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Alcohol outlets and youth alcohol use: Exposure in suburban areas

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Abstract

The purpose of this study was to explore how exposure to alcohol outlets (around home and school) influenced alcohol use among 242 high-school students (mean age 16.4, 48.8% male, 93.4% White). Results found no relationship between alcohol outlet exposure, using a measure of both distance to and density around students' homes and schools, and alcohol use. This study suggests that outlet exposure may not influence alcohol use among mostly White, middle- class, and suburban youth. However, the lack of association may also reflect the lower level of alcohol outlets present in low-density residential environments as well as differences in accessibility.

Keywords

alcohol outlet density; adolescent alcohol use; alcohol outlet exposure

Introduction

Alcohol use is common among youth. By twelfth grade, 72.7% of adolescents report ever using alcohol and 56.4% report having been drunk at least once (Johnston et al., 2007). However, alcohol use in adolescence is associated with a wide array of negative consequences (Stueve and O'Donnell, 2005), such as adolescent injuries, drinking and driving and an increased rate of other risk behaviors, including sexual activity, violence and drug use (DiClemente et al., 2001, Romer, 2003, Jessor, 1998).

There are three main social and environmental factors that have been suggested as risks for adolescent alcohol use. First, family factors have been found to be important predictors of adolescent substance use (Coombs et al., 1991, Resnick et al., 1997, Wills et al., 2003). Second, peers have been shown to influence alcohol use though modeling behavior (Field et al., 2002, Hawkins et al., 1997, Kosterman et al., 2000, Simons-Morton et al., 2001) peer influence (Sieving et al., 2000) and peer norms (Maney et al., 2002).

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The third factor of influence is the physical environment. Some forms of communication and influence are located in space. Alcohol advertising on billboards, buses, and similar places is one such environmental influence that has been found to shape adolescent's beliefs, attitudes and alcohol behaviors (Ellickson et al., 2005, Fleming et al., 2004, Grube and Waiters, 2005, Grube and Wallack, 1994, Mazis, 1995, Pasch et al., 2007, Snyder et al., 2006, Stacy et al., 2004). Exposure to alcohol outlets due to distance, densities in a specific area, or liberal opening hours and low drinking age requirements may be another important adverse environmental influence. Higher alcohol outlet densities have been found to be related to self-reported youth drinking and driving (Treno et al., 2003) and associated with heavy drinking, frequent drinking, and drinking-related problems among college students (Weitzman et al., 2003).

This spatial relationship of alcohol-related problems and alcohol outlet density has been well explored among adults, as have the predictive nature of alcohol outlet density to alcohol consumption patterns and the relationship of alcohol-related mortality and morbidity and social context (Freisthler et al., 2003, Gruenewald et al., 1996, Hanson and Wieczorek, 2002, Millar and Gruenewald, 1997, Wieczorek and Hanson, 1997, Livingston et al., 2007). Research has also shown that increased density of neighborhood alcohol outlets has been associated with decreases in social capital (Theall et al., 2008), increased violence in suburban areas (Livingston, 2008), increased assault rates (Livingston, 2007, Reid et al., 2003), increased violent crime rates (Zhu et al., 2004), increased rates of child maltreatment (Freisthler et al., 2005), and increased rates of motor vehicle crashes (Treno et al., 2007). Yet, there is a paucity of published literature on youth alcohol use and distance to and density of alcohol outlets. The exposure to alcohol outlets is important among adolescents, particularly as the distance to and density of alcohol outlets may increase access for youth and alter perceptions of an environment such that alcohol use is seen as normative. As Gruenewald (2007) has suggested "alcohol outlets are environmental features of communities that expose populations to opportunities to drink and socially model others' drinking behavior (p.870)".

Therefore, the purpose of this study was to explore how exposure to alcohol outlets was associated with adolescent alcohol use. In particular, this study examined the density of alcohol outlets around the adolescent's home and school, distance to outlets from home and school and exposure en-route from school to home. We hypothesized that exposure to increased alcohol outlets would be related to increased past month alcohol use and drunkenness.

