However, results of regression diagnostics for spatially lagged global models indicated significant heteroskedasticity in error terms in the global models. We used GeoDa for Exploratory Spatial Data Analysis (Anselin, 1996) to identify possible spatial regime that may be at play in creating heteroskedasticity in error terms (e.g., we interactively brushed and evaluated standard deviation maps of residuals, evaluated boxplots for outliers and leverage). Subsequently, we conducted grouping analysis ArcMap 10.2.2. to create a spatial regime variable along distinct geographic divisions in robbery distribution (North Milwaukee block groups versus South Milwaukee block groups). All of the spatial regime models were estimated using GeoDaSpace with Spatial Two Stage Least Squares Estimation (S2SLS) for the two regimes (North and South).

We conducted two sets of analyses. The first set of analyses controlled for indicators of routine activities and social disorganization, and included population density, proportion young, proportion African American, proportion single headed households, proportion renters, poverty, distance from city center, and the spatial lag term (*Rho*) for robbery density. The second set of analyses accounted for direct and moderating effects of social disorganization index on robberies, routine activities indicators (population density and proportion young population) and distance from city center. In each of these two sets of analyses, we estimated nine models to examine whether (1) robbery density is associated with total alcohol outlet density; (2) robbery density is associated with on-premise alcohol outlet density, and (3) robbery density is associated with off-premise alcohol outlet density.

3. Results

To provide a background context about the study research site, Fig. 1 shows the state of Wisconsin and the location of Milwaukee as a research study site, and its proximity to other major Wisconsin and Illinois cities.



Fig. 1. Location of research study site.

Figs. 2 and 3 show spatial distribution of robbery density and of total alcohol outlet density, respectively, for Milwaukee block groups, using the traditional data classing method of natural breaks in the data with five classes. Fig. 2 shows that robbery density is very high southwest and especially northwest of city center. Fig.

3 shows that total alcohol outlet density is very high in block groups that are in the center of the city and especially in those close to city center.

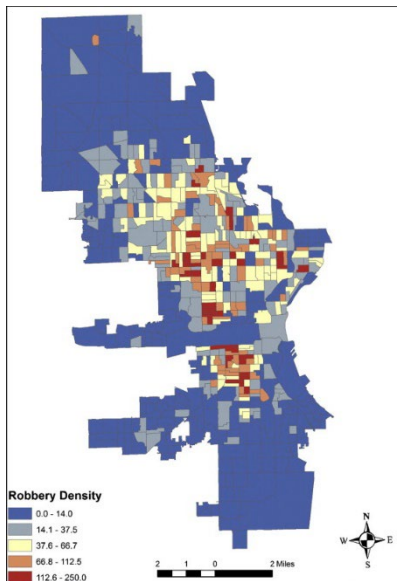


Fig. 2. Number of robberies per square mile (by block group) in Milwaukee, WI, 2013.

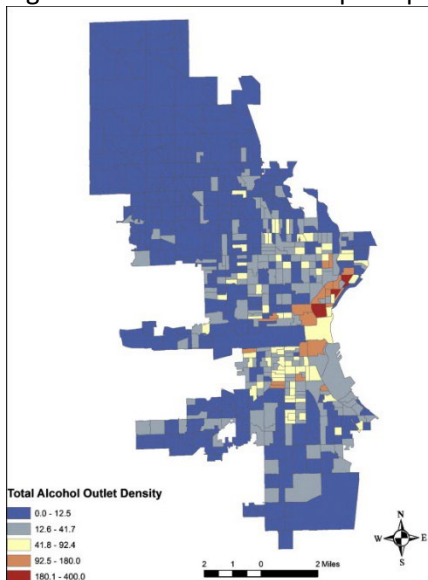


Fig. 3. Number of total alcohol outlets per square mile (by block group) in Milwaukee, WI, 2013.

Figs. 4 and 5 show spatial distribution of transformed (i.e., square root) values of robbery density and total alcohol outlet density, respectively, for Milwaukee block groups. These figures are provided to illustrate the distribution of the transformed variables of robbery density and total alcohol outlet density, which were utilized in the statistical models described below.

