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Impact of Survey Setting on Current Tobacco Product Use: National Youth Tobacco Survey, 2021

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Abstract

Purpose: To examine whether survey setting was associated with youth reporting of current (past 30-day) use of any tobacco product, e-cigarettes, cigarettes, and cigars.

Methods: Data from the 2021 National Youth Tobacco Survey (NYTS) were used to estimate the prevalence of current use of any tobacco product, e-cigarettes, cigarettes, and cigars by survey setting, sociodemographic characteristics, peer tobacco use, and other tobacco product use. Multivariable regression was used to test the impact of survey setting on current tobacco use. Tobacco access sources among current users were compared by survey setting.

Results: Among students who participated in the 2021 NYTS, 50.8% reported taking the survey on school campus and 49.2% at home/other place. The prevalence of current use of any tobacco product, e-cigarettes, cigarettes, and cigars was higher among students completing the survey on school campus than at home/other place. After adjusting for covariates, this association persisted only for current use of any tobacco product (adjusted odds ratio = 1.57; 95% confidence interval, 1.28–1.91) and e-cigarettes (adjusted odds ratio = 1.43; 95% confidence interval, 1.20–1.71). Current users reported similar sources of access to tobacco products, regardless of survey setting.

Discussion: The likelihood of youth reporting current use of any tobacco product and e-cigarettes differed by survey setting. Such differences could be due to lack of privacy at home, peer influence in school settings, and other unmeasured characteristics. Methodological changes were made due to COVID-19; caution is warranted in comparing results from the 2021 NYTS with those of previous or future NYTS conducted primarily on school campus.

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Supplementary Data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.jadohealth.2022.10.012>.

Keywords

Survey setting; COVID-19 pandemic; Youth tobacco product use; Smoking; e-cigarettes; National Youth Tobacco Survey

Obtaining accurate estimates of youth commercial tobacco product use is important for public health surveillance and prevention efforts. Researchers have found that varying survey methodologies and administration, such as mode of administration, sampling design, question wording and placement, and data processing techniques, could contribute to differences in estimates [1–3]. School-based surveys have typically produced higher estimates of youth tobacco use compared with household surveys [4–7]. In school-based surveys, eligible students from selected classes generally complete the survey in a group setting while on the school campus. By contrast, selected youth respondents in household surveys may complete the survey in the presence or within earshot of a parent or adult family member.

Privacy concerns at home have been offered as a possible reason for the differences in estimates between school-based and household surveys [3,8]. Moreover, different privacy levels in the home may affect how youth reported past substance use. For example, according to youth data from the National Survey on Drug Use and Health, completely private interviews produced the highest prevalence estimates of lifetime, past-year, and past-month cigarette smoking while the least private interviews with constant presence of another person produced the lowest estimates [3]. In another study, Brener and colleagues randomly assigned 9th and 11th graders into one of four conditions and examined effects of survey setting (school vs. home) and mode of administration (paper and pencil instrument vs. computer-assisted self-interviewing) on estimates of self-reported tobacco use and other health risk behaviors [4]. They found no differences in current cigarette and cigar use by survey setting. However, for other behaviors, a significant main effect of survey setting was found; students who completed the survey in school settings had higher odds of reporting certain behaviors (e.g., drug use, suicide, sexual behaviors) than those who completed the survey in home settings. Furthermore, a study by Boyd and others combined youth data from the 2015–2016 Monitoring the Future (MTF) and the Population Assessment of Tobacco and Health (PATH) Study to explore why MTF estimates of youth past 30-day e-cigarette use and cigarette smoking were higher than the PATH Study estimates [9]. In multivariable analyses, this exploratory study found that friends' e-cigarette and cigarette use mediated the differences in MTF and PATH Study estimates, suggesting greater peer effects in school settings as a potential reason for the differences by survey type [9]. Relatedly, social desirability bias could also explain some of the differences in estimates between school-based and household surveys [6]. As students may perceive parental disapproval of youth tobacco experimentation and use and adhere to the social norms, students participating in household surveys may be less inclined to report their tobacco use behaviors.

The National Youth Tobacco Survey (NYTS) is a national, school-based survey that focuses exclusively on youth tobacco use patterns and associated factors and serves as one of the data sources for informing tobacco regulatory science and guiding tobacco control efforts.

