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E-cigarette use among Florida youth with and without asthma

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Abstract

Introduction—Prevalence of electronic cigarette (e-cigarettes) use has increased dramatically among youth in recent years. However, little is known about e-cigarette use among youth with asthma, and how it differs by metropolitan status. This study assessed the prevalence of e-cigarette use among youth by metropolitan status, and examined the associations between e-cigarette use, susceptibility to cigarette smoking, and asthma attack.

Methods—High school students who participated in the 2012 Florida Youth Tobacco Survey were included in this study (n=36085). Information on demographics, asthma status, ever and past-30-day use of e-cigarettes, susceptibility to cigarette smoking, having asthma attacks in the past 12 months were collected. Data were weighted to be representative of Florida high school students. Analyses were conducted in 2015.

Results—Overall, prevalence of ever and past-30-day use of e-cigarettes among Florida high school students who reported having asthma were 10.4% and 5.3% respectively, which was higher than their counterparts who had never been diagnosed with asthma (ever use=7.2% and past 30-day use=2.5%; $p<0.01$). Among high school students with asthma, e-cigarette use was also more common to those who were in non-metropolitan and rural counties than those who were in the metropolitan counties ($p<0.05$). Ever and past 30-day e-cigarette use was associated with susceptibility to cigarette smoking among participants with asthma and those who never tried cigarettes (n=2410; Ever use: AOR=3.96, 95% CI=1.49, 10.56; past-30-day use: AOR=422.10, 95% CI=50.29, >999.99). Past-30-day e-cigarette use was associated with having an asthma attack in the past 12 months among participants with asthma (n=5865; $p<0.01$).

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Conclusions—E-cigarette use is more common among Florida high school youth with asthma, and is associated with susceptibility to cigarette smoking in this population.

Keywords

Youth; electronic cigarettes; asthma; susceptibility to smoking

INTRODUCTION

Electronic cigarettes (e-cigarettes) use is on the rise among youth in the US. Data from the National Youth Tobacco Survey (NYTS) showed that past-30-day use of e-cigarettes increased from 0.6% in 2011 to 3.9% in 2014 among middle school students, and from 1.5% to 13.4% among high school students.¹ The prevalence of past-30-day e-cigarette use surpassed the prevalence of past-30-day cigarette use in 2014 (2.5% among middle school students; 9.2% among high school students).¹ While a 2014 systematic review suggested that e-cigarettes could be less harmful substitutes for cigarettes,² scientists criticized the weak methodologies employed in current research to evaluate the harm of e-cigarettes, the lack of evidence on long term health effects of e-cigarette use, and the potential influenced by “conflicts of interest surrounding its funding”.^{3, 4} Additionally, e-cigarette use among youth may still poses health risks. For example, nicotine has known negative effects on brain development.^{5–7} Additionally, cross-sectional and longitudinal data suggests that e-cigarettes may introduce youth to tobacco use, and youth who use e-cigarettes are more likely to progress into using cigarettes. The NYTS data showed that ever e-cigarette use was positively associated with susceptibility to smoking among youth who never smoked cigarettes.⁸ A cohort study of 9th graders who had never used combustible tobacco products at baseline found that e-cigarette use at baseline predicted subsequent initiation of combustible tobacco use.⁹ Another cohort study of youth and young adults who were not susceptible to cigarette smoking at baseline found that e-cigarette use at baseline predicted cigarette smoking at follow-up.¹⁰

One youth subpopulation that is of particular concern is youth who have asthma. It is known that individuals with asthma are more likely to smoke cigarettes compared to individuals without asthma, even though smoking is associated with poorer asthma control.^{11, 12} Exposure to secondhand smoke among children with asthma also increases the risk of having an asthma attack.¹¹ Clinical trials and observational studies showed that common respiratory effects of e-cigarette use were coughing, throat irritation, and chest pain and tightening among non-asthmatic individuals.^{13–15} These symptoms may be more severe among youth with asthma who have sensitive airways. However, little is known about e-cigarette use among youth with asthma.

