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Tobacco outlet density near home and school: Associations with smoking and norms among US teens

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Abstract

This study examined whether living or going to school in neighborhoods with higher tobacco outlet density is associated with higher odds of cigarette smoking among teens, and with perceptions of greater smoking prevalence and peer approval. Using an Internet panel that is representative of US households, we matched data from teen-parent pairs ($n=2,771$, surveyed June 2011–December 2012) with environmental data about home and school neighborhoods. Density was measured as the number of tobacco outlets per square mile for a ½-mile roadway service area around each participant's home and school. Logistic regressions tested relationships between tobacco outlet density near home and schools with ever smoking. Linear regressions tested relationships between density, perceived prevalence and peer approval. Models were adjusted for teen, parent/household and neighborhood characteristics. In total, 41.0% of US teens (ages 13–16) lived within ½ mile of a tobacco outlet, and 44.4% attended school within 1,000 feet of a tobacco outlet. Higher tobacco outlet density near home was associated with higher odds of ever smoking, although the relationship was small, $OR=1.01$, 95% CI (1.00,1.02). Higher tobacco outlet density near home was also associated with perceptions that more adults smoked, $coef.=0.09$, 95% CI (0.01,0.17). Higher tobacco outlet density near schools was not associated with any outcomes. Living in neighborhoods with higher tobacco outlet density may contribute to teen smoking by increasing access to tobacco products and by cultivating perceptions that smoking is more prevalent. Policy interventions to restrict tobacco outlet density should not be limited to school environments.

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Introduction

There are approximately 375,000 tobacco outlets in the contiguous U.S., nearly seven for every 1,000 school-age youth¹. Many of these outlets are convenience stores or small markets, which are popular destinations for teens: 47.5% reported visiting these stores at least weekly². Tobacco outlets are concentrated in school neighborhoods with higher proportions of Hispanic and low-income students³. In neighborhoods with a higher concentration of tobacco outlets, youth are more likely to report purchasing their own cigarettes^{4, 5} and underage sales are more prevalent^{6, 7}.

Concern about disparities in retail access to tobacco products has inspired a growing body of literature that examines whether teens who live or attend school in neighborhoods with higher tobacco outlet density are more likely to smoke. Several studies document that higher tobacco outlet density in school neighborhoods is associated with higher odds of teens' ever smoking^{8, 9}, current smoking^{10, 11}, susceptibility to future smoking¹², and with greater school-level smoking prevalence³. However, other studies report null findings^{13, 14}. Higher tobacco outlet density where teens live, defined as tract, city or county, is also associated with higher odds of current smoking¹⁵ and ever smoking^{16, 17}. Again, other studies report null findings^{7, 18}.

Two studies have compared tobacco outlet density in both home and school neighborhoods. In California, higher density within 0.75 and 1-mile buffers of teens' home was associated with more frequent smoking, but density near schools was not¹⁹. In Scotland, youth who lived in areas with the highest outlet density had 53% higher odds of being a current smoker; conversely, youth who attended schools in areas of highest outlet density had significantly lower odds of ever smoking and being a current smoker²⁰. The authors suggested that mandatory school uniforms and higher levels of surveillance among outlets located in close proximity to schools may deter both purchase attempts and underage sales²⁰. Two studies examined distance to nearest tobacco outlet from either school or home as a predictor of teen smoking behavior but neither detected any relationship^{18, 19}.

Higher tobacco outlet density reduces search costs for cigarettes and increases environmental cues to smoke^{21–24}. In addition, living or going to school in areas that are more saturated with tobacco outlets may serve to normalize tobacco use^{25, 26}. In New York state, higher tobacco outlet density was associated with an increased likelihood that youth think smoking makes them look cool and fit in⁵. However, the association of outlet density with other normative perceptions about tobacco use has received little attention.

The current study contributes to the literature on tobacco outlet density and youth smoking in three ways: (1) it estimates tobacco outlet density and proximity near home and school for a representative sample of US households with teens; (2) it examines whether higher tobacco outlet density near homes, near schools, or both, are associated with higher odds of ever smoking cigarettes, after adjusting for both individual and neighborhood characteristics; (3) it examines a previously unexplored hypothesis about tobacco outlet density and normalization of smoking, by investigating whether youth who live or attend school in areas

with higher tobacco outlet density perceive that smoking is more prevalent or perceive greater approval for smoking among peers.

