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Association of School Social Networks' Influence and Mass Media Factors With Cigarette Smoking Among Asthmatic Students

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Abstract

BACKGROUND—Around 10% of adolescent students under 18 years have current asthma. Asthmatic adolescents smoke as much or more than non-asthmatic adolescents. We explored the association between exposure to mass media and social networks' influence with asthmatic student smoking, and variations of these exposures by sex.

METHODS—This study included 9755 asthmatic and 38,487 non-asthmatic middle and high school students. Secondary data analysis incorporated the complex sample design; and univariate, bivariate, and logistic regression statistics.

RESULTS—Asthmatic students had greater odds of smoking than non-asthmatic students. Asthmatic female students were more likely than asthmatic male students to have been exposed to secondhand smoke in rooms or cars and to smoking actors, but less likely to associate smoking with intent to wear tobacco-marketing products, or with looking cool/fitting in. Asthmatic male and female students, who have smoking friends, were exposed to secondhand smoke in rooms (only girls) or cars, intended to smoke if best friends offered cigarettes, or received/bought tobacco marketing products had greater odds of smoking than other asthmatic students.

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Human Subjects Approval Statement

The Maryland Department of Health and Mental Hygiene's institutional review board provided prior human subjects research approval.

CONCLUSIONS—The observed associations suggest the need for general interventions to reduce middle and high school students' cigarette smoking as well as targeted interventions for asthmatic adolescent students.

Keywords

adolescent; asthma; smoking; mass media; students

Asthma is a common chronic disease among adolescent students, and was one of the 5 most common reasons for pediatric treat-and-release for emergency department visits among 5- to 14-year-old children in 2010.[1] In 2013, 26.3% of high school and 23.5% of middle school students in Maryland reported ever having been told by a doctor or nurse that they had asthma.[2] Avoidance of smoking and exposure to secondhand smoke has been recommended for people with asthma,[3] because persons with asthma who smoke experience higher rates of hospitalization and reduced quality of life when compared with non-smokers with asthma.[4] Previous studies have found that adolescents with current asthma smoke as many or more cigarettes than adolescents without asthma.[5-8] For example, adolescents reporting having had an asthma episode or attack are more likely than other adolescents to report lifetime daily cigarette use and current frequent cigarette use.[5] In addition, a recent study has shown that high school students with asthma have a higher prevalence of hookah smoking than other students.[9]

Despite the large number of studies identifying relationships between peers, school programs, family members, and media for adolescent smokers,[10-13] our understanding of the role of these factors for asthmatic adolescent smokers remains limited. Previous studies of asthmatic adolescent smoking have examined environmental smoking exposure, alcohol, communication with parents, as well as intrapersonal factors such as autonomy, depression, smoking prevalence, asthma management.[6,14,15]

Sex has an impact on adolescents' school social networks including peer selection, patterning of peer ties, and peer influence making.[16] Research is needed to explore whether and to what extent exposure to smoking in mass media has a similar influence on adolescent tobacco use and variations by sex.[17] This study aims to determine whether exposure to mass media and school social networks' influence are associated with current smoking status among asthmatic adolescent students by sex and if these associations vary by sex.

METHODS

Participants

This is a secondary analysis of cross-sectional, complex sample survey data from the 2006 Maryland Youth Tobacco Survey (MYTS). A 2-stage sampling process involving school and classroom level sampling included a total of 48 strata: 24 strata for Maryland's 24 political jurisdictions, 1 substratum of middle schools, and 1 substratum of high schools for each political jurisdiction.

Procedures

Paper-and-pencil format questionnaires were self-administered during October-December 2006 in individual classrooms or in alternative locations using Centers for Disease Control and Prevention (CDC) protocols for administration. A total of 82,500 adolescents from 308 high school and middle schools were selected, for an overall response rate was 86.7%. For this article, adolescents were excluded if less than 12 years of age or older than 17 years of age (N = 9658); responded “don't know” to the question about asthma (N = 5400); or had inconsistent responses to the smoking questions such as reported smoking a cigarette 1 or more days during the past 30 days but had not smoked at least part of a cigarette in the past 30 days (N = 19,200). The initial descriptive analysis includes 9755 asthmatic and 38,487 non-asthmatic adolescents (Table 1).

