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Risk for Exposure to Alcohol, Tobacco, and Other Drugs on the Route to and from School: The Role of Alcohol Outlets

AJ Milam, PhD[1], **CDM Furr-Holden, PhD**[1], **MC Cooley-Strickland, PhD**[1,2], **CP Bradshaw, PhD**[1], and **PJ Leaf, PhD**[1]

[1]Johns Hopkins Bloomberg School of Public Health; Department of Mental Health; 624 N. Broadway, 8th floor; Baltimore, MD; 21205

[2]University of California-Los Angeles; NPI-Semel Institute, Center for Culture and Health; 760 Westwood Plaza, Los Angeles, CA 90095, USA

Abstract

Despite the national push encouraging children to walk to school, little work has been done to examine what hazards children encounter on the route to school. This study examined the association between the presence of alcohol outlets on children's route to school and perceived safety on the route to school as well as exposure to alcohol, tobacco, and other drugs (ATOD). Data come from a community-based epidemiological study of 394 urban elementary school students. Participants' residential address, school location, and alcohol outlet data were geocoded and the route to school was mapped. The route to school layer and the geocoded alcohol outlet data were joined to determine the number of alcohol outlets children pass on the route to school. Logistic regression models estimated the association between the presence of alcohol outlets on the route to school, alcohol and drug exposure, and self-reported safety. Children with an alcohol outlet on the route to school were more likely to be offered ATOD (OR= 2.20, p=.02) as well as be exposed to drug selling (OR=1.72, p=.02) and seeing people using drugs (OR=1.93, p=.02). After adjusting for individual-level variables the relationship between presence of alcohol outlets and being offered ATOD and seeing people using drugs remained significant. However, after adjusting for individual-level control variables and a proxy for the larger neighborhood context, the association between the presence of alcohol outlets and exposure to ATOD was no longer significant. As national campaigns are encouraging children to walk to school it is essential to consider what children are exposed to on the route to school.

Keywords

Alcohol; drugs; children; African Americans

As obesity rates continue to increase in the U.S. and globally, researchers, practitioners, and policymakers have explored possible solutions to curb the growing epidemic. Encouraging children to walk to school has been a major focus to promote physical activity and decrease obesity in children (Boarnet, Anderson, Day, McMillan, & Alfonzo, 2005; Transportation Alternatives, 2002; Tudor-Locke, Ainsworth, & Popkin, 2001). Yet, there has been a substantial decrease in the percentage of children walking to school over the past few decades. In 1961, 87% of children who lived within one mile of school walked or biked to school compared to 55% of children in 2001 (Dellinger & Staunton, 2002; McDonald, 2005). A review by McMillian (2005) found that children's travel to school should be

Corresponding author: Adam J. Milam; phone: 410-347-3209 fax: 410-955-9088; amilam@jhsph.edu.

interdisciplinary, as there are both transportation and public health factors to consider. Yet, little research has explored neighborhood factors that are associated with children walking to school and what children actually encounter on the route to school; this current investigation will explore the latter. Before practitioners and policy-makers encourage children to walk to school, there needs to be a better understanding of what hazards children may encounter on the route to school.

The current study examined the association between the presence of alcohol outlets on children's route to school and youths' exposure to alcohol, tobacco, and other drugs (ATOD) as well as their perception of safety on the route to school. Given the prior research suggesting that alcohol outlets are magnets for crime and incivility (Franklin, LaVeist, Webster, & Pan, 2010; Gorman, Speer, Gruenewald, & Labouvie, 2001; Livingston, 2008; Scribner, Cohen, Kaplan, & Allen, 1999), we hypothesized that the presence of alcohol outlets on children's route to school would be associated with increased safety concerns on the way to and from school. More specifically, several studies have consistently found that the density of alcohol outlets is associated with increased rates of violent crime. For example, Franklin et al. (2010) found a positive association between alcohol outlet density and rates of violent crime in Washington, DC, independent of neighborhood structural factors and the prevalence of weapon arrests. Studies have also suggested that decreasing the density of alcohol outlet in a neighborhood can decrease adverse outcomes including traffic injuries, alcohol consumption, and violent crimes (Holder et al., 2000; Reynolds, Holder, & Gruenewald, 1997).