Methods

Participants

The data for this study are from the Transdisciplinary Research on Energetics and Cancer - Identifying Determinants of Eating and Activity study (Lytle, under review). Adolescents and one of their parents (n=349 student/parent pairs) were recruited from within the seven-county metropolitan area of Minneapolis-St. Paul, Minnesota. The adolescents were primarily White (93.4%), with a mean age of about 15 years. Approximately half (48.8%) were male, and nearly 80% of the sample lived with both parents. Students attended schools mostly in suburban areas (83.6% suburban, 16.4% urban). Given the very low prevalence of risk behaviors among junior high and middle school students in this sample (0% for past month drunkenness and 2% for past month alcohol use), the participants in this analysis were limited to those who were in high school (9–11th grades) (n=242). See Table 1 for demographic information.

Measures

Geographic Information System (GIS) data were used to calculate the distance to and density of alcohol outlets from a participant's house, his/her school and the path between. Distance measures closest exposure, density the likely frequency of exposure. (Forsyth and Lytle, Under

review). Dun and Bradstreet 2006 (www.dnb.com) business data provided an address for any bar or store selling alcohol. Distances and density were calculated in two ways, network and straight line. Network refers to a path from the source (participant's home, school, route) and the alcohol outlet that can be reached by someone on foot along a street network. A straight line distance refers to the straight line distance to or density of alcohol outlets from the source (participant's home, school, route), regardless of street patterns. Using ArcGIS v.9 (ESRI, 2005), network and straight line distances were calculated from the participant's home and school to the nearest store or bar selling alcohol. Densities or numbers of stores were also calculated in network and straight line buffer distances by dividing the total number of stores or bars selling alcohol by the land area, excluding water. Buffer distances calculated ranged from a 200 meter buffer to a 3000 meter buffer. For the purposes of this study, largely due to the suburban geography and to maximize variability, we chose to examine the 3000 meter buffers (i.e., nearly 2 miles). In addition, the youth in our sample are more mobile and may be better able to travel further from the home or school environment, therefore, the 3000 meter buffer was also chosen to reflect this potential increased exposure.

Students completed a questionnaire which included two questions adopted from the Monitoring the Future Study to assess alcohol use (Johnston et al., 1998). The first question asked how many times in the past month they had alcohol to drink, including beer, wine and liquor (not including sips) with response options ranging from 0 to 40 or more. The second question asked how many times in the past month they had "gotten really drunk" from drinking alcoholic beverages. Response options ranged from 0 to 10 or more times. The Institutional Review Board at the University of Minnesota approved all study methods.

Analysis

Descriptive analyses of the exposure (alcohol outlets) and outcome (alcohol use) variables were conducted to determine the distribution of each of the variables. Cross-sectional linear regression analyses using PROC GLM in SAS (version 9.1) (SAS, 2005) were conducted to assess how exposure to alcohol outlets (density around home and school, distance from home and school, and density of home to school route) influenced past month alcohol use and past month drunkenness. Several covariates (gender, school grade, and parent's highest level of education) were selected for inclusion in the models, based on previously documented associations with the exposures and outcomes of interest here and their potential role as confounders (U. S. Department of Health and Human Services, 2007, Donovan, 2007, Pemberton et al., 2008). Parent's highest level of education represented the highest level of education for the parents who resided in the house (assessed on the parent survey). For the analyses assessing exposure to alcohol outlets around schools, additional analyses were conducted with school level covariates (% of students receiving free/reduced lunch and % White). These additional covariates did not change the final results; therefore the results from the more parsimonious models are presented here.

Missing data on individual survey items ranged from 0.01% (parent's education) to 0.004% (past month alcohol use). Observations with missing data were excluded from models; thus while the total sample size was 242, individual models do vary in sample size.

Results

The prevalence of alcohol use in the past month was 26.1% and past month drunkenness was 8.7%. The density of alcohol outlets within 3000 meters around the student's home, both on a network route and a straight route, was low (see Table 2). The average count of alcohol outlets within 3000 meters street network distance of the student's home was 3.9 (range 0–57) and the mean within 3000 meters straight line distance was 6.7 (range 0–26). The average distance

from the student's home to the nearest alcohol outlet on a network route was 2835.6 meters (just over 1 3/4 miles). On a straight route the distance was 2121.2 meters (almost 1 1/3 miles).

The density of alcohol outlets within 3000 meters of schools was similar to that around homes (see Table 2). The average count of alcohol outlets within 3000 meters street network distance around schools was 5.6 (range 0–30) on straight line and 7.7 (range 0–39) on a straight route. The average distance from the student's school to the nearest alcohol outlet on a network route was 1432.6 meters (0.9 miles). On a straight route the average distance was 1837.2 meters (1.14 miles). On the shortest street network route from home to school, students encountered on average 1 alcohol outlet (range 0–1).

The results of the cross-sectional linear regression analyses found that the density of alcohol outlets around the student's home on either a network or straight route was not related to past month alcohol use or past month drunkenness (see Table 3). The same null findings resulted for the count of alcohol outlets around the student's home and the distance to the nearest alcohol outlet from the student's home as well as outlets around the student's school.

Discussion

Little research to date has examined the relationship between outlet density and alcohol use among youth. Literature suggests that young adolescents primarily obtain access to alcohol from their parents, but as they progress into high school, the sources of alcohol begins to shift toward peers, older friends and commercial sources (Hearst et al., 2007), therefore supporting the hypothesis that as density increases and distance decreases (increased access), alcohol use may increase. The lack of association found in this study may be related to the lower prevalence of the exposure and outcome, or that alcohol density and distance to outlets does not play a role in alcohol use for these ages. Certainly, the traditional zoning regulation of suburban areas, by design, restricts access to commercial resources in general. In addition, suburban youth may continue to rely on parents for access to alcohol both because of distance and potentially due to stricter enforcement of access regulations in suburban areas.

This paper uses individualized measures of geographical variables—alcohol outlet distance and density. That is, people are not assigned to pre-existing geographical units that may well have unequal sizes and where several individuals may well be clustered. Rather measurement geographies are built around individuals using fine-grained, parcel-level data on the built environment. Then the geographical measures are entered into the analysis like other individual measures. While there is some overlap of buffers in the study due to proximity of respondents, further accounting for this overlap is likely to have reduced the significance of the already insignificant findings.

The lower prevalence of alcohol use and the limited exposure to alcohol outlets around home, school and on the way to school may have led to reduced power to detect an effect. While the prevalence of alcohol use was lower in this sample, research does suggest that suburban youth are not at decreased risk for alcohol use than urban youth (Levine and Coupey, 2003) and suburban youth have been shown to have higher rates of ever using alcohol than national samples (Larkin et al., 2007). Another limitation of this study is the lack of diversity in the sample. Our sample is largely White, middle-class with low prevalence of risk behaviors in general. This restricts our ability to generalize findings.

This study contributes to the larger body of literature by highlighting research on the effect of the built environment on mostly suburban adolescents. Although we found that there were relatively lower rates of alcohol use among the students in our sample, we also found fairly low exposure to alcohol outlets. While literature on suburban communities has largely focused on negative issues of transportation (Cervero and Duncan, 2003), social connectedness

(Leyden, 2003) and limitations to physical activity (Saelens et al., 2003), to our knowledge no work to date has been conducted to examine at the reduced access to alcohol outlets. In general, the body of built environment literature focusing on proximity to fast food, alcohol outlets and convenience store food access will have to contend with the low density of businesses in large, encapsulated residential neighborhoods. Additional work is needed to identify what environmental features have an influence on adolescent health outcomes as well as what distances are meaningful to be considered exposures for adolescents. In addition, research on the effect of exposure to outlets on the normative beliefs of adolescents is also needed to determine if exposure may influence adolescent's perceptions of the normative nature of alcohol use. Finally, other important next steps will be to replicate this study in an urban environment with greater proximity to alcohol outlets and a more diverse sample.

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Table 1

Descriptive demographic characteristics of the study sample (n=242)

Age, years	16.4
	%
Gender	
Male	48.8
Female	51.2
Grade level	
9th grade	19.8
10th grade	23.1
11th grade	57.0
School type	
Public	84.7
Private	13.6
Home-schooled	1.7
School location	
Suburban	89.0
Urban	11.0
Race/ethnicity	
White	93.4
African American	1.2
Asian	0.4
Mixed[1]	5.0
Family structure	
Mother and father together	79.3
Mother and father equally, but separate	2.9
Parent and step-parent	4.6
Mother mostly	11.8
Parent Education	
Less than HS	0.0
HS or GED	3.4
Some college	18.4
College degree	33.1
Training beyond college	45.2

[1] Report more than one ethnicity

Table 2

Distance, Density, and Count of Alcohol Outlets around Homes and Schools (n=242)

Home				School			
Density (total number of alcohol outlets/total land area)							
	Mean	**SD**	**Range**		**Mean**	**SD**	**Range**
3000 m network buffer	0.003	0.0	0–0.02	3000 m network buffer	0.004	0.0	0–0.02
3000 m straight line buffer	0.003	0.0	0–0.02	3000 m straight line buffer	0.003	0.0	0–0.01
Count of Outlets							
	Mean	**SD**	**Range**		**Mean**	**SD**	**Range**
3000 m network buffer	3.9	4.8	0–26	3000 m network buffer	5.6	5.3	0–30
3000 m straight line buffer	6.7	8.0	0–57	3000 m straight line buffer	7.7	7.6	0–39
Distance to closest outlet (meters)							
	Mean	**SD**	**Range**		**Mean**	**SD**	**Range**
Network	2853.6	2865.7	106.0–26,988.8	Network	1837.2	1962.1	191.3–16536.6
Straight line	2121.2	2249.8	84.9–19,941.1	Straight line	1432.6	1638.2	155.7–14430.1

Table 3

Association between Alcohol Outlet Density and Distance to Alcohol Outlets for both Home and School (n=242)

	Past 30 Day Alcohol Use			Past Month Drunkenness		
	Estimate[1]	**SE**	**p-value**	**Estimate[1]**	**SE**	**p-value**
Home						
Density						
3000 m network buffer	−1.47	12.34	0.91	7.30	8.39	0.39
3000 m straight line buffer	2.85	15.32	0.85	13.30	10.40	0.20
Count of Outlets						
3000 m network buffer	0.003	0.01	0.77	0.008	0.01	0.22
3000 m straight line buffer	0.001	0.01	0.81	0.005	0.00	0.20
Distance						
Network	−0.00002	0.00	0.17	−0.00001	0.00	0.17
Straight	−0.00003	0.00	0.19	−0.00002	0.00	0.15
School						
Density						
3000 m network buffer	−2.03	15.56	0.90	0.83	10.46	0.94
3000 m straight line buffer	1.60	17.80	0.93	−0.55	11.96	0.96
Count of Outlets						
3000 m network buffer	−0.002	0.01	0.87	−0.001	0.01	0.87
3000 m straight line buffer	0.0003	0.01	0.97	−0.001	0.00	0.85
Distance						
Network	−0.00004	0.00	0.14	−0.00003	0.00	0.19
Straight	−0.00004	0.00	0.23	−0.00002	0.00	0.35
Route from Home to School	0.44	0.71	0.54	0.17	0.48	0.72

[1] adjusted for grade, gender, socio-economic status