Youth Indoor and Outdoor Exposure to Secondhand Smoke and Secondhand Aerosol

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Abstract

Introduction: Secondhand smoke and secondhand aerosol exposure are important public health concerns. This is the first study to present separate estimates of public indoor and outdoor secondhand smoke and secondhand aerosol exposure among U.S. youth.

Methods: Data came from the 2020 National Youth Tobacco Survey, an annual cross-sectional survey of U.S. students in Grades 6–12. Self-reported past 30–day indoor and outdoor secondhand smoke and secondhand aerosol exposures were assessed separately. Weighted prevalence and adjusted prevalence ratios for each outcome were assessed among students overall and stratified by sex, school level, race/ethnicity, sexual orientation, and current tobacco product use; prevalence also was calculated among those who did not currently use tobacco.

Results: Exposure to secondhand smoke and secondhand aerosol was reported by 60.6% (95% CI=58.7, 62.4) and 44.5% (95% CI=42.1, 46.9) of U.S. youth, respectively. Among all students, 37.6% (95% CI=36.0, 39.2) and 53.3% (95% CI=51.4, 55.2) reported indoor and outdoor secondhand smoke exposure, respectively; 34.9% (95% CI=32.9, 37.4) and 36.8% (95% CI=34.6, 38.9) reported indoor and outdoor secondhand aerosol exposure, respectively. After adjustment, female versus male students (adjusted prevalence ratio=1.15–1.30) and those who currently use versus do not use combustible tobacco products (adjusted prevalence ratio=1.15–1.36) were more likely to report exposure to all outcomes.

Conclusions: Approximately 1 in 2 students overall reported outdoor secondhand smoke exposure, and 1 in 3 students reported exposures to each indoor secondhand smoke, indoor

secondhand aerosol, and outdoor secondhand aerosol. Separate estimates of indoor and outdoor secondhand smoke and secondhand aerosol exposure, along with data on correlates of exposure, provide information to support comprehensive indoor and outdoor smoke-free policies.

INTRODUCTION

The negative health impacts of secondhand smoke (SHS) exposure are well documented, and there is no risk-free level of SHS exposure.[1] In 2017, an estimated 13.2 million middle- and high-school students were exposed to SHS in indoor or outdoor public places.[2] SHS-associated health conditions differ by age, with exposed children at risk of respiratory infections and more frequent and severe asthma attacks, whereas adults are at a higher risk of coronary heart disease and lung cancer than those who are unexposed.[1] Comprehensive smoke-free air laws, which prohibit smoking in indoor public places, including workplaces, bars, and restaurants, have been passed in states and communities to protect the public from SHS exposure. To date, 27 U.S. states, the District of Columbia, several U.S. territories, and >1,000 municipalities have implemented such laws.[3,4] However, as of January 2021, it is estimated that approximately 40% of Americans are not covered by smoke-free indoor air policies in bars, restaurants, and work sites and may be exposed to SHS.[5] Thus, it remains important to characterize the levels of SHS exposure, particularly among youth and other population groups that may lack coverage.

The recent increased use of E-cigarettes introduces secondhand aerosol (SHA) exposure as an additional public health concern. Although the long-term health impacts of SHA exposure are unknown, the aerosol from E-cigarettes is not harmless.[6] SHA can contain harmful and potentially harmful chemicals, including volatile organic compounds such as benzene and heavy metals such as nickel, tin, and lead.[6] Data from the National Youth Tobacco Survey (NYTS) show that although SHS exposure decreased during 2015–2018, there was a significant increase in SHA exposure.[7]

There are few studies that report SHS and SHA exposure among youth[2,7–10]; earlier studies show that exposure to SHA was associated with higher susceptibility to E-cigarette use,[7,8] highlighting the importance of reducing SHA exposure among youth.

No studies have reported on SHS and SHA exposure in indoor and outdoor settings, separately, among U.S. youth. Given that policies aiming to prevent SHS and SHA exposures in these settings differ, and that, indoor policies are more common than outdoor policies,[11] this study can increase the awareness of exposure and provide important evidence to help inform SHS and SHA prevention strategies. Currently, 15 states, the District of Columbia, and Puerto Rico include E-cigarettes in their statewide smoke-free laws[3]; this study provides information for states and communities about youth exposure to SHS and SHA. Building on previous studies that provide estimates of SHS and SHA exposure,[2,7] this study aims to present estimates for prevalence and correlates of SHS and SHA exposures, overall and separately, for indoor and outdoor public settings among a nationally representative sample of U.S. middle- and high-school students.

METHODS

Study Sample

Data came from the 2020 NYTS, a cross-sectional self-administered electronic survey of students attending public and private schools in Grades 6–12. A 3-stage cluster sampling procedure was used to generate a nationally representative sample of U.S. students. In 2020, a total of 14,531 students participated, with an overall response rate of 43.6%. Data were collected from January 16 to March 16, 2020; the data collection period was truncated owing to school closures associated with the coronavirus disease 2019 (COVID-19) pandemic.[12] As a secondary analysis of deidentified public-use data, this study was not subject to human subjects' review.

Measures

The NYTS queried indoor and outdoor exposure separately for the first time in 2020. A total of 9 nonmutually exclusive outcomes were examined in this study: self-reported exposure to indoor SHS, indoor SHA, outdoor SHS, and outdoor SHA, along with the following composite measures: overall SHS (indoor and outdoor combined), overall SHA (indoor and outdoor combined), indoor exposure (SHS or SHA), outdoor exposure (SHS or SHA), and exposure to either SHS or SHA.