The density of alcohol outlets has also been found to be associated with increased alcohol consumption among adolescents and adults and exposure to alcohol, tobacco, and other drugs (Huckle, Huakau, Sweetsur, Huisman, & Casswell, 2008; Kuntsche & Kuendig, 2005; Kypri, Bell, Hay, & Baxter, 2008; McCord & Ratcliffe, 2007; Treno, Ponicki, Remer, & Gruenewald, 2008; Troung & Strum, 2009; Weitzman, Folkman, Folkman, & Wechsler, 2003), although some studies have not found this to be true (e.g., Pasch, Hearst, Nelson, Forsyth, & Lytle, 2009; Pollack, Cubbin, Ahn, & Winkleby, 2005; Schonlau et al., 2008). For example, McCord and Ratcliffe (2007) explored alcohol outlets as crime attractors, specifically focusing on drug markets. Alcohol outlets are ideal locations for drug markets because alcohol outlets are more likely to be located in socially and physically disorganized communities, they attract drug users as many use multiple substances, and areas of violent crime tend to be accessible by public transportation. Based on the extant studies, we expected the presence of alcohol outlets on the route to school would be associated with children's increased exposure to ATOD.

The relationship between neighborhood context (e.g. social and physical disorder) and alcohol outlets is complex and understudied. Prior research has found that alcohol outlets are more likely to be in poor and disadvantaged communities (LaVeist & Wallace, 2000). Alcohol outlets and alcohol advertising are also more prevalent in minority communities (Pasch et al., 2009). Given prior research that has found a positive association between neighborhood disorder (which often includes measures of the alcohol environment) and exposure to alcohol, tobacco, and other drugs (Crum et al, 1996; Furr-Holden et al., 2011; Lillie-Blanton et al., 1993) and the work that has found a relationship between alcohol outlet density and neighborhood disadvantage (LaVeist & Wallace, 2000), it is essential to include measures of the broader neighborhood context when studying the impact of alcohol outlets.

Few studies have examined exposure to alcohol outlets and adverse outcomes during pre-adolescence (Freisthler, Gruenewald, Remer, Lery, & Needell, 2007; Freisthler, Midanik, & Gruenewald, 2004). Pasch et al. (2009) studied the association between distance to alcohol outlets, density of alcohol outlets around adolescents' home and school, and on the route to

school and its impact on alcohol use among suburban adolescents. They did not find evidence of an association between distance to alcohol outlets, or the density of alcohol outlets and adolescent alcohol use. The authors concluded that the null findings may have been due to the low density of alcohol outlets or the low prevalence of use in the sample of adolescents. Other studies have found that children walking to school in predominately minority neighborhoods were three times more likely to pass a tobacco or alcohol billboard compared to children walking to school in a predominately Caucasian community (Hackbarth, Silverstri, & Cosper, 1995). Pasch et al. (2009a) also found that alcohol and tobacco billboards were more likely to be proximal to schools with more Hispanic students.

From a policy standpoint alcohol, outlets are a salient environmental feature that can be regulated by zoning and land use regulations (Ashe, Jernigan, Kline, & Galaz, 2003). Through police powers (i.e. the right for states to make laws and regulations to govern the health and welfare of its citizens, Tenth Amendment of the US Constitution), states have the ability to designate specific zoning areas and zoning policies since alcohol outlets are associated with public health problems (e.g., crime, alcohol use; Ashe et al., 2003; Wittman, 1997). For example, in Maryland alcohol outlets cannot be within 300 feet of a church or school. Some states have also begun to limit the density of “unhealthy” businesses including alcohol outlets and fast food restaurants (Sturm & Cohen, 2009). This current study builds on prior literature suggesting that alcohol outlet density would be associated with adverse health outcomes in order to better understand the types of environmental hazards children are exposed to when in route to school.

Method

Participants

Data for this study come from the Multiple Opportunities to Reach Excellence (MORE) Project, a community-based epidemiological study. The original goal of this longitudinal study was to better understand the impact of chronic violence exposure on elementary school-aged children’s emotional, substance use, behavior, and academic functioning (Cooley-Strickland et al, 2009). The 55 Community Statistical Areas (CSAs) in Baltimore City were ranked based on homicide rate in 2002. Three violence strata were created based on the homicide rate and divided into tertiles corresponding to low, moderate, and high violence. There were 10 CSAs in Baltimore City with no homicides in 2002; these neighborhoods were placed in the low violence strata, the four CSAs in the middle of the distribution were placed in the moderate violence strata, and the four CSAs with highest homicide rate were classified as high violence. The investigators selected the two largest elementary schools in each violence strata, resulting in a sample of six elementary schools. Two of the schools originally contacted declined to participate and the next largest elementary schools were contacted and subsequently agreed to participate.

