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The Moderating Role of Gender in the Relationship Between Tobacco Outlet Exposure and Tobacco Use Among African American Young Adults

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Abstract

Tobacco outlet exposure is a correlate of tobacco use with potential differences by gender that warrant attention. The aim of this study is to explore the moderating role of gender in the relationship between tobacco outlet exposure and past month tobacco use among African American young adults 21 to 24 years old. This cross-sectional study ($n = 283$) used geospatial methods to determine the number of tobacco outlets within walking distance (i.e., a quarter mile) of participants' homes and distance to the nearest outlet. Logistic regression models were used to test interactions between gender and tobacco outlet exposure (i.e., density and proximity). Tobacco outlets were classified based on whether or not they were licensed to sell tobacco only (TO outlets) or tobacco and alcohol (TA outlets). Neither density nor proximity was associated with past month tobacco use in the pooled models. However, gender modified the relationship between TO outlet density and tobacco use, and this relationship was significant only among women (OR = 1.02; $p < 0.01$; adjusted OR = 1.01; $p < 0.05$). This study underscores the importance of reducing tobacco outlet density in residential neighborhoods, especially TO outlets, as well as highlights potential gender differences in the relationship between tobacco outlet density and tobacco use.

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Compliance with Ethical Standards: All procedures performed in this study, which involved human participants, were in accordance with the ethical standards of the Institutional Review Board at The Johns Hopkins Bloomberg School of Public Health and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Conflicts of Interest: The authors declare that they have no conflicts of interest.

Informed Consent: Informed consent was obtained from all individual participants included in the study.

Keywords

gender; Tobacco outlets; Young adults; African Americans

Introduction

The built environment is an important correlate of tobacco use among youth and young adults, and the influence of certain built environmental characteristics on tobacco use vary by gender (Brown et al. 2014; Lambert et al. 2004; Miles 2006). In a study conducted in Baltimore, Maryland, among a sample of predominately African American young adults 1-year post high school, gender modified the relationship between perceived neighborhood drug involvement and tobacco use. For every unit increase in perceptions of neighborhood drug involvement among women, the odds of past month tobacco use increased 49 %, whereas this relationship was not significant among men (Brown et al. 2014). However, in a multicity European study among people 15 years old and older, men were more susceptible to environmental cues (e.g., litter and graffiti) to smoke relative to women (Miles 2006). The results from these two studies highlight the importance of examining gender differences in the relationship between the built environment and tobacco use. One important environmental characteristic that warrants further attention is exposure to tobacco outlets (e.g., tobacco outlet density and proximity to tobacco outlets). Low-income, minority neighborhoods are often inundated with tobacco outlets (Fakunle et al. 2010; Hyland et al. 2003; Peterson et al. 2011; Rodriguez et al. 2013; Schneider et al. 2005; Yu et al. 2010), and there is a positive association between tobacco outlet exposure (e.g., density, proximity, tobacco advertisement) and tobacco use (Henriksen et al. 2008; Johns et al. 2013; Li et al. 2009; Lipperman-Kreda et al. 2012; Lipperman-Kreda et al. 2013; McCarthy et al. 2009; Novak et al. 2006; Pokorny et al. 2003; Reid et al. 2005; West et al. 2010). However, studies exploring the relationship between exposure to tobacco outlets and tobacco use have not focused primarily on African American young adults or on gender differences in the relationship between tobacco outlet exposure and tobacco use among this population. In some African American neighborhoods, as many as 50 % of young adults smoke cigarettes (Smith et al. 2007), and insight into built environmental correlates of tobacco use (e.g., tobacco outlets) may help explain mechanisms driving high rates of tobacco use in urban environments.