This study examined the prevalence of e-cigarette use among youth with asthma, and compared the prevalence to that of youth without asthma. It further investigated whether the association between asthma status and e-cigarette use differed by metropolitan status, given the higher prevalence of tobacco use in non-metropolitan/rural areas than metropolitan areas.¹⁶ Additionally, it assessed the associations between e-cigarette use and susceptibility

to cigarette smoking (a known predictor of future smoking initiation among youth¹⁷), and asthma attacks.

METHODS

Study population

The Florida Youth Tobacco Survey (FYTS)¹⁸ is conducted statewide annually by the Florida Department of Health that aims at tracking indicators of tobacco use and exposure to secondhand smoke among public middle and high school students in Florida. During even years, county-level demographic data of the sampled schools were also ascertained. It used a two-stage cluster probability sample design. In the first stage, a sample of public middle and high schools was randomly selected to participate in the survey. In the second stage, a sample of classrooms was randomly selected within each selected school. All students in those classes were then asked to complete a self-administered scannable paper and pencil survey. The 2012 FYTS was administered in spring 2012. A total of 75,428 students within 746 selected public schools completed the survey, resulting in response rates of 77% among middle school students and 73% among high school students. Data were collected from 66 of 67 counties in Florida, with the exclusion of Osceola County due to the county's abstention in the survey. Data from Hardee County was suppressed due to an "unrepresentative sampling methodology."¹⁸ In this study, only high school participants were included (n=36085) because of the low prevalence of e-cigarettes use among middle school participants. The study is a secondary data analysis on de-identified data and therefore exempted from Institutional Review Board approval.

Measures

Demographic information including age, gender, race/ethnicity, and metropolitan status was collected. Race/ethnicity was assessed by asking the participants to indicate if they were Hispanic/Latino (yes/no), and the best ethnic category describing them (American Indian or Alaska Native, Asia, Black or African American, Native Hawaiian or Other Pacific Islander, White, other). Responses were recoded into Hispanic, non-Hispanic White, non-Hispanic Asian, non-Hispanic Black, Native American (including American Indian, Alaska Native, Native Hawaiian or Other Pacific Islander) and other. County-level metropolitan status associated with the sampled schools, developed by the U.S. Department of Agriculture Economic Research Service, was dichotomized into metro (code 1–3) and non-metro/rural (code 4–9, which include completely rural counties).¹⁹

Participants' asthma status was assessed by asking them to indicate if they currently have asthma (options: never diagnosed, currently has asthma, does not currently have asthma, and unsure about current asthma status). Participants were also asked if they had an asthma attack during the past 12 months (yes/no). E-cigarette use was assessed by asking the participants if they had ever tried using an electronic cigarette (yes/no), and if they had used an electronic cigarette during the past 30 days (yes/no). E-cigarettes were described to the participants as "battery-operated devices that look, feel, and taste like a tobacco cigarette." Participants reported the number of days they had smoked cigarettes during the 30 days prior to the survey. Participants who had never tried smoking a cigarette were asked four

questions: (1) “Do you think you will try a cigarette soon?”, (2) “Do you think you will smoke a cigarette at anytime during the next year?”, (3) “Do you think you will be smoking cigarettes 5 years from now?”, and (4) “If one of your best friends offered you a cigarette, would you smoke it?” If participants responded anything other than “no” to the first question and “definitely not” to the other three questions, they were classified as susceptible to cigarette smoking.¹⁷ Participants were asked if anyone in their home smokes cigarettes now (yes/no). Positive social norm towards smoking was assessed by asking the participants if they have seen students, teachers, staff, or other adults smoking on school property which may indicate they were in close proximity to a smoker (yes/no). Exposure to secondhand smoking was assessed by asking if participants were in the same room with someone who was smoking cigarettes in the past 7 days (0–7 days, dichotomized into 0 day vs. 1+ days), if they rode in a car with someone who was smoking cigarettes in the past 7 days (0–7 days, dichotomized into 0 day vs. 1+ days).

Statistical analysis

Analyses were weighted to be representative of high school students in Florida and to account for clustered sampling. Demographic characteristics and e-cigarette use behaviors were compared between the youth attending high schools located in metro versus non-metro/rural counties using Chi-Square tests. Since youth in metropolitan areas were more likely than those in non-metropolitan area to be racial/ethnic minorities and heavier smokers ($p<0.05$), subsequent analyses were stratified by metropolitan status. The weighted prevalence of ever and past-30-day e-cigarette use by demographics, number of days smoked cigarettes in the past 30 days, and asthma status by metropolitan status was then estimated. Weighted logistic regression models were used to examine the following associations. First, associations between demographics, number of days smoked in the past 30 days, asthma status, and ever and past-30-day e-cigarette use were assessed, stratified by metropolitan status. Additionally, the interaction between metropolitan status and asthma status was tested for statistical significance ($p<0.05$). Second, association between e-cigarette use and susceptibility to cigarette smoking among youth who had never tried smoking cigarettes were examined ($n=2410$), adjusting for demographic characteristics and living with smokers. Third, association between past-30-day e-cigarette use and having an asthma attack in the past 12 months among those who reported having asthma was assessed ($n=5865$), while adjusting for demographics, days smoked in the past 30 days, and exposure to secondhand smoke. All analyses were conducted in SAS® version 9.3 (Cary, NC), using PROC SURVEYREG, PROC SURVEYFREQ or PROC SURVEYLOGISTIC. Analyses were conducted in 2015.

RESULTS

Table 1 shows the weighted distributions of the characteristics of the overall sample and by metropolitan status. Compared to Florida youth attending schools in metro counties, Florida youth attending schools in non-metro/rural counties were more likely to be non-Hispanic White and to have smoked in the past 30 days.

Ever use of e-cigarettes

The weighted prevalence of ever e-cigarette use among Florida high school students was 8.2% (metro=8.0% vs. non-metro/rural=11.0%; Rao-Scott Chi-Square $p<0.01$). In metro counties, female students (compared to male students), and Hispanic and non-Hispanic Black students (compared to non-Hispanic White students) were less likely to have ever used e-cigarettes ($p<0.05$; Table 2). In contrast, high school students who reported any smoking in the past 30 days were more likely than those who reported no smoking in the past 30 days to have ever used e-cigarettes ($p<0.05$). Similarly, high school students who reported currently having asthma were more likely than those who were never diagnosed with asthma to have ever used e-cigarettes ($p<0.05$). Similar associations were observed in non-metro/rural counties, except that non-Hispanic Asian high school student were less likely than non-Hispanic White high school students to report ever e-cigarette use ($p<0.05$), and the prevalence of ever e-cigarette use did not differ by gender. The prevalence of ever e-cigarette use among non-metro/rural high school students who reported current having asthma was higher than that of metro high school students who reported currently having asthma (18.2% vs. 9.9%; $p=0.0455$).

Past-30-day use of e-cigarettes

The weighted prevalence of past-30-day e-cigarette use was 3.3% (metro=3.2% vs. non-metro/rural=4.8%; Rao-Scott Chi-Square $p<0.01$). In metro counties, female students (compared to male students), and non-Hispanic Black students youth (compared to non-Hispanic White student) were less likely to have used e-cigarettes in the past 30 days ($p<0.05$; Table 3). However, Native American students (compared to non-Hispanic White students), students who reported any smoking in the past 30 days (compared to students who did not smoke in the past 30 days), and students who reported currently having asthma (compared to students who were never diagnosed with asthma) were more likely to have used e-cigarettes in the past 30 days ($p<0.05$). These associations were somewhat different in non-metro/rural counties. No racial/ethnic differences in past-30-day e-cigarette use were observed in non-metro/rural counties, while being younger (compared to being older), and being female (compared to being male) were associated with lower odds of using e-cigarettes in the past 30 days ($p<0.05$). The prevalence of past-30-day e-cigarette use among non-metro/rural high school students who reported current having asthma was higher than that of metro high school students who reported currently having asthma (9.5% vs. 5.1%; $p=0.0413$).

E-cigarette use, susceptibility to smoking, and having an asthma attack

Among Florida high school students who reported currently having asthma and had never tried smoking cigarettes, ever e-cigarette use was associated with 3.96 times the odds of being susceptible to smoking compared to those who never used e-cigarettes (95% confident interval=1.49, 10.56; Figure 1a). A similar finding was observed with past-30-day e-cigarette use and susceptibility to smoking, but because there was only 4.5% ($n=4$) of participants who used e-cigarettes in the past 30 days were not susceptible to smoking, the adjusted confidence interval was unstable. Finally, among Florida high school students that reported currently having asthma, past-30-day use of e-cigarettes was positively associated

with reporting an asthma attack in the past 12 months (adjusted odd ratio=1.78, 95% confidence interval=1.20, 2.64; Figure 1b).

DISCUSSION

Available scientific evidence suggests that e-cigarette use could have adverse health effects among youth, especially among youth with asthma.^{5, 13–15} While it is known that people with asthma are more likely than people without asthma to smoke cigarettes,¹² the association between asthma status and e-cigarette use independent of cigarette use among youth has not been previously reported. This study showed that Florida high school students who currently have asthma were more likely than those who were never diagnosed with asthma to have tried e-cigarettes and to have used e-cigarettes in the past 30 days. Moreover, the prevalence is significantly higher in non-metro/rural Florida counties versus metro counties. The reasons for these findings are unclear, but the following scenario is speculated. It is known that e-cigarettes are advertised as healthier alternatives to cigarettes.^{20, 21} These advertisements are also reaching an increasing number of youth (estimated to be 24 million youth in 2013, a 256% increase from 2011).²² Perhaps, exposure to these advertisements makes youth with asthma believe that e-cigarettes are safer for them to use than cigarettes. This hypothesis is supported by findings from a previous study showing that believing e-cigarettes are less harmful than cigarettes predicted subsequent experimentation with e-cigarettes among young adults.²³ The higher prevalence of e-cigarette use among Florida high school students with asthma who attended schools located in non-metro/rural areas could be due to the overall higher prevalence of tobacco use in the non-metro/rural sample, especially when many of the high school students who used e-cigarettes also smoked cigarettes.

The finding that e-cigarette use was associated with susceptibility to cigarette smoking among never-smoking Florida high school students with asthma concurs with the finding from a previous study.⁸ However, this previous study did not examine the effect of e-cigarette use on susceptibility to smoking specifically among youth with asthma. Given the cross-sectional study design, this finding needs to be interpreted with caution. On one hand, it is possible that youth with asthma who are interested in trying cigarette smoking opt to experiment with e-cigarettes instead or as a complementary product. The recent decline in the prevalence of cigarette smoking and the increase in e-cigarette use among Florida youth may support this hypothesis.²⁴ However, the decline in youth smoking prevalence in Florida is probably multifaceted and no studies to date showed that electronic cigarette use deterred youth from cigarette smoking. On the other hand, it is also possible that after experimenting with e-cigarettes, some youth with asthma may not have a severe asthmatic reaction, which potentially encourages them to continue e-cigarette use. This hypothesis is supported by the findings from two cohort studies. The first study found that e-cigarette use predicted subsequent initiation of combustible tobacco product use after following a cohort of 9th graders in California;⁹ the second study found that baseline e-cigarette use predicted subsequent cigarette smoking after following a national cohort of 16–26 year-olds who were not susceptible to smoking at baseline.¹⁰ A potential limitation of the current study is that the past-30-day e-cigarette use measure included participants who may only have used e-cigarette once or twice in the past 30 days. A previous study among Minnesota adults

pointed out that a certain proportion of individuals who used e-cigarettes in the past 30 days could still be experimenting with e-cigarettes.²⁵ Future studies need to measure the frequency of e-cigarette use to further distinguish e-cigarette experimenters from habitual users.

The association between past-30-day e-cigarette use and past-12-month asthma attack status should also be interpreted with caution given the cross-sectional study design and the difference in referenced time frames in these items. One possible interpretation is that youth with poorly controlled asthma are more interested in using e-cigarettes. This could be problematic as it suggests that highly vulnerable asthmatic youth are using e-cigarettes. On the other hand, past-30-day e-cigarette use could represent current e-cigarette use beyond the specific time period, much like past-30-day smoking is interpreted as current smoking. If that is the case, this finding could suggest that e-cigarette use may trigger asthma attacks. This is plausible given the known negative effects of e-cigarettes use include coughing, throat irritation, chest pain, and chest tightening, which could be due to bronchial spasm.¹³

While data from NYTS 2011 and 2012 showed that e-cigarette use was most prevalent in non-Hispanic White youth,²⁶ we found that among high school students attending schools located in metro counties in Florida, past-30-day use of e-cigarettes was more prevalent among Native American students than non-Hispanic White students. This could be due to a larger and more diverse sample in FYTS than NYTS, and the additional geographic information collected in FYTS (i.e., metropolitan status), which allowed us to perform a more fine-grained analysis. The racial/ethnic e-cigarette use pattern may also exhibit geographical variation.

Given the study sample was drawn from schools from a single state, our findings may not be generalizable to youth who are not in school or who reside in other states or the United States as a whole. The cross-sectional design of the study limits our ability to determine the temporal sequences between e-cigarette experimentation and susceptibility to cigarette smoking, and between e-cigarette use and having an asthma attack in the past twelve months. Future national longitudinal studies are needed to confirm our findings on e-cigarette use, susceptibility to cigarette smoking, and asthma attacks. Future qualitative studies are also warranted to understand the reasons for e-cigarette use among youth with asthma, particularly those who reside in non-metro/rural areas. The definition of e-cigarettes in the survey only included cigarette-like devices; therefore the prevalence does not represent all electronic nicotine delivery system (ENDS) use (which include vapor pen, e-hookah, etc.) The survey was also conducted during the time when the e-cigarette market was emerging. Therefore, respondents who used e-cigarette may be the early adopters and may not represent the current youth e-cigarette users. The current study was also unable to control for socioeconomic status (SES) since the information was not collected in the survey. Therefore our findings may subject to the confounding effect of SES since it is associated with asthma and cigarette smoking. The strengths of this study is that FYTS is the only surveillance system to date that measures asthma status (which is not assessed in NYTS or Youth Risk Behaviors Surveillance System), which allows us to examine the association between asthma and e-cigarette use.

Youth with asthma were more likely than youth without asthma to use e-cigarettes in the present sample. E-cigarette use among youth with asthma was associated with susceptibility to cigarette smoking and asthma attacks. Educating youth with asthma about the potential risks related to e-cigarette use should be part of a larger educational campaign on the potential risks of e-cigarette use.

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Figure 1.

Associations between electronic cigarette use, susceptibility to smoking and having an asthma attack in the past 12 months.

a. Adjusted for age, race/ethnicity, gender, metropolitan status, and living with someone who smokes. b. Adjusted for age, race/ethnicity, gender, metropolitan status, days smoked cigarettes in the past 30 days, positive social norm towards smoking, and exposure to secondhand smoke.

Table 1

Weighted demographic characteristics of the overall sample and by metropolitan status.

	Overall	Metro	Non-metro	
Variables	N (%)	N (%)	N (%)	p-value
Age	16.08 (0.02)	16.07 (0.02)	16.17 (0.04)	0.06
Gender				
Female	389248 (50.8%)	365976 (50.7%)	23272 (52.3%)	0.21
Male	376936 (49.2%)	355735 (49.3%)	21201 (47.7%)	
Race/ethnicity				
Non-Hispanic White	349753 (44.8%)	322106 (43.8%)	5549 (61.1%)	<0.01
Hispanic	208889 (26.8%)	201457 (27.4%)	1821 (16.4%)	
Native American	6815 (0.9%)	6291 (0.9%)	202 (1.2%)	
Non-Hispanic Asian	14731 (1.9%)	14373 (1.9%)	127 (0.8%)	
Non-Hispanic Black	177794 (22.8%)	169461 (23.1%)	1300 (18.4%)	
Other	22151 (2.8%)	21195 (2.9%)	341 (2.1%)	
Days smoked cigarettes in the past 30 days				
None	691746 (88.7%)	654130 (89.0%)	37616 (83.1%)	<0.01
1–2 days	25905 (3.3%)	23910 (3.3%)	1994 (4.4%)	
3–5 days	12700 (1.6%)	11769 (1.6%)	931 (2.1%)	
6–9 days	9223 (1.2%)	8325 (1.1%)	898 (2.0%)	
10–19 days	9887 (1.3%)	8892 (1.2%)	995 (2.2%)	
20–29 days	8422 (1.1%)	7554 (1.0%)	868 (1.9%)	
All 30 days	22112 (2.8%)	20147 (2.7%)	1965 (4.3%)	
Asthma status#				
Never diagnosed	453079 (61.5%)	22340 (61.6%)	3842 (59.4%)	0.07
Diagnosed, currently having asthma	83605 (11.3%)	4370 (11.3%)	784 (11.3%)	
Diagnosed, currently not having asthma	129732 (17.6%)	6798 (17.6%)	1433 (18.0%)	
Diagnosed, unsure about current status	3961 (9.6%)	3884 (9.5%)	774 (11.2%)	
Ever used e-cigarettes				
Yes	3185 (8.2%)	2226 (8.0%)	959 (11.0%)	<0.01
No	31843 (91.8%)	23699 (92.0%)	8144 (89.0%)	
Past-30-use of e-cigarettes				
Yes	1320 (3.3%)	895 (3.2%)	425 (4.8%)	<0.01
No	33521 (96.7%)	24879 (96.8%)	8642 (95.2%)	

Means and standard deviations are presented for age. Differences between metro and non-metro participants were tested using t-test and Chi-square tests.

Table 2

Associations between demographics, smoking behavior, asthma status, and ever use of electronic cigarettes by metropolitan status.

Variables	Metro		Non-metro	
	% ever used	AOR (95% CI)	% ever used	AOR (95% CI)
Age	--	0.98 (0.93, 1.03)	--	0.97 (0.90, 1.04)
Gender				
Female	6.5%	0.76 (0.67, 0.87)	9.7%	0.86 (0.67, 1.11)
Male	9.3%	1.00	12.1%	1.00
Race/ethnicity				
Non-Hispanic White	10.7%	1.00	13.2%	1.00
Hispanic	7.6%	0.78 (0.65, 0.94)	8.6%	0.65 (0.48, 0.87)
Native American	12.3%	0.89 (0.55, 1.41)	19.3%	1.75 (0.74, 4.13)
Non-Hispanic Asian	5.8%	0.56 (0.29, 1.10)	1.6%	0.13 (0.04, 0.39)
Non-Hispanic Black	3.0%	0.36 (0.27, 0.49)	5.2%	0.43 (0.30, 0.62)
Other	8.3%	0.77 (0.57, 1.04)	11.1%	0.81 (0.44, 1.49)
Days smoked cigarettes in the past 30 days				
None	4.0%	1.00	5.3%	1.00
1–2 days	25.6%	7.38 (5.92, 9.19)	24.3%	5.29 (3.74, 7.48)
3–5 days	29.8%	9.24 (6.80, 12.55)	27.6%	5.90 (3.74, 9.31)
6–9 days	34.0%	11.73 (7.86, 17.51)	35.9%	10.14 (5.94, 17.29)
10–19 days	47.9%	21.34 (14.96, 30.45)	41.7%	12.85 (8.87, 18.60)
20–29 days	47.4%	19.89 (14.05, 28.18)	40.3%	10.63 (7.00, 16.13)
All 30 days	63.7%	38.78 (30.21, 49.79)	60.3%	26.43 (18.71, 37.35)
Asthma status[#]				
Never diagnosed	7.0%	1.00	9.7%	1.00
Diagnosed, currently having asthma	9.9%	1.28 (1.01, 1.63)	18.2%	1.72 (1.20, 2.45)
Diagnosed, currently not having asthma	8.9%	1.07 (0.89, 1.27)	10.1%	0.76 (0.58, 1.00)
Diagnosed, unsure about current status	9.6%	1.17 (0.94, 1.46)	9.6%	0.75 (0.54, 1.03)