All students were asked 2 separate questions to assess indoor exposure. *During the past 30 days, on how many days did you breathe the [smoke from someone who was smoking tobacco products/vapor from someone who was using an e-cigarette] in an indoor public place? Examples of indoor public places are school buildings, stores, restaurants, and sports arenas.*

All students were asked 2 separate questions to assess outdoor exposure. *During the past 30 days, on how many days did you breathe the [smoke from someone who was smoking tobacco products/vapor from someone who was using an e-cigarette] in an outdoor public place? Examples of outdoor public places are school grounds, parking lots, stadiums, and parks.*

For each question, response categories were *0 days, 1 or 2 days, 3 to 5 days, 6 to 9 days, 10 to 19 days, 20 to 29 days*, and *all 30 days*. Students with a nonmissing response other than *0 days* were defined as being exposed for each outcome.

Students who reported exposure to either indoor SHS or outdoor SHS were defined as having overall exposure to SHS. *Students who reported no exposure to indoor SHS and outdoor SHS* were defined as having no overall SHS exposure.

Students who reported exposure to either indoor SHA or outdoor SHA were defined as having overall exposure to SHA. *Students who reported no exposure to indoor SHA and outdoor SHA* were defined as having no overall SHA exposure.

Students who reported exposure to either indoor SHS or indoor SHA were defined as having indoor exposure. *Students who reported no exposure to indoor SHS and indoor SHA* were defined as having no indoor exposure.

Students who reported exposure to either outdoor SHS or outdoor SHA were defined as having outdoor exposure. *Students who reported no exposure to outdoor SHS and outdoor SHA* were defined as having no outdoor exposure.

Students who reported exposure to either indoor SHS, outdoor SHS, indoor SHA, or outdoor SHA were defined as having exposure to SHS or SHA. *Students who reported no exposure to any of these variables* were defined as having no exposure to SHS or SHA.

Statistical Analysis

Weighted prevalence estimates and 95% CIs for each outcome are reported overall and by study covariates: sex (male, female), school level (middle school [Grades 6–8], high school [Grades 9–12]), race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, and non-Hispanic other [non-Hispanic American Indian, non-Hispanic Asian, and non-Hispanic Native Hawaiian or other Pacific Islander]), sexual orientation (heterosexual, gay/lesbian/bisexual, not sure), current (past 30–day) use of any tobacco product (E-cigarettes, cigarettes, cigars, smokeless tobacco [including chewing tobacco, snuff, or dip, snus, or dissolvable tobacco], hookah, pipe tobacco, bidis, or heated tobacco products; yes, no), current E-cigarette use (yes, no), current combustible tobacco product use (cigarettes, cigars, hookah, pipe tobacco, or bidis; yes, no), current smokeless tobacco use (yes, no), and household tobacco product use (no tobacco use, combustible tobacco only, smokeless tobacco only, E-cigarettes only, other combination of tobacco). Data were weighted to account for the complex survey design and to adjust for nonresponse.

Chi-square tests were used to examine bivariate differences in covariates ($p<0.05$ was considered statistically significant). Adjusted prevalence ratios (APRs) and 95% CIs for each outcome were calculated using multivariable logistic regression models with predictive margins adjusted for sex, school level, race/ethnicity, sexual orientation, current combustible tobacco product use, current E-cigarette use, current smokeless tobacco product use, and household member tobacco use. Weighted prevalence estimates also were calculated among current nonusers of tobacco; results are presented in Appendix Table 1 (available online). Population estimates of current use were rounded down to the nearest 10,000 people. Analyses were conducted using SUDAAN, version 11.0.3. Unstable estimates because of small subgroup size (<50) or having a relative SE >0.3 are not shown.

RESULTS

Exposure to any SHS or SHA, either indoor or outdoor, was reported by 67.7% (95% CI=65.6, 69.8; 18.1 million) of students (Table 1). Indoor or outdoor SHS exposure was reported by 60.6% (95% CI=58.7, 62.4; 16.1 million) of students. Indoor or outdoor SHA exposure was reported by 44.5% (95% CI=42.1, 46.9; 12.0 million) of students. Indoor exposure to either SHS or SHA was reported by 51.1% (95% CI=48.9, 53.2; 13.7 million)

of students. Prevalence of outdoor exposure to either SHS or SHA was slightly greater, at 60.1% (95% CI=58.0, 62.2; 15.9 million students).

Indoor SHS exposure was reported by 37.6% (95% CI=36.0, 39.2; 10.0 million) of students, and outdoor SHS exposure was reported by 53.3% (95% CI=51.4, 55.2; 14.2 million) (Table 2). Indoor SHA exposure was reported by 34.9% (95% CI=32.9, 37.4; 9.4 million) of students, and outdoor SHA exposure was reported by 36.8% (95% CI=34.6, 38.9; 9.7 million). Among students who reported exposure to any of the queried indoor or outdoor outcomes, most reported exposure on 1–2 days in the past 30 days (Figure 1).

In multivariable-adjusted logistic regression models examining the correlates for indoor SHS, outdoor SHS, indoor SHA, and outdoor SHA among all students, female students were more likely to report all outcomes than male students (indoor SHS: APR=1.16, 95% CI=1.11, 1.20; outdoor SHS: APR=1.30, 95% CI=1.24, 1.36; indoor SHA: APR=1.15, 95% CI=1.08, 1.22; outdoor SHA: APR=1.25, 95% CI=1.19, 1.32) (Table 2). Middle-school students were less likely to report exposure to indoor SHA (APR=0.63, 95% CI=0.56, 0.70) and outdoor SHA (APR=0.80, 95% CI=0.73, 0.87) than high-school students but were more likely to report exposure to indoor SHS (APR=1.07, 95% CI=1.00, 1.13). Non-Hispanic Black students were significantly less likely to report exposure to outdoor SHS, indoor SHA, and outdoor SHA than non-Hispanic White students (range, APRs: 0.74 [outdoor SHA] to 0.80 [outdoor SHS]). Students identifying as gay, lesbian, or bisexual were more likely to report exposure to indoor SHS (APR=1.10, 95% CI=1.02, 1.19) and outdoor SHS (APR=1.11, 95% CI=1.05, 1.17) than heterosexual students. Students who currently used combustible tobacco products (versus not) were more likely to report both indoor and outdoor exposure to both SHS and SHA (range, APRs: 1.15 [outdoor SHA] to 1.36 [indoor SHS]); those who currently used E-cigarettes were more likely to report exposure to SHS in indoor settings (APR=1.19, 95% CI=1.09, 1.29) and SHA in indoor (APR=1.61, 95% CI=1.46, 1.77) and outdoor (APR=1.50, 95% CI=1.38, 1.62) settings than those who did not currently use E-cigarettes. Finally, all categories of household tobacco use were associated with increased prevalence of all outcomes, with the exception of smokeless tobacco and exclusive E-cigarette use on outdoor SHS (Table 3).

Correlate patterns were similar for the 5 studied composite measures (Appendix Table 2, available online). For example, female students were more likely to report all-composite outcomes than male students (range, APRs: 1.13 [indoor SHS or indoor SHA] to 1.23 [outdoor SHS or outdoor SHA]). An additional analysis examining the prevalences of indoor SHS, outdoor SHS, indoor SHA, and outdoor SHA among those not currently using any tobacco products also yielded similar results as those reported among the entire study population in Table 2 (Appendix Table 1, available online).

DISCUSSION

This study is the first to report separate estimates of exposure to public indoor and outdoor SHS and SHA for U.S. youth. Approximately 1 in 3 U.S. middle- and high-school students reported exposure to indoor SHA, indoor SHS, and outdoor SHA in the past 30 days. In addition, more than half of U.S. students reported outdoor SHS exposure in the past

30 days. Separate estimates for indoor and outdoor exposure provide greater detail on where students report being exposed to these constituents and therefore could be used to develop targeted strategies to reduce such exposures. Observed differences in exposure by demographic characteristics can be used to aid public health practitioners in the development of prevention programs. Estimated SHS exposure in indoor and outdoor public places combined was higher in this study at 60.6% than at 48.7% of 2018 NYTS respondents.[7] This result is surprising because SHS exposure has decreased over the past few years[7]; it is possible that the combination of the indoor and outdoor measures to determine this prevalence provides a better representation of the exposure of students. By contrast, it is also possible that combining 2 questions led to an overestimation of the true prevalence. Nonetheless, given its known health effects,[1] updated estimates of SHS exposure are important to track the progress of smoke-free policies and to inform states and communities about the extent and burden of exposure among youth.

Concurrent with the increase of E-cigarette use among both youth[6] and adults,[13,14] reported SHA exposure among youth has increased.[7] Both the combined (44.5%) and separate (34.9%) public indoor and outdoor (36.8%) SHA exposures presented in this report are higher than the combined indoor/outdoor youth SHA exposure estimate reported in 2018 (33.2%).[7] Notably, E-cigarettes have been the most commonly used tobacco product among youth since 2014.[15] One important source of SHA for youth may be school grounds. In the 2019 NYTS, 33% of youth reported observing E-cigarette use inside a school bathroom or locker room; 33% also reported observing E-cigarette use outside of the school-on-school grounds.[16] Because SHA is not harmless,[6] it remains important to monitor youths' SHA exposures, given that youth E-cigarette use is an epidemic and that the E-cigarette marketplace is evolving.[17]

Prohibitions on indoor tobacco product use are more common than those on outdoor use, with 22,710 U.S. municipalities covered by smoke-free provisions in nonhospitality workplaces, restaurants, and bars compared with 3,861 states, commonwealths, territories, cities, and counties with outdoor regulations as of January 1, 2021.[11] This may be reflected in the finding that reported that outdoor SHS exposure was higher than indoor SHS exposure overall and among all studied subgroups. In addition, more students reported outdoor SHS/SHA exposure than those who reported indoor SHS/SHA exposure, underlying the importance of addressing outdoor exposure. Thus, understanding both indoor and outdoor youth secondhand tobacco product exposure patterns can provide support for future policies aimed at reducing SHS and SHA exposure, particularly in public outdoor locations.

Demographic differences observed in this study for public indoor and outdoor exposures were similar to those reported previously for overall SHS/SHA exposures.[2,8] Furthermore, youth identifying as gay, lesbian, or bisexual reported a higher prevalence of SHS and SHA exposure than heterosexual students; although this has been observed among sexual minority adults in California[18] and lesbian and bisexual adult women nationally,[19] not as much is known about SHS and SHA exposures by sexual orientation among youth. However, youth identifying as gay, lesbian, or bisexual have higher tobacco product use overall.[20] Together, these findings suggest that further work needs to be done to ascertain where these students

are being exposed to SHS and SHA publicly to inform future programs to reduce SHS and SHA exposures.

