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Alcohol and Violence in a Nonmetropolitan College Town: Alcohol Outlet Density, Outlet Type, and Assault

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# Abstract

This study examined the association between alcohol outlet density and violence in a nonmetropolitan college town. Nearly all prior empirical research examining this association has been undertaken in large urban cities. Using data on Bloomington, Indiana, block groups, we estimated ordinary least squared and spatially lagged regression models to determine whether alcohol outlet density was associated with assault density, and we also took into account the seriousness of violence (i.e., simple and aggravated assault) and different alcohol outlet types (i.e., off-premise, restaurants, and bars). The results showed that total alcohol outlet density was significantly associated with both simple and aggravated assault density in a nonmetropolitan college town. In addition, restaurant and bar densities were significantly associated with simple assault density, whereas off-premise and bar densities were significantly associated with aggravated assault density. These results not only extend the geographic scope of this relationship to nonmetropolitan towns but also have important policy implications.

## Keywords

alcohol outlet density, alcohol outlet type, assault density, college town

# Introduction

Although it became clear early on that alcohol consumption often accompanies violence (e.g., Wolfgang & Strohm, 1956; for comprehensive review, see Levine, 1984), U.S. criminological research on this topic did not fully develop until the early 1980s. Since that time, a growing literature that examines the structural-level association (e.g., social disorganization, land use patterns) has joined that assessing the individual-level association between alcohol and violence. This literature, using geographic units such as census tracts, cities, states, and nations has revealed a consistent relationship between alcohol availability and violence (e.g., Norström, 2000; Roman, Reid, Bhati, & Tereshchenko, 2008), and more recent studies have shown that the strength of this association may vary by type of alcohol outlet (e.g., Gruenewald, Freisthler, Remer, LaScala, & Treno, 2006).

While much of the structural-level research on alcohol availability and violence has appeared in noncriminological journals (e.g., Graham & Livingston’s, 2011, work appeared in the *Drug and Alcohol Review*), several criminological theories (e.g., Cohen & Felson, 1979; Shaw & McKay, 1942; Stark, 1987) may aid in explaining an association. First, it could be that the association between alcohol and violence exists because some alcohol outlets are located in socially disorganized neighborhoods and, as such, are immediately surrounded by physical and social disarray (Sampson & Raudenbush, 1999; Shaw & McKay, 1942). Another theoretical explanation for this relationship may be the appearance of alcohol outlets and their immediate environment. If the alcohol outlet is unkempt, for example, it may signal to potential offenders that norms are ambiguous and that the owners of those establishments might not intervene when conflicts arise (Stark, 1987). Alternatively, it could be that the alcohol and violence association can be explained by the routine activities of individuals who consume alcohol, or the convergence in time and space of motivated offenders and suitable targets in the absence of capable guardians (Cohen & Felson, 1979).

This study contributes to the existing literature in several ways. First, we take into account the seriousness of violence by examining the density of both simple and aggravated assaults. Second, we recognize that different types of alcohol outlets (i.e., off-premise, restaurants, and bars) may be differentially associated with violence. Third, we estimate spatially informed regression models to control for possible presence of spatial autocorrelation. Fourth, we use smaller units of analysis, block groups, than most prior studies. This is especially important because using larger units of analysis (e.g., cities, zip codes, states) may obscure the fundamental nature of outlet density (Parker & Wolz, 1979) and can increase the likelihood of aggregation bias. Focus on smaller units of analysis is in line with recent work in environmental and spatial criminology that argues that smaller units of analysis are more appropriate both theoretically and empirically (Weisburd, Bernasco, & Bruinsma, 2009). Finally, the key innovation and contribution of this study is that we test the association in a nonmetropolitan college town. Most prior studies that examined the relationship between alcohol outlet density and violence have done so in large urban areas (e.g., Chicago, Washington, D.C.), and ours is among the first to test the association in a nonmetropolitan setting.

# Literature Review

The association between alcohol and violence was found both at the individual and structural level (e.g., Gustafson, 1994; Pridemore & Grubesic, 2011). At the individual level, alcohol consumption can encourage violence by disrupting normal brain function and weakening brain mechanisms that control impulsive behaviors (Gustafson, 1994). In addition, alcohol consumption impairs information processing in individuals, so that the individuals under the influence of alcohol are likely to misinterpret social cues and overreact in their violent response (Clements & Schumacher, 2010). However, violence can also result from expectations that individuals have about the effect of alcohol, rather than the direct effect of alcohol itself. For example, Gustafson (1994) suggested that alcohol consumption may promote violence if individuals who consume alcohol expect that alcohol consumption will lead to increased violence (also see Chermack & Taylor, 1995; Dermen & George, 1989; Gustafson, 1985).