To be eligible, students had to be between the ages of 8 and 12, enrolled at one of the selected Baltimore City Public Schools, speak English, and live with an English-speaking parent or guardian. Children with serious mental disorders were not eligible for participation. Recruitment materials were distributed in classrooms and mailed to the residential addresses of eligible participants; MORE Project staff also contacted eligible households via telephone. Incentives were offered to encourage participation. Consent was obtained from parents and principals. Data collection began in January 2007 with 490 consenting families; the consent rate for the study was 67% (Cooley et al., 2009). Of the families who agreed to participate and consented, 87% had a child interview, 88% had a teacher interview, and 66% had a parent interview. Trained interviewers conducted child assessments during the school day in a private location within the school using pencil and paper and computer assessments; parent interviews were conducted over the phone or in-

person (at the parent's home or at the researchers' office); teacher interviews were conducted using a paper assessment at the end of the school year. The first cohort of children (n = 425; 87% with child interviews) was followed for two subsequent waves of data collection.

The analytical sample included 394 (93%) of the children who completed the child interview. There were no differences between the analytical sample (n = 394) and the entire sample of children interviewed (n = 425) in race, gender, age or free lunch status. Approximately 86% of the sample was African American. Fifty-four percent of the sample was female and the average age was 9.6 years old (SD=1.1; $Median$ = 10.0). The majority of children received free and reduced lunch (86.5%, n = 347). Table 1 displays additional demographic the characteristics of the sample.

Measures

Exposure Opportunity: Alcohol, Tobacco, and Other Drugs—Opportunity to use alcohol, tobacco, and other drugs and ATOD exposure was measured using questions from the Baltimore Substance Use Scale (BSUS; Chilcoat, Dishion, & Anthony, 1995; Chilcoat & Anthony, 1996; Kellam & Anthony 1998). The BSUS consists of 90 questions focused on youth's knowledge, current and/or anticipated use of tobacco, alcohol, marijuana, crack cocaine, heroin, inhalants, and stimulants (Chilcoat, et al., 1995; Cooley et al., 2009). Given the age of this population this investigation will focus on questions related to exposure and opportunity to use ATOD instead of actual use. Initiation of ATOD use closely follows opportunities to use alcohol, tobacco, and other drugs (Wagner & Anthony, 2002; Van Etten & Anthony, 1999). Opportunity to use ATOD was a composite variable created using the following question stem: "Have you ever been offered ____?" This question was asked for tobacco, alcohol, marijuana, crack, cocaine, heroin, ecstasy, and methamphetamine. Approximately 15% of the sample reported that they had been offered at least one of the drug included in the BSUS. Additionally, the following two questions were also used as outcomes: "Have you ever seen someone smoking marijuana?" and "Have you ever seen someone selling drugs?".

Safety on the Route to School—The MORE Project assessed the children's perceived safety on their route to school. Children were asked, "How safe are the neighborhoods you walk through to get to and from school?". This item was answered on a four-point Likert scale (very safe to not safe at all). This item was dichotomized (a little safe and not safe at all [1]; very safe and safe [0]). Approximately 26% of the children reported that the neighborhoods they walk through to get to and from school were a little safe or not safe at all.

Predictor Variable: Alcohol Outlet Count—The count of alcohol outlets that children pass by on the route to school is the main predictor in this investigation. This variable is described in greater detail in the Spatial Analysis subsection.

Control Variables—The adjusted models will control for sex (male/female), free and reduced price lunch status (proxy for low socioeconomic status), age (in years), mode of transportation to and from school (e.g. walk, bus, car), and neighborhood physical disorder (a proxy for neighborhood disadvantage). Children are eligible for free or reduced lunch if their family income is below 185% of the federal poverty level. In Baltimore City Public Schools, 84% of students are eligible for free and reduced lunch. For mode of transportation to and from school, the students were asked, "How they usually get to and from school." The response options included walk alone, walk with other children, walk with parents, ride the bus, and ride in the car. This variable was recoded (walk to school[1] & car, bus and