Methods

An online survey of teens and their parents provided data for smoking behaviors, normative perceptions, and demographic characteristics of teens, parents and their households. These survey data were matched with neighborhood-level data about participants' residence and school neighborhoods.

GfK (formerly Knowledge Networks) maintains a nationally representative Internet panel of US households, recruited using probability-based random-digit dialing and address-based sampling. We surveyed teen-parent pairs from GfK's existing panel of households with teens (ages 13–16 years) in order to capture smoking initiation among youth age 13 or older. GfK divides its panel into active and inactive components. The active group has responded to recent survey requests; the inactive group has not responded to recent surveys, or is known to be on vacation or ill, but can still be contacted for surveys. We included eligible households from both groups. All households were recruited similarly, and data were collected at the same time. In order to obtain adequate sample size (determined by a power calculation), participants were recruited in three cohorts. The first cohort was surveyed between April and June of 2011 (57.2% of sample), the second between September and October of 2011 (15.3% of sample) and the third from October through December 2012 (27.6% of sample). Parental consent and teen assent were obtained using a protocol approved by Stanford University's Institutional Review Board. Among eligible households, the response rate was 40%, which is consistent with other online surveys²⁷. Of the parent-teen pair respondents with completed surveys, 44% were active panelists and 56% were from the inactive households. We tested whether being from an inactive household, alone or in combination with tobacco outlet density, explained the study outcomes. It did not, and was therefore not included in the analyses.

One eligible teen (age 13–16) and parent from each household were surveyed. The parent survey (42 items) assessed parental smoking, beliefs, and demographic information about the teen and the household; the teen survey (57 items) assessed teen smoking behaviors and beliefs. Both teens and parents were asked to report the name of the school that the teen attended.

Outcome measures

All primary outcome measures were self-reported by teens. Ever smoking was defined as a report of ever trying a cigarette (even a puff) and included current smokers who reported any cigarette smoking in the past 30 days. In addition, the study examined three normative perceptions about smoking. Using a sliding (thermometer) scale from 0 to 100 percent, participants estimated smoking prevalence for students in their grade at their school, adults in their community, and adults in their state. Responses for the two adult prevalence items were averaged ($r=0.71$, $p<0.01$). Using a 4-point scale (1=definitely no, 4=definitely yes), teens reported whether their friends "think it is OK to smoke cigarettes once in a while," and

this item was repeated for most students in their school. The two items were averaged ($r=0.57$, $p<.01$).

Teen/household covariates

Teens reported their age, gender, typical grades in school, and how many of their closest friends smoked cigarettes. A measure for self-reported grades was dichotomized at the median, and mostly B+ or higher was the referent category. Exposure to peer smoking compared youth with no friends who smoked and those with at least one friend who smokes cigarettes.

Parent-reported variables were teens' race/ethnicity and whether or not any adult in the household currently smoked. Race was collapsed into three categories: African American, White, and all other (including multiple races) because there was not a large enough number of Asian and Pacific Islander respondents to support a separate category for this group.

Household income was provided by the panel vendor using 19 response options of varying interval widths; these were recoded using the midpoint of each income interval and treated as a continuous variable in the analyses.

Home and school neighborhoods

The panel vendor provided latitude/longitude coordinates for home addresses with a 100-foot random shift to protect participant anonymity. We used the open-ended responses for school names reported by the teen, parent or both (90.2% of cases) to search street addresses, then used ArcGIS v10.1 to map every school to latitude/longitude (mapping rate=94.8%).

For each teen, ego-centric neighborhoods were defined by 1/2-mile roadway network service area around the participant's home and school, following recommendations for studying environmental influences on health behaviors²⁸. Home neighborhoods were centered on the address point provided by the panel vendor. School neighborhood boundaries were created from our estimate of the campus center point. For each school address, we calculated a 90-degree offset from the street and added a constant distance, using a larger offset for high schools (429 feet) than for middle schools (377 feet). These estimates were derived from school boundary shapefiles for California public schools.

Only 10.9% of participants lived within 1 mile of school, such that their individual home and school neighborhoods overlapped. In addition, 9.3% of teens were home schooled and therefore had identical home and school neighborhoods. Only 3.2% of participants' home neighborhoods overlapped with another participant's home neighborhood.

Tobacco outlet density and proximity

These measures were computed separately for home and school neighborhoods, using purchased address data for likely tobacco outlets in all zip codes that contained or were adjacent to each teen's residence and school ($n=33,144$). A list of likely tobacco outlets was created by purchasing addresses from two independent sources, Reference USA and Dun & Bradstreet, for outlets with a primary and/or secondary North American Industry

Classification System (NAICS) business code for the store types that represent 98% of tobacco sales in the US²⁹. The purchased lists were cleaned to remove likely duplicates and retail chains known not to sell tobacco, merged and again checked for duplication. Using ArcGIS v10.1, likely tobacco outlets within home and school neighborhoods were mapped (mapping rate=99.7%), and tobacco outlet density was measured separately for home and school neighborhoods by counting outlets within each roadway network buffer and dividing by the land area (square miles). Proximity to nearest tobacco outlet in roadway miles was computed for both home and school. The presence of any tobacco outlet within 1,000 feet of school was coded because the Food and Drug Administration (FDA) considered this distance in its 1996 rule to restrict outdoor tobacco advertising near elementary and secondary schools, and because 1,000 feet is a commonly used to define drug-free school zones³. In addition, previous research suggested that 1,000 feet is the minimum distance required for a policy to be effective in reducing exposure to point-of-sale marketing near schools³⁰.

Neighborhood covariates

Intercensal estimates (GeoLytics, Inc.) were extracted to characterize ego-centric home and school neighborhoods in terms of race (% African American), ethnicity (% Hispanic), and percent of population in poverty. Census data were weighted in proportion to tract area when neighborhoods contained multiple tracts. In addition, the panel vendor designated whether or not each residence was located in a Metropolitan Statistical Area, and households located outside these areas were coded as rural. This variable was not available for school neighborhoods and therefore excluded from those analyses.

Statistical analysis

The panel vendor used a raking procedure to create a weighting variable for the current study. Teens' age, race, region of residence, and household income were used to compute a weighting variable for all respondents (from both active and inactive panel households) in order to generalize to the population of US 13–16 year olds. Descriptive statistics were used to compare students with valid school data to those without school data (home schooled n=214, did not attend school n=6, or were missing valid school data n=181). For all subgroup comparisons, tests for differences in numeric variables used independent sample t-tests and for categorical variables chi-square tests.

Bivariate relationships between predictors and outcomes were examined using logistic regression (ever smoking) and linear regression (perceived teen smoking prevalence, perceived adult smoking prevalence, and perceived approval). A log-transformed version of estimated peer smoking prevalence was used in regression models because it was skewed positively. Adjusted logistic and linear regressions stratified by neighborhood type (home and school) modeled ever smoked a cigarette as a function of the primary predictor neighborhood tobacco outlet density, adjusting for individual characteristics, peer/parent/household attributes, and neighborhood characteristics. A secondary analysis used logistic regression to examine which individual characteristics and peer/parent/household attributes were associated with higher odds of living within ½ mile of at least one tobacco outlet. Data about persons and places were linked and statistical analyses were conducted in 2015.

Results

In total, 2,771 teen-parent pairs completed the online survey and 2,372 (85.6%) had valid data for school address. The analysis sample ($n=2,771$) was approximately half female, and predominantly (70.2%) Hispanic or non-Hispanic white, and 18.7% reported ever smoking a cigarette (Table 1). We did not model current smoking because the incidence rate was 3.9%. Hispanics comprised a greater proportion of teens with school data (16.5%) than teens without school data (12.5%) ($p=0.046$), but school data did not differ on other variables in Table 1 (data not shown).

Table 2 summarizes descriptive statistics for outlet density, proximity and other characteristics of home and school neighborhoods. Approximately 4 in 10 US teens ages 13–16 lived within walking distance ($\frac{1}{2}$ mile) of at least one tobacco outlet, and more than $\frac{3}{4}$ attended school within walking distance of at least one tobacco outlet (Table 2). Nearly half attended school within 1,000 feet of at least one tobacco outlet. Tobacco outlet density was greater in school than in home neighborhoods (14.7 versus 3.9 outlets per square mile). Both measures were skewed positively and correlated ($Rho=0.27$, $p<0.001$).