Findings of empirical studies that move beyond these individual-level explanations for the association between alcohol and violence point to a strong association between alcohol outlet density, alcohol outlet type, and violence. In general, a significant relationship between the density of alcohol outlets and violence rates has been found in a number of empirical studies (Britt, Carlin, Toomey, & Wagenaar, 2005; Gruenewald & Remer, 2006; Laranjeira & Hinkly, 2002; Lipton & Gruenewald, 2002; Livingston, 2008a, 2008b; Norström, 2000; Pridemore & Grubesic, 2011; Roman et al., 2008; Zhu, Gorman, & Horel, 2004). Scribner, MacKinnon, and Dwyer (1995) examined the risk of assaultive violence and alcohol availability in Los Angeles County and found that higher levels of alcohol outlet density were significantly associated with higher rates of assaultive violence. Speer, Gorman, Labouvie, and Ontkush (1998) found that the relationship between alcohol outlet density and violence was strongest at the smallest units of analysis. A number of subsequent studies confirmed the finding that alcohol outlet density was significantly associated with rates of assaultive violence at the census tract level and the census block group level (Alaniz, Cartmill, & Parker, 1998; Gorman, Speer, Gruenewald, & Labouvie, 2001; Reid, Hughey, & Peterson, 2003; Scribner, Cohen, Kaplan, & Allen, 1999). For example, a recent study by Pridemore and Grubesic (2011) analyzed data from Cincinnati block groups and found a significant association between outlet density and assault density. Specifically, they found that an increase in one restaurant or one bar per square mile is associated with 1.15 and 1.35 more simple assaults per square mile, respectively, while an increase in one off-premise alcohol outlet per square mile is associated with 2.3 more simple assaults and 0.6 more aggravated assaults per square mile. A related genre of studies found that a reduction in alcohol availability can reduce alcohol-related violence and that change in outlet density is associated with change in violence (Livingston, 2008b; Nemtsov, 1998; Pridemore & Snowden, 2009; Varnik, Kolves, Vali, Tooding, & Wasserman, 2006).

The distinction between different types of alcohol outlets is important. Grouping all alcohol outlets into a single variable obscures the fact that not all alcohol outlets are the same. Some alcohol outlets are designed for on-premise alcohol consumption, while others are designed with convenience in mind, where a customer can walk in and purchase an alcoholic beverage to consume off-premise. This characteristic alone is associated with varying levels of risk in terms of levels of assault. Of course, not even all off-premise alcohol outlets are the same. While some are solely places where customers buy alcohol and carry it out for consumption somewhere else, some off-premise outlets serve as a social gathering spot where alcoholic beverages are consumed in the course of social interaction, usually in an adjoining parking lot or alley. For example, Alaniz et al. (1998) studied only off-premise alcohol outlets and found that off-premise alcohol outlets are social attractors that draw people to their location in the search for entertainment, relaxation, and “time out” opportunities. Not all on-premise alcohol outlets are the same either. Some on-premise outlets are restaurants, for example, where the food and restaurant setting is the main attraction and alcohol consumption usually accompanies the meal. However, the main attraction of bars is the alcohol and the social setting. Even more simply, some outlets attract a greater number of patrons and have a larger volume of alcohol sales relative to others.

Due to these differences, a number of scholars recognized the need to separate alcohol outlets into off-premise and on-premise outlets (Gorman, Speer, Labouvie, & Subaiya, 1998; Gruenewald et al., 2006; Gruenewald & Remer, 2006; Lipton & Gruenewald, 2002; Scribner et al., 1995; Scribner et al., 1999). Scribner et al. (1999), for example, found that the rate of assaultive violence was significantly associated with the density of both off-premise and on-premise alcohol outlets, although the effect size was higher for the density of off-premise outlets relative to the density of on-premise alcohol outlets . Branas, Elliott, Richmond, Culhane, and Wiebe (2009) found that being in an area of high off-premise alcohol availability significantly increases the risk of being assaulted with a gun, whereas being in an area of high on-premise alcohol outlet availability does not change the risk. Costanza, Bankston, and Shihadeh (2001) found that the density of package-only (i.e., off-premise) outlets increases the risk of violent crime but that the density of taverns (i.e., on-premise) had no effect. In addition, Gruenewald et al. (2006) found that assault rates were significantly related to local densities of off-premise alcohol outlets and not to the density of on-premise alcohol outlets. Similarly to the Gruenewald et al. (2006) findings, Pridemore and Grubesic (2011) found that the association between alcohol outlet density and violence rates was stronger for off-premise alcohol outlets relative to on-premise alcohol outlets.

The relationship between alcohol outlet density and violence may be confounded by neighborhood characteristics. Empirical research that examined the effect of alcohol outlet density and controlled for social, economic, and demographic variables, however, confirmed the alcohol–violence association found in previous studies even when controlling for these neighborhood characteristics. For example, a Gorman et al. (2001) study that examined the relationship between alcohol outlet density and violence at the block group level found that the outlet–violence association remained after controlling for sociodemographic variables, and that the variables together explained 73% of variance in violent crime. In addition, Pridemore and Grubesic (2011, 2012a) not only highlighted the relative importance of off-premise outlets, but their findings held when controlling for common structural covariates of violence, including those for social disorganization.