other [0]). The neighborhood physical disorder score is based on an exploratory factor analysis (EFA) of eight indicators that are theoretically related to neighborhood physical disorder: unboarded abandoned structures, boarded abandoned structures, structures with broken windows, vacant houses, graffiti, evidence of vandalism, unmaintained properties (e.g., paint chipping, missing bricks) and vacant lots (Cohen, Farley, & Mason, 2003; Furr-Holden et al., 2011; Perkins, Meeks, & Taylor, 1992). Four items consistently loaded together (loadings: .76-.82) had prevalence greater than 5%: unboarded abandoned structures, boarded abandoned structures, presence of graffiti, and unmaintained properties. The fit indices for the EFA were good; the chi-square test for model fit was insignificant ($p = .42$) indicating that the model fits the data, the Standardized Root Mean Square Residual (SRMR) was .03, and the Root Mean Square Error of Approximation (RMSEA) was estimated at zero (.08>SRMR and .06>RMSEA indicates a good fit; Hu & Bentler, 1999). The neighborhood physical disorder score was created by multiplying the factor loadings from the EFA by one if the indicator was present and summing the score for each participant's block face. The score ranged from 0 to 3.19, with a mean of 1.32 ($SD = 1.03$).

Alcohol Outlet Data—Data on all the alcohol outlets ($n = 1338$) in the records of the Board of Liquor License Commissioners for Baltimore City were obtained for this investigation. The data included address and license type of all establishments licensed to sell alcohol in Baltimore City in 2007. There are 14 alcohol license classes in Baltimore City. This investigation will focus on off-premise license classes (e.g., package goods stores; $n = 788$). Off-premise license classes include package good stores that sell liquor, beer, and wine, package good stores that sell wine and beer, and seven-day taverns that can sell package goods. Studies generally find that off-premise outlets are more strongly associated with drinking problems, crime, and violence (Schonlau et al., 2008; Scribner et al., 1999). Unlike bars and restaurants (i.e., on premise alcohol outlets), off-premise alcohol outlets can sell alcoholic beverages in large quantities, which can be consumed in uncontrolled environments (e.g., motor vehicles, outside the outlet, home; LaVeist & Wallace, 2000). In bars and restaurants, servers control how much patrons receive and can stop serving patrons if they appear intoxicated. The uncontrolled environment coupled with the potential to purchase large quantities can lead to excessive consumption and injuries. Excluded from these analyses are bars without off-premise sales and restaurants.

Neighborhood data: The NIfETy Instrument—Studies have found a relationship between neighborhood disorder, visible cues within the neighborhood environment that reflects lack of order and social control within the neighborhood (Ross & Mirowsky, 1999; Skogan, 1990), and exposure to ATOD (Crum, Lillie-Blanton, & Anthony, 1996; Furr-Holden et al., 2011; Lillie-Blanton, Anthony, & Schuster, 1993). Additionally, studies have found that neighborhood context is associated with presence of alcohol outlets (LaVeist & Wallace, 2000; Pasch et al., 2009). Accordingly, this investigation will control for neighborhood context using neighborhood physical disorder using items from the Neighborhood Inventory for Environmental Typology (NIfETy), a standardized instrument that is used to assess characteristics of the neighborhood environment related to violence, alcohol, and other drug (VAOD) exposure (Furr-Holden et al., 2008). Due to the cross-sectional study design we are unable to determine whether neighborhood disorder mediates (i.e. alcohol outlets create neighborhood disorder and neighborhood disorder then leads to exposure to ATOD), confounds (i.e. neighborhood disorder is associated with both the presence of alcohol outlets and ATOD exposure but is not in the casual pathway) or causes the relationship between alcohol outlet density and youth exposure to ATOD. In a cross-sectional design a mediator and confounder behaves similarly. Longitudinal data would be needed to determine whether the neighborhood environment influences alcohol outlet density or whether the alcohol outlets produce disorder within the neighborhood

environment. This study will treat neighborhood disorder as a confounder with the understanding that it could potentially be a mediator.

