Socio-Spatial Patterning of Off-Sale and On-Sale Alcohol Outlets in a Texas City

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Abstract

Introduction and Aims—To examine the socio-spatial patterning of off-sale and on-sale alcohol outlets following a policy change that ended prohibition of off-sale outlets in Lubbock, Texas.

Design and Methods—The spatial patterning of alcohol outlets by licensing type was examined using the k-function difference (D statistic) to compare the relative degree of spatial aggregation of the two types of alcohol outlets and by the spatial scan statistic to identify statistically significant geographic clusters of outlets. The sociodemographic characteristics of the areas containing clusters of outlets were compared to the rest of the city. In addition, the socioeconomic characteristics of census block groups with and without existing on-sale outlets were compared, as were the socioeconomic characteristics of census block groups with and without the newly issued off-sale licenses.

Results—The existing on-sale premises in Lubbock and the newly established off-sale premises introduced as a result of the 2009 policy change displayed different spatial patterns, with the latter being more spatially dispersed. A large cluster of on-sale outlets identified in the north-east of the city was located in a socially and economically disadvantaged area of the city.

Discussion and Conclusion—The findings support the view that it is important to understand the local context of deprivation within a city when examining the location of alcohol outlets and add to the existing research by drawing attention to the importance of geographic scale in assessing such relationships.

Keywords

alcohol outlets; spatial patterns; neighbourhood socioeconomic conditions

Introduction

Problems such as youth violence, child abuse and neglect, and domestic violence take an especially heavy toll on communities that are disadvantaged and disenfranchised [1,2]. Recently research has begun to focus on the part the local built environment plays in the generation of such problems [3]. One such feature that has attracted the attention of researchers is the alcohol environment, especially the physical availability of alcohol through bars, liquor stores and other outlets such as supermarkets and convenience stores. Indeed, a growing body of research exists showing an association between local alcohol availability and both alcohol consumption and alcohol-related harms such as violence and child abuse [4-6]. This has led researchers to speculate as to whether an over-concentration

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of alcohol outlets in disadvantaged neighbourhoods might contribute to the problems that these experience.

To this end, a number of ecological studies have examined the location and density of alcohol outlets in relation to economic deprivation and/or racial and ethnic composition of neighbourhoods. To date, four national studies, two in the USA and two in New Zealand, have been conducted. Using more than 9000 urban zip codes in the US as the unit of analysis, Romley et al. [7] found that density was higher in non-white low-income neighbourhoods compared to white low- and high-income areas and non-white high-income areas. The results for bars, however, were less clear as these were sensitive to the population density of the zip code and the measure of outlet density employed (per capita versus per roadway mile). Berke et al. [8] expanded upon the study of Romley et al. [7] by including rural as well as urban communities and additional types of outlets such as gas stations and grocery and convenience stores. They found a high density of outlets in urban tracts with higher levels of poverty and a greater proportion of African American and Hispanic residents. No association was found in suburban or rural tracts. The first of the New Zealand studies examined the number of alcohol outlets in 22,780 urban census mesh-blocks (average population of about 100) and found a clear social gradient, with more outlets in more deprived neighbourhoods [9]. In the later study from New Zealand, Hay et al. [10] examined roadway travel distance to the nearest alcohol outlet for rural census units as well as urban, and found that distance to bars, pubs, clubs and liquor stores was shorter in deprived areas than wealthier areas. The effects were stronger in urban areas than rural.