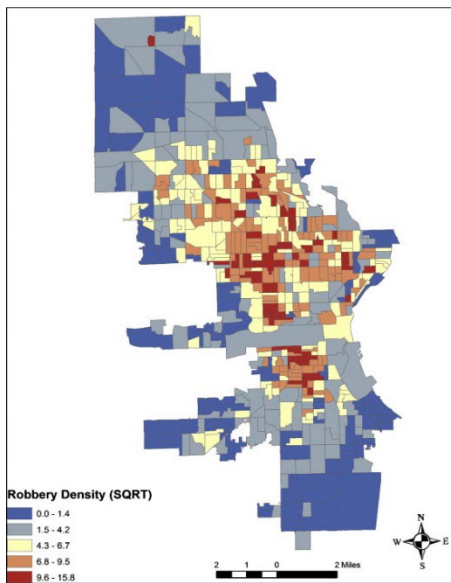


Fig. 4. Square root of robbery density (by block group) in Milwaukee, WI, 2013.

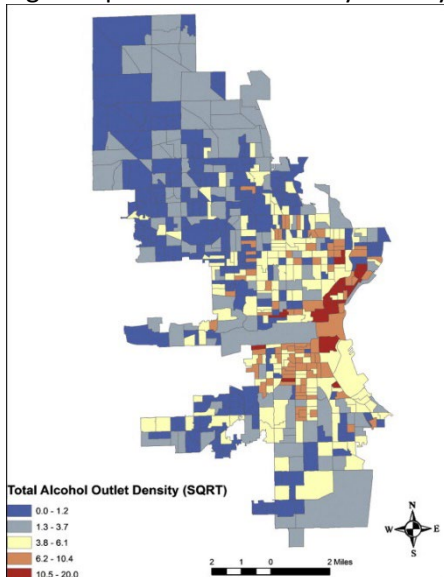


Fig. 5. Square root of total alcohol outlet density (by block group) in Milwaukee, WI, 2013.

We considered additional traditional data classing methods (i.e., quartile, equal interval, and standard deviation) for their use in displaying the values of robbery density and total alcohol outlet density, in light of choosing the most strategic mapping approach that would be sensitive to the nature of the data distribution (see Brewer and Pickle, 2002, Smith, 1986). Ultimately, the natural breaks classing method was chosen as it resulted in the highest value of Goodness of Variance Fit (i.e., relative to quartile classing method). Therefore, as noted above, these figures show spatial distribution of these variables according to the natural breaks classing method with five classes.

Descriptive statistics for the outcome, main predictor, and control variables used in regression models are presented in Table 1. On average, Milwaukee block groups contained about 37 incidents of robbery per square mile and about 22 alcohol outlets per square mile, most of which were on-premise alcohol outlets (e.g., bars and restaurants). Social disorganization index for Milwaukee block groups ranged from -6.02 (suggesting social organization) to 8.16 (suggesting social disorganization).

Table 1. Descriptive statistics for Milwaukee block groups ($N = 571$).

Empty Cell	Min.	Max.	Mean	S.D.
Robbery density	0.00	250.00	37.31	40.85
Total alcohol outlet density	0.00	400.00	22.39	39.77
On-premise alcohol outlet density	0.00	377.78	16.20	35.50
Off-premise alcohol outlet density	0.00	83.33	6.19	11.47
Population density	376.50	51050.00	10489.05	6583.87
Proportion young	0.03	0.88	0.17	0.10
Proportion African American	0.00	0.98	0.43	0.37
Proportion single headed households	0.00	0.66	0.22	0.13
Proportion renter occupied housing units	0.03	0.98	0.49	0.18
Proportion living in poverty	0.00	0.85	0.21	0.15
Distance from city center	0.00	10.97	3.90	2.21
Social disorganization index	-6.02	8.16	0.01	2.56

Table 2 shows the correlation matrix for Milwaukee block groups. As expected, the density of robbery was positively and significantly associated with total alcohol outlet density ($r = .20$), on-premise alcohol outlet density ($r = .10$), and off-premise alcohol outlet density ($r = .38$). Social disorganization index was positively and significantly associated with robbery density ($r = .49$), total alcohol outlet density ($r = .15$), and off-premise alcohol outlet density ($r = .29$).

Table 3 shows the results of robbery density regressed on total alcohol outlet density and control variables for Milwaukee block groups. Model 1 is a global model and examined the association between total alcohol outlet density and robbery density net of control variables. In Model 1, we see that total alcohol outlet density was positively and significantly associated with robbery density. The spatial lag term (Rho) associated with robberies was a positive and significant contributor to the model. Additionally, one of the routine activities theory variables was significantly associated with robbery density, although it was in the opposite direction than expected. Population density was positively associated with robbery density, suggesting an unexpected relationship between a greater guardianship through more “eyes on the street” and a greater number of robberies. Moreover, two out of four social disorganization variables were associated with robbery density. Specifically, there was a positive and significant association between proportion African American and robbery density, and between proportion single parent households and robbery density. The model explained about 59% of the variance in robbery density. Because Breusch–Pagan Test suggested heteroskedasticity in error terms in Model 1, Models 2 and 3 were estimated to explore the influence of spatial regime and provide a more disaggregate analysis of the relationship between robbery and total alcohol outlet density. Results of these two spatial regime models suggest that there were significant differences between South Milwaukee block groups and North Milwaukee block groups. For example, while total alcohol outlet density, population density, and proportion African American were significantly and positively associated with robbery density in North Milwaukee block groups, there was no evidence that these variables played a role in robbery density in South Milwaukee block groups.

Table 4 shows results of Models 4–6 that were estimated to assess the relationship between robbery density and on-premise alcohol outlet density, net of control variables. The association between robbery density and on-premise alcohol outlet density appeared to be statistically significant only in the global model (Model 4), although the p -value was borderline significant ($p = 0.0459$) and prohibits us from making definite conclusions. Results of Model 4 suggest that population density continued to be a significant contributor to the model, along with several social disorganization variables, such as proportion African American, proportion single parent households, and proportion living in poverty, and the spatial lag term (Rho). Model 4 explained

about 58% of the variance in robbery density. However, differences along the spatial regime were noted as population density and proportion African American were only positively and significantly associated with robbery density in the North Milwaukee block groups. Moreover, the results of the global model seen in Model 4 suggest that the association between the proportion of single parent households, proportion living in poverty, and on-premise alcohol outlet density with robbery density was only significant in the global model and not in the spatial regime models (Model 5 and Model 6).

Lastly, Table 5 shows results of Models 7–9 that examined the association between off-premise alcohol outlet density and robbery density net of control variables. Results of Model 7 suggested that off-premise alcohol outlet density was positively and significantly associated with robbery density. The spatial lag (*Rho*) associated with robbery density in the Model 7 was a positive and significant contributor to the model. Additionally, population density was positively and significantly associated with robbery density, and so was the proportion African American. The model explained about 59% of the variance in robbery density. There were significant differences across spatial regimes, between South Milwaukee block groups and North Milwaukee block groups. For example, while there is a positive and significant association between population density and proportion African American with robbery density in North Milwaukee block groups, there is no evidence that population density and proportion African American play a role in robbery density in South Milwaukee block groups. Nonetheless, the association between off-premise alcohol outlet density and robbery density was evident not only in the global model as seen in Model 7, but also in the spatial regime models, Model 8 and Model 9.

Next, we examined the association between alcohol outlet density and robbery density, and tested for the direct and moderating effect of social disorganization index in Milwaukee census block groups. Table 6 shows the results of robbery density regressed on alcohol outlet types, social disorganization index, and control variables for Milwaukee block groups. Model 10 examined the association between total alcohol outlet density and robbery density net of control variables. In Model 10 we see that total alcohol outlet density was not significantly associated with robbery density, when directly controlling for social disorganization index, which was positively and significantly associated with robbery density. Model 10 also suggests that, as in Model 1, both population density and the spatial lag term (*Rho*) associated with robbery density were positive and significant contributors to the model. The model explained about 56% of the variance in robbery density. Results of Models 11 and 12 suggest that there were significant spatial regime differences between South Milwaukee block groups and North Milwaukee block groups. For example, while there is a positive and significant association between population density and robbery density, and between social disorganization and robbery density in North Milwaukee block groups, there is no evidence of such relationships for South Milwaukee block groups.

Table 7 shows results of global and spatial regime models that examined the association between on-premise alcohol outlet density and robbery density. Results of Model 13 suggest that the density of on-premise alcohol outlets was not significantly associated with robbery density net of control variables. However, like in the Model 10 above, social disorganization was a positive and significant contributor to the model. Additionally, both population density and spatial lag term (*Rho*) were associated with robbery density. This model explained about 55% of the variance in robbery density. Significant differences in the spatial regime for Milwaukee block groups were noted in the relationship of robbery density with population density and with social disorganization. For example, results of Model 15 suggest that social disorganization was positively associated with robbery density in the North Milwaukee block groups. However, results of Model 14 suggest no significant association between social disorganization and robbery density in South Milwaukee block groups.

Lastly, Table 8 shows results of models that examined whether association exists between off-premise alcohol outlet density and robbery density. Results of Model 16 suggest that although social disorganization remained a positive and significant contributor to the model, the density of off-premise alcohol outlets was also significantly and positively associated with robbery density across global and spatial regime models. Both population density

and spatial lag term (*Rho*) were significantly associated with robbery density in the global model, as evidenced in Model 16. This model explained about 56% of variance in robbery density. Once again, the differences in spatial regimes were noted. For example, results of Model 18 suggest that both population density and social disorganization were significantly associated with robbery density in North Milwaukee block groups, although they were not so in South Milwaukee block groups as shown in Model 17. Nevertheless, the density of off-premise alcohol outlet density was positively associated with robbery density across the global and the spatial regime models.

Table 2. Correlation matrix for Milwaukee block groups ($N = 571$).

Empty Cell	1	2	3	4	5	6	7	8	9	10	11	12
1. Robbery density	1											
2. Total alcohol outlet density	.202**	1										
3. On-premise alcohol outlet density	.105*	.960**	1									
4. Off-premise alcohol outlet density	.377**	.497**	.233**	1								
5. Population density	.468**	.409**	.334**	.386**	1							
6. Proportion young	.162**	.266**	.256**	.131**	.368**	1						
7. Proportion African American	.341**	-.215**	-.266**	.080	-.141**	-.004	1					
8. Proportion single headed households	.424**	-.185**	-.263**	.172**	.088*	-.079	.747**	1				
9. Proportion renter occupied housing units	.356**	.335**	.298**	.239**	.435**	.458**	.173**	.252**	1			
10. Proportion living in poverty	.530**	.181**	.090*	.350**	.365**	.330**	.447**	.574**	.584**	1		
11. Distance from city center	-.362**	-.443**	-.397**	-.308**	-.475**	-.362**	.061	.015	-.435**	-.422**	1	
12. Social disorganization index	.493**	.146**	.069	.293**	.390**	.243**	.385**	.668**	.754**	.799**	-.262**	1

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Table 3. Robberies density regressed on total alcohol outlet density and control variables for Milwaukee block groups.

Empty Cell	Model 1 Spatial lag Global model ($N = 571$)		Model 2 S2SLS South ($N = 119$)		Model 3 S2SLS North ($N = 452$)	
	B	SE	B	SE	B	SE
Constant	-0.36	0.50	-1.11	1.15	-0.60	0.81
Population density	0.00**	0.00	0.00	0.00	0.00**	0.00
Proportion young	-0.70	1.15	5.89	9.99	-1.27	1.27
Proportion African American	2.22**	0.46	-1.29	7.12	1.89**	0.54
Proportion single parent households	2.93*	1.35	0.52	4.78	3.06	1.58
Proportion renter occupied housing units	0.13	0.71	-0.11	1.37	0.60	0.85
Proportion living in poverty	1.90	1.02	-0.86	2.97	1.92	1.11
Distance from city center	-0.08	0.06	0.07	0.17	-0.06	0.08
<i>Rho</i> sqrt robbery density	0.39**	0.05	0.74*	0.30	0.42**	0.12
Sqrt total alcohol outlet density	0.11**	0.04	0.10	0.08	0.11*	0.04
<i>R</i> -squared	58.79		–		–	
Pseudo <i>R</i> -squared	–		30.15		52.52	

Multicollinearity condition number	15.23		–		–	
S.E. of regression	2.29		–		–	
Log likelihood	–1291.19		–		–	
Akaike information criterion	2602.39		–		–	
Schwarz criterion	2645.86		–		–	
Breusch–Pagan Test	61.36**		–		–	
Anselin-Kelejian Test	–		1.58		0.47	
Global Chow Test	–		–		13.53	

* $p < .05$.

** $p < .01$.

Table 4. Robberies density regressed on on-premise alcohol outlet density and control variables for Milwaukee block groups.

Empty Cell	Model 4 Spatial lag Global model ($N = 571$)		Model 5 S2SLS South ($N = 119$)		Model 6 S2SLS North ($N = 452$)	
	B	SE	B	SE	B	SE
Constant	–0.22	0.50	–1.04	1.15	–0.53	0.81
Population density	0.00**	0.00	0.00	0.00	0.00**	0.00
Proportion young	–0.82	1.15	5.66	10.07	–1.33	1.27
Proportion African American	2.20**	0.46	–1.40	7.16	1.84**	0.54
Proportion single parent households	2.91*	1.36	0.17	4.84	2.96	1.59
Proportion renter occupied housing units	0.18	0.72	–0.02	1.38	0.63	0.86
Proportion living in poverty	2.10*	1.03	–0.42	2.97	2.10	1.11
Distance from city center	–0.10	0.06	0.06	0.18	–0.07	0.08
<i>Rho</i> sqrt robbery density	0.39**	0.05	0.76*	0.30	0.44**	0.12
Sqrt on-premise alcohol outlet density	0.08*	0.04	0.07	0.08	0.08	0.04
<i>R</i> -squared	58.41		–		–	
Pseudo <i>R</i> -squared			29.40		52.17	
Multicollinearity condition number	15.01		–		–	
S.E. of regression	2.30		–		–	
Log likelihood	–1293.81		–		–	
Akaike information criterion	2607.62		–		–	
Schwarz criterion	2651.1		–		–	
Breusch–Pagan Test	63.93**		–		–	
Anselin-Kelejian Test	–		1.82		0.79	

Global Chow Test	–		–		12.35	
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* $p < .05$.

** $p < .01$.

Table 5. Robberies density regressed on off-premise alcohol outlet density and control variables for Milwaukee block groups.

Empty Cell	Model 7 Spatial lag Global model ($N = 571$)		Model 8 S2SLS South ($N = 119$)		Model 9 S2SLS North ($N = 452$)	
	B	SE	B	SE	B	SE
Constant	–0.04	0.49	–0.50	1.11	–0.28	0.79
Population density	0.00**	0.00	0.00	0.00	0.00**	0.00
Proportion young	–0.75	1.15	8.12	9.78	–1.35	1.27
Proportion African American	2.08**	0.45	–1.95	6.97	1.67**	0.53
Proportion single parent households	2.49	1.34	0.01	4.62	2.61	1.57
Proportion renter occupied housing units	0.56	0.70	0.02	1.33	1.06	0.84
Proportion living in poverty	1.70	1.03	–1.63	2.91	1.72	1.12
Distance from city center	–0.12	0.05	–0.03	1.17	–0.09	0.08
<i>Rho</i> sqrt robbery density	0.38**	0.05	0.64*	0.03	0.43**	0.11
Sqrt off-premise alcohol outlet density	0.16**	0.05	0.29**	0.11	0.14*	0.06
<i>R</i> -squared	58.77		–		–	
Pseudo <i>R</i> -squared	–		32.99		52.42	
Multicollinearity condition number	14.77		–		–	
S.E. of regression	2.29		–		–	
Log likelihood	–1290.88		–		–	
Akaike information criterion	2601.76		–		–	
Schwarz criterion	2645.24		–		–	
Breusch–Pagan Test	59.78**		–		–	
Anselin-Kelejian Test	–		0.87		0.78	
Global Chow Test	–		–		14.75	

* $p < .05$.

** $p < .01$.

Table 6. Robberies density regressed on total alcohol outlet density, social disorganization, and control variables for Milwaukee block groups.

Empty Cell	Model 10 Spatial lag Global model (<i>N</i> = 571)		Model 11 S2SLS South (<i>N</i> = 119)		Model 12 S2SLS North (<i>N</i> = 452)	
	B	SE	B	SE	B	SE
Constant	1.58**	0.49	0.48	1.62	1.48	1.21
Population density	0.00**	0.00	0.00	0.00	0.00**	0.00
Proportion young	-0.78	1.09	5.74	9.13	-1.36	1.31
Social disorganization	0.32**	0.06	0.01	0.13	0.32**	0.08
Distance from city center	-0.04	0.06	0.12	0.17	-0.03	0.09
<i>Rho</i> sqrt robbery density	0.54**	0.04	0.52	0.35	0.59**	0.14
Sqrt total alcohol outlet density	0.04	0.04	0.10	0.08	0.05	0.04
Total alcohol outlet × social disorganization index	0.00	0.01	0.01	0.02	-0.00	0.02
<i>R</i> -squared	55.61		–		–	
Pseudo <i>R</i> -squared	–		29.70		49.30	
Multicollinearity condition number	10.10		–		–	
S.E. of regression	2.38		–		–	
Log likelihood	-1321.75		–		–	
Akaike information criterion	2659.49		–		–	
Schwarz criterion	2694.27		–		–	
Breusch–Pagan Test	41.64**		–		–	
Anselin-Kelejian Test	–		0.11		0.74	
Global Chow Test	–		–		10.50	

* *p* < .05.