The NIfETy instrument includes seven domains: (1) physical layout of the block, (2) types of structures, (3) adult activity, (4) youth activity, (5) physical disorder and order, (6) social disorder and order, and (7) violence and AOD indicators. The NIfETy assessments are conducted independently by a pair of trained field raters. The raters travel to their assigned blocks and perform the ratings; raters spend an average of 30 minutes on each block. The environmental assessments are entered into personal digital assistants (PDAs) that are programmed with the instrument; the data is then uploaded to a secure server. In a larger study, NIfETy assessments are conducted on a stratified sample of block faces that are randomly selected from each residential neighborhood in Baltimore City. For this study, NIfETy ratings were conducted on each child's residential block face within three months of their annual assessment. The block-level data were then merged with the self-report survey data. If more than one participant lived on the same block the environmental assessment was conducted once and used for each participant residing on that block.

The NIfETy instrument is both valid and reliable (Furr-Holden et al., 2010). The NIfETy has high reliability for the total scale [Internal Consistency Reliability (ICC) is .84], the VAOD subscale (ICC=.71), and across raters (ICC=.67-.79). Validity metrics are also good. NIfETy indicators of VAOD exposure correlated strongly with self-reported VAOD exposure from a sample of young adults and also with local crime data (Furr-Holden et al., 2010). For a more detailed description of the NIfETy and its psychometric properties, see Fur-Holden et al. (2008) and Furr-Holden et al. (2010).

Spatial Analysis

Alcohol outlet location data were geocoded using ArcGIS v.9 (ESRI, 2005). There were 1338 addresses included in list obtained from the Liquor Board. Nearly all (99.8%; n = 1336) of the addresses were geocoded including 787 off-premise and 549 on-premise alcohol outlets. The residential addresses of the children were also geocoded. The Network Analyst tool in ArcGIS was used to create the shortest route from the participants' home to their school. The Network Analysts calculates the route based on street networks. Network analysts accounts for walking paths and excludes natural borders and boundaries, such as a large body of water or a highway that people often do not cross in the course of moving through their neighborhood.

Spatial buffers (264 feet~1/2 of a Baltimore City block) were then placed around the routes to allow this feature to be joined with the alcohol outlet data layer. The buffers also allow for slight deviations in the route and would capture outlets visible from the route to school. The count of alcohol outlets within the buffer was determined using the spatial join tool (a tool used to append data from one map layer to another map layer using geographic location) in ArcGIS. More than a third of the children had an alcohol outlet on their route to school (35.4%). The number of alcohol outlets on the route to school ranged from 0 to 15, the mean count was .98 (SD = 2.15, $Median$= .00). The alcohol count was skewed and non-normal (Shapiro-Wilk = .70, p<.01) and normality did not improve with transformations (i.e. log-, inverse-, and squared-transformations) so the alcohol outlet count was dichotomized (at least one off-premise alcohol outlet [1]; no off-premise alcohol outlets [0]). These variables were then exported into STATA 11.2 and appended to self-report data.

Sixty-one participants (14.4%) were missing data on the neighborhood physical disorder scale. Inverse distance weighting was used to estimate the neighborhood physical disorder scale for participants with a geocoded address. IDW is available in the Spatial Analyst extension in ArcGIS. Inverse distance weighting is a commonly used interpolation method

that approximates a value to an unsampled point based on weighted averages from neighboring points (Burrough, 1986; Watson, 1987, Watson, 1992). The interpolated value of the unsampled point is most influenced by the closer points (i.e., the closer points have a greater weight). The unadjusted models were run with and without the estimated neighborhood data from the interpolation. The mean for the neighborhood physical disorder score with the interpolated data was 1.34 (*SD* = 1.03), which was similar to the non-interpolated neighborhood physical disorder score (*M* = 1.32, *SD* = 1.03). All outcomes of interest (alcohol and other drug exposure and perceived safety) were analyzed for spatial autocorrelation (Moran's I) in ArcGIS 9.3. There was no evidence of spatial autocorrelation (i.e. $p>.05$).

Statistical Analysis

Missing data—Missing data ranged from 0 to 19.3%. Twenty-four children (5.6%) were missing useable address information, forty-six children (10.8%) were missing data on free and reduced lunch status, and sixteen children (3.8%) were missing outcome data from the child interview. Sixty-one participants were missing data on the neighborhood disorder scale, which was estimated using imputations described above. In order to maintain the sample size we used all available data for the regression models, resulting in 394 children in the unadjusted model and 377 children in the adjusted models.