Adjusted for all variables in the table. Bolded estimates were statistically significant (p<0.05).

[#] Metro/nonmetro*asthma status interaction p<0.01.n

Table 3

Associations between demographics, smoking behavior, asthma status, and past-30-day use of electronic cigarettes by metropolitan status.

Variables	Metro		Non-metro	
	% ever used	AOR (95% CI)	% ever used	AOR (95% CI)
Age	--	0.88 (0.82, 0.94)	--	0.90 (0.81, 1.00)
Gender				
Female	2.1%	0.57 (0.46, 0.71)	3.3%	0.61 (0.44, 0.84)
Male	4.2%	1.00	6.1%	1.00
Race/ethnicity				
Non-Hispanic White	3.9%	1.00	5.4%	1.00
Hispanic	3.5%	1.13 (0.88, 1.45)	4.3%	0.89 (0.63, 1.25)
Native American	8.5%	1.94 (1.09, 3.44)	8.1%	1.28 (0.46, 3.54)
Non-Hispanic Asian	2.7%	0.91 (0.42, 1.95)	2.2%	0.66 (0.23, 1.86)
Non-Hispanic Black	1.3%	0.63 (0.42, 0.95)	2.8%	0.73 (0.43, 1.25)
Other	3.5%	0.97 (0.59, 1.57)	5.8%	1.17 (0.59, 2.31)
Days smoked cigarettes in the past 30 days				
None	1.0%	1.00	1.3%	1.00
1–2 days	9.8%	9.03 (6.40, 12.75)	12.0%	9.60 (6.13, 15.03)
3–5 days	14.0%	14.14 (9.11, 21.93)	15.9%	10.96 (5.88, 20.45)
6–9 days	12.3%	15.18 (8.70, 26.49)	16.1%	14.14 (8.20, 24.38)
10–19 days	26.0%	35.98 (23.86, 54.27)	22.0%	22.60 (14.21, 35.93)
20–29 days	24.5%	32.33 (20.78, 50.32)	22.9%	16.09 (8.57, 30.20)
All 30 days	41.4%	62.53 (46.19, 84.65)	38.3%	48.28 (35.55, 65.56)
Asthma status[#]				
Never diagnosed	2.5%	1.00	3.5%	1.00
Diagnosed, currently having asthma	5.1%	1.55 (1.17, 2.05)	9.5%	2.20 (1.47, 3.31)
Diagnosed, currently not having asthma	4.0%	1.29 (0.99, 1.67)	4.3%	0.81 (0.50, 1.33)
Diagnosed, unsure about current status	4.4%	1.33 (0.91, 1.94)	4.9%	0.99 (0.60, 1.64)

Adjusted for all variables in the table. Bolded estimates were statistically significant (p<0.05).

[#]Metro/nonmetro*asthma status interaction p=0.05.