These neighborhood characteristics may influence the alcohol–violence association in other ways. For example, neighborhoods that are plagued by poor economic conditions, where residents frequently move in and out, and where there are many racial/ethnic groups that live together might not be able to implement limitations on alcohol availability (Shaw & McKay, 1942). In fact, recent work by Nielsen, Hill, French, and Hernandez (2010) found that lower levels of community organization were associated with higher density of alcohol outlets. A greater density of outlets might then serve as an attractor of community members who are at higher risk of criminal activity and community outsiders. Disorganized areas attract deviant and crime-prone individuals and activities (Stark, 1987). For example, if people use off-premise alcohol outlets as a social gathering spot and congregate there to consume alcoholic beverages after the outlet has closed for the day, there is no one who can intervene if crime occurs. When an outlet like a convenience store is used as a social gathering spot and even a de facto tavern (Block & Block, 1995), this pattern of use creates another deviant place, a community within the larger community, where formal law enforcement is lenient. Alternatively, Pridemore and Grubesic (2012a) found that social disorganization moderates the association between alcohol outlet density and assault density. That is, the strength of the association was stronger in disorganized communities and weaker or nonexistent in organized communities. The same authors found similar moderating effects of land use on the association between alcohol outlet density and assault density in urban block groups (Pridemore & Grubesic, 2012b). Specifically, Pridemore and Grubesic (2012b) calculated location quotients for each land use type in Cincinnati, Ohio, and found that areas with commercial and public housing land uses were significantly associated with both simple and aggravated assault density in Cincinnati, Ohio. In addition, Stucky and Ottensmann (2009) found that residential high-density land use has a direct effect on assaults in Indianapolis, Indiana.

Alcohol outlets might also serve as locations for other types of deviance like prostitution and drug sales (Alaniz et al., 1998) that might increase the risk of violence. These risky outlets may also further damage collective efficacy (Sampson & Raudenbush, 1999) and the ability of neighborhoods to exert social control. The alcohol outlets can also have an effect on property values (Gyimah-Brempong, 2001), which could force people to move out of the area, especially when alcohol outlets begin to show signs of physical and social disorder (e.g., broken bottles, public drinking) that further contributes to the disorganization of neighborhoods in a vicious social cycle.

All of this suggests a consistent association between alcohol outlet density and violence. None of these studies, however, have examined this association in nonmetropolitan college towns, and ours is among the first to do so. Specifically, we test the hypothesis that the density of total alcohol outlets will be associated with total assault density in a nonmetropolitan college town of Bloomington, Indiana. In addition, we test whether the association exists for different alcohol outlet types (i.e., off-premise, restaurants, and bars) and different levels of harm (i.e., simple and aggravated assaults). There are theoretical reasons to believe that different outlet types will have an influence on different levels of harm. For example, off-premise alcohol outlets are places where informal social control ends the moment the patron leaves the premise and as such these places may be more likely to experience greater levels of seriousness of assault. In restaurants and bars, however, there are other patrons or trained staff who may act quickly in cases of problematic behavior before the conflict escalates to more serious harm.

# Data and Method

## Data

### Unit of Analysis

The research site for this study was Bloomington, Indiana, a small midwestern town that has a total area of 19.7 square miles. In 2006, the population was estimated to be 69,274 (U.S. Census Bureau, 2000). According to the 2000 U.S. Census, the median household income in the city in 1999 was US $25,377, well below the median household income for the state of Indiana of US $41,567. The per capita income for the city in 1999 was U S$16,481. Bloomington is home to Indiana University, with a student body of 40,000 undergraduate and graduate students who play an important role in the life of the city. Because it houses a large state university and its students, Bloomington is a typical college town that has the typical alcohol-related problems associated with such places (e.g., binge drinking, underage drinking, etc.; Wechsler, Kuo, Lee, & Dowdall, 2000; Wechsler & Nelson, 2001).

The units of analysis were all census block groups that lie within the boundaries of the city of Bloomington (*N* = 65). Block group population ranges from 393 to 4,588, with a mean of 1,268 (U.S. Census Bureau, 2000).

### Dependent Variables

The dependent variable in this analysis was assault density per square mile aggregated over a 2-year period. This variable was further disaggregated into aggravated and simple assault density per square mile. Data on assaults were obtained from the Bloomington Police Department. These records contained the Indiana statute code (i.e., IC code), case type (e.g., whether simple assault, aggravated assault, or battery with a deadly weapon, which was coded as aggravated assault), and the address of the incident. These data were geocoded using ArcView software, and aggregated to the block group. Aggravated assault density ranged from 0 to 243 per square mile, with a mean of 17, and simple assault density ranged from 0 to 861 per square mile, with a mean of 62. Figures 1 and 2 are maps of Bloomington with block groups shaded by density of simple and aggravated assaults, respectively.