Logistic regression models via Generalized Estimating Equations (GEE) were used to estimate the strength of association between the presence of alcohol outlets and adverse outcomes. GEE accounts for the clustering of outcomes by neighborhood by providing robust standard errors (Zeger & Liang, 1986). To determine the degree of clustering, intraclass correlation coefficients were calculated for each outcome using neighborhood as the cluster. All intraclass correlation coefficients were below 6%. Odds ratios were estimated to convey the strength of the association. Significant findings were reported for alpha levels below .05 and marginally significant findings (or trends) were reported for alpha levels between .05 and .10. Each outcome of interest was analyzed independently. Given the complex relationship between neighborhood disorder and the presence of alcohol outlets, two adjusted models were used. The semi-adjusted included statistical adjustment for individual-level variables, mode of transportation to school (walking vs. other) sex, and free or reduced lunch status. The fully-adjusted models were extended to include a proxy for the larger neighborhood-level context, neighborhood physical disorder. STATA 11.2 was used for all statistical analyses (StataCorp. 2009).

Results

Descriptive Statistics

The prevalence of the outcome and predictor variables are included in the methods sections. The number of alcohol outlets on the route to school ranged from 0 to 15, the mean count was .98 (*SD* = 2.15, Median = .00). Among participants with at least one alcohol outlet on the route to school (n =137), the mean count of alcohol outlets on the route to school was 2.8 (*SD* = 2.9, *Median* = 2.0). Chi-squared tests were used to determine whether mode of transportation to school differed by the presence of alcohol outlets on the route to school; the test revealed that there were no differences in mode of transportation by presence/absence of alcohol outlets on the route to school ($\chi = 3.0$, $p = .08$).

Unadjusted Logistic Regression Models

To address our primary research questions regarding the association between the presence of alcohol outlets on the route to school and exposure to ATOD, we conducted a series of logistic regression models for the following outcomes: offered alcohol, tobacco, and other

drugs, seeing people smoking marijuana, seeing people selling drugs, and perceived safety on the walk to and from school (see Table 2). Neighborhood physical disorder was positively associated with seeing people smoking marijuana (OR = 1.40, p <.01), seeing people selling drugs (OR = 1.29, p =.03), and perceived safety on the route to and from school (OR = 1.54, p <.01). Children living in poverty were nearly 2.6 times more likely to see people smoking marijuana (OR = 2.56, p <.01) and more than three times more likely to see people selling drugs (OR = 3.15, p <.01). Males and older children were also more likely to be offered ATOD (OR = 2.59, p <.01 & OR = 1.49, p =.01, respectively).

Children with an alcohol outlet on their route to school were more two times more likely to be offered alcohol, tobacco, or other drugs (OR = 2.20, p =.02). There was also a positive and statistically significant relationship between the presence of alcohol outlets on the route to school and seeing people smoking marijuana (OR = 1.93, p =.01). Children were also more likely to report seeing people selling drugs if there was an alcohol outlet on their route to school (OR = 1.72, p =.02). The association between the presence of alcohol outlets and perceived safety on the route to school did not statistical significance (OR = 1.62, p =.07). Mode of transportation was not associated exposure to ATOD or perceived safety on the route to school.

Semi-adjusted Logistic Regression Models

The semi-adjusted model controlled for individual-level variables, mode of transportation and demographic variables: sex, age, and socioeconomic status (Table 3). There was a strong and significant association between socioeconomic status and seeing people smoking marijuana (OR= 2.44, p<.01) as well as seeing people selling drugs (OR = 3.13, p<.01). Males and age continued to be associated with opportunities to use alcohol, tobacco, and other drugs in the semi-adjusted model (OR = 2.25, p<.01 & OR=1.39, p =.02, respectively).

After adjusting for the demographic variables and mode of transportation to school, there was a significant association between the presence of an alcohol outlet on the route to school and opportunity to use alcohol, tobacco, and other drugs (OR = 2.17, p =.04). The presence of alcohol outlets was also associated with seeing people smoking marijuana after adjusting for control variables (OR = 1.73, p =.03). The presence of alcohol outlets on the route to school was no longer associated with seeing people selling drugs in the semi-adjusted model (OR = 1.47, p =.11).