The current study builds upon and extends the literature in this area in three distinct ways: First, gender differences in tobacco outlet exposure and tobacco use are assessed among African American young adults who live in the inner city, thus who are at high risk for tobacco outlet exposure. Second, tobacco outlet exposure is assessed via density and proximity at the neighborhood level (i.e., within in walking distance of participants' homes) to allow inferences to be made about the role of tobacco outlets in residential communities. Third, tobacco outlets are categorized based on whether or not they are licensed to sell tobacco only (TO outlets) or licensed to sell both tobacco and alcohol (TA outlets). This is important because TA and TO outlets are different such that stores that sell both tobacco and alcohol are considered alcohol outlets from a policy perspective in Baltimore City, thus are subject to density and zoning restriction pertaining to alcohol retail (Thornton et al. 2013),

whereas stores that sell tobacco only are not bound by these regulations. The risk of tobacco use attributable to exposure to tobacco outlets may vary based on whether or not the outlets sell tobacco only versus tobacco and alcohol for two important reasons: First, the density of TA outlets is inherently lower than that of TO outlets due to the policy restrictions on alcohol outlets. This difference in density may drive the relationship between tobacco use and tobacco outlet exposure, making a case for regulations to reduce tobacco outlet density in general, as compared to only regulating alcohol outlets, some of which happen to sell tobacco. Second, despite the lower density of TA outlets, these outlets promote use of multiple substances (i.e., tobacco and alcohol) through advertisement and sales. Interpreting environmental cues from TA outlets that say both alcohol and tobacco use are acceptable may have a synergistic effect on the use of either substance, thus examining TA and TO outlets separately is warranted and this study takes the first steps in exploring potential distinctions.

Given the study by Brown and colleagues (2014) that found that African American young adult women from this cohort were more susceptible to environmental cues to tobacco use, we have two hypotheses for the current study. First, gender will moderate the relationship between tobacco outlet exposure and tobacco use, such that tobacco outlet density and past month tobacco use will be positively associated for both men and women, with a stronger association among women controlling for potential confounders. Second, proximity to tobacco outlets will be inversely associated with past month tobacco, with a stronger association for women.

Method

Data Sources

Baltimore Prevention Program (BPP) Data—In 1993, a total of 799 first grade students and their families, representative of the number of students entering first grade in nine public elementary schools in Baltimore City, were recruited to participate in the BPP trial, a randomized controlled trial that evaluated two first grade preventive interventions—a classroom-centered (CC) intervention and family-school partnership (FSP) intervention—aimed at improving academic success, reducing concentration problems, and reducing aggressive and shy behaviors. Substance abuse prevention was among the distal targets of the interventions. Participants were followed into adulthood. See Ialongo et al. 1999 for more information. The Institutional Review Board at The Johns Hopkins Bloomberg School of Public Health approved this study.

Participants in the current cross-sectional investigation were 283 African American young adults residing in Baltimore City in 2009. The analytic sample was drawn from the larger BPP cohort. Inclusion criteria for the current study were limited to African American participants who lived in Baltimore City in 2009. Of the total number of participants living in Baltimore City in 2009 ($n = 316$), 96 % were African American. A total of 613 participants completed the BPP interview in 2009, and 316 lived in Baltimore City. Of the 302 participants who met inclusion criteria (i.e., African Americans living in Baltimore City), approximately 6 % ($n = 19$) were missing information on a covariate of interest (i.e., $n = 1$ was missing on friends who smoke cigarettes; $n = 11$ were missing on history of tobacco

use; $n = 7$ were missing on baseline intervention status) and were excluded from the analytic sample. Participants included in the analytic sample ($n = 283$) did not differ significantly from those excluded with respect to age, gender, education, history of tobacco use, friends who smoke cigarettes, past month alcohol use, or past month marijuana use. Participants did however differ by ability to meet financial needs ($\chi^2 = 4.8$, $df = 1$, $p < 0.05$). Among the participants included in the sample, 57% did not have enough money to meet their financial needs as compared to 48 % of those who were excluded. According to the US Census Bureau, 24 % of people in Baltimore City lived below the poverty level from 2009–013 (which overlaps with the time frame that participants were sampled) compared to 10 % of people in the entire state (US Census Bureau 2015). This may help explain why a larger percentage of participants in the study were not able to meet their financial needs compared to those excluded.