Definitions of Outcomes and Predictors

We considered participants as having asthma (asthmatics) if they self-reported that a doctor or a nurse ever told them that they have asthma. Participants were categorized as nonsmokers if they answered they have never performed any of the following behaviors: (1) tried cigarettes even 1 or 2 puffs; (2) smoked a whole cigarette; and (3) smoked a cigarette in their entire life. Participants were categorized as current smokers if they had smoked cigarettes 1 or more days during the past 30 days and had smoked at least part of a cigarette in the past 30 days. Participants were asked to indicate which racial/ethnic group best identified them: American Indian or Alaskan Native, Asian, Black, or African American, Hispanic or Latino, Native Hawaiian/Pacific Islander, White.

Predictor variables included exposure to mass media messages including exposure to Internet cigarette/tobacco ads, actors using tobacco on TV or in movies, athletes using tobacco on TV, and convenience store or gas station tobacco advertisements; receipt/purchase of anything that has a tobacco company name/picture on it; intention to wear anything that has a tobacco company name/picture on it. Other predictor variables included role modeling of social network members such as having close friends who smoke cigarettes; smoking allowed at home; exposure to secondhand smoke in room or car; thinking smoking cigarettes makes young people look cool/fit in. Influence from social network actors predictor variables included intention to smoke if best friends offer cigarette; receipt of explanation from parents/guardians on dangers of tobacco use and warning them not to smoke cigarettes; belief that smokers have more friends; and receipt of classes about why young people smoke and effects of smoking cigarettes.

Statistical Methods

Analytic weights were constructed to reflect the likelihood of sampling each student, adjust for non-response, and allow the data to be generalized to Maryland's adolescent student population. To examine individual characteristics of asthmatic adolescent student nonsmokers versus smokers, we dichotomized dependent and predictor variables. Kappa statistics were used to test collinearity between independent variables[18] using unweighted data because the SPSS 18.0 (SPSS Inc., Chicago, IL) complex sample feature cannot perform this analysis.

Bivariate logistic regression analysis determined whether there was differential exposure to mass media, social network factors, and social networks' influence by sex. Further bivariate logistic regression tested whether exposure to mass media, social network factors and social networks' influence was associated with smoking status by sex; factors with significant ($p < .05$) associations were then entered in 3 multivariate models (Tables 2-4). The association between outcome and predictor variables was measured using logistic regression modeling (odds ratio [OD] and 95% confidence interval [CI]). Estimates with a Relative Standard Error (RSE) greater than 30% were considered unreliable and not reported. All multivariate models controlled for high school level, self-perceived health status, and income. SPSS 18.0 was used to perform statistical analysis, taking into account the complex sample design and analytic weights.

RESULTS

Table 1 presents descriptive characteristics for asthmatic and non-asthmatic adolescent students including 1366 asthmatic and 4157 non-asthmatic adolescent current smokers. About half of all adolescents were girls (49.4%), or had a weekly income of $10 or less (45.7%). The largest racial/ethnic groups in the sample were Whites (48.6%) and Blacks (37.7%) followed by Latinos (5.5%), Asians (%.4%), American Indians/Alaskan Natives (1.9%), and Native Hawaiian/Pacific Islanders (0.9%). Most adolescents were enrolled in high school (62.2%), and almost all self-perceived their health status as good, very good, or excellent (93.4%).

The odds of being a smoker were greater for asthmatic adolescent students (OR = 1.36, 95% CI 1.25, 1.48) compared to non-asthmatic adolescent students (not shown). Asthmatic adolescents had greater odds of smoking than non-asthmatic adolescents regardless of sex, race/ethnicity (with the exception of American Indian/Alaskan Natives, Latinos, and Native Hawaiian/Pacific Islanders), education, weekly income, and self-perceived health status (Table 1).

Exposure to Mass Media Factors Among Asthmatic Adolescent Students

Asthmatic girls were more likely than asthmatic boys to have seen actors using tobacco on TV or in movies, but less likely to have the intention to wear something that has a tobacco company name or picture on it (not shown). Asthmatic adolescent students were more likely than their non-asthmatic counterparts to have received, bought, or have the intention to wear something that has a tobacco company name or picture on it (not shown).