Adjusting for household income, African American youth were more than twice as likely as white youth to live near a tobacco outlet and other racial groups (combined) were also twice as likely to live near a tobacco outlet (see Table 3). Adjusting for teen race and ethnicity, each \$10K increase in household income was associated with a 7% decrease in the odds of living near a tobacco retailer (see Table 3).

Table 4 summarizes the unadjusted and adjusted models for ever smoking, modeled separately home and school neighborhoods. Cohort membership was not significantly related to ever smoking in bivariate or adjusted models ($p\text{-value}>0.65$), and was removed from the analyses. Adjusting for individual demographics and other neighborhood characteristics, higher tobacco outlet density near home was associated with a small but significant increase in the odds of ever smoking ($OR=1.01$, 95% CI (1.00, 1.01), $p<0.01$). This was equivalent to a 1 percentage point increase in the odds of ever smoking for each additional store within walking distance of home, or a 10 percentage point increase in the odds of ever smoking for a one standard deviation increase in tobacco outlet density. Adjusting for individual demographics, other environmental factors associated with higher odds of ever smoking were living in neighborhoods that were rural or had a higher proportion of African American residents.

None of the school neighborhood characteristics were associated with higher odds of ever smoking among teens, including tobacco outlet density (Table 4). Ancillary analyses that replaced tobacco outlet density with variables about outlet proximity, such as the presence of any tobacco outlet within 1,000 feet of school and distance from school to the nearest tobacco outlet, also yielded null results (data not shown).

On average, teens estimated that 25.9% of their same-grade peers ($SD=24.2$) smoked cigarettes, and that approximately twice as many adults ($M=50.1\%$, $SD=22.1$) smoked. In bivariate models, tobacco outlet density near homes was a significant predictor of perceived prevalence of smoking by adults ($coef.=0.24$, $p<0.001$), but density did not predict smoking

prevalence by peers or peer approval for smoking. Outlet density near schools was not significantly related to any of the three normative perceptions measures in bivariate models (data not shown). Therefore, adjusted models to predict normative perceptions about smoking were fit for tobacco outlet density in home neighborhoods but not for schools because it was not correlated with any outcomes.

After controlling for individual, peer/parent/household and neighborhood covariates, living in neighborhoods with higher tobacco outlet density was associated with perceptions of greater smoking prevalence by adults (coef.=0.09, $p<0.01$) (See Table 5). Consistent with previous studies, being younger, female, non-White race, having at least one friend who smokes, one parent who smokes, lower household income, and living in a rural neighborhood and in a neighborhood with higher levels of poverty (p -values <0.05) were also associated with perceptions of greater smoking prevalence by adults. Although normative perceptions differed by sample cohort (p -values <0.05), its inclusion did not meaningfully affect coefficients or significance levels of any primary predictors or other correlates, so it was excluded from models.

Living in neighborhoods with higher tobacco outlet density was not associated with perceptions of greater smoking prevalence by peers or with greater approval of smoking by peers. Indeed, few of the environmental factors that were measured were associated with these outcomes, except that teens who lived in rural neighborhoods perceived significantly greater peer approval for smoking than teens who lived in more urban neighborhoods (coef =0.12, $p<0.01$) (see Table 5). Other characteristics associated with perceptions of greater peer approval for smoking were being Hispanic, earning lower grades, and exposure to peers who smoke.

Discussion

This nationally representative survey of US teens suggests that tobacco outlets are omnipresent in young people's environment. Approximately 41% of US teens lived within walking distance of at least one tobacco outlet. The odds of living nearby were more than twice as likely for African American teens, even after adjusting for household income. More than three in four US teens (78%) attended school within walking distance at least one tobacco outlet. Statistics from a national sample may serve as a useful benchmark for state and local efforts to decrease tobacco outlet density and to remedy neighborhood inequities.

Higher odds of ever smoking were associated with living in areas with higher tobacco outlet density, but not with attending school in neighborhoods with higher outlet density. Thus, results from this study confirm a pattern that was observed previously in a study of 50 midsize California cities¹⁹: that tobacco outlet density near teens' homes appears to matter more than density near schools. One possible explanation is that any measure of tobacco outlet density near schools contains more noise (less accuracy) than measuring tobacco outlet density near homes. School names were self-reported, and the current study lacked information about school boundaries other than the street address. Although we incorporated an adjustment for campus size to better estimate the campus center point from the street address, actual school boundaries would be preferable for defining school neighborhoods.

Unfortunately, such boundary data are not widely available or accessible. Using an address point to substitute for school boundary data may underestimate tobacco outlet density near schools³¹, and therefore underestimate the association of tobacco outlet density in school neighborhoods with teens' smoking behavior and normative perceptions.

This study is among the first to provide evidence that is consistent with a theory that a preponderance of tobacco outlets in the environment serves to normalize smoking. In adjusted models, higher tobacco outlet density near teens' homes was associated with perceptions of greater smoking prevalence among adults. This was only true for perceptions about adult smoking, not about youth smoking. This finding builds on a New York study suggesting that county-level measures of density were associated with a greater likelihood that teens' thought smoking made them look cool.⁵ Future research should consider a variety of attitudinal outcomes, including perceived risks and benefits of tobacco use as well as support for tobacco control policies, which may vary as function of routine exposure to tobacco outlets.

The availability of geocoded data for a large representative sample of US households with teens, allowed for studying environmental risk factors for smoking as an attribute of person-centered buffers²⁸. In addition, measures of tobacco outlet density were created with data for likely tobacco outlets from two independent sources. Previous research confirms that purchased lists have good concordance with density measures from obtained from state outlet licensing^{32, 33}, which would have been too difficult to obtain for a sample of US households with teens.

Limitations of this study are the cross-sectional design, which is typical of most studies about outlet density, and a modest response rate, which is characteristic of Internet panels with teen respondents²⁷. Prevalence of ever smoking in this sample was similar to that of other national surveys during the same timeframe.³⁴ However, the sample size and the prevalence of current smoking were too small to detect an association of tobacco outlet density with current smoking that has been reported elsewhere⁹. The relationship of density to current smoking may be stronger than the relationship of density to ever smoking, which includes teens who merely experimented once or twice. Future research should consider current smoking as well as outcomes related to other tobacco products, especially given the rising prevalence of e-cigarette and poly-tobacco use among youth^{35, 36}. Indeed, the retail availability of e-cigarettes increased dramatically since these data were collected in 2012³⁷. Although CVS Caremark abandoned tobacco sales in 2014, dollar stores started selling tobacco, and tobacco specialty shops are increasing^{38, 39}. It seems unlikely that these changes would weaken the relationships between tobacco outlet density, teen smoking, and normative perceptions about tobacco use.

Conclusion

Local policy interventions to limit tobacco outlet density typically focus on limiting outlet proximity to schools^{3, 30, 40}. However, results of this study suggest that state and local policies to reduce tobacco outlet density should not focus on outlets near schools exclusively. It is important to reduce the presence of tobacco outlets everywhere, particularly

near teens' home. Using outlet licensing and zoning ordinances to control land use are important strategies to reduce the retail availability of tobacco products in communities⁴¹. Such tools should be applied broadly to reduce inequities in tobacco outlet density, particularly focusing on neighborhoods with higher proportions of youth, for whom environmental exposure may normalize tobacco use and influence smoking initiation.

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LH, NCS and SPF designed the study. NCS conducted the analyses and drafted the manuscript with TOJ. All authors contributed critical feedback and approved the final version. Some findings were presented at the 2015 Annual Meeting of the Society for Research on Nicotine & Tobacco.

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Highlights

41.0% of US teens (ages 13–16) lived within ½ mile of a tobacco outlet.

44.0% of teens attended school within 1,000 feet of a tobacco outlet.

Regardless of income, Black teens were twice as likely to live near a tobacco outlet.

Teens who lived near more tobacco outlets were more likely to try smoking.

Policies to reduce tobacco outlet density should not be limited to school environments.

Table 1

Sample descriptive statistics, overall and split by ever smoked: US teens (ages 13–16), 2011–2012