Tobacco Outlet Data—Data on 1184 retail establishments (e.g., smoke shops, corner stores, grocery stores) licensed to sell cigarettes in Baltimore City in 2009 were obtained from the Circuit Court for Baltimore City. Retail establishments for these analyses were classified based on whether or not they were licensed to sell both tobacco and alcohol or licensed to sell tobacco only. Duplicate address locations were removed ($n = 51$) based on latitude and longitude. The remaining 1133 outlets were analyzed in this study. These 1133 addresses were compared to a list of establishments licensed to sell alcohol in Baltimore City ($n = 1,340$) obtained from the Board of Liquor License Commissioners for Baltimore City—45 duplicate locations were removed from this list for a final alcohol outlet count of 1295. There were 356 sets of latitude and longitude coordinates that appeared in both the tobacco outlet list and the alcohol outlet list, and these 356 locations were classified as TA outlets in this study. The remaining 777 outlets from the tobacco outlet list were classified as TO outlets in the analyses.

Measures

Outcome—Current tobacco use was the outcome and assessed via self-report. Participants who reported having used tobacco within the past month were considered current users. Audio computer-assisted self-interview methods were used to assess tobacco use to promote privacy and obtain accurate and complete responses (Storr et al. 2002). A binary variable, tobacco use anytime within the past month was coded 1, otherwise 0.

Exposures—There were two (continuous) exposures of interest—tobacco outlet density within walking distance of participants' homes and proximity to the nearest tobacco outlet (explained in detailed in the spatial analyses section). A quarter-mile was used to measure walking distance because in urban centers, the density of and access to commercial businesses is typically greater, and residential walking distance is often shorter than a half mile (Milam et al. 2014). Proximity was measured by calculating the network distance from each participant's home to the nearest tobacco outlet.

Moderator—Gender was hypothesized to moderate the relationship between tobacco outlet exposure and tobacco use. Four interactions terms were tested: gender and TO outlet

density; gender and TA outlet density; gender and proximity to the nearest TO outlet; and gender and proximity to the nearest TA outlet.

Confounders—The following confounders were controlled for using binary variables—financial strain (i.e., having at least enough money to meet needs), education (i.e., at least a high school diploma or GED), history of tobacco use (i.e., having ever used tobacco prior to the year of interview), association with friends who smoke cigarettes, past month alcohol use, and past month marijuana use. Confounders were selected based on previous literature (Brown et al. 2014; Henriksen et al. 2008; Johns et al. 2013; Li et al. 2009; McCarthy et al. 2009; Milam et al. 2014; Novak et al. 2006; Reitzel et al. 2011; West et al. 2010). Baseline intervention status was included as a covariate considering participants were sampled from a larger intervention study. A three-level categorical variable was used representing the family-school partnership intervention, the classroom-centered intervention, and the control group (i.e., standard classroom setting). The control group was the reference category.

Spatial Analyses—Tobacco outlet and alcohol outlet locations were geocoded using ArcGIS v.10.1 (ESRI 2012). Geocoding is the process used to assign a spatial location to an address record (Waller and Gotway 2004). Quarter-mile network buffers (i.e., walking distance) were added around each participant's home using the Network Analysis Extension Service Area tool in ArcGIS, which accounts for navigating street networks, as compared to straight line distance, which ignores street networks. Network Analysis investigates the flow in and out of networks (e.g., street networks), therefore accounting for walking paths that participants would use to navigate their neighborhoods. This offers a better approximation of the actual paths participants may travel (Cromely and McLafferty 2012). The area of each quarter-mile network buffer varies depending on the street networks, whereas in Euclidean (i.e., straight line) distance, the area of each buffer would be constant. However, Euclidean distance does not account for street networks, and use of Euclidean distance in this case would overestimate tobacco outlet density. In these analyses, the count of outlets per quarter-mile of participants' homes was divided by the area (measured in square miles) of each network buffer, as a way to standardize the density measure by accounting for the variation in the area of the network buffers. Buffers around participants' homes were within the city limits.

The count of tobacco outlets per quarter-mile was determined using the spatial joining tool in ArcGIS. Spatial joining is a process used to combine multiple map layers into one data set (Waller and Gotway 2004). Proximity to the nearest tobacco outlet from each participant's home was determined using the Network Analyst Extension feature in ArcMap.