Another group of studies has focused on the association between alcohol outlets locations and economic deprivation and/or racial and ethnic composition within small geographic units of a single location such as a city, county or state. The early study of Gorman and Speer [11] was primarily a descriptive analysis focused on four neighbourhoods in Newark, New Jersey with the highest concentration of alcohol outlets. These contained a quarter of the city's population but more than half of its alcohol outlets. Two of the high outlet-density neighbourhoods were very poor and contained a high concentration of African American and Hispanics, but the others were the central business district and a more affluent area with many restaurants. In a more formal statistical analysis, LaVeist and Wallace [12] examined the association between per capita off-premise outlets and percent population African American in 194 census tracts in Baltimore, Maryland and found that such outlets were more likely to be located in predominantly African American neighbourhoods. Two other US studies of off-premise outlets have examined economic deprivation as well as racial/ethnic composition. In the first of these, Bluthenthal et al. [13] examined the association between two measures of alcohol availability (outlets per roadway miles and outlets per capita) and four socioeconomic indicators (percent of males unemployed, percent of families living below the poverty level, percent of households on public assistance, and median household income) and racial/ethnic composition (percent African American, Hispanic or white) in 187 census tracts in Los Angeles, California and southern Louisiana. Of the socioeconomic indicators only percent of families living below the poverty level was associated with density measured in outlets per mile in the multivariate analysis and none of these indicators were associated with the per capita measure. Of the racial/ethnic composition variables, the only association found was an inverse relationship between per cent African American and outlets per roadway mile. Nielsen et al. [14] examined both racial/ethnic composition and indicators of three measures of social disorganization, one of which was socioeconomic disadvantage. This analysis of 1853 outlets in 424 Census tracts in San Diego County, California found that socioeconomic disadvantage was predictive of the number of outlets in a tract but that its racial/ethnic composition (percent African American or percent Hispanic) was not.

Studies of specific cities and states from outside the USA have focused on economic deprivation and not race/ethnicity. Livingstone [15] examined the distribution of alcohol outlets in the state of Victoria, Australia, using Census Collection Districts (average population of about 500). The patterns differed between urban and rural districts: in the latter, density of all types of outlets was greater in areas of economic disadvantage, whereas in the former the density of clubs and off-sale outlets was greater in disadvantaged areas but density of hotels and restaurants was greater in advantaged areas. Schneider and Gruber [16] examined the location of 353 alcohol outlets in 18 of the 269 "social areas" (defined as conjoined clusters of streets and houses which share certain characteristics and attributes) in the city of Cologne, Germany. Results showed that as the affluence of the area declined the average distance to an alcohol outlet decreased and density of outlets increased. Finally, a recent study by Ellaway et al. [17], which examined the spatial distribution of alcohol outlets in Glasgow, Scotland, found a mixed pattern with some economically deprived areas containing a very high concentration of outlets while other such neighbourhoods contained a very low concentration.

The current analysis used data from a study of the effects of the introduction of off-sale outlets in Lubbock, Texas [18] to explore demographic and socioeconomic characteristics of neighbourhoods with and without newly opened alcohol outlets and those with and without existing on-sale outlets. In addition, the relative degree of spatial clustering of the two types of outlets was assessed and the demographic and socioeconomic characteristics of the Census tracts within which clusters occurred were examined.

Data and methods

The study was conducted using data pertaining to the city of Lubbock, Texas (estimated 2011 population = 233,740, plus about 31,000 students at Texas Tech University). Lubbock is somewhat different from cities examined in previous studies of neighbourhood demographic and socioeconomic conditions and alcohol outlet density and location. It is geographically isolated, with the closest population centre being Amarillo (124 miles away), followed by Oklahoma City, Fort Worth, Albuquerque and Las Cruces (each of which is 300 to 400 miles away). In addition, three of the eight counties surrounding Lubbock are totally "dry" (i.e. the sale of alcohol beverage is illegal) and none of the remaining five is totally "wet" (about half of the precincts in four of these countries are dry, and the one county that has no dry precincts allows only off-premise sales of beer and wine). Also, with 20% of the population living below the poverty level, the city has a higher poverty rate than Texas (17%) and the USA (15%) [19,20]. This is quite a lot higher than the poverty rate of 13% for San Diego County (studied by Nielsen et al. [14]), about the same as the rate of 22% for Baltimore (studied by LaVeist and Wallace [12]) but lower than the rate of 26% for Newark and New Orleans (studied by Gorman and Speer [11] and Bluthenthal et al. [13], respectively) [21-24]. In addition, Lubbock has a relatively small African American population (8.2% according to the 2010 US Census) but quite a large Hispanic population (32.1%) [19]. Most of the remaining population of the city is non-Hispanic white (55.7%) [19].

The new alcohol licensing policy that introduced off-sale premises in the city went into effect on 23 September 2009 [18]. Accordingly, off-sale permits issued after the policy change, as well as on-sale outlets active during the same time period (i.e. September 2009 to December 2011), were identified through the Texas Alcoholic Beverage Commission online database. This includes the name, address, issue and expiration dates, and type of permit of the outlet, specifically off-sale venues (e.g. package good stores, convenience stores, gas stations, supermarkets) versus on-sale venues (e.g. bars, restaurants, private clubs) [25]. All alcohol outlets were geocoded by street address with 100% match rate, and these geocoded

locations by licensing type were used for further spatial and statistical analyses. Additionally, the following Census block group data on neighbourhood population and socioeconomic variables were obtained from the 2006-2010 American Community Survey five-year estimate [26]: % Black, % Hispanic; % population that is male and aged 15–24, % population over 16, % unemployed over age 16, % female-headed households with children, % families below poverty, % of residents over age one who have lived in the different house one year ago, % homes that are renter-occupied, and % vacant housing units.

The spatial patterning of alcohol outlets by licensing type was examined by two spatial clustering methods. First, the k-function difference (D statistic) was used to compare the relative degree of spatial aggregation (both the direction and spatial range of the difference) of the two types of alcohol outlets [27]. Under the null hypothesis of random distribution of outlets within the two datasets, the expected value of the difference is zero (i.e. the k-functions of the two datasets are the same). Positive values of the D statistic indicate a more strongly aggregated pattern to the data, while negative values indicate less spatially aggregated patterns in the data relative to the spatial patterns of the comparison dataset. When the estimated D statistic deviated from zero by greater than two standard deviations, this was interpreted as a statistically significant difference between the two spatial patterns. The D statistics was evaluated over a 5 mile distance in sequential steps of one mile, and 95 % confidence intervals on the D statistic were obtained. Additionally, the spatial scan statistic with spatial Bernoulli model was employed to identify statistically significant clusters of alcohol outlets. We used point locations of on-sale and off-sale outlets to identify the geographic location of clusters, and 999 Monte Carlo replications were performed to calculate relative risks and log likelihood ratio [28].

Lastly, with regard to the association between the location of each of the two types of alcohol outlet and socioeconomic indicators of neighbourhood deprivation two analyses were conducted. First, the demographic and socioeconomic characteristics of census block groups with and without existing on-sale outlets during the period September 2009 through December 2011 were compared, as were the demographic and socioeconomic characteristics of census block groups with and without the newly issued off-sale licenses. Second, clusters of each type of alcohol outlet were identified and the demographic and socioeconomic characteristics of the areas containing clusters of outlets were compared to the rest of the city.

Results

Figure 1a shows the location of all of the newly established off-sale outlets during the 28-month period following the alcohol policy change (n=150) and Figure 1b shows the location of the active on-sale outlets for the same time period (n=224). In addition, Figure 1b shows the two clusters of on-sale outlets that were identified using the spatial scan statistic. A large cluster of on-sale outlets was identified in the north-east of the city (Cluster A in Figure 1b), while a smaller cluster was identified in the south-east of the city (Cluster B in Figure 1b). These clusters include approximately 15% (n=25) and 9% (n=16) of the block groups in the city, with an average population (16 years and older) of 943 and 1016, respectively (similar to the average population size of 1,019 in the rest of city). Other neighbourhood demographic and socioeconomic characteristics were further compared between clusters and the rest of city (shown in Table 2 below). No such clusters were identified for the off-sale outlets which reveal a more scattered spatial pattern, especially along the main roads crossing the city. Specifically, as shown in Figure 1a, the new off-sale outlets concentrated along the main highways that ran through the city or along the roads running east-west across the city (indicated by either the highway or street number on the map). Of the 115

new off-sale premises, 117 (77%) were located along these roads or within one third of a mile of them.

Figure 2 presents the results of the analysis that examined the difference in k-function between off-sale outlets and on-sale outlets (the solid line indicating the D statistic and the dotted lines the 95 % confidence limits). It shows that there was a statistically significant difference for spatial scales up to three miles between the patterning of the newly opened off-sale outlets and the existing on-sale outlets, with the former being less spatially aggregated than the latter.

Table 1 compares the socioeconomic characteristics of Lubbock census block groups with and without newly issued off-sale outlets as well as active on-sale outlets during the same 28-month time period. More than half of the block groups contained at least one on-sale outlet (51%) or one off-sale outlet (55%), and the population size of each was similar (an average of 1,016 individuals 16 years and over for block groups with an on-sale outlet and an average of 990 individuals 16 years and over for block groups with an off-sale outlet). Block groups with active on-sale outlets were lower in % female-headed households with children and % Black and higher in % population over age 16 years than those without outlets. No differences were observed between block groups with and without newly established off-sale premises.