Limitations

This study is subject to some limitations. First, the NYTS 2020 data collection period was truncated owing to the COVID-19 pandemic and school closures, which resulted in a lower school participation rate (49.9%) than in prior years. However, the student participation rate (87.4%) was high, and the weighted sample yielded nationally representative estimates. This period of data collection represents a period before widespread stay-at-home orders were in place, so it was unlikely that the COVID-19 pandemic would have affected the estimates of SHS or SHA exposures from this study. As with all self-reported data, these results may be subject to inaccurate recall. Given the wording of the SHS/SHA questions, it is possible that students who currently smoked may have reported SHS/SHA exposure to their own smoke/aerosol. In addition, there may have been reduced awareness of SHA because it does not always have a distinct smell[21] as SHS does. Only exposure to SHS and SHA in public places was captured, thus excluding exposures in cars and homes, resulting in underestimation of total SHS and SHA exposure. Because overall SHS and SHA use was not queried on the 2020 NYTS, composite measures were constructed using indoor and outdoor measures and may not accurately represent overall SHS and SHA. Finally, because the NYTS was administered to enrolled students in public and private schools, these results may not be generalizable to all school-aged U.S. youth.

CONCLUSIONS

Results of this study show that millions of youth report being exposed to SHS and SHA in indoor and outdoor public places. These results emphasize the continued exposure that exists in both indoor and outdoor locations even with the comprehensive smoke-free policies in some states. Among states with comprehensive smoke-free laws that address SHS exposure, only more than half (15 states, the District of Columbia, and Puerto Rico) currently include E-cigarettes in their jurisdiction-wide policies.[3] Opportunities exist for the improvement of current comprehensive smoke-free laws through the integration of E-cigarettes and other novel tobacco products into state, territorial, and local laws. In addition, because there are some subgroups (e.g., girls) who consistently reported elevated SHS and SHA exposure, these may be groups that may benefit from enhanced public policies or messaging to reduce their exposure to SHS and SHA. These findings can be used by communities who are exploring opportunities to protect individuals from SHS/SHA.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

ACKNOWLEDGMENTS

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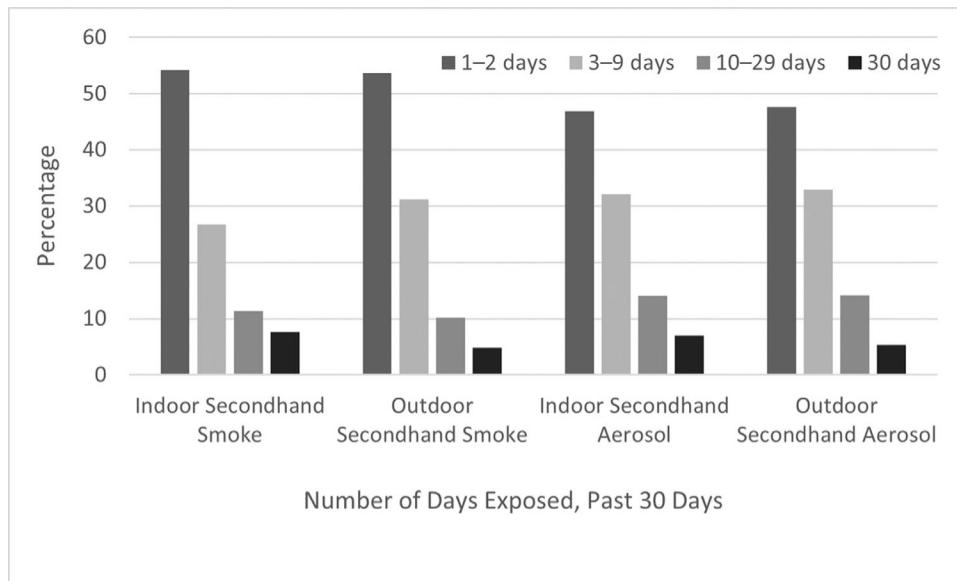
Figure 1.
Frequency of self-reported exposure to indoor and outdoor secondhand smoke and secondhand aerosol exposure during the past 30 days among U.S. middle- and high-school students reporting any exposure, National Youth Tobacco Survey, 2020.

Table 1.

Prevalence of Self-Reported Exposure to Secondhand Smoke and Secondhand Aerosol and NYTS 2020