Statistical Analyses

Primary analyses and sensitivity analyses were conducted. In the primary analyses, separate models were estimated based on whether or not outlets sold tobacco only or tobacco and alcohol. In the sensitivity analyses, the distinction between TO and TA outlet was not made, and outlets were pooled together. The primary statistical analyses were conducted in six steps. First, descriptive statistics were calculated using chi-square tests, Student's *t* tests, and Fisher exact tests to assess differences in demographic characteristics by past month tobacco

use. Second, unadjusted logistic regression models and 95 % confidence intervals (CIs) were used to estimate the odds of reporting past month tobacco use by tobacco outlet density and proximity to the nearest tobacco outlet and to assess the association between each independent control variable with tobacco use. Third, multivariable logistic regression models with 95 % CIs were estimated to examine the association of tobacco outlet density and proximity on past month tobacco use, controlling for baseline intervention status, gender (the moderator), and confounders (i.e., financial strain, education, history of tobacco use, association with friends who smoke cigarettes, past month alcohol use, and past month marijuana use). Fourth, interaction terms were created between (1) gender and TO outlet density, (2) gender and TA outlet density, (3) gender and TO outlet proximity, and (4) gender and TA outlet proximity. Fifth, additional multivariable logistic regression models were estimated for each interaction term separately, controlling for the same confounders in step 3. Finally, in step 6, models were stratified by gender given a significant interaction term in step 5. The sensitivity analyses repeated steps 2 through 6, pooling the outlets to explore the relationship between tobacco outlet density and tobacco use. In both the primary and the sensitivity analyses, all logistic regression models were estimated via generalized estimating equations (GEE). GEE estimates were used to account for potential clustering of the outcome by census tract, by providing robust standard errors (Zeger and Liang 1986). Data were analyzed using Stata/SE statistical software version 13 (Stata 2013).

Results

Sample Description

Among this sample, 17.3 % ($n = 49$) of participants used tobacco within the past month. Participants ranged in age from 21.2 to 23.6 years old (mean = 22.2 years; standard deviation [SD] = 0.41 years). Approximately half of the participants were male (51.2 %). More than eight in ten participants had at least a high school diploma or GED (84.8 %); over half had less than enough money to meet their needs (57.2 %), no history of tobacco use (53.7 %), and had no friends who smoked cigarettes (60.4 %). The average proximity to a TO outlet from a participant's home was about a third of a mile (i.e., 554 meters; SD = 462 meters), and about 0.41 miles (i.e., 662 meters; SD = 503 meters) for a TA outlet. The average density per square mile was 16.6 outlets (SD = 26.6 outlets) for retail outlets that sold tobacco only and 7.1 outlets per square mile (SD = 11.4 outlets) for outlets that sold both tobacco and alcohol. Sample characteristics according to past month tobacco use are reported in Table 1.

Tobacco Outlet Density

Density of TO outlets was not significantly associated with past month tobacco use in the pooled unadjusted (OR = 1.01, $p = 0.16$) or adjusted (adjusted OR [aOR] = 1.00, $p = 0.63$) models controlling for gender, financial strain, education, history of tobacco use, association with friends who smoke, past month alcohol use, past month marijuana use, and baseline intervention status. However, gender significantly modified the relationship between tobacco outlet density and tobacco use as indicated by a significant interaction term (aOR = 1.03, $p < 0.01$). Results were therefore stratified by gender (Model 1) and reported in Table 2 for women and Table 3 for men. Every unit increase in TO outlet density (i.e., the addition of

one outlet per square mile) was significantly associated with tobacco use for women (aOR = 1.01, $p < 0.05$), but not men (aOR = 0.98, $p = 0.11$).