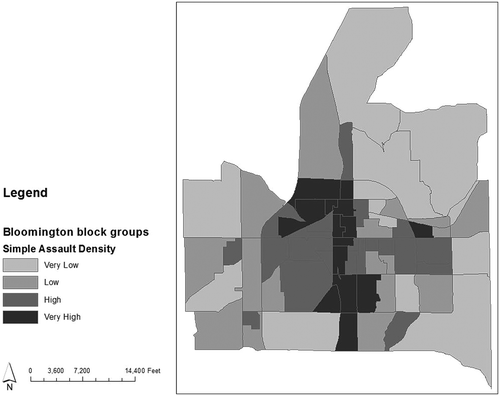


Figure 1. Spatial distribution of simple assault density for Bloomington, Indiana, block groups , 2008-2009.

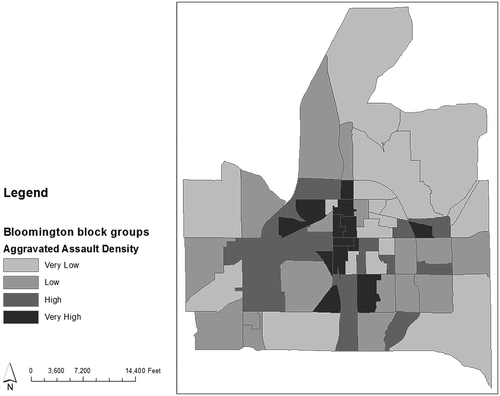
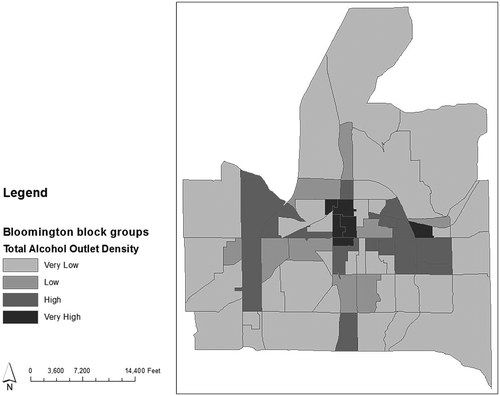


Figure 2. Spatial distribution of aggravated assault density for Bloomington, Indiana, block groups , 2008-2009.

The measures for aggravated and simple assaults were calculated based on the number of incidents investigated by the police from January 1, 2008, through December 31, 2009, for each census block group. The police data on aggravated and simple assaults were standardized by the total land area of each census block group (i.e., per square mile), rather than by the population of a census block group (e.g., per 100 residents). If we standardized the data on assaults with a traditional, population-based rate, the resulting metric would take into account only the population that lives in each block group, implying that all victims and offenders reside in the same block group (Gibbs & Erickson, 1976). An assault rate standardized in this manner fails to account for the fact that both victims and offenders go to other block groups as they go about their daily activities, including purchasing alcoholic beverages, drinking, and becoming assault victims and offenders in block groups other than those in which they reside.

### Independent Variables

The main independent variable in this study was alcohol outlet density. Alcohol outlet density was measured as the number of all outlets per square mile in each block group. We created a measure for all alcohol outlets and also disaggregated by the license type into broad categories of off-premise (i.e., liquor, convenience, and grocery stores), restaurants, and bars. Data on alcohol outlets were obtained from the Indiana Alcohol and Tobacco Commission (IATC) and were based on permit information for all establishments registered with the IATC for 2010. Data included information on business name, permit type and number, street address, and the permit expiration date. As of 2010, there were more than 200 licenses issued to local businesses to sell alcoholic beverages to the public in Bloomington. Addresses of the outlets were used to geocode the location of each outlet using ArcMap and aggregated to the block group level. The skew statistics for the measures of alcohol outlet density (including outlet types) were greater than twice their standard errors, so we used the natural logarithm of each to normalize the distributions. Figure 3 is a map of Bloomington block groups with the location of all alcohol outlets, with block groups shaded by total outlet density per square mile.



**Figure 3.** Spatial distribution of total alcohol outlet density for Bloomington, Indiana, block groups (*N* = 65), 2010.

### Control Variables

We included several structural characteristics of communities to control for confounding effects. This is important because neighborhood characteristics have been shown to be associated with alcohol outlet density (Nielsen et al., 2010) and with violence (Shaw & McKay, 1942). Our controls included the proportion of the population living below poverty line, the proportion of households in the block group headed by a female and with a child below the age of 18 years, the proportion of the population that is African American, and population density. The skew statistics for these variables were greater than twice their standard errors, so we used the natural logarithm of each to normalize the distributions. We also controlled for prior levels of violence by using a measure for simple and aggravated assault density between January 1, 2004, and December 31, 2005. Prior research in this area suggested the importance of using the temporal lag of crime to account for unobserved block group–specific heterogeneity (Roman et al., 2008). Data on each of these control variables were obtained from the 2000 U.S. Census Bureau, with the exception of simple and aggravated assault density from 2004 and 2005, data for which were obtained from the Bloomington Police Department.

## Method

Two different modeling approaches, ordinary least squares (OLS) and spatially lagged regression, were used to examine the relationship between alcohol outlets and assaults.