Sample characteristics	N[a]	Either SHS or SHA		SHS (indoor or outdoor)		SHA (indoor or outdoor)		Indoor SHS or indoor SHA		Outdoor SHS or outdoor SHA	
		%[b] (95% CI)	Weighted population estimate[c]	%[b] (95% CI)	Weighted population estimate[c]	% (95% CI)	Weighted population estimate	% (95% CI)	Weighted population estimate	% (95% CI)	Weighted population estimate
Overall	14,531	67.7 (65.6, 69.8)	18,120,000	60.6 (58.7, 62.4)	16,150,000	44.5 (42.1, 46.9)	11,970,000	51.1 (48.9, 53.2)	13,660,000	60.1 (58.0, 62.2)	15,920,000
Sex											
Male	7,153	62.4 (59.9, 64.7)	8,360,000	54.6 (52.4, 56.8)	7,300,000	40.2 (37.5, 43.0)	5,440,000	47.7 (45.2, 50.2)	6,400,000	53.8 (51.2, 56.3)	7,130,000
Female	7,339	73.2 (71.2, 75.2)	9,720,000	66.5 (64.6, 68.4)	8,810,000	48.8 (46.5, 51.2)	6,500,000	54.5 (52.4, 56.6)	7,230,000	66.5 (64.5, 68.5)	8,760,000
p-value[d]		**<0.01**		**<0.01**		**<0.01**		**<0.01**		**<0.01**	
School level											
Middle school	7,042	62.8 (60.3, 65.2)	7,320,000	58.6 (56.3, 60.9)	6,820,000	34.6 (32.2, 37.2)	4,060,000	43.9 (41.6, 46.1)	5,110,000	55.8 (53.4, 58.2)	6,430,000
High school	7,153	71.6 (69.0, 74.2)	10,760,000	62.1 (59.6, 64.4)	9,290,000	52.2 (49.1, 55.2)	7,880,000	56.7 (53.9, 59.4)	8,520,000	63.5 (60.8, 66.1)	9,460,000
p-value		**<0.01**		0.02		**<0.01**		**<0.01**		**<0.01**	
Race/ethnicity											
Non-Hispanic White	7,071	71.2 (68.9, 73.4)	10,040,000	63.1 (61.0, 65.2)	8,870,000	49.0 (46.5, 51.5)	6,930,000	54.4 (52.0, 56.7)	7,670,000	63.3 (61.1, 65.5)	8,860,000
Non-Hispanic Black	1,602	59.6 (54.1, 64.8)	1,920,00	53.4 (47.7, 59.1)	1,710,000	32.2 (27.7, 37.1)	1,030,000	43.9 (39.4, 48.4)	1,400,000	50.9 (45.5, 56.3)	1,610,000
Hispanic	4,355	65.9 (63.3, 68.4)	4,490,000	59.1 (56.6, 61.5)	4,030,000	43.4 (40.4, 46.5)	2,990,000	50.3 (47.8, 52.8)	3,430,000	58.7 (56.0, 61.4)	3,960,000
Non-Hispanic other	1,138	65.3 (60.2, 70.1)	1,330,000	60.5 (55.7, 65.1)	1,230,000	39.4 (31.7, 47.8)	810,000	45.1 (37.4, 53.0)	920,000	59.2 (53.8, 64.3)	1,200,000
p-value		**<0.01**		**<0.01**		**<0.01**		**<0.01**		**<0.01**	
Sexual orientation											
Heterosexual	11,500	67.8 (65.7, 69.7)	14,670,000	60.3 (58.4, 62.1)	13,010,000	44.6 (42.2, 47.0)	9,700,000	50.8 (48.8, 52.9)	11,010,000	59.8 (57.8, 61.9)	12,860,000
Gay/lesbian/bisexual	1,370	76.4 (73.0, 79.5)	1,980,000	70.2 (67.0, 73.3)	1,820,000	53.9 (50.0, 57.7)	1,400,000	61.5 (57.7, 65.3)	1,590,000	70.5 (66.7, 74.1)	1,800,000

Sample characteristics	N[a]	Either SHS or SHA %[b] (95% CI)	Either SHS or SHA Weighted population estimate[c]	SHS (indoor or outdoor) %[b] (95% CI)	SHS (indoor or outdoor) Weighted population estimate[c]	SHA (indoor or outdoor) % (95% CI)	SHA (indoor or outdoor) Weighted population estimate	Indoor SHS or indoor SHA % (95% CI)	Indoor SHS or indoor SHA Weighted population estimate	Outdoor SHS or outdoor SHA % (95% CI)	Outdoor SHS or outdoor SHA Weighted population estimate
Not sure	1,155	58.4 (53.7, 63.0)	1,200,000	52.6 (48.2, 57.0)	1,070,000	34.8 (30.5, 39.4)	720,000	42.3 (37.8, 47.0)	870,000	50.9 (46.7, 55.1)	1,020,000
p-value		<0.01		<0.01		<0.01		<0.01		<0.01	
Current any tobacco use[e]											
No	12,339	65.4 (63.3, 67.5)	1,4830,000	59.4 (57.4, 61.3)	13,440,000	40.4 (38.2, 42.6)	9,180,000	47.3 (45.2, 49.3)	10,710,000	58.1 (55.9, 60.2)	13,060,000
Yes	2,187	80.6 (77.9, 83.1)	3,280,000	67.1 (64.1, 70.0)	2,710,000	67.2 (63.8, 70.5)	2,780,000	72.2 (69.1, 75.1)	2,940,000	71.7 (68.4, 74.7)	2,860,000
p-value		<0.01		<0.01		<0.01		<0.01		<0.01	
Current combustible tobacco use[f]											
No	13,593	66.9 (64.7, 68.9)	16,720,000	59.7 (57.9, 61.6)	14,910,000	43.0 (40.7, 45.3)	10,810,000	49.6 (47.5, 51.6)	12,400,000	59.2 (57.1, 61.2)	14,680,000
Yes	929	80.5 (76.9, 83.7)	1,390,000	72.2 (67.6, 76.3)	1,230,000	65.9 (61.1, 70.4)	1,150,000	72.9 (68.7, 76.8)	1,260,000	74.2 (69.3, 78.5)	1,240,000
p-value		<0.01		<0.01		<0.01		<0.01		<0.01	
Current E-cigarette use											
No	12,716	65.5 (63.4, 67.6)	15,310,000	59.5 (57.5, 61.5)	13,890,000	40.5 (38.3, 42.8)	9,500,000	47.7 (45.6, 49.7)	11,140,000	58.1 (56.0, 60.3)	13,460,000
Yes	1,769	83.1 (80.2, 85.7)	2,770,000	67.9 (64.8, 70.8)	2,240,000	72.0 (68.5, 75.2)	2,430,000	74.9 (71.5, 78.0)	2,500,000	74.0 (70.8, 76.9)	2,420,000
p-value		<0.01		<0.01		<0.01		<0.01		<0.01	
Current smokeless tobacco product use											
No	14,177	67.4 (65.3, 69.5)	17,620,000	60.3 (58.4, 62.2)	15,730,000	43.9 (41.5, 46.4)	11,540,000	50.6 (48.4, 52.7)	13,230,000	59.8 (57.7, 61.9)	15,490,000
Yes	332	82.6 (76.2, 87.6)	490,000	71.3 (64.3, 77.3)	410,000	69.8 (62.6, 76.1)	420,000	72.5 (64.6, 79.2)	430,000	73.2 (65.7, 79.5)	420,000
p-value		<0.01		<0.01		<0.01		<0.01		<0.01	
Household member tobacco product use											
No tobacco use	9,091	62.1 (59.6, 64.5)	10,590,000	55.5 (53.2, 57.6)	9,430,000	39.4 (36.8, 41.9)	6,752,000	43.5 (41.3, 45.8)	7,420,000	55.4 (52.9, 57.8)	9,370,000
Combustible tobacco only	2,580	75.6 (71.9, 79.0)	3,610,000	70.2 (66.8, 73.4)	3,340,000	44.3 (40.7, 48.0)	2,140,000	60.0 (56.3, 63.5)	2,860,000	65.3 (61.7, 68.7)	3,090,000

Sample characteristics	N[a]	Either SHS or SHA		SHS (indoor or outdoor)		SHA (indoor or outdoor)		Indoor SHS or indoor SHA		Outdoor SHS or outdoor SHA	
		%[b] (95% CI)	Weighted population estimate[c]	%[b] (95% CI)	Weighted population estimate[c]	% (95% CI)	Weighted population estimate	% (95% CI)	Weighted population estimate	% (95% CI)	Weighted population estimate
Smokeless tobacco only	470	73.4 (68.4, 78.0)	660,000	63.7 (57.7, 69.4)	570,000	52.5 (46.8, 58.2)	470,000	59.8 (54.6, 64.8)	540,000	63.3 (57.0, 69.1)	560,000
E-cigarettes only	609	82.0 (78.3, 85.2)	930,000	61.8 (57.3, 66.1)	700,000	71.9 (66.8, 76.4)	810,000	74.0 (70.2, 77.4)	840,000	71.1 (65.6, 76.0)	800,000
Other combination of tobacco	1,297	86.4 (83.1, 89.1)	2,080,000	78.7 (75.4, 81.7)	1,890,000	68.5 (64.0, 72.6)	1,640,000	75.3 (70.8, 79.4)	1,800,000	79.3 (75.4, 82.7)	1,890,000
p-value		**<0.01**		**<0.01**		**<0.01**		**<0.01**		**<0.01**	

Note: Boldface indicates statistical significance (*p*<0.05).

NYTS, National Youth Tobacco Survey; SHA, secondhand aerosol; SHS, secondhand smoke.

[a] Unweighted number of respondents.

[b] Weighted percentage.

[c] Estimated weighted total number of youths exposed was rounded down to the nearest 10,000 persons.

[d] *p*-Value from chi-square test.

[e] Use of any of the following tobacco products in the past 30 days: E-cigarettes, cigarettes, cigars, hookah, pipe tobacco, bidis, chewing tobacco, snuff, dip, snus, dissolvable tobacco, or heated tobacco products.

[f] Use of any of the following tobacco products in the last 30 days: cigarette, cigar, pipe, bidis, or hookah.

Table 2.

Prevalence of Self-Reported Exposure to Indoor and Outdoor Secondhand Smoke and Secondhand Aerosol and NYTS 2020

Sample characteristics	N[a]	Indoor SHS		Outdoor SHS		Indoor SHA		Outdoor SHA	
		%[b] (95% CI)	Weighted population estimate[c]	% (95% CI)	Weighted population estimate	% (95% CI)	Weighted population estimate	% (95% CI)	Weighted population estimate
Overall	14,531	37.6 (36.0, 39.2)	10,040,000	53.3 (51.4, 55.2)	14,190,000	34.9 (32.9, 37.4)	9,370,000	36.8 (34.6, 38.9)	9,720,000
Sex									
Male	7,153	34.6 (32.8, 36.3)	4,630,000	46.1 (43.8, 48.5)	6,160,000	32.3 (29.5, 35.2)	4,350,000	32.6 (30.2, 35.0)	4,310,000
Female	7,339	40.6 (38.8, 42.4)	5,380,000	60.6 (58.7, 62.5)	8,000,000	37.6 (35.2, 40.0)	4,990,000	41.0 (38.8, 43.2)	5,390,000
p-value[d]		<0.01		<0.01		<0.01		<0.01	
School level									
Middle school	7,042	37.3 (35.6, 39.0)	4,350,000	50.8 (48.6, 53.1)	5,900,000	23.3 (20.9, 25.8)	2,720,000	29.7 (27.5, 32.0)	3,420,000
High school	7,153	37.8 (35.6, 40.0)	5,670,000	55.2 (52.8, 57.7)	8,260,000	43.9 (40.9, 47.0)	6,620,000	42.2 (39.5, 45.0)	6,270,000
p-value		0.70		0.01		<0.01		<0.01	
Race/ethnicity									
Non-Hispanic White	7,071	38.4 (36.5, 40.3)	5,400,000	56.3 (54.3, 58.3)	7,890,000	39.2 (36.7, 41.8)	5,530,000	40.3 (38.1, 42.5)	5,640,000
Non-Hispanic Black	1,602	36.5 (32.2, 41.1)	1,170,000	44.3 (38.7, 50.0)	1,410,000	24.4 (20.7, 28.5)	780,000	25.9 (22.1, 30.2)	810,000
Hispanic	4,355	37.4 (35.4, 39.5)	2,560,00	51.9 (49.3, 54.4)	3,530,000	33.6 (30.7, 36.5)	2,310,000	36.2 (33.7, 38.9)	2,450,000
Non-Hispanic other	1,138	35.4 (30.8, 40.3)	720,000	54.3 (49.4, 59.1)	1,100,000	28.8 (21.0, 38.0)	590,000	32.7 (25.2, 41.2)	660,000
p-value		0.50		<0.01		<0.01		<0.01	
Sexual orientation									
Heterosexual	11,500	36.8 (35.2, 38.3)	7,950,000	52.9 (51.0, 54.8)	11,430,000	35.0 (32.6, 37.5)	7,600,000	36.6 (34.5, 38.8)	7,850,000
Gay/lesbian/bisexual	1,370	47.2 (44.1, 50.4)	1,230,000	64.0 (60.6, 67.3)	1,640,000	44.0 (39.6, 48.5)	1,140,000	45.6 (42.0, 49.3)	1,170,000
Not sure	1,155	34.4 (30.3, 38.8)	700,000	45.0 (41.0, 49.1)	910,000	25.2 (21.3, 29.6)	520,000	29.0 (25.3, 32.8)	590,000
p-value		<0.01		<0.01		<0.01		<0.01	
Current any tobacco use[e]									
No	12,339	35.3 (33.7, 36.9)	7,990,000	52.5 (50.5, 54.5)	11,880,000	30.3 (28.1, 32.6)	6,890,000	33.2 (31.3, 35.1)	7,450,000
Yes	2,187	50.6 (48.0, 53.3)	2,050,000	57.6 (54.5, 60.7)	2,300,000	60.4 (56.7, 64.1)	2,470,000	57.0 (53.3, 60.6)	2,260,000
p-value		<0.01		<0.01		<0.01		<0.01	
Current combustible tobacco use[f]									
No	13,593	36.1 (34.6, 37.7)	9,040,000	52.5 (50.6, 54.4)	13,090,000	33.2 (30.9, 35.6)	8,340,000	35.4 (33.4, 37.4)	8,770,000

Sample characteristics	N[a]	Indoor SHS % [b] (95% CI)	Indoor SHS Weighted population estimate[c]	Outdoor SHS % (95% CI)	Outdoor SHS Weighted population estimate	Indoor SHA % (95% CI)	Indoor SHA Weighted population estimate	Outdoor SHA % (95% CI)	Outdoor SHA Weighted population estimate
Yes	929	58.7 (53.7, 63.4)	1,000,000	64.9 (60.1, 69.5)	1,090,000	59.2 (54.0, 64.3)	1,030,000	57.3 (51.3, 63.1)	950,000
p-value		**<0.01**		**<0.01**		**<0.01**		**<0.01**	
Current E-cigarette use									
No	12,716	35.8 (34.2, 37.4)	8,360,000	52.6 (50.6, 54.7)	12,260,000	30.6 (28.4, 32.8)	7,170,000	33.3 (31.3, 35.3)	7,700,000
Yes	1,769	50.5 (47.5, 53.5)	1,670,000	58.2 (54.9, 61.4)	1,900,000	65.1 (61.3, 68.7)	2,170,000	61.3 (57.7, 64.8)	1,990,000
p-value		**<0.01**		**0.01**		**<0.01**		**<0.01**	
Current smokeless tobacco product use									
No	14,177	37.2 (35.6, 38.8)	9,720,000	53.1 (51.2, 55.0)	13,820,000	34.3 (31.9, 36.8)	89,930,000	36.3 (34.1, 38.4)	9,380,000
Yes	332	54.3 (47.3, 61.1)	320,000	62.6 (55.8, 69.0)	360,000	62.7 (53.9, 70.8)	370,000	59.6 (50.1, 68.5)	340,000
p-value		**<0.01**		**0.01**		**<0.01**		**<0.01**	
Household member tobacco product use									
No tobacco use	9,091	31.6 (30.1, 33.1)	5,390,000	49.3 (47.1, 51.5)	8,380,000	29.3 (26.6, 32.0)	5,000,000	32.3 (30.1, 34.5)	5,470,000
Combustible tobacco only	2,580	48.6 (45.4, 51.9)	2,310,000	59.7 (56.2, 63.1)	2,850,000	34.9 (31.6, 38.4)	1,680,000	36.3 (33.2, 39.5)	1,710,000
Smokeless tobacco only	470	42.8 (36.9, 48.9)	380,000	55.1 (48.2, 61.8)	490,000	42.7 (36.9, 48.7)	380,000	43.5 (37.8, 49.3)	380,000
E-cigarettes only	609	42.5 (38.0, 47.1)	480,000	53.7 (48.6, 58.7)	600,000	65.1 (59.7, 70.1)	730,000	60.0 (54.3, 65.3)	670,000
Other combination of tobacco	1,297	56.3 (52.1, 60.4)	1,340,000	71.0 (66.9, 74.8)	1,670,000	60.1 (55.2, 64.8)	1,430,000	58.4 (53.5, 63.1)	1,370,000
p-value		**<0.01**		**<0.01**		**<0.01**		**<0.01**	

Note: Boldface indicates statistical significance (*p*<0.05).

NYTS, National Youth Tobacco Survey; SHA, secondhand aerosol; SHS, secondhand smoke.

[a] Unweighted number of respondents.

[b] Weighted percentage.

[c] Estimated weighted total number of youths exposed was rounded down to the nearest 10,000 persons.

[d] *p*-Value from chi-square test.

[e] Use of any of the following tobacco products in the past 30 days: E-cigarettes, cigarettes, cigars, hookah, pipe tobacco, bidis, chewing tobacco, snuff, dip, snus, dissolvable tobacco, or heated tobacco products.

[f] Use of any of the following tobacco products in the last 30 days: cigarette, cigar, pipe, bidis, or hookah.

Table 3.

Correlates of Self-Reported Indoor and Outdoor Secondhand Smoke and Secondhand Aerosol Exposure, NYTS 2020

Variables	Indoor SHS, APR[a] (95% CI)	Outdoor SHS, APR (95% CI)	Indoor SHA, APR (95% CI)	Outdoor SHA, APR (95% CI)
Sex				
Male	ref	ref	ref	ref
Female	1.16 (1.11, 1.20)	1.30 (1.24, 1.36)	1.15 (1.08, 1.22)	1.25 (1.19, 1.32)
School level				
High school	ref	ref	ref	ref
Middle school	1.07 (1.00, 1.13)	0.95 (0.90, 1.02)	0.63 (0.56, 0.70)	0.80 (0.73, 0.87)
Race/ethnicity				
Non-Hispanic White	ref	ref	ref	ref
Non-Hispanic Black	1.00 (0.90, 1.11)	0.80 (0.71, 0.90)	0.75 (0.65, 0.87)	0.74 (0.64, 0.85)
Hispanic	1.02 (0.95, 1.08)	0.95 (0.90, 1.00)	0.94 (0.88, 1.01)	0.97 (0.90, 1.04)
Non-Hispanic other	0.99 (0.88, 1.11)	1.02 (0.93, 1.11)	0.88 (0.73, 1.05)	0.92 (0.77, 1.10)
Sexual orientation				
Heterosexual	ref	ref	ref	ref
Gay/lesbian/bisexual	1.10 (1.02, 1.19)	1.11 (1.05, 1.17)	1.06 (0.96, 1.16)	1.07 (0.99, 1.15)
Not sure	0.92 (0.82, 1.05)	0.86 (0.80, 0.94)	0.85 (0.76, 0.96)	0.86 (0.77, 0.96)
Current combustible tobacco product use[b]				
No	ref	ref	ref	ref
Yes	1.36 (1.21, 1.52)	1.18 (1.09, 1.28)	1.16 (1.02, 1.31)	1.15 (1.03, 1.29)
Current E-cigarette use				
No	ref	ref	ref	ref
Yes	1.19 (1.09, 1.29)	0.96 (0.90, 1.03)	1.61 (1.46, 1.77)	1.50 (1.38, 1.62)
Current smokeless tobacco product use				
No	ref	ref	ref	ref
Yes	1.10 (0.93, 1.30)	1.07 (0.96, 1.20)	1.17 (0.99, 1.38)	1.13 (0.93, 1.36)
Household member tobacco use				
No tobacco use	ref	ref	ref	ref
Combustible tobacco only	1.48 (1.39, 1.57)	1.19 (1.12, 1.26)	1.15 (1.07, 1.22)	1.09 (1.02, 1.16)
Smokeless tobacco only	1.29 (1.11, 1.49)	1.05 (0.92, 1.20)	1.32 (1.16, 1.50)	1.23 (1.08, 1.40)

Variables	Indoor SHS, APR[a] (95% CI)	Outdoor SHS, APR (95% CI)	Indoor SHA, APR (95% CI)	Outdoor SHA, APR (95% CI)
E-cigarettes only	**1.26 (1.12, 1.41)**	1.04 (0.95, 1.14)	**1.90 (1.68, 2.15)**	**1.62 (1.44, 1.82)**
Other combination of tobacco	**1.60 (1.49, 1.72)**	**1.35 (1.27, 1.43)**	**1.69 (1.51, 1.88)**	**1.53 (1.39, 1.68)**

Note: Boldface indicates statistical significance (p<0.05).

APR, adjusted prevalence ratio; NYTS, National Youth Tobacco Survey; SHA, secondhand aerosol; SHS, secondhand smoke.

[a] Multivariable logistic regression models were adjusted for sex, school level, race/ethnicity, sexual orientation, current combustible tobacco product use, current E-cigarette use, current smokeless tobacco product use, and household tobacco use.

[b] Use of any of the following tobacco products in the last 30 days: current cigarette, cigar, pipe, bidi, or hookah.