The relationship between TA outlet density and past month tobacco use was not significant in the pooled unadjusted (OR = 1.01, $p = 0.71$) or adjusted models (aOR = 0.99, $p = 0.86$)—(controlling for gender, financial strain, education, history of tobacco use, association with friends who smoke, past month alcohol use, past month marijuana use, and baseline intervention status). However, there was a significant interaction between TA outlet density and gender (aOR = 1.06, $p < 0.05$), thus results were stratified by gender (Model 2) and reported in Table 2 for women and Table 3 for men. TA outlet density was not significantly associated with past month tobacco use in the gender-stratified models. However, among women in the unadjusted model, there was a trend toward significance in the relationship between TA outlet density and past month tobacco use (OR = 1.03, $p = 0.056$).

Proximity to Tobacco Outlets

Proximity to the nearest TO outlet was not significantly associated with past month tobacco use in the pooled unadjusted model (OR = 1.00, $p = 0.46$) or adjusted model (aOR = 1.00, $p = 0.99$) controlling for gender, financial strain, education, history of tobacco use, association with friends who smoke, past month alcohol use, past month marijuana use, and baseline intervention status. The interaction term between proximity to the nearest TO outlet and gender was significant (aOR = 0.99, $p < 0.05$). When stratified by gender, distance to the nearest TO outlet was not significantly associated with tobacco use for women (OR = 1.00, $p = 0.25$; aOR = 1.00, $p = 0.21$) or men (OR = 1.00, $p = 0.84$; aOR = 1.00, $p = 0.13$).

Proximity to the nearest TA outlet was not significantly associated with past month tobacco use in the pooled unadjusted model (OR = 1.00, $p = 0.96$) or the adjusted model (aOR = 1.00, $p = 0.99$) controlling for gender, financial strain, education, history of tobacco use, association with friends who smoke, past month alcohol use, past month marijuana use, and baseline intervention status. The interaction term between proximity to the nearest TA outlet and gender was significant (aOR = 0.99, $p < 0.05$). When stratified by gender, distance to the nearest TA outlet was not significantly associated with tobacco use for either women (OR = 1.00, $p = 0.30$; aOR = 1.00, $p = 0.21$) or men (OR = 1.00, $p = 0.30$; aOR = 1.00, $p = 0.18$).

Sensitivity Analyses

In a sensitivity analysis (using the same control variables used in the primary analyses) when tobacco outlet density was calculated using all 1133 outlets (i.e., 777 TO outlets plus 356 TA outlets), the relationship between tobacco outlet density in the pooled sample ($n = 283$) remained insignificant (OR = 1.01, $p = 0.25$; aOR = 1.00, $p = 0.74$), and the interaction term between gender and tobacco outlet density was significant (aOR = 1.03, $p = 0.001$), indicative of gender differences. When stratified by gender, tobacco outlet density was not significantly associated with past month tobacco use for men (OR = 1.00, $p = 0.54$; aOR = 0.98, $p = 0.08$). Among women, in the unadjusted sensitivity analysis, tobacco outlet density was positively and significantly associated with past month tobacco use (OR = 1.01, $p < 0.01$); however, this relationship was diminished in the adjusted model (aOR = 1.01, $p =$

0.06), thereby masking the significant relationship between TO outlet density and tobacco use noted in the main analyses.

Discussion

Summary

This study aimed to assess gender differences in the relationship between tobacco outlet exposure (i.e., density and proximity) at the neighborhood level (i.e., within a quarter-mile of participants' homes) and past month tobacco use among African American young adults. There were three central findings: First, gender moderated the relationship between TO outlet density and tobacco use, such that the association was positive and significant only among women. Second, separating outlets based on whether or not they sold tobacco only versus tobacco and alcohol revealed gender differences that were indiscernible in sensitivity analyses that did not differentiate between TO and TA outlets. Third, proximity to the nearest tobacco outlet was not associated with past month tobacco use.

Gender Differences

Social norms related to tobacco access behavior tend to differ for men and women (Difranza et al. 1996; Leatherdale and Strath 2007; Proctor et al. 2012; Robinson et al. 1998). However, three studies that specifically assessed gender differences in the relationship between tobacco outlet exposure and tobacco use showed that gender did not modify the relationship between exposure to tobacco outlets and tobacco use (Cantrell et al. 2014; Johns et al. 2013; Pokorny et al. 2003). However, inner-city African American young adults were not the primary focus of either study. Brown and colleagues 2014 sampled the cohort used in the current study and found that gender moderated the relationship between the neighborhood environment—specifically perceived drug activity (e.g., seeing someone use or sell drugs)—and tobacco use, and women were more vulnerable to environmental cues to tobacco use. In low-income African American communities, illegal drug activity (e.g., selling drugs) often occurs around tobacco and alcohol outlets, especially corner stores. Greater density of these outlets may increase exposure to drug activity (Milam et al. 2013). Exposure to drug activity could be a potential form of stress for this population, which mediates the relationship between tobacco outlet density and tobacco use. The current study did not assess the indirect effects of tobacco outlet density and tobacco use, but this mediated pathway could potentially explain the gender differences in this study and should be explored in future research. Reducing tobacco outlets in low-income African American neighborhoods may have implications for both reducing tobacco use, as well as the social disorder (e.g., drug selling) that occurs around these outlets.

TO Versus TA Outlets

Among women, there was a significant association between TO outlets and past month tobacco use after adjusting for important confounders. This relationship did not exist for TA outlets and tobacco use, and there were no significant relationships between either type of outlet and tobacco use among men. From a policy perspective, TA outlets are subject to zoning and density regulations pertaining to alcohol outlets. The rules and regulations of the Baltimore City liquor board established a maximum alcohol outlet density of 1 outlet per

1000 residents, and zoning laws prohibit the establishment of new off-premise alcohol outlets in residential areas (Thornton et al. 2013). Therefore, alcohol outlets that also sell tobacco (i.e., TA outlets) are subject to the zoning and density restrictions related to alcohol retail, whereas TO outlets are not. This helps explain the higher density of TO outlets relative to TA outlets, and this density difference may be the driving factor in the relationship between outlet type and tobacco use. Furthermore, these results are consistent with prior research among this cohort asserting that alcohol outlets are not significantly associated with tobacco use (Milam et al. 2014). The current study is the first to assess potential differences in the association between TO and TA outlets on tobacco use. Additional research is needed to corroborate these findings, as well as to explore whether or not mechanisms driving the association between TA outlet exposure and TO outlet exposure and tobacco use differ.

Proximity to Tobacco Outlets

Proximity to tobacco outlets was not significantly associated with tobacco use in the pooled models, and the strength of association of the interaction between gender and proximity to either TO or TA outlets was negligible (i.e., odds ratio of nearly 1) although statistically significant. These marginal associations, coupled with smaller sample sizes in the gender stratified models, help explain the non-statistically significant results between proximity and tobacco use when stratified by gender. Previous literature on this cohort suggested that proximity to alcohol outlets is not significantly associated with tobacco use (Milam et al. 2014). Given that a proportion of alcohol outlets also sell tobacco (i.e., TA outlets), it is plausible that proximity to either tobacco or alcohol outlets among African American young adults is a weak predictor of tobacco use relative to tobacco outlet density. Given the limited amount of research that focuses on this population, additional research is warranted to corroborate these findings. Adult studies among other populations find mixed results regarding the significance of proximity to tobacco outlets on tobacco use behaviors (e.g., Cantrell et al. 2014; Chuang et al. 2005; Reitzel et al. 2011).

Limitations

Study findings must be interpreted in light of important limitations. First, the cross-sectional design does not lend itself to causal inference because of temporal ambiguity between the exposure and outcome. Additionally, all participants were African American, young adults, living in the inner city; therefore, inferences from this study may not be generalizable to other populations or geographical areas. Furthermore, tobacco and other drug use were assessed via self-report, increasing the potential for recall bias in the reported use of these substances.

Strengths

The limitations of this study should not overshadow the strengths. This study assessed the association of tobacco outlet exposure and tobacco use among a high-risk population. This is important because studies that have assessed the relationship between tobacco outlet exposure and tobacco use have not focused exclusively on inner-city, African American young adults. Additionally, this study elucidates the moderating role of gender on environmental cues of tobacco use, which may be important to practitioners aiming to

develop environmentally based interventions to reduce tobacco use among this population. Furthermore, tobacco outlets were classified based on whether or not they were licensed to sell tobacco only or tobacco and alcohol, and inferences from this distinction may be important to future policies aiming to reduce tobacco outlet density.