Fully-Adjusted Model

The fully-adjusted model included a proxy for the larger neighborhood context, specifically, neighborhood physical disorder in addition to individual-level variables: mode of transportation to school, sex, age, and socioeconomic status. Neighborhood physical disorder was associated with seeing people smoking marijuana and perceived safety on the route to school (OR = 1.24, p =.02 and OR = 1.52, p<.01, respectively) after adjusting for control variables. The relationship between the presence of alcohol outlets and opportunities to use alcohol, tobacco, and other drugs as well as seeing people smoking marijuana which remained significant in the semi-adjusted model was no longer statistically significant in the fully-adjusted models but reached trend levels (OR = 2.01, p =.09 and OR = 1.52, p =.08, respectively).

Discussion

Over the last decade, national and international campaigns have been implemented to encourage children to walk to school. However, little research has examined the factors that promote (or hinder) children walking to school (McMillian, 2005; Rossen et al., 2011).

Furthermore, studies have not examined what risk factors children are exposed to on the route to school. The current study sought to determine the association between alcohol outlets on the route to school and exposure to ATOD as well as perceived safety on the route to school. The regression analyses indicated that there was an independent association between alcohol outlets on the route to school and exposure to ATOD. The association between the presence of alcohol outlets and being offered alcohol, tobacco, and other drugs as well as seeing people smoking marijuana remained significant after adjusting for individual-level characteristics. However, in the fully-adjusted model that included a proxy for the larger neighborhood context, the association between alcohol outlets and being offered ATOD as well as seeing people smoking marijuana was no longer significant. It appears that neighborhood physical disorder confounded the relationship between the presence of alcohol outlets and exposure ATOD. This finding is consistent with prior investigations (Crum et al., 1996; Storr, Chen, & Anthony, 2004), which have also reported associations between neighborhood disorder and exposure to ATOD. We are only aware of one other investigation examining the impact of alcohol outlets on the route to school (Pasch et al., 2009), which did not find an association between alcohol outlets on the route to school and alcohol use.

Ideally, this investigation would have used children's or parents' description of the children's route to school, however, we use geospatial tools to determine the shortest route to school based on street networks. This method for estimating walking paths also accounts for major barriers (e.g., buildings) and bodies of water. Buffers were placed around the route to allow for slight deviations on the route to school. We recently completed an observational study where trained raters conducted field visits to identify walking routes to school for a subset of children included in this investigation. We examined environmental factors that children were exposed to on the walk to school (e.g., alcohol outlets, drug paraphernalia, people using drugs). This work also will allow us to determine the validity of the GIS routes used in the current investigation. Our preliminary findings from this follow up study suggest that some children do take routes to school that are not included in street networks, such as paths through parks and other properties.

The current study is timely for several reasons. Over the past decade urban centers including Boston, Baltimore, and New York have expanded elementary schools (i.e., K-8 schools) to include middle school grades (grades 6^{th}-8^{th}) and closing middle schools. Middle school age is a time of transition as youth are beginning puberty and are influenced more by their peers (Chung, Elias, & Schneider 1995; Elias, Gara, & Ubriaco, 1985). This is also a time of increased ATOD use and delinquency (D'Amico et al., 2005; Elias et al., 1985; Estell et al., 2007). In Baltimore, elementary schools are generally located within walking distance of children's home. With the expansion of elementary schools, there will be a greater number of older students walking to school and potentially exposed to risk factors related to ATOD use.

Alcohol outlets were identified in this study as being a potential risk factor on the route to school. This finding is also timely because recent legislation in Maryland limited the hours of operations for alcohol outlets in small redevelopment area. The majority of alcohol outlets in Baltimore city are allowed to open at 6am; however, the new legislation restricts opening hours to 9 am, which is after children have walked to school. Future investigations should examine how children exposure to ATOD alters as a result of this new legislation.

This study does have some limitations that are important to keep in mind when considering the findings. First, there was no indication of where or when the children were exposed to or offered the opportunity to use alcohol, tobacco, or other drugs. The opportunity to use ATOD could have occurred outside of the children's neighborhood. Related to this

limitation, was the reliance on a single indicator for exposure for the outcomes of interest (i.e, exposure to ATOD and perceived safety on the route to school). Future investigations should include measures specific to location. This study also used a relatively homogenous sample of children in terms of race and age, which limits generalizability. Related to this was the recruitment of participants; children were recruited from six schools in three violence strata, which also limits generalizability. Future studies should replicate this investigation with representative populations and in other geographic locations.