Association Between Mass Media and Current Smoking Among Asthmatic Adolescent Students

Asthmatic adolescent students, who had received, bought, or have the intention to wear something that has a tobacco company name or picture on it had greater odds of smoking than those who had not received, bought, or intended to use such products (Table 2). Asthmatic adolescent boys who had seen athletes using tobacco on TV had greater odds of smoking than those who had not seen them.

Exposure to Social Network Influence Factors Among Asthmatic Adolescent Students

Compared to their non-asthmatic counterparts, asthmatic adolescent students were more likely to have close friends who smoke (OR = 1.21; 95% CI = 1.13, 1.30), have been exposed to secondhand smoke in a room (OR = 1.17; 95% CI = 1.10, 1.25) or in a car (OR = 1.17; 95% CI = 1.10, 1.24), think cigarette smoking makes adolescents look cool or fit in (OR = 1.16; 95% CI = 1.08, 1.24), have the intention to smoke if one of their friends offered them a cigarette (OR = 1.13; 95% CI = 1.06, 1.21), or think that smoking adolescents have more friends (OR = 1.12; 95% CI = 1.04, 1.18), (not shown). Asthmatic adolescent students were less likely to have attended classes regarding the harmful effects of smoking (OR = 0.88; 95% CI = 0.83, 0.94) than their non-asthmatic counterparts (not shown). Asthmatic adolescent girls were more likely than asthmatic adolescent boys to have been exposed to secondhand smoke in a room (OR = 1.42; 95% CI = 1.25, 1.61) or in a car (OR = 1.27; 95% CI = 1.12, 1.50), but less likely to think smoking cigarettes makes adolescents look cool or fit in (OR = 0.69, 95% CI = 0.60, 0.79) (not shown).

Association Between Social Network Factors Only and Cigarette Smoking Among Asthmatic Adolescent Students

Asthmatic adolescent students who reported having close friends who smoked cigarettes (other students), having been exposed to secondhand smoke in a room (girls) or in a car (boys and girls), and having the intention to smoke if one of their best friends offered them a cigarette (boys and girls) had greater odds of being a current cigarette smoker (Table 3).

Association Between Both Social Network and Mass Media Factors and Cigarette Smoking Among Asthmatic Adolescent Students

The third comprehensive multivariate model showed that friends play a crucial role in asthmatic adolescent smoking (Table 4). Asthmatic adolescent students who reported having at least 1 close friend who smoked cigarettes (boys and girls), secondhand smoke in a room (girls) or in a car (boys and girls), an intention to smoke if one of their best friends offered them a cigarette (boys and girls), and having received or bought anything that has a tobacco company name or picture on it (boys and girls) had greater odds of smoking than their counterparts who were not exposed to these factors.

DISCUSSION

Our study confirms previous study findings suggesting that asthmatic adolescent students are more likely to smoke compared to non-asthmatic adolescent students.[5] According to a report from the Surgeon General (2010), the evidence is sufficient to conclude that there is a causal relationship between adolescent active smoking and wheezing severe enough to be diagnosed as asthma in susceptible child and adolescent populations.[19] Results from a longitudinal study (22 months) among 7426 Dutch adolescents aimed at investigating whether smoking was predictive of asthma development or whether asthma predicts smoking onset among adolescents suggested bidirectionality: On the one hand, having asthma symptoms predicted smoking onset, and on the other hand, baseline smoking was found to increase the risk of developing asthma and asthma symptoms.[20] This research also found that adolescents with current diagnosed asthma who started smoking during the

course of the study were more often regular smokers than experimenters, indicating an accelerated development in smoking behavior among adolescents with asthma. [20] It has been suggested that some adolescents experiencing more asthma symptoms may become regular smokers because of the short-term anti-inflammatory effects of smoking on allergic inflammation caused by one or several of the known components in cigarette smoke.[20]

This is one of the first studies with a large sample size that analyzes the association between smoking among asthmatic adolescent students with school social networks' influence and mass media factors by sex. Another strength of our study includes the diversity and representativeness of the general population of adolescent students in Maryland middle and high schools. Multiple questions assessed exposure to media and social networks' influence.