Conclusion

The fact that TO outlets are not restricted by the density and zoning laws that govern TA outlets is a clear bias, which sends the message that only alcohol outlet density, and not tobacco outlet density, is worth controlling. This message contradicts public health efforts to reduce tobacco use and health disparities among marginalized groups. Policy makers and public health advocates should act with urgency to reduce tobacco outlets in residential areas, as tobacco outlet density is a malleable environmental correlate of tobacco use that, if reduced can, potentially reduce tobacco use among vulnerable populations.

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Table 1
Sample characteristics by past month tobacco use in 2009 (N=283)

Characteristics	Tobacco use within the past month			Total, <i>n</i> (%)
	Yes (<i>n</i> = 49)	No (<i>n</i> = 234)	<i>p</i> value	
Age (years)				283 (100)
Mean (SE)	22.3 (0.05)	22.2 (0.03)	0.80 ^a	[Mean = 22.2; SE = 0.02]
Gender (no. (%))			0.22	
Female	20 (14.5)	118 (85.5)		138 (100)
Male	29 (20.0)	116 (80.0)		145 (100)
Income (no. (%))			0.06	
Able to meet needs	15 (12.4)	106 (87.6)		121 (100)
Unable to meet needs	34 (21.0)	128 (79.0)		162 (100)
Education (no. (%))			<0.001	
HS Diploma/GED	33 (13.8)	207 (86.2)		240 (100)
<HS Diploma/GED	16 (37.2)	27 (62.8)		43 (100)
Hx tobacco use (no. (%))			<0.001 ^b	
Yes	42 (32.1)	89 (67.9)		131 (100)
No	7 (4.6)	145 (95.4)		152 (100)
Friends smoke (no. (%))			<0.001	
Yes	35 (31.2)	77 (68.8)		112 (100)
No	14 (8.2)	157 (91.8)		171 (100)
Alcohol use (no. (%))			<0.01	
Yes	27 (28.1)	69 (71.9)		96 (100)
No	22 (11.8)	165 (88.2)		187 (100)
Marijuana use (no. (%))			<0.001	
Yes	19 (52.8)	17 (47.2)		36 (100)
No	30 (12.1)	217 (87.9)		247 (100)
Intervention			0.84	
Classroom	18 (18.4)	80 (81.6)		98 (100)
Family	16 (18.2)	72 (81.8)		88 (100)
Control	15 (15.5)	82 (84.5)		97 (100)
Proximity				
Tobacco only				283 (100)
Mean (SE)	504.9 (58.7)	565.0 (30.9)	0.41	[Mean = 554.6; SE = 27.5]
Tobacco/alcohol				283 (100)
Mean (SE)	664.4 (70.9)	662.1 (33.1)	0.98	[Mean = 662.5; SE = 29.9]
Density				
Tobacco only			0.16	283 (100.0)
Mean (SE)	22.9 (5.1)	22.9 (5.1)		[Mean = 16.6; SE = 1.6]
Tobacco/alcohol			0.64	283 (100)
Mean (SE)	7.8 (1.8)	7.0 (0.7)		[Mean = 7.1; SE = 0.7]

p Values based on chi-squared test unless otherwise noted. Tobacco only indicates that the retail outlets held a license to sell cigarettes, but not alcohol. Tobacco/Alcohol indicates that the retail outlets held a license to sell cigarettes and alcohol. Density per square mile

SE standard error, *HS* high school, *Hx* history

^aStudent's *t* test

^bFisher's exact test

Table 2
Odds ratios and 95 % confidence intervals (CIs) of the association between past month tobacco use and tobacco outlet density among young adult African American females living in Baltimore City, Maryland in 2009 (*n*=138)