***p* < .01.

Table 7. Robberies density regressed on on-premise alcohol outlet density, social disorganization, and control variables for Milwaukee block groups.

Empty Cell	Model 13 Spatial lag Global model (<i>N</i> = 571)		Model 14 S2SLS South (<i>N</i> = 119)		Model 15 S2SLS North (<i>N</i> = 452)	
	B	SE	B	SE	B	SE
Constant	1.91**	0.48	-0.11	1.64	1.42	1.14
Population density	0.00**	0.00	0.00	0.00	0.00**	0.00
Proportion young	-0.76	1.08	6.26	9.30	-1.13	1.28
Social disorganization	0.34**	0.06	0.05	0.13	0.31**	0.08

Distance from city center	-0.09	0.06	-0.02	0.17	-0.05	0.09
<i>Rho</i> sqrt robbery density	0.53**	0.04	0.45	0.38	0.63**	0.13
Sqrt on-premise alcohol outlet density	-0.02	0.04	0.05	0.08	-0.00	0.04
On-premise × Social disorganization index	-0.00	0.01	-0.00	0.02	-0.01	0.02
<i>R</i> -squared	55.42		–		–	
Pseudo <i>R</i> -squared	–		28.59		49.25	
Multicollinearity condition number	9.69		–		–	
S.E. of regression	2.38		–		–	
Log likelihood	-1322.12		–		–	
Akaike information criterion	2660.24		–		–	
Schwarz criterion	2695.02		–		–	
Breusch–Pagan Test	41.88**		–		–	
Anselin-Kelejian Test	–		0.02		1.85	
Global Chow Test	–		–		9.24	

* $p < .05$.

** $p < .01$.

Table 8. Robberies density regressed on off-premise alcohol outlet density, social disorganization, and control variables for Milwaukee block groups.

Empty Cell	Model 16 Spatial lag Global model ($N = 571$)		Model 17 S2SLS South ($N = 119$)		Model 18 S2SLS North ($N = 452$)	
	B	SE	B	SE	B	SE
Constant	1.57**	0.47	-0.95	1.43	2.75*	1.13
Population density	0.00**	0.00	0.00	0.00	0.00**	0.00
Proportion young	-0.84	1.08	6.78	8.75	-2.28	1.34
Social disorganization	0.31**	0.05	-0.08	0.13	0.41**	0.08
Distance from city center	-0.05	0.05	0.01	0.14	-0.11	0.09
<i>Rho</i> sqrt robbery density	0.53**	0.04	0.69**	0.24	0.40**	0.14
Sqrt off-premise alcohol outlet density	0.21**	0.06	0.30**	0.11	0.24**	0.07
Off-premise × social disorganization index	-0.03	0.02	0.04	0.04	-0.05	0.03
<i>R</i> -squared	56.38		–		–	
Pseudo <i>R</i> -squared	–		33.20		48.72	
Multicollinearity condition number	9.56		–		–	
S.E. of regression	2.35		–		–	
Log likelihood	-1315.68		–		–	

Akaike information criterion	2647.36		–		–	
Schwarz criterion	2682.14		–		–	
Breusch–Pagan Test	41.44**		–		–	
Anselin-Kelejian Test	–		1.48		0.10	
Global Chow Test	–		–		19.95*	

* $p < .05$.

** $p < .01$.

We also examined the possibility that the relationship between alcohol outlets and robbery was moderated by social disorganization. To test for this possibility, we calculated three interaction terms (social disorganization index and total alcohol outlet density, social disorganization index and on-premise alcohol outlet density, and social disorganization index and off-premise alcohol outlet density) and included them in the analyses. The results shown in Models 10–18 revealed that none of the interaction terms significantly predicted robbery density, suggesting that off-premise alcohol outlets have an independent effect on robberies, regardless of the other neighborhood conditions examined in this study.