One of the key assumptions in the linear regression model is that variables that influence the dependent variable, other than the independent variables, are not systematically related to each other (Berry, 1993). Following Tobler’s (1970) first law of geography that “everything is related to everything else, but near things are more related than distant things” (Tobler, 1970, p. 236) and Anselin’s work on spatial dependence in linear regression models (Anselin, 1988, 1989; Anselin & Bera, 1998), we assumed that assaults from one unit of analysis could be predicted from neighboring units of analysis as we used spatially distributed data and units of analysis that have artificially imposed boundaries. Spatially distributed data generally exhibit patterned variation, or spatial autocorrelation, so that those data points that are closer together in space are more likely to have similar characteristics than those that are further apart (which indicate positive spatial autocorrelation). Thus, even though the OLS estimator has been used in prior research that examined the relationship between alcohol outlet density and assault density (e.g., Gorman et al., 1998), spatially informed regression models may be more appropriate when analyzing data that are spatially distributed.

We tested for spatial autocorrelation by using the Moran’s *I* statistic. The global Moran’s *I* indicates in a range of −1 to +1 whether a variable of interest in one unit is correlated with itself in the other units. Once this spatial autocorrelation has been identified, we can control for it by adding a term for it (Rho) to our models. Initially, we specified all of the models of interest as OLS models using GeoDa software (Anselin, Syabri, & Youngihn, 2006). Doing so provided a regression output with diagnostics for spatial dependence, which gave us information about the existence of spatial dependence, and if so, whether a lag or error model were more appropriate for these data. In our simple assault models, we found evidence of spatial autocorrelation and thus we employed spatially informed regression models for simple assaults. In the models where the density of aggravated assaults were of interest, the results of Moran’s *I* statistic indicated that spatial autocorrelation did not exist in the ordinary linear regression residuals, and thus we specified aggravated assault models as OLS models.

# Results

Table 1 provides the results of models estimating the effect of total outlet density on simple and aggravated assault density. Model 1 examined the association between total outlet density and simple assault density net of control variables. This was a spatial regression model that used a first-order queen matrix. The *R*2 value shows that Model 1 explained about 85% of the variance in simple assault density by the density of alcohol outlets and the control variables for Bloomington block groups, including prior levels of simple assault. In Model 1, we see that alcohol outlet density was positively and significantly associated with simple assault density. The spatial lag (Rho) associated with simple assault density in the Model 1 measured the average influence of neighboring block groups on a block group of interest, and it was a positive and significant contributor to the model.

**Table 1.** Spatial Lag (Model 1) and OLS (Model 2) Models for Total Outlet Density and Simple and Aggravated Assault Density .

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Model 1: Simple assault density |  |  | Model 2: Aggravated assault density |  |  |
|  | *B* | *SE* | *p* | *B* | *SE* | *p* |
| Constant | −1.10 | 0.67 | .10 | −0.90 | 1.06 | .40 |
| Ln total outlet density | 0.18 | 0.07 | .01 | 0.18 | 0.11 | .11 |
| Rho simple assault | 0.25 | 0.10 | .01 | — | — | — |
| Ln control simple assault | 0.67 | 0.07 | .00 | — | — | — |
| Ln control aggravated assault | — | — | — | 0.40 | 0.13 | .00 |
| Ln population density | 0.14 | 0.09 | .11 | 0.18 | 0.14 | .20 |
| Ln % poverty | 0.84 | 0.76 | .27 | 2.96 | 1.14 | .01 |
| Ln % African American | 1.27 | 0.63 | .05 | 0.72 | 1.03 | .49 |
| Ln % female-headed household | −1.24 | 0.72 | .08 | 0.42 | 1.14 | .71 |
| Adjusted *R*2 |  | .846 |  |  | .447 |  |
| Rho |  | 0.253 (*p =* .012) |  |  | — |  |
| *SE* |  | 0.673 |  |  | 1.03 |  |
| Breusch–Pagan |  | 8.167 (*p =* .227) |  |  | 7.28 (*p =* .295) |  |

Note: OLS = ordinary least squares.

The second model explored the relationship between total outlet density and aggravated assault density net of control variables. The OLS estimator was used here because, unlike in the first model, the neighboring influence of aggravated assault density did not improve the model (i.e., there was no need to control for spatial autocorrelation). Model 2 explained about 45% of the variance in aggravated assault density by density of alcohol outlets and the control variables for Bloomington block groups, including prior levels of aggravated assault. The second model suggests a significant association between total outlet density and aggravated assault density net of the control variables, though the *p* value does not allow for definitive conclusions. That is, given theoretical expectations, the one-tailed *p* value is .055, and the relatively small number of cases provides evidence of an association, but this evidence is weaker than for simple assaults.

Models 3 through 8 in Tables 2 and 3 were estimated to provide a more disaggregate analysis of the relationship between simple assault density and different alcohol outlet types (Models 3-5) and aggravated assault density and different alcohol outlet types (Models 6-8). Table 2 displays the results when the spatial density of simple assault was regressed on off-premise outlets (Model 3), restaurants (Model 4), and bars (Model 5). The *R*2 values show that Models 3 to 5 each explained approximately 84% of the variance in simple assault density by alcohol outlets and the control variables for Bloomington block groups. The spatial lag (Rho) associated with simple assault density in the models was a positive and significant contributor to the models, as it was in the global model found in Table 1. Whereas the relationship between simple assault density and off-premise outlet density was not statistically significant , there was a positive and significant relationship between simple assault density and restaurant density and bar density .

**Table 2.** Spatial Lag Models for Simple Assault Density and Outlet Density, by Outlet Type .

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Model 3: Off-premise |  |  | Model 4: Restaurants |  |  | Model 5: Bars |  |  |
|  | *B* | *SE* | *p* | *B* | *SE* | *p* | *B* | *SE* | *p* |
| Constant | −1.22 | 0.70 | .08 | −1.12 | 0.67 | .09 | −1.17 | 0.69 | .08 |
| Ln off-premise density | 0.13 | 0.11 | .24 | — | — | — | — | — | — |
| Ln restaurant density | — | — | — | 0.20 | 0.07 | .01 | — | — | — |
| Ln bar density | — | — | — | — | — | — | 0.22 | 0.12 | .06 |
| Rho simple assault | 0.28 | 0.10 | .00 | 0.26 | 0.09 | .01 | 0.24 | 0.10 | .01 |
| Ln control simple assault | 0.69 | 0.08 | .00 | 0.69 | 0.07 | .00 | 0.69 | 0.07 | .00 |
| Ln population density | 0.16 | 0.09 | .08 | 0.14 | 0.09 | .10 | 0.17 | 0.09 | .05 |
| Ln % poverty | 0.90 | 0.80 | .26 | 0.83 | 0.76 | .27 | 0.99 | 0.78 | .20 |
| Ln % African American | 1.12 | 0.66 | .09 | 1.28 | 0.63 | .04 | 1.09 | 0.64 | .09 |
| Ln % female-headed household | −1.21 | 0.75 | .10 | −1.31 | 0.72 | .07 | −1.58 | 0.76 | .04 |
| Adjusted *R*2 |  | .833 |  |  | .847 |  |  | .839 |  |
| Rho |  | 0.284 (*p* = .007) |  |  | 0.262 (*p* = .009) |  |  | 0.241 (*p* = .022) |  |
| *SE* |  | 0.700 |  |  | 0.672 |  |  | 0.690 |  |
| Breusch–Pagan |  | 5.699 (p = .458) |  |  | 8.081 (p = .232) |  |  | 8.549 (p = .201) |  |

**Table 3.** OLS Models for Aggravated Assault Density and Outlet Density, by Outlet Type .

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Model 6: Off-premise |  |  | Model 7: Restaurants |  |  | Model 8: Bars |  |  |
|  | *B* | *SE* | *p* | *B* | *SE* | *p* | *B* | *SE* | *p* |
| Constant | −0.80 | 1.04 | .45 | −1.01 | 1.08 | .35 | −1.02 | 1.04 | .33 |
| Ln off-premise density | 0.36 | 0.16 | .02 | — | — | — | — | — | — |
| Ln restaurant density | — | — | — | 0.06 | 0.13 | .66 | — | — | — |
| Ln bar density | — | — | — | — | — | — | 0.38 | 0.19 | .05 |
| Ln control aggravated assault | 0.41 | 0.13 | .00 | 0.45 | 0.14 | .00 | 0.33 | 0.14 | .03 |
| Ln population density | 0.17 | 0.14 | .23 | 0.21 | 0.14 | .14 | 0.22 | 0.14 | .11 |
| Ln % poverty | 2.53 | 1.14 | .03 | 3.24 | 1.15 | .01 | 3.18 | 1.11 | .01 |
| Ln % African American | 0.77 | 1.00 | .45 | 0.49 | 1.05 | .64 | 0.67 | 1.01 | .51 |
| Ln % female-headed household | 0.50 | 1.12 | .66 | 0.42 | 1.17 | .72 | −0.12 | 1.16 | .91 |
| *R*2 |  | .521 |  |  | .478 |  |  | .509 |  |
| *SE* |  | 1.008 |  |  | 1.052 |  |  | 1.020 |  |
| Breusch–Pagan |  | 13.207 (*p =* .039) |  |  | 7.880 (*p =* .247) |  |  | 9.426 (*p =* .151) |  |

Note: OLS = ordinary least squares.

Table 3 shows the results when the density of aggravated assault was regressed on off-premise outlets (Model 6), restaurants (Model 7), and bars (Model 8). The *R*2 value shows that Models 6 to 8 explained approximately 50% of the variance in aggravated assault density by the density of alcohol outlets and the control variables for Bloomington block groups. Whereas the relationship between aggravated assault density and restaurants was not statistically significant , the relationship was positive and statistically significant between aggravated assault density and off-premise outlet density and bar density .