Despite these limitations, this study explored a potentially important and malleable risk factor that children may encounter on the route to school. As national campaigns are encouraging children to walk to school it is essential to determine what children are exposed to on the route to school. Identifying these factors is especially important as the exposure is repeated daily for several months each year. It will be important to examine this relationship as the children age and are more likely to be offered and use ATOD.

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Table 1

Sociodemographic characteristics and exposure to alcohol, tobacco, and other drugs (*n*=394)

Characteristic	n (%)
Gender	
Male	183 (46.5)
Female	211 (53.5)
Race	
African American	339 (86.0)
Bi-racial/mixed	31 (7.9)
Caucasian	13 (3.3)
Other	11 (2.8)
Mean age (SD)	9.6 (1.1)
Lunch Status[a]	
Free/Reduced	320 (86.0)
Paid	53 (14.0)
How do you usually get to and from school?	
Walk	219 (55.6)
Bus	26 (6.6)
Car	140 (35.5)
Other	9 (2.3)
Alcohol outlets on route to school	137 (34.8)
Offered alcohol, tobacco or other drug	59 (15.0)
Seen people smoking marijuana	174 (44.2)
Seen people selling drugs	184 (46.7)
Perceived safety on route to school[b]	102 (25.9)

[a] n=379

[b] n=393

Table 2

Unadjusted Logistic Regression Models: Presence of alcohol outlets on the route to school and exposure to alcohol, tobacco, and other drugs (*n*=394)

	Offered alcohol, tobacco, or other drugs		Seen people smoking marijuana		Seen people selling drugs		Perceived safety on route to school	
	OR	***p***	**OR**	***p***	**OR**	***p***	**OR**	***p***
Presence of alcohol outlets on route to school	2.20	0.02	1.93	0.01	1.72	0.02	1.62	0.07
Mode of transportation (walking vs. other)	1.30	0.33	1.10	0.43	1.03	0.87	1.13	0.54
Neighborhood Physical Disorder[a]	1.26	0.04	1.39	<0.01	1.27	0.05	1.59	<0.01
Neighborhood Physical Disorder w/Interpolation	1.23	0.08	1.40	<0.01	1.29	0.03	1.54	<0.01
Free/Reduced Lunch[b]	0.83	0.70	2.56	<0.01	3.15	<0.01	1.09	0.77
Boys	2.59	<0.01	1.14	0.48	0.98	0.88	0.75	0.18
Age	1.49	0.01	1.17	0.15	1.24	<0.01	0.92	0.34

[a] n=356,

[b] n=379

Table 3

Semi-Adjusted Logistic Regression Models: Presence of alcohol outlets on the route to school and exposure to alcohol, tobacco, and other drugs (*n*=377)

	Offered alcohol, tobacco, or other drugs		Seen people smoking marijuana		Seen people selling drugs		Perceived safety on route to school	
	OR	***p***	**OR**	***p***	**OR**	***p***	**OR**	***p***
Presence of alcohol outlets on route to school	2.17	0.04	1.73	0.03	1.47	0.11	1.73	0.07
Mode of transportation	1.29	0.37	0.95	0.72	0.89	0.58	1.26	0.23
Free/Reduced Lunch	0.67	0.38	2.44	<0.01	3.13	<0.01	0.99	0.98
Boys	2.25	<0.01	1.03	0.87	0.96	0.82	0.69	0.10
Age	1.39	0.02	1.15	0.28	1.24	<0.01	0.86	0.12

Table 4

Fully-Adjusted Logistic Regression Models: Presence of alcohol outlets on the route to school and exposure to alcohol, tobacco, and other drugs (*n*=377)

	Offered alcohol, tobacco, or other drugs		Seen people smoking marijuana		Seen people selling drugs		Perceived safety on route to school	
	OR	***p***	**OR**	***p***	**OR**	***p***	**OR**	***p***
Presence of alcohol outlets on route to school	2.01	0.09	1.53	0.08	1.33	0.25	1.22	0.54
Mode of transportation	1.22	0.49	0.88	0.34	0.84	0.45	1.01	0.95
Neighborhood Physical Disorder	1.06	0.69	1.24	0.02	1.15	0.28	1.52	<0.01
Free/Reduced Lunch	0.65	0.38	2.25	<0.01	2.96	<0.01	0.86	0.61
Boys	2.19	<0.01	1.06	0.73	0.97	0.85	0.68	0.09
Age	1.38	0.03	1.15	0.29	1.24	<0.01	0.84	0.08