4. Discussion

This study examined the role that alcohol outlets (e.g., bars and restaurants, and liquor and convenience stores) play in community robbery incidents. It extends previous research by providing a more nuanced picture of the association between alcohol outlets and robberies. We achieved this by controlling for important contextual characteristics of neighborhoods and including measures of sociodemographic composition that might influence the association between alcohol outlets and robberies. Also, we used a direct measure of social disorganization that we operationalized as an index consisting of ethnic heterogeneity, residential instability, poverty, and single parent households.

The findings of this study show some support for the proposed hypotheses. Areas that have higher densities of various types of alcohol outlets appear to have higher densities of robberies after controlling for individual neighborhood characteristics that are often associated with robberies (e.g., population density, proportion of the population that are young, proportion of households that are single parent households, etc.). Additionally, areas that have higher densities of on-premise alcohol outlets (e.g., bars and restaurants) appear to have higher densities of robberies, net of control variables; although, the borderline significance value prohibits us from making strong conclusions. Lastly, areas that have higher densities of off-premise alcohol outlets (e.g., convenience stores and liquor stores) also appear to have higher densities of robberies, net of control variables. Neighborhoods with high availability of alcohol outlets can serve as social attractors (Parker, 1993); they can attract robberies by bringing a flow of unguarded vulnerable victims or generate robberies by providing public places that are easily accessible to the public (e.g., places that are located on main street, or near public transportation stations) and lack place managers (Brantingham and Brantingham, 1995, Eck, 1995). For example, neighborhoods with high availability of bars produce at closing time intoxicated patrons who are vulnerable victims and could be a suitable target for robbery, while liquor stores lack effective guardianship once the patron leaves the premise and becomes vulnerable and a suitable target for robbery. Additionally, alcohol outlets attract crime by providing a social group context in which social interactions occur (Parker, 1993). Routine activities of individuals often involve meeting and socializing at bars or restaurants and the routine activities within this social group context can expose individuals to situations in which they become victims of robberies.

The findings of this study regarding the association between various types of alcohol outlets and robbery are similar to that of Bernasco et al. (2013) and Bernasco and Block (2011). Bernasco and Block (2011), found that blocks with bars and clubs, as well as liquor stores, inside their boundaries had the highest robbery count even after controlling for poverty, percentage of African American, and ethnic heterogeneity of Chicago census blocks. Bernasco et al. (2013) found that the odds of a block being selected for robbery was 38% for blocks that contained liquor stores and 20% for blocks that contained bars and clubs. Additionally, Smith et al. (2000) found that the number of retail businesses (e.g., bars, restaurants, gas stations) was positively associated with street robbery, even after controlling for the number of single parent households, distance from center of city, the number of African Americans, and racial heterogeneity of Census face blocks of a medium sized southeastern U.S. city.

Additionally, we found that when directly accounting for social disorganization levels of Milwaukee block groups, the association remained only between off-premise alcohol outlet density and robbery density. This finding is different from Nielsen and Martinez's (2003) study who found that total alcohol outlet density was associated with robbery when using data aggregated to Miami census tracts, even when controlling for census tract disadvantage index. Given our findings, it appears that in Milwaukee the role of social disorganization better explains robberies that occur in the city relative to all types of alcohol outlets and on-premise alcohol outlets, except for off-premise alcohol outlets. This particular finding on the association between off-premise alcohol outlet density and robbery suggests an important influence of this type of alcohol outlet on violence, relative to that of all types of alcohol outlets and of on-premise alcohol outlets (e.g., bars, restaurants).

Off-premise alcohol outlets (e.g., liquor or convenience stores) may contribute to robbery in various ways. First, they may be a risky type of micro-place within neighborhoods where surveillance and guardianship is low, relative to on-premise alcohol outlets. In bars, for example, there may be staff working at the door whose function is to look out for problematic behavior in and around the bars. In liquor stores, on the other hand, surveillance may end the moment a patron leaves the premise. Second, off-premise alcohol outlets may compete with other alcohol outlets for their market share of customers and provide lower prices, so that greater concentration of off-premise alcohol outlets in a given neighborhood could result in a greater availability of alcoholic beverages and a concentration of vulnerable, intoxicated individuals in those neighborhoods. This is especially important in the context of off-premise alcohol outlets, which typically are used as "de facto taverns" in urban settings such as Milwaukee. Third, off-premise alcohol outlets may contribute to robberies because they are (1) crime attractors and their function makes them well suited for motivated offenders to find attractive and weakly guarded victims or targets (Brantingham and Brantingham, 1995), or (2) crime generators and they bring together to its location particular type of offenders and targets (Brantingham and Brantingham, 1995, Gorman et al., 2013). Quite possibly, the risk of being robbed may vary by age and gender characteristics of off-premise outlet patrons and staff (Tita and Griffiths, 2005), as well as other types of off-premise alcohol outlet characteristics. There might be something about the characteristics of off-premise alcohol outlets themselves that contribute to robberies, such as business policies and practices, the types of customers who visit the outlets, the employees who work there, or the appearance of the immediate environment around the outlet (Snowden and Pridemore, 2014). Thus, more work is warranted in identifying off-premise alcohol outlet characteristics and their role in violence in general and in robbery in particular.

4.1. Limitations

There are a few limitations to consider in light of our findings. First, we used data that included robbery incidents that were actually reported to the police. A large proportion of robberies possibly go unreported, especially in instances of robberies in the context of illicit markets. Because data are recorded by one recording office within the Milwaukee Police Department, differences in reporting across units of analysis may present less of a problem. However, this would still leave a problem with differential reporting to the police. Baumer (2002) found differential reporting of less serious crimes to police by socioeconomic disadvantage, and this could have an influence on results based on police robbery data. Second, the robbery data that we obtained does not allow us to examine the association between alcohol outlets and different types of robberies (e.g., street versus commercial) that occurred in Milwaukee. It is possible that the effect of alcohol outlets on various types of robberies would be different, as motivations and opportunities to commit different types of robberies in different contexts may vary. An additional limitation is associated with the unit of analysis (i.e., census block group) used in this study. While the census block group is a commonly used unit of analysis in neighborhood level studies of violence, and is better theoretically grounded than the use of census tracts, zip codes, or counties, it contains artificially imposed boundaries that are used to capture neighborhood boundaries. The use of street segments that are comprised of street blocks, or street corners and block faces (e.g., Braga et al.,

2011, Groff and Lockwood, 2014, Smith et al., 2000) might better represent natural neighborhood boundaries and reduce the likelihood of pattern obfuscation (Andersen and Malleson, 2011), making it a more appropriate spatial unit of analysis for estimating the association of alcohol outlets and neighborhood robbery occurrences. Fourth, our study does not control for the influence of other retail establishments that might serve as crime attractors (e.g., gas stations, laundromats, pawn shops, check cashing services, vice-related incidents) on neighborhood robbery levels, or directly test for availability of vulnerable targets (e.g., number of intoxicated individuals). Lastly, our data does not allow us to examine the proximity of alcohol outlets to other retail stores, main streets, intersections, or bus stops which could also contribute to neighborhood robbery levels. In spite of these limitations, our study was carefully designed to advance our understanding of the relationship between alcohol outlets and robbery using data from a large urban city. This study achieved this by using spatially informed models that controlled for several neighborhood characteristics, disaggregating alcohol outlets into different types for the purposes of analyses, and directly testing for the influence of social disorganization on robberies and the moderating effect of social disorganization on the association between alcohol outlets and robberies.

5. Conclusions

Robbery is a serious violent crime. The role of alcohol outlets in robbery incidents was noted in recent studies (e.g., Bernasco and Block, 2011) and our study confirms that concentrations of off-premise alcohol outlets (e.g., liquor or convenience stores) are important contributors to robbery incidents. It appears that one way to influence a violent event such as robbery is to influence alcohol availability levels via policy mechanisms. Reducing robbery, for example, could be achieved by (1) reducing the number of alcohol outlets that are allowed to operate within a neighborhood, (2) limiting new licenses for areas that already have outlets too close together, (3) limiting the hours and days of sales of alcoholic beverages (Popova et al., 2009, Rossow and Norstrom, 2012), (4) enforcing the current laws that prohibit serving intoxicated patrons (Leonard, 2001), (5) permanently closing outlets that continually violate liquor laws. Reducing the number of outlets where alcohol can be purchased and carried out for consumption elsewhere (e.g., liquor stores), may especially be important in light of the findings from this study. As Gruenewald (2008) recently stated, the search for an explanation on the mechanism of how alcohol outlets influence social problems has only just begun.

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