	Overall (n=2,771)	By smoking status	
		Never (n=2,253)	Ever or current (n=518)
Student characteristics			
Age	14.4 (1.1)	14.5 (1.1)	14.9 (1.0)
Gender			
Female	48.7%	49.6%	44.9%
Male	51.3%	50.4%	55.1%
Race			
White	70.2%	70.1%	71.4%
African American	14.7%	14.7%	14.5%
Other	15.1%	15.2%	14.1%
Ethnicity			
Non-Hispanic	80.3%	80.4%	79.7%
Hispanic	19.7%	19.6%	20.3%
Low grades (Mostly B's or lower)	32.9%	28.5%	51.8%
Peer/Parent/Household			
At least one friend smokes	20.6%	13.6%	51.2%
Parent smokes	15.4%	12.9%	26.1%
Household income	71,108 (48,250)	74,120 (48,466)	58,051 (44,607)
Normative Perceptions			
Perceived Prevalence			
Teens in your grade	25.9 (24.2)	22.4 (22.3)	41.0 (25.8)
Adults in your community and state [^]	50.1 (22.1)	48.3 (21.6)	57.7 (22.6)
Perceived approval (max=4)	2.0 (0.8)	1.9 (0.7)	2.7 (0.8)

Note. Cell entries are % or mean (standard deviation).

[^] Mean of two measures: Estimated smoking prevalence of adults in participants' community and in state.

Table 2

Descriptive statistics for home and school neighborhoods, defined by ½-mile roadway networks

	Home neighborhoods (n=2,771)		School neighborhoods (n =2,368)	
Density				
Tobacco outlets per square mile	3.9	(9.5)	14.7	(33.2)
Proximity				
At least one outlet within ½ mile	41.0%		78.4%	
At least one outlet within 1,000 feet	N/A		44.4%	
Census-based characteristics				
% African American	11.5%	(19.9)	10.5%	(17.6)
% Hispanic	14.7%	(19.5)	14.8%	(19.1)
% Below poverty level	13.0%	(10.3)	13.4%	(10.3)
Land area (sq. miles)	0.9	(0.3)	0.8	(0.3)
Rural (not in MSA), %	15.8%		N/A	

Note: Cell entries are % or mean (standard deviation). Neighborhood characteristics for ½-mile roadway network service areas were computed with 2011 Intercensal estimates (GeoLytics, Inc.).

Table 3

Characteristics associated with living within 1/2 mile of at least one tobacco outlet: US teens (ages 13–16), 2011–2012

	At least one tobacco outlet within 1/2 mile of home	
	OR	95% CI
Teen characteristics		
Age	1.01	(0.94, 1.09)
Gender (male)	0.85 *	(0.72, 1.00)
Race		
White	Ref.	
African American	2.17 ***	(1.73, 2.72)
All other	1.98 ***	(1.52, 2.56)
Ethnicity (Hispanic)	1.29 *	(1.05, 1.59)
Low grades (B's or lower)	1.21 *	(1.01, 1.44)
Parent/Peer/Household		
At least one friend smokes	1.22	(1.00, 1.50)
Parent smokes	1.02	(0.82, 1.28)
Household income (\$10k)	0.93 ***	(0.92, 0.95)
Rural (not in MSA)	0.55 ***	(0.44, 0.69)
Constant	0.76	

*
p 0.05;

**
p 0.01;

p 0.001.

Associations of individual, household, and neighborhood characteristics with ever smoking: US teens (ages 13–16), 2011–2012

Table 4

	Unadjusted models			Adjusted models		
	OR	95% CI	OR	Home neighborhood (n=2,741)	95% CI	School neighborhood (n=2,356)
Teen characteristics						
Age	1.40***	(1.28, 1.53)	1.23***		(1.11, 1.36)	1.24*** (1.12, 1.38)
Gender (male)	1.21	(1.00, 1.47)	1.15		(1.15, 1.42)	1.19 (0.94, 1.49)
Race						
White	Ref.		Ref.			Ref.
African American	0.97	(0.75, 1.23)	0.55**		(0.36, 0.83)	0.72 (0.50, 1.04)
Asian/API/All other	0.82	(0.60, 1.14)	0.89		(0.61, 1.30)	1.03 (0.70, 1.53)
Ethnicity (Hispanic)	1.04	(0.82, 1.32)	0.95		(0.69, 1.31)	0.84 (0.60, 1.17)
Low grades (mostly B's or lower)	2.70***	(2.22, 3.28)	1.97***		(1.58, 2.46)	2.19*** (1.74, 2.76)
Peer/Parent/Household						
At least one friend smokes	6.65***	(5.39, 8.21)	4.91***		(3.92, 6.15)	4.68*** (3.69, 5.95)
Parent smokes (yes)	2.38***	(1.89, 3.00)	1.80***		(1.38, 2.35)	1.59** (1.19, 2.12)
Household income	0.93***	(0.91, 0.95)	0.98		(0.95, 1.00)	0.96** (0.93, 0.99)
Home neighborhood						
% African American	1.01***	(1.00, 1.01)	1.11**		(1.03, 1.19)	
% Hispanic	1.00***	(1.00, 1.01)	0.98		(0.92, 1.05)	
% Population in poverty	1.03***	(1.02, 1.04)	1.04		(0.91, 1.19)	
Rural (not in MSA)	1.69***	(1.33, 2.15)	1.55**		(1.15, 2.08)	N/A
School neighborhood						
% African American	1.00	(1.00, 1.01)				1.00 (0.93, 1.08)
% Hispanic	1.00	(1.00, 1.01)				1.00 (0.99, 1.01)
% Population in poverty	1.02***	(1.01, 1.03)				1.01 (0.99, 1.02)
Tobacco outlet density						
Near home (n=2,771)	1.01	(1.01, 1.02)	1.01*		(1.00, 1.02)	

Adjusted models					
Unadjusted models		Home neighborhood (n=2,741)		School neighborhood (n=2,356)	
OR	95% CI	OR	95% CI	OR	95% CI
1.00	(1.00, 1.01)	0.00	--	1.00	(1.00, 1.01)
Near school (n=2,367)					
Constant					
				0.01	--

Notes: Tobacco outlet density=tobacco outlets per square mile; neighborhood characteristics were scaled for 10-percentage point increase;

* p<0.05,
** p<0.01,
*** p<0.

Adjusted associations individual, household and neighborhood characteristics with normative perceptions: US teens (ages 13–16), 2011–2012

Table 5

	Perceived Prevalence			Perceived Approval		
	Peer smoking		Adult smoking	Peer smoking		Adult smoking
	Coef.	95% CI	Coef.	95% CI	Coef.	95% CI
Teen characteristics						
Age	0.15***	(0.13, 0.16)	−1.16***	(−1.83, −0.48)	0.09***	(0.07, 0.12)
Gender (male)	−0.07***	(−0.11, −0.03)	−3.43***	(−4.93, −1.92)	−0.02	(−0.07, 0.03)
Race						
White	Ref.		Ref.		Ref.	
African American	0.62	(−0.01, 0.13)	6.48***	(3.66, 9.31)	−0.08	(−0.18, 0.01)
All other	−0.01	(−0.08, 0.06)	2.80*	(0.58, 5.03)	0.03	(−0.04, 0.11)
Ethnicity (Hispanic)	0.02	(−0.04, 0.07)	1.32	(−0.92, 3.55)	0.08*	(0.01, 0.16)
Low grades (B's or lower)	0.09***	(0.06, 0.14)	1.38	(−0.28, 3.04)	0.14**	(0.08, 0.2)
Peer/Parent/Household						
At least one friend smokes	0.42***	(0.37, 0.47)	10.44***	(8.5, 12.37)	0.98***	(0.91, 1.04)
Parent smokes	0.01	(−0.05, 0.06)	6.12***	(3.99, 8.25)	0.01	(−0.06, 0.08)
Household income (\$10k)	−0.01*	(−0.01, 0.00)	−0.94***	(−1.12, −0.76)	−0.01	(−0.02, 0.00)
Home neighborhood						
% African American	0.00	(−0.01, 0.01)	0.16	(−0.38, 0.7)	0.01	(−0.01, 0.03)
% Hispanic	0.01	(−0.01, 0.02)	0.21	(−0.28, 0.7)	−0.01	(−0.03, 0.01)
% Population in poverty	0.01	(−0.01, 0.04)	1.39**	(0.39, 2.39)	0.02	(−0.02, 0.05)
Rural (not in MSA)	−0.03	(−0.09, 0.03)	5.03***	(2.81, 7.24)	0.12**	(0.05, 0.20)
Tobacco outlet density near home	0.00	(0.00, 0.00)	0.09*	(0.01, 0.17)	0.00	(0.00, 0.00)
Constant	1.04***	(−1.31, −0.78)	66.71***	(56.71, 76.72)	0.45*	(0.11, 0.79)

Notes. Perceived prevalence (max=100%) and peer approval (max=4). Perceived prevalence of peer smoking was log transformed; household income scaled (\$10 K) and neighborhood characteristics were scaled for 10-percentage point increase;

* p 0.05;

** p 0.01;

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