Table 2 compares the demographic and socioeconomic characteristics of Lubbock Census block groups encompassed within the two clusters of on-sale outlets (identified in Figure 1b) with the remainder of the block groups in Lubbock. With the exception of having a lower % Hispanic population and a higher % population over 16 there were no statistically significant differences between the block groups encompassed within the smaller cluster in the south-west of the city and those in the rest of the city. In contrast, the block groups within the larger cluster in the north-east of the city had a significantly younger population (especially young males), significantly more Hispanics, a significantly more transient population (as indicated by higher % rental properties and population movement, and more vacant housing), and higher levels of poverty and unemployment.

Discussion

The results of the analysis focused on the entire city are discussed first, as this is most in keeping with the type of analysis conducted in previous studies. This is followed by a discussion of the results of the exploratory clustering analysis. Finally, a discussion of some of the limitations of the work presented herein is presented. First, when block groups for the entire city were used as the unit of analysis no association between outlet location (on-sale or off-sale) and socioeconomic disadvantage was observed. This is neither consistent nor inconsistent with the results of previous studies as these present something of a mixed bag. As discussed in the introduction, the national studies suggest that location of the community matters (e.g., urban versus rural) as does type of outlet, population density, and the measure of outlet density used in the analysis. The studies of smaller geographic units also give a somewhat mixed picture, especially with regard to race/ethnicity. Two found no effect for the race/ethnic composition of communities [13,14], whereas one found strong effects [12]. The findings regarding economic deprivation are more consistent, with studies from the US, Europe and New Zealand all showing a strong tendency for outlets to concentrate in disadvantaged neighbourhoods. However, even some of these studies [e.g. 11,17] found that some of the more affluent neighbourhoods had high densities of certain types of outlets such as nightclubs or restaurants.

Like the descriptive analysis of Gorman and Speer [11], which identified two specific Newark neighbourhoods with high concentrations of alcohol outlets and very high concentrations of minority groups, our exploratory clustering analysis identified one socially and economically disadvantaged area of the city that had a high concentration of on-sale outlets. In contrast, the analysis identified no such clusters of off-sale outlets. Rather these were dispersed throughout the city and especially along the major highways and roads that run through it. As in most Texas cities, people in Lubbock move around by car rather than walk and its off-sale outlets appear placed to be easily accessible to the adult population of the city as it goes about its routine activities (such as traveling to work and buying groceries). It is worth noting in this respect that a great many of the new off-sale outlets were simply located within existing commercial premises such as convenience stores, gas stations, pharmacies, mini-marts and supermarkets. Thus, the pattern observed in the maps and spatial analysis (i.e., spread out along major roadways) is likely to be one typical to convenience stores rather than liquor stores *per se*. These findings support the view that it is important to understand local context when examining access to alcohol within a city [17]. Specifically with regard to off-sale outlets, Texas is a state in which people drive a great deal rather than walk, and alcohol is frequently sold in places that also sell other basic consumer products such as food, clothing and gasoline.

The broader implications of this for the study of the geographic and spatial distribution of alcohol outlets within a community is that it might be a phenomenon best approached from a mechanistic or systems perspective that eschews the making "law-like" statements (e.g. "alcohol outlets will always concentrate in poor neighborhoods") and instead emphasises the locality and specificity of causal processes. As noted by Hedstrom and Ylikoski "Whether *a* is a cause of *b* depends on facts about spatiotemporally restricted causal process, not on what would happen in other similar situations" [29, p. 53]. Accordingly, the reasons that the spatial patterning of alcohol outlets in *Place A* looks the way it does, and looks different from the spatial patterns observed in *Place B* and *Place C*, will largely depend on the initial conditions and dynamic processes at play within each location.

Viewed from such a systems perspective [30,31], it would be surprising if the spatial patterning of outlets in Lubbock looked like the spatial patterning of outlets in Newark, or San Diego, or New Orleans, or Baltimore, since the initial conditions and internal dynamics of each place are very different. Lubbock is a relatively newly-developed and planned city, built on a grid system with cell-shaped block groups in most areas. Thus, it is different from older cities with smaller and irregular-sized block groups, highly concentrated economic activities (e.g., central business districts) and historical segregation of certain sociodemographic groups into specific neighbourhoods. It is one of the fastest growing "Sunbelt" cities in the south-west United States, whereas old industrial cities such as Newark, Baltimore and New Orleans have seen a decline in population over the past 30 years. As noted above, Lubbock is a geographically isolated location (being the principal city of the Lubbock Metropolitan Statistical Area that includes only three sparely populated counties), whereas Newark, Baltimore and San Diego are each part of much larger urban conurbations. Lubbock is very much a university town, while New Orleans has a tourist industry focused on entertainment and dining and San Diego is the homeport of the US Navy's Pacific Fleet as well as being home to one of the largest training facilities for the US Marines. All of the aforementioned differences will affect the spatial patterning of alcohol outlets within these locations, and will help explain why the patterns in Lubbock look different to those in other US cities. This is not to say that statements about the regularities of phenomena such as alcohol outlet locations are impossible and that every place is a totally unique case, but rather that there will be limitations to the generalizability of such statements [29]. And given the relatively small number of places in which the spatial patterning of alcohol outlet locations has been studied, and the myriad of differences between these

places, it is not at all surprising that broad statements about the regularities of this phenomenon are currently difficult to formulate.

There are two main limitations of the research presented in this paper. First, it should be acknowledged that the clustering analysis was very much an exploratory exercise. The more traditional analysis using Census block groups as the unit of analysis revealed few positive associations, but what appeared to be different spatial patterns for on-sale and off-sale premises were evident in the maps. The clustering analysis allowed these to be quantified, but it was conducted *post hoc* (as was the analysis of the demographic and socioeconomic features of the two clusters of on-sale outlets). Second, the licensing codes of the Texas Alcoholic Beverage Commission do not allow a very fine distinction between alcohol outlets within the broad categories of off-sale and on-sale. Thus, we were unable to examine whether specific types of outlets (e.g., bars rather than restaurant) concentrated in specific areas of the city.

Acknowledgments

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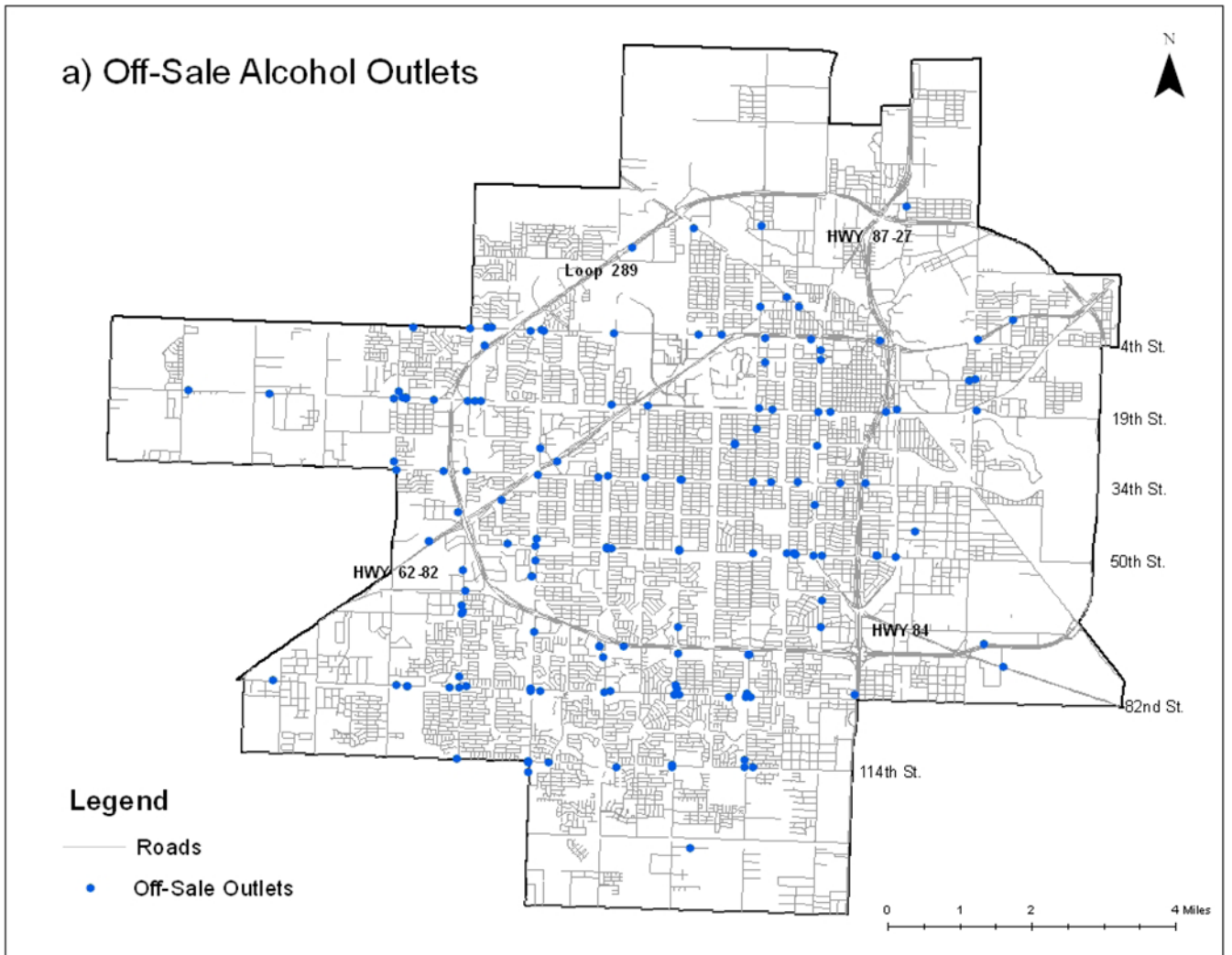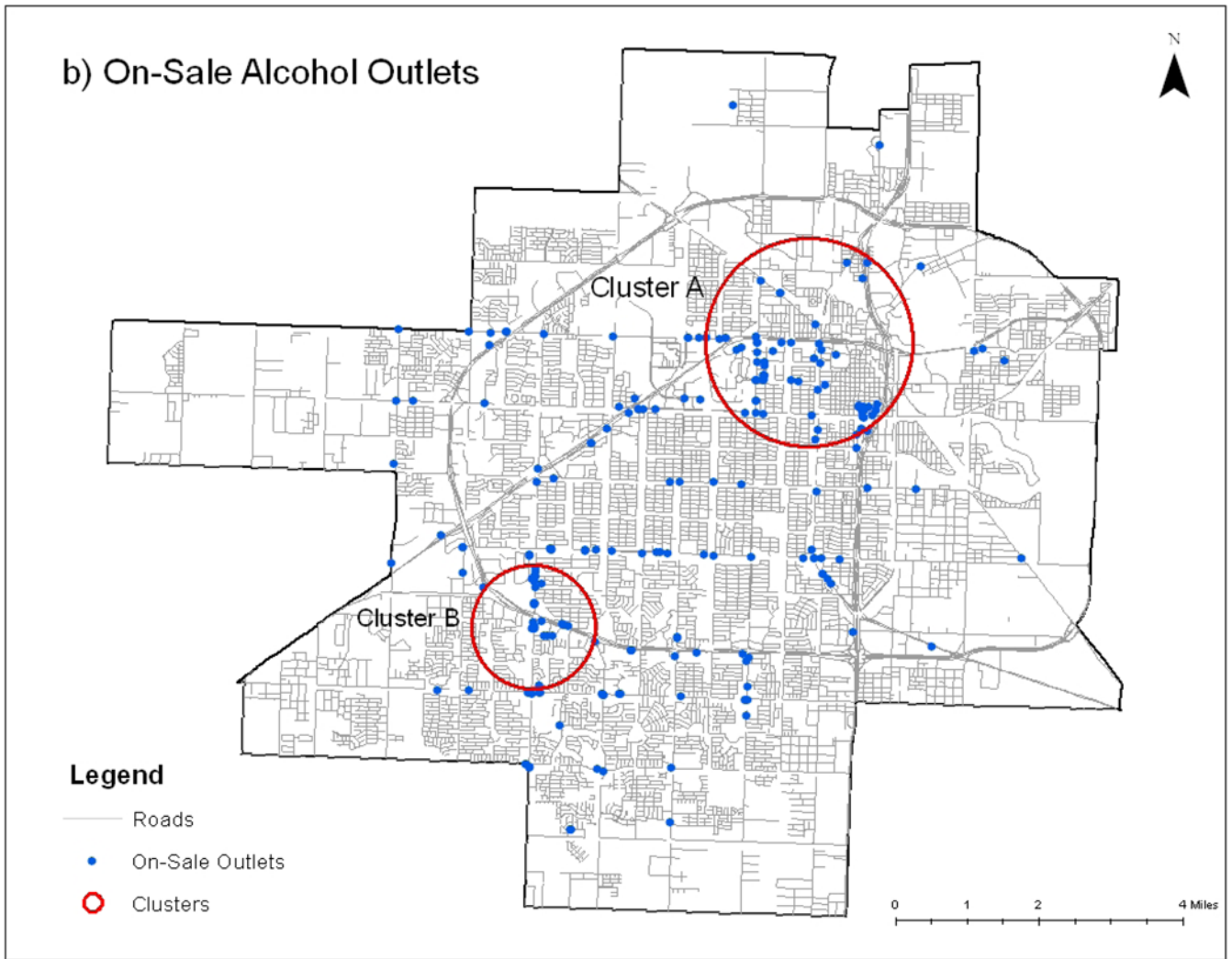
Figure 1.
Spatial patterns of alcohol outlets by license type: a) Off-sale; b) On-sale.
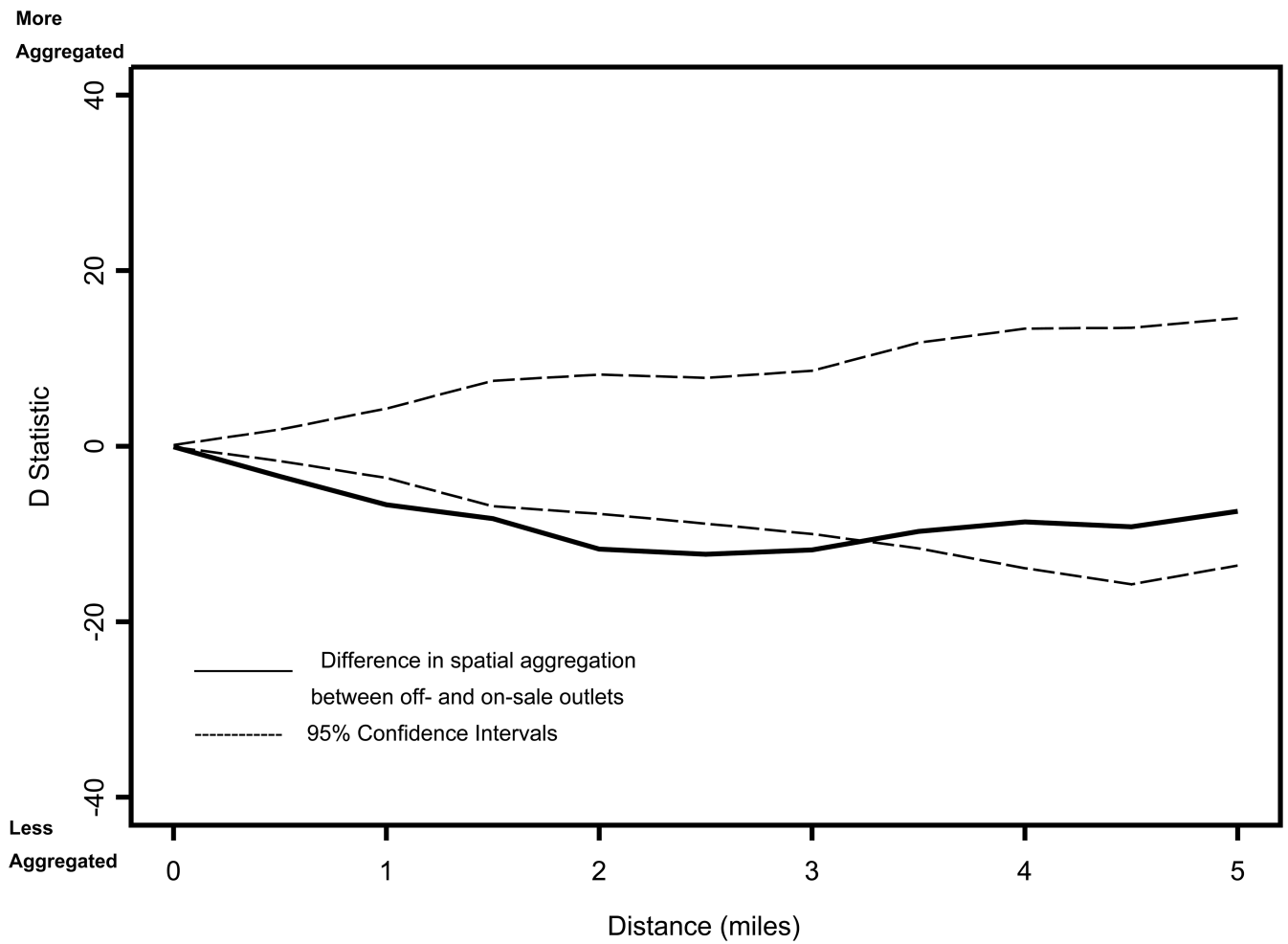
Figure 2.
Difference in k-Function between off-sale and on-sale outlets (D statistic, solid line) with
95% confidence intervals (dashed lines) (September 2009 – December 2011).

Table 1

Socioeconomic characteristics (Mean/SD) of Lubbock Census block groups with and without on-sale and off-sale alcohol outlets (September, 2009 –December, 2011)

	Active on-sale license		Newly issued off-sale license	
	Block groups without outlets	Block groups with outlets	Block groups without outlets	Block groups with outlets
Unemployed (%)	18.8(9.1)	18.7(9.2)	18.0(8.4)	19.3(9.7)
Poverty (%)	17.5(19.2)	15.7(20.9)	16.2(17.3)	16.9(22.1)
Vacant housing (%)	9.3(8.9)	9.2(8.5)	8.4(8.1)	10.0(9.1)
Female-headed household with children (%)	12.0(10.5)	8.0(8.0)**	9.7(10.2)	10.2(8.9)
Renter (%)	42.6(27.1)	45.6(27.2)	42.8(25.0)	45.2(28.7)
Mover (%)	26.4(16.2)	27.6(19.3)	28.6(18.3)	25.7(17.3)
Male 15-24 (%)	10.4(8.9)	12.9(13.4)	12.5(13.3)	11.0(9.7)
Population > 16 (%)	77.8(9.0)	81.7(9.2)**	80.4(10.5)	79.3(8.2)
Black (%)	10.9(18.6)	6.2(10.5)*	8.9(15.0)	8.2(15.4)
Hispanic (%)	33.3(25.4)	28.8(23.7)	30.2(24.3)	31.7(24.9)

*
$P < 0.05$

**
$P < 0.01$

Table 2

Socioeconomic characteristics (Mean/SD) of Lubbock Census block groups encompassed by each of the two clusters of on-sale alcohol outlets compared to the remaining census block groups in the city (Cluster A in the north-east of the city and Cluster B in the south-west of the city; see Figure 1b)

	Cluster A		Cluster B		Rest of Lubbock	
	Mean	SD	Mean	SD	Mean	SD
Unemployed (%)	26.5**	12.9	14.6	8.0	17.5	7.1
Poverty (%)	30.9**	29.4	9.5	17.9	14.2	15.9
Vacant housing (%)	12.6*	9.8	6.8	9.0	8.8	8.2
Female-headed household with children (%)	8.8	9.4	7.1	7.8	10.6	9.6
Renter (%)	67.4**	28.6	49.6	31.8	38.9	24.0
Moved (%)	39.5**	27.7	26.7	17.2	24.2	13.3
Male 15-24 (%)	23.2**	20.1	9.4	6.6	9.3	6.7
Population > 16 (%)	83.4**	13.3	84.4**	8.3	78.4	7.8
Black (%)	8.1	14.6	2.9	4.4	9.3	16.1
Hispanic (%)	46.3**	33.7	16.6*	13.8	29.3	21.5

*
P < 0.05

**
P <0.01

Drug Alcohol Rev. Author manuscript; available in PMC 2015 March 01.