Some limitations should be acknowledged. First, we used a single question to determine self-reported asthma status because medical records were not available. Individuals who had previously been diagnosed with asthma but did not currently have asthma could not be identified. Second, self-reported smoking status was not biochemically verified, and questions were not asked in the parent survey about hookah use. Third, the cross-sectional study design did not allow an assessment of the temporal sequence of asthma and smoking, or for causal inferences to be made regarding predictor variables. The associations observed in our study therefore need to be confirmed with future longitudinal studies using independently verified measures of asthma and smoking status. Fourth, exposures to mass media factors were estimated with single questions. Fifth, we did not follow up to determine whether tobacco usage/paraphernalia intentions were performed. However, we are using standardized questions to assess the proportion of adolescents who would ever use or wear something that has a tobacco company name or picture on it. Finally, this study is based on the most recent available data at the time of data analysis (2010 data are now available). Because the prevalence of cigarette smoking (2006: 10.0%; 95% CI: 9.5%, 10.5% and 2010: 9.6%; 95% CI: 9.2%, 10.0%) among middle and high school students and the lifetime prevalence of asthma (2006: 13.1%; 95% CI: 11.5%,14.7% and 2010: 16.4%; 95% CI: 14.6%, 18.2%) among children ages 0-17 have not changed significantly in Maryland between 2006 and 2010, we do not expect the associations presented in this study to change substantially.[21,22]

Our results suggest that having received or bought anything that has a tobacco company name or picture on it was associated with cigarette smoking. Although not shown, similar associations were found for non-asthmatic adolescent boys and girls with the addition that the intention to wear anything that has a tobacco company name or picture on it was also associated with non-asthmatic male student smoking. Possessing or being willing to use tobacco promotional materials has been identified as a significant predictor not only for being an asthmatic smoker, but also to initiate cigarette smoking.[23] Further studies should explore the effectiveness of using newer counter-marketing approaches including "branding" anti-tobacco campaigns, targeting messages to high risk and special audiences, building youth movements against tobacco, and distributing anti-tobacco gear such as T-shirts, hats, posters, and stickers to prevent smoking among asthmatic youth.[24]

Musicians, actors, and athletes can be role models and influence adolescents' normative expectations about health risk.[25] In our study, approximately 3 out of 4 asthmatic adolescent students were exposed to actors using tobacco on TV or in movies, and 1 out of 4 asthmatic adolescent students were exposed to athletes using tobacco on TV. Exposure to athletes using tobacco on TV was associated with smoking among asthmatic adolescent male students. Awareness campaigns are needed to inform athletes and actors of the potential negative impact of their smoking on adolescent students.[25] It has been suggested that smoking cessation and control media campaigns including those with actors and athletes should use a highly emotional approach to make ads more likely to be recalled, to be perceived as more effective, and to be thought about and discussed.[26,27]

According to a recent report from the Surgeon General, changing the motion picture rating criteria for R movies to reflect tobacco use could have substantial implications in cigarette use among adolescent students.[28] This report suggests that reducing the current annual mean of 275 tobacco images to 10 or less would reduce adolescent smoking rates by 18%, and therefore, 1 million tobacco deaths among children and adolescent students could be prevented.[28] Dr Stanton A. Glantz from the Smoke Free Movies project at the University of California, San Francisco enumerates other strategies including (1) requiring studios and theaters to run a proven-effective anti-smoking ad (not produced by a tobacco company) before any film with any tobacco presence, in any distribution channel, regardless of its Motion Picture Association of America rating, (2) prohibiting tobacco brand identification in films and the presence of tobacco brand imagery such as billboards in the background of any movie scene, and (3) posting a certification in the closing credits declaring that nobody on the production received cash money, free cigarettes, or other gifts, free publicity, interest-free loans or anything else of value from anyone in exchange for using or displaying tobacco.[29]

School cessation and initiation programs have the potential to capitalize on peer influence. Similar to Zibikowski et al's findings, we found that cigarette offers from best friends is the strongest predictor of smoking for asthmatic adolescent students.[7] Although it was not the focus of our current study, we also found similar results for non-asthmatic adolescents. One implication of this is that it is important to identify adolescent school leaders who can serve as role models as well as sources of information about not smoking. These school programs should also use social marketing techniques to appeal to and reach these adolescents taking into account different realities, expectations, and perceptions that adolescents may have.[9,30] For example, asthmatic adolescents were more likely than other high school students to have the perception that hookah is less harmful than cigarette smoking.[9]

Our findings suggest the need for general interventions to reduce middle and high school students' cigarette smoking as well as targeted interventions for asthmatic adolescent students. The CDC recommends the implementation of school curriculum focusing on tobacco use prevention from kindergarten to 12th grade, with increased intensity in junior high or middle school when most accelerated smoking onset occurs.[31] These interventions should improve communication among school nurses, providers, and parents;[32] and reinforce the creation of social capital to promote social acceptance of being a nonsmoker person. Adolescent students could be concerned with the consequences of quitting smoking

such as peer rejection and destruction of social standing.[33] The CDC suggests that to obtain larger and more sustained effects, school-based prevention programs should be implemented in combination with supplementary or complementary family, mass media and community-based programs as well as taxation and smokefree policies, among other initiatives.[34] It is crucial to work with diverse partners for sustaining these school programs.[35] Some schools have implemented tobacco-free campus policy that includes no tobacco use or advertising on school property allowed by anyone at any time. Innovative approaches to support adolescent smoking reduction/cessation include mobile phone-based cessation interventions using interactive and automated features so that participants could receive text messages that support their quit attempt. Other innovative approaches include the use of digital media to track asthma conditions, triggers and related activities and message content changes over the course of the intervention such as text responses provided on demand to participants encountering urges to smoke.[36,37] Because nurse delivered asthma management and education in schools has been shown to improve quality of life; and reduce absenteeism, number of days of interrupted activity, and emergency department usage; school nurses could also provide smoking cessation messages.[38,39]

Tailored smoking reduction/cessation strategies for asthmatic adolescent students have included the use of Web-based tailored asthma intervention programs with a referral coordinator;[40] a laptop computer-assisted decision-making program consisting of a 10-minute counseling session;[41] educational programs using peer leader interactions through videos, games, and activities;[42] and the dissemination of messages capitalizing on the influential role of older peers on younger adolescents.[43] Future studies should identify the impact of cessation smoking messages that are (1) tailored to asthmatic students, (2) focused on the health effects due to smoking, and (3) delivered by self-identified asthmatic actors and athletes. Alternative tobacco products should also be addressed by future studies because high school students with asthma are not only more likely to use hookah, but also to perceive that hookah use is less harmful than cigarette smoking when compared to other students.[9]

IMPLICATIONS FOR SCHOOL HEALTH

As suggested by the literature, we found that asthmatic adolescent students were more likely to smoke compared to non-asthmatic adolescent students.[5] School campaigns reducing adolescents' exposure to secondhand smoke should target all asthmatic middle and high school students. School tobacco cessation and initiation programs targeting asthmatic students have capitalized on peer influence available in their social networks; peer interaction through videos, games and activities; and the use of websites and a laptop computer-assisted decision-making program. These school programs should be implemented in combination with complementary family, mass media and community-based programs as well as taxation and smoke-free policies, among other initiatives.[34] Anti-tobacco campaigns targeting male adolescent students should take advantage of the influence that musicians, actors, and athletes have on adolescent students' normative expectations about health risk.

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Table 1

Current Smoking Rates by Asthma Status, Sociodemographic Characteristics, and Self-Perceived Health Status

	Asthmatic adolescent students	Non-asthmatic adolescent students	
	% Current smokers	% Current smokers	p-Value*
All adolescents	14.1	10.8	<.001
Sex			
Girls	14.1	10.0	<.001
Boys	14.1	11.5	<.001
Race/ethnicity			
American Indian or Alaskan Native	20.9	13.9	
Black or African American	9.5	6.7	<.001
Asian	16.1	5.8	<.001
Hispanic or Latino	17.1	13.5	
Native Hawaiian/Pacific Islander	30.8	20.8	
White	17.0	13.6	< .001
Education			
Middle school	6.9	3.3	< .001
High school	18.5	15.3	< .001
Weekly income†			
$10 or less	8.4	5.2	< .001
More than $10	18.0	15.6	< .001
Self-perceived health status			
Good/verygood/excellent	11.6	9.6	< .001
Fair/poor	36.2	29.0	< .01

*Chi-square test for independence of current smoker % between asthmatic adolescents and non-asthmatic adolescents taking into account the complex survey design.

†Income includes the amount of money they get from a job and other sources (allowance) during an average week.

Table 2

Multivariate Logistic Regression Model Comparing Exposure to Messages From New and Traditional Mass Media for Current Cigarette Smoking Among Asthmatic Adolescent Students

	Asthmatic adolescent female students			Asthmatic adolescent male students		
Significant predictor*	**AOR**	**95% CI**	**p-Value**	**AOR**	**95% CI**	**p-Value**
Exposure to messages from newand traditional mass media						
Exposed to athletes using tobacco on TV some or most of the time	1.11	(0.83, 1.47)	.49	2.28	(1.76, 2.96)	< .001
Received or bought anything that has a tobacco company name or picture on it	5.66	(4.47, 7.16)	<.001	5.49	(4.17, 7.21)	< .001
Have the intention to wear something that has a tobacco company name or picture on it†	3.14	(2.37, 4.15)	<.001	2.32	(1.71, 3.14)	< .001

AOR, adjusted odds ratio; CI, confidence interval. Multivariate analysis controlling for weekly income, education, and self-perceived health status are shown. Odd ratios reflect the relative likelihood that the adolescent is a current cigarette smoker.

*This table only presents predictors with at least 1 statistically significant estimate.

†Such as a lighter, T-shirt, hat, or sunglasses.

Table 3

Multivariate Logistic Regression Model Comparing Social Networks' Influence for Current Cigarette Smoking Among Asthmatic Adolescent Students

	Asthmatic adolescent female students			Asthmatic adolescent male students		
Significant predictor*	**AOR**	**95% CI**	**p-Value**	**AOR**	**95% CI**	**p-Value**
Have at least 1 close friend who smokes cigarettes	6.09	(4.16, 8.92)	<.001	5.26	(3.34, 8.28)	< .001
Exposed to secondhand smoke in a room†	3.42	(2.20, 5.33)	<.001	1.27	(0.77, 2.09)	
Exposed to secondhand smoke in a car‡	2.98	(1.87, 4.77)	<.001	5.02	(3.23, 7.81)	< .001
Have the intention to smoke if one of their best friends offered them a cigarette	48.38	(27.49, 85.16)	<.001	19.09	(11.73, 31.09)	< .001

AOR, adjusted odds ratio; CI, confidence interval. Multivariate analysis controlling for weekly income, education, and self-perceived health status are shown. Odd ratios reflect the relative likelihood that the adolescent is a current cigarette smoker.

*This table only presents predictors with at least 1 statistically significant estimate.

†Exposure to secondhand smoke in a room at least 1 day during the past 7 days.

‡Exposure to secondhand smoke in a car at least 1 day during the past 7 days.

Table 4

Comprehensive Multivariate Logistic Regression Model Comparing Social Networks' Influence, and Exposure to Messages From New and Traditional Mass Media for Current Cigarette Smoking Among Asthmatic Adolescent Students

	Asthmatic adolescent female students			Asthmatic adolescent male students		
Significant predictor*	**AOR**	**95% CI**	**p-Value**	**AOR**	**95% CI**	**p-Value**
Exposure to messages from newand traditional mass media						
Received or bought anything that has a tobacco company name or picture on it	2.73	(1.74, 4.27)	< .001	3.42	(2.34, 4.99)	< .001
Social Networks' Influence						
Have at least 1 close friend who smokes cigarettes	6.23	(4.12, 9.41)	< .001	4.44	(2.79, 7.06)	< .001
Exposed to secondhand smoke in a room†	3.59	(2.17, 5.92)	< .001	1.29	(0.76, 2.18)	.34
Exposed to secondhand smoke in a car‡	2.69	(1.63, 4.45)	< .001	4.67	(2.89, 7.54)	< .001
Have the intention to smoke if one of their best friends offered them a cigarette	53.18	(28.53, 99.14)	< .001	19.43	(11.38, 33.23)	< .001

AOR, adjusted odds ratio; CI, confidence interval. Multivariate analysis controlling for weekly income, education, and self-perceived health status are shown. Odd ratios reflect the relative likelihood that the adolescent is a current cigarette smoker.

*This table only presents predictors with at least 1 statistically significant estimate.

†Exposure to secondhand smoke in a room at least 1 day during the past 7 days.

‡Exposure to secondhand smoke in a car at least 1 day during the past 7 days.