Characteristics	uOR	aOR ^a (Model 1)	aOR ^b (Model 2)
Income	0.44 (0.16–1.20)	0.41 (0.11–1.53)	0.41 (0.11–1.55)
Education	0.25 (0.07–0.84) *	0.31 (0.08–1.18)	0.30 (0.07–1.22)
Hx tobacco use	9.95 (2.96–33.37) ***	5.46 (1.56–19.09) **	5.83 (1.72–19.76) **
Friends smoke	5.64 (1.96–16.22) ***	3.35 (0.88–12.68)	3.84 (1.01–14.57) *
Alcohol use	3.48 (1.19–10.16) *	3.44 (1.08–10.91) *	3.47 (1.02–11.76) *
Marijuana use	3.44 (0.98–12.09)	0.93 (0.15–5.84)	0.76 (0.09–6.64)
Density: tobacco ^c	1.02 (1.01–1.03) **	1.01 (1.00–1.03) *	–
Density: tobacco/alcohol	1.03 (0.99–1.07)	–	1.04 (0.99–1.10)
Intervention			
Control	ref	ref	ref
Classroom	2.09 (0.62–6.96)	2.24 (0.48–10.46)	2.33 (0.48–11.23)
Family	1.34 (0.39–4.64)	0.95 (0.22–4.03)	0.86 (0.19–3.87)

uOR unadjusted odds ratio, aOR adjusted odds ratio, CI conference interval, Hx history, ref reference group

* *p* value < 0.05;

** *p* value 0.01;

*** *p* value 0.001

^a aOR/Model: The adjusted odds ratio for model 1, which assesses the relationship between past month tobacco use and density (per square mile) of retail outlets licensed to sell tobacco only; adjusted for all variables in the table

^b aOR/Model 2: The adjusted odds ratio for model 2, which assesses the relationship between past month tobacco use and density (per square mile) of retail outlets licensed to sell both tobacco and alcohol; adjusted for all variables in the table

^c The unrounded 95 % CI relating density to past month tobacco use in model 1 is (1.000371, 1.029905); *p*-value = 0.044

Table 3
Odds ratios and 95 % confidence intervals (CIs) of the association between past month tobacco use and tobacco outlet density among young adult African American males living in Baltimore City, Maryland in 2009 (n=145)

Characteristics	uOR	aOR ^a (Model 1)	aOR ^b (Model 2)
Income	0.63 (0.21–1.88)	1.31 (0.36–4.77)	1.31 (0.36–4.77)
Education	0.28 (0.12–0.65) **	0.36 (0.10–1.33)	0.41 (0.12–1.45)
Hx tobacco use	10.07 (2.58–39.30) ***	7.38 (1.42–38.45) *	6.99 (1.34–36.33) *
Friends smoke	5.03 (2.37–10.66) ***	2.18 (0.65–7.25)	1.92 (0.64–5.80)
Alcohol use	3.09 (1.25–7.60) **	1.24 (0.42–3.73)	1.92 (0.64–5.80)
Marijuana use	14.42 (5.08–40.92) ***	15.81 (4.37–57.19) ***	11.25 (2.97–42.60) ***
Density: tobacco	1.00 (0.98–1.01)	0.98 (0.95–1.00)	–
Density: tobacco/alcohol	0.98 (0.94–1.02)	–	0.97 (0.93–1.01)
Intervention			
Control	ref	ref	ref
Classroom	0.82 (0.33–2.06)	0.26 (0.07–0.92) *	0.27 (0.09–0.86) *
Family	1.15 (0.41–3.23)	0.33 (0.06–1.80)	0.44 (0.11–1.80)

uOR unadjusted odds ratio, aOR adjusted odds ratio, CI conference interval, Hx history, ref reference group

* p value < 0.05;

** p value 0.01;

*** p value 0.001

^a aOR/Model 1: The adjusted odds ratio for model 1, which assesses the relationship between past month tobacco use and density (per square mile) of retail outlets licensed to sell tobacco only; adjusted for all variables in the table

^b aOR/Model 2, The adjusted odds ratio for model 2, which assesses the relationship between past month tobacco use and density (per square mile) of retail outlets licensed to sell both tobacco and alcohol; adjusted for all variables in the table