The spatial regression models described above used first-order queen weight matrix. We also estimated the same models using first-order rook weight matrix and the results were identical to those described above. Last, we also estimated the same models using k-3 nearest-neighbors matrix and the results were identical for all of the models.

We also examined results of regression diagnostic tests to ensure that the models were stable. Using first-order queen contiguity matrix and specifying OLS model, the value of Moran’s *I* for error terms in Model 1 was 0.54 , while the values of Lagrange Multiplier (lag) and Robust LM (lag) test statistic were significant, suggesting a lack of autocorrelation in the regression residuals, and that the spatial lag regression model better suit the properties of the data specified in Model 1. The stronger fit of the spatial lag model was also evident in the values of log likelihood, Akaike info criterion, and Schwarz criterion, all of which were reduced in the spatial lag model relative to the OLS model. In addition, spatial autoregressive coefficient Rho was estimated as 0.25 and was significant . Two spatial lag model diagnostics, the Breusch–Pagan test for heteroskedasticity in the error terms and the Likelihood Ratio Test, confirmed the lack of heteroskedasticity in the error terms and strong significance of the spatial autoregressive coefficient. The diagnostics for the remaining models that tested the association between simple assault density and subtypes of alcohol outlets (Models 3-5) suggested similar conclusions as that described for Model 1.

For Model 2 and Models 6 to 8, we followed the same steps outlined above to assess the stability of the models. First, we specified OLS regression for each of the models. For each one of the models, the value of Moran’s *I* in error terms was nonsignificant , indicating a lack of autocorrelation in the regression residuals. Next, we looked at the test statistics of the spatial lag and spatial error models, both of which were nonsignificant, and concluded that OLS regression models better suited the properties of the data used for Model 2 and Models 6 to 8. However, to be sure, we also ran spatial lag and spatial error regression for these models, and regression diagnostics indicated a weaker fit of the spatial dependence (lag or error) models, relative to the OLS model. The weaker fit of the spatial lag or error models was particularly evident in the values of log likelihood, Akaike info criterion, and Schwarz criterion, all of which were higher in the spatial lag or error models relative to the OLS model. Thus, models that have simple assault density as the dependent variable were specified as the spatial lag models, while models that have aggravated assault density as the dependent variable were specified as the OLS models.

# Discussion

This study examined whether there is a relationship between alcohol outlet density and assault density in a nonmetropolitan college town, taking into account varying types of outlets and levels of assault. The results of model estimation show that in a nonmetropolitan college town, the relationship varies between the different types of outlets and the different types of assaults. The density of all outlets, alcohol-selling restaurants, and bars were all positively and significantly associated with simple assault density, whereas off-premise outlet density and bar density were positively and significantly associated with aggravated assault density.

These results for a nonmetropolitan college town are consistent with prior work showing a general association between total outlet density and violence in larger cities. Scribner et al. (1995) examined the risk of assaultive violence and alcohol availability in Los Angeles County and found that higher levels of alcohol outlet density were significantly associated with higher rates of assaultive violence. A number of subsequent studies confirmed the finding that alcohol outlet density was significantly associated with rates of assaultive violence at the census tract level and the census block group level (Alaniz et al., 1998; Gorman et al., 2001; Pridemore & Grubesic, 2011; Reid et al., 2003; Scribner et al., 1999; Speer et al., 1998). In addition, looking at specific outlet types and assault types, these findings are also similar to the findings of Gruenewald et al. (2006) study, which found a significant association between off-premise density and serious assault, and no association between restaurant density and serious assault. Similarly, Pridemore and Grubesic (2011) used data from Cincinnati block groups to assess the relationship between alcohol outlet density and assault density, including different subtypes of each, and found that the association between alcohol outlet density and violence rates was stronger for off-premise alcohol outlets relative to on-premise alcohol outlets. In addition, Branas et al. (2009) found that being in an area of high off-premise alcohol availability significantly increases the risk of being assaulted with a gun, whereas being in an area of high on-premise alcohol outlet availability does not change the risk. Costanza et al. (2001) presented a similar finding that the density of package-only (i.e., off-premise) outlets increases the risk of violent crime but that the density of taverns (i.e., on-premise) had no effect.

In spite of these similar findings, there are some inconsistencies with recent research. For example, our results are different in some respects from that of Pridemore and Grubesic (2011). Unlike in their study, our results indicated a lack of association between simple assault density and off-premise outlet density and between aggravated assault density and restaurant density. One possible explanation for the difference in the findings between simple assault density and restaurant density could be that in a college town characterized by high levels of binge drinking, restaurant personnel may be more aware of problem drinkers, and thus may employ multiple safeguards to protect against this, including staff who can quickly act to bring the problematic behavior under control or to the attention of the police, thereby limiting inappropriate behavior from escalating into more serious assaultive violence. However, off-premise outlets do not have such mechanisms in place, especially because most of the off-premise outlets in Bloomington are convenience stores or gas stations. Thus, more serious assaultive violence is likely to be associated with off-premise outlet where there are no social control agents who can de-escalate violent encounters once they begin. And of course, most alcohol purchased from off-premise outlets is consumed in homes or other private or semiprivate settings where there is a lack of formal and informal social control mechanisms in place to limit the occurrence and escalation of violent events. This is especially true in our study area, where college house parties are common. Last, the association between bar density and assault may exist because of the common view of bars, especially college bars, as places where anything goes, as patrons take “time-out” from everyday norms. Fights and other displays of masculinity may even be expected in these settings. In such deviant places (Stark, 1987), behavior that normally would not be tolerated becomes accepted, rules about interpersonal respect and tolerance become clouded, and behavior that under normal circumstances would not be bothersome to individual patrons may become troubling especially in the presence of bystanders and consumption of alcoholic beverages.

There are a few major limitations to our analyses that must be considered. First, we use data based on police records of those assaults that are actually reported to the police. Many acts of low-level violence and even more serious acts of violence go unreported and thus the dependent variable is likely a conservative estimate of the true levels of assaultive violence in a college town. However, if reporting and recording procedures are similar across units of analysis (Baumer, 2002), which is likely the case as the data are recorded and provided by one recording office that is a part of Bloomington Police Department, and acts of serious violent behavior are likely to be similarly reported across different block groups, then the measurement limitations associated with police records are less problematic.

A second limitation is associated with the major independent variables used for the analysis. Although total outlet density, as well as the density of off-premise outlets, restaurants, and bars is a commonly used proxy for measuring the influence of alcohol on violence, it is a limited measure because it does not inform us how much alcohol is sold or consumed within block groups. In addition, this proxy also fails to take into account other characteristics of outlets that may be associated with differential risk of assault (e.g., the location of the outlet, the shelf space devoted to alcoholic beverages, whether the outlet sells single-serve beverages, ratio of male to female employees, ratio of employees to patrons, etc.). A study that controls for actual alcohol sales or alcohol consumption within Bloomington block groups would provide more informative estimates of the association between alcohol outlet density and assault density. Unfortunately, such data are proprietary information and unavailable for analysis.

A third main limitation of this study is associated with the potential moderating role that other community characteristics may play in the association between alcohol outlets and assaults. While this study controls for several structural covariates of violence, these and other community characteristics (e.g., social disorganization, land use) may serve to moderate or mediate the association between alcohol outlet density and assault density. For example, recent studies by Pridemore and Grubesic (2012a, 2012b) found that in a large urban city, the association between alcohol outlet density and assault density is stronger in disorganized block groups and in block groups with heavy industry and public housing. Future studies of the association between alcohol outlets and assaults should examine whether this moderating effect exists in nonmetropolitan college towns as social disorganization and land use may operate differently in nonmetropolitan or college towns or small towns in general in their relation to crime and how they influence relationships with crime of other variables like alcohol outlet density.

# Conclusion

In sum, this study examined whether relationship between alcohol outlet density and assault density exists in a nonmetropolitan college town. We did so by using data from quintessential college town of Bloomington, Indiana, using block groups as our unit of analysis, taking into account different types of outlets and varying levels of assault, and estimating spatial lag regression models where appropriate to take into account spatial autocorrelation. The results of model estimation revealed that in a college town, the relationship between different types of outlets and different types of assaults varies. Significant relationships exist between simple assaults and the density of all outlets, restaurants, bars, as well as between aggravated assaults and the density of off-premise outlets and bars. These results are largely consistent with the empirical literature on alcohol outlet density and assaultive violence in larger urban settings (e.g., Roman et al., 2008; Scribner et al., 1995; Zhu et al., 2004) and the main contribution of this study to the alcohol–violence literature is discovering that the association between alcohol outlet density and assault density holds in a nonurban setting.

The implications of these findings are important for public policy. Most of the structural factors that are consistently found to be associated with violence, such as poverty and social disorganization (Pridemore, 2011; Shaw & McKay, 1942), are difficult to change through policy mechanisms. However, a structural characteristic of a neighborhood like alcohol outlet density is more amenable to change (though still difficult) via policies that would either set density thresholds or not allow a new off-premise outlet within a certain distance of an existing one. Such alcohol policies can promote responsible alcohol service and consumption, and subsequently reduce alcohol-related harm, including violence, in the communities.

Future studies should undertake similar research in other nonmetropolitan college towns to test the generalizability of our findings. Research on smaller communities should also test whether other community characteristics (e.g., social disorganization, ethnic/racial density) influence the association between alcohol outlets and assaults. For example, social disorganization and land use have been recently found to moderate the association between alcohol outlet density and assault density in a large city (Pridemore & Grubesic, 2012a, 2012b). This is important, as recent research found that social disorganization gives rise to high alcohol outlet density (Nielsen et al., 2010). These important structural characteristics have been examined in large urban cities, but less is known about whether these same characteristics would influence the relationship between alcohol outlet density and assault density in a nonmetropolitan college town. This is important because social disorganization and land use may operate differently in small towns in their relation to crime and they may moderate the relationship between crime and alcohol outlet density.

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