The 2021 NYTS was conducted amid the COVID-19 pandemic and presented unique opportunities for methodological research on the impact of survey setting on youth reporting of tobacco use behaviors. For the 2021 NYTS, changes were made to the data collection procedures due to state and local COVID-19 protocols (e.g., remote learning, restrictive travel, visitor access), including transitioning to a fully online survey administration and allowing eligible students to complete the survey in classrooms, at home, or in some other remote learning settings. Furthermore, unlike previous research that compared estimates from different survey types, the current study examined the impact of survey setting using a single sample of youth drawn for the 2021 NYTS and administered the survey in different survey settings while holding other methodological factors constant. The objectives of this study were to: assess the most recent prevalence of self-reported current (past 30-day) use of any tobacco product, e-cigarettes, cigarettes, and cigars among middle and high school students by survey setting, sociodemographic characteristics, perceived peer tobacco use, and current use of other tobacco products; and examine whether survey setting was associated with reporting of current use of any tobacco product, e-cigarettes, cigarettes, and cigars. Additionally, the current study described how and where current tobacco users accessed tobacco products by survey setting in order to understand whether attending school in person compared to remotely was associated with access to tobacco products during the ongoing COVID-19 pandemic.

Methods

Data source

The NYTS is an annual cross-sectional, school-based, self-administered survey of US middle school (grades 6–8) and high school (grades 9–12) students. A stratified, three-stage cluster sampling design is used to produce a nationally representative sample of students in grades 6 through 12 who attend public and private schools. Since 2019, the NYTS has transitioned to an electronic survey and administered the survey using provided tablets in schools with on-site support provided by trained survey administrators; the overall response rate in 2020 was 43.6% [10]. Due to emergency COVID-19 protocols across the country during the 2021 NYTS data collection period (January 18, 2021 to May 21, 2021), the 2021 survey was administered using a web-based survey and allowed eligible students to participate in classrooms, at home, or at some other learning place as part of their class activities. Participation in the NYTS was voluntary. Parental consent and student assent were required to participate in the survey. A total of 20,413 students from 279 schools participated in the 2021 NYTS, with an overall response rate of 44.6% (a product of 81.2% student and 54.9% school response rates). The 2021 NYTS was reviewed and approved by the Office of Management and Budget, the contracted data collectors' institutional review board, and the institutional review board of the Centers for Disease Control and Prevention. Detailed information on the NYTS methodology is available elsewhere [10].

Measures

Survey setting.—Survey setting was assessed by the question, “Where are you currently taking the survey?” Response options included “in a school building/classroom,” “at home (virtual learning),” and “some other place.” A dichotomous variable was created to indicate

whether respondents completed the survey “in a school building/classroom” (hereafter referred to as “on school campus”) or “at home” or “some other place” (hereafter referred to as “at home/other place”). Respondents with missing data (n = 853) were excluded from analyses.

Current tobacco product use.—The term “tobacco” as used in this study refers to commercial tobacco products and not to sacred and traditional use of tobacco by some American Indian communities. Current use of e-cigarettes, cigarettes, and cigars (cigars, cigarillos, little cigars) was defined as use of the respective product on 1 day during the past 30 days. Current use of any tobacco product was defined as use of one or more of the following tobacco products on 1 day during the past 30 days: cigarettes, e-cigarettes, cigars, smokeless tobacco (chewing tobacco, snuff, dip, snus, and dissolvable tobacco), hookahs, pipe tobacco, bidis, heated tobacco products, and nicotine pouches. Current use of other tobacco products was defined as use of one or more tobacco products other than the outcome of interest.

Sociodemographic characteristics.—Sociodemographic characteristics were self-reported and included: school level (middle school, high school), sex (female, male), race and ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, non-Hispanic other race), sexual and gender identity (lesbian, gay, bisexual, or transgender [LGBT]; not lesbian, gay, bisexual, nor transgender; unknown), past-year grades in school (mostly A’s or B’s, mostly C’s or lower, none of these grades or not sure), and speaking a language other than English at home (yes, no). Additionally, two composite scales assessed symptoms of psychological distress (none, mild/moderate, severe) using the Patient Health Questionnaire for Depression and Anxiety (PHQ-4) [11] and levels of family affluence (low, medium, high) using the Family Affluence Scale [12,13]. Detailed information on the sexual and gender identity questions and composite scales is provided in the Online Supplement.

Perceived peer tobacco use.—Perceived peer cigarette smoking and e-cigarette use were assessed separately by the following questions: “Out of every 10 students in your grade at school, how many do you think smoke cigarettes?” and “Out of every 10 students in your grade at school, how many do you think use e-cigarettes?” Respondents could select a response from 0 to 10. Responses were categorized as “less than 50%” (0–4 students) and “50% or more” (5–10 students).

Access to tobacco products.—For each tobacco product, access sources were assessed by two questions, “During the past 30 days, how did you get your [tobacco product]?” (respondents could select one or more of eight specified responses); and “During the past 30 days, where did you buy your [tobacco product]?” (respondents could select one or more of 12 specified responses). Responses were combined across all tobacco products that the respondent reported using during the past 30 days.

Statistical analysis

Statistical analyses were conducted using SAS-callable SUDAAN (version 11.0.3, Research Triangle Institute) to account for the NYTS’s complex sample design. Weighted prevalence

estimates and 95% confidence intervals (CIs) for current use of any tobacco product, e-cigarettes, cigarettes, and cigars were calculated by survey setting and other student characteristics. When applicable, population numbers were estimated from probability weights. For bivariate analyses, differences were considered statistically significant if $p < .05$ (two-sided); findings from analyses of differences by survey setting were not adjusted for multiplicity. Multivariable logistic regression models were run to examine the association of survey setting on current use of any tobacco product, e-cigarettes, cigarettes, and cigars. School level, sex, and race and ethnicity were considered important covariates and a priori included in the final regression models. For other variables, a purposeful covariate selection process was used to determine their inclusion in the final models [14,15]. Any variable with $p < .25$ on the Wald test from univariate logistic regression was included in a multivariable model (Step 1). If a variable was significant at $p < .1$ in the multivariable model (covariate) or removing the variable caused changes in any remaining parameter more than 20% (confounder), the variable was kept in the model (Step 2). Variables that were not included in Step 1 were added back to the model one at a time and evaluated if they were covariates or confounders. Through this iterative process, the final model for each outcome was specified. To make sure the models had the same sample size in each step of the iterative process, only students with complete data were included. Weighted numbers were rounded down to the nearest 10,000 persons. Estimates were considered statistically unreliable and suppressed if a relative standard error was greater than 30% or an unweighted denominator was less than 50.

Results

Among middle and high school students who participated in the 2021 NYTS, 50.8% reported taking the survey on school campus and 49.2% at home/other place (Table 1). By survey setting, higher percentages of males (54.6% vs. 50.5%), non-Hispanic White students (67.8% vs. 39.7%), those with severe psychological distress (13.7% vs. 11.4%), those categorized as having high family affluence (34.1% vs. 26.4%), speaking English at home (82.1% vs. 59.9%), and those who reported current use of any tobacco product (11.7% vs. 6.9%), e-cigarettes (9.7% vs. 5.5%), cigarettes (2.0% vs. 1.0%), or cigars (1.8% vs. 1.2%) completed the survey on school campus than at home/other place. No significant differences by survey setting were found relative to school level, sexual or gender identity, past-year grades in school, and perceived peer e-cigarette or cigarette use.

Prevalence of current tobacco use, by survey setting

Overall, higher percentages of students completing the survey on school campus reported current use of any tobacco product (11.7% vs. 6.9%, $p < .0001$), e-cigarettes (9.7% vs. 5.5%, $p < .0001$), cigarettes (2.0% vs. 1.0%, $p = .0004$), and cigars (1.8% vs. 1.2%, $p = .0109$) compared with those completing the survey at home/other place (Table 2). When stratified by other student characteristics, the prevalence estimates of current use of any tobacco product and e-cigarettes were higher among students in most subgroups who completed the survey on school campus than among those who completed the survey at home/other place. However, these differences did not reach statistical significance in certain subgroups, especially for current cigarette and cigar use.

Associations between survey setting and current tobacco use

In unadjusted analyses, students completing the survey on school campus had higher odds of reporting all four current use measures compared with those completing the survey at home/other place. After adjustment for covariates, the associations persisted for current use of any tobacco product (adjusted odds ratio = 1.57; 95% CI, 1.28–1.91) and e-cigarettes (adjusted odds ratio = 1.43; 95% CI, 1.20–1.71). With respect to cigarettes and cigars, survey setting was not significantly associated with current use in the adjusted models (Table 3).

Other correlates were also associated with current tobacco product use. In multivariable models, results varied by tobacco product. For e-cigarettes, after adjusting for survey setting, high school students, those with increasing symptoms of psychological distress, those who got mostly C's or lower grades in school, those speaking English at home, those who perceived at least half of their peers used e-cigarettes, and those who reported current use of other tobacco products were more likely to report current use. Compared to non-Hispanic White students, students of all other racial and ethnic groups were less likely to report current e-cigarette use. For cigarettes, males, those identifying as LGBT, those who got mostly C's or lower grades in school, those who perceived at least half of their peers smoked cigarettes, and those who reported current use of other tobacco products were more likely to report current use. For cigars, high school students, male students, non-Hispanic Black students, and those who reported current use of other tobacco products were more likely to report current use.

Access to tobacco products, by survey setting

Among current users of any tobacco product, the most commonly reported way of getting their tobacco products was getting them from a friend or buying the products themselves (Table 4). By survey setting, a higher percentage of students completing the survey on school campus than those completing at home/other place reported having someone else buy tobacco products for them (32.0% vs. 25.0%, $p = .0223$), having asked someone to give them some (23.8% vs. 11.3%, $p < .0001$), and taking the products from a store or from another person (7.2% vs. 4.2%, $p = .0327$) (Table 4). By purchase location, 25.9% of students completing the survey on school campus reported purchasing their tobacco products from another person (family member, friend, someone else) compared with 17.2% of those completing the survey at home/other place ($p = .0021$). Other commonly cited purchase locations, irrespective of survey completion setting, included gas stations or convenience stores and vape shops or tobacco shops.

Discussion

The 2021 NYTS provided a unique opportunity to examine the impact of survey setting on youth reporting of tobacco use behaviors during the COVID-19 pandemic. This study found that the reported prevalence of current use of any tobacco product, e-cigarettes, cigarettes, and cigars was higher among students completing the survey on school campus than those completing the survey at home/other place. However, after adjustment for various student-level characteristics, including perceived peer tobacco use, the associations persisted only for current use of any tobacco product and e-cigarettes. For current use of

cigarettes and cigars, after adjustment, the associations were no longer significant, which may be partly due to small sample sizes as the prevalence estimates of use for these products were low [16]. These findings are partially consistent with other studies [4,9]. In their experimental study, Brener and others found no differences in the estimates of current cigarette and cigar use by survey setting even after adjusting for age, sex, and race and ethnicity [4]. Additionally, based on the analyses of combined 2015–2016 MTF and PATH Study data, Boyd and others found no differences in youth reporting of current e-cigarette and cigarette use between the two surveys, especially when friends' e-cigarette and cigarette use were added to the models [9]. However, because MTF and PATH Study estimates were based on data collected using disparate methodologies, these results could vary due to methodological differences, such as mode of administration, sample design and coverage, fielding period, and question wording and placement. Furthermore, the multivariable analyses were unweighted without incorporating the complex survey designs of MTF and the PATH Study.

This study's findings are generally consistent with other studies demonstrating that high school students, those with poor mental health indicators [17], those with low academic performance [18], and those who perceived higher peer tobacco use [19] were more likely to use tobacco products. In addition, the current study indicated that non-Hispanic White students were most likely to report current use of e-cigarettes among students of different racial and ethnic backgrounds, while non-Hispanic Black students were more likely to report current cigar use compared with their non-Hispanic White peers; this result is consistent with the extant literature [20,21]. While most tobacco-related diseases and deaths are caused by cigarettes and other combustible tobacco products [22], most initiation of tobacco products occurs during adolescence and young adulthood [23] and youth use of any tobacco products is concerning.

The current study found that youth reported similar sources of access to tobacco products whether they attended school in person or remotely during the spring of 2021. Regardless of survey completion setting, the most commonly reported way of getting tobacco products was from a friend or buying the products themselves; vape shops or tobacco shops, and gas stations or convenience stores were the most commonly reported places where youth purchased their tobacco products. However, compared with those completing the survey at home/other place, a higher proportion of students completing the survey on school campus reported accessing their tobacco products through various social sources, including buying the products from another person, asking someone else to buy them, or asking someone else to give them some. Our findings add additional context to studies conducted in 2020, reporting that during the COVID-19 pandemic, youth perceived decreases in the availability of e-cigarettes [24] and found it harder to get e-cigarettes because they could not go to vape shops or gas stations [25].

According to data from an ongoing nationally representative research panel of US households, by May 2021, about 50% of students attended school in person, 30% remotely, and 20% in a hybrid mode [26]. These breakdowns by instructional modality are similar to this study's findings. Previous literature has reported that access to, and parent preference for, in person learning were higher among non-Hispanic White students, those in rural

or suburban areas, and younger students [26,27]. Additionally, inconsistent reporting of cigarette smoking has been observed by survey setting among certain subgroups, such as younger students, non-Hispanic Black and Hispanic students, and those with nonsmoking parents and friends; such groups were more likely to provide a positive report of cigarette smoking while in a school setting followed by a negative report during household interviews [28]. When estimates from different pairs of school-based and household surveys are compared, differences in tobacco use estimates are generally larger for younger students and infrequent cigarette smokers [6]. Taken together, the differences in current tobacco use by survey setting observed in the current study could be due to reasons such as lack of privacy at home, peer influence in school settings, and access to tobacco products. Also, these differences could be due to other unmeasured characteristics related to the ongoing COVID-19 pandemic which may have possibly impacted students' access to in person learning and tobacco use.

Limitations of the current study are worth noting. First, because this study did not randomly assign students to different survey settings, we could not ensure that students in the two settings were comparable relative to characteristics associated with current tobacco use. Further, the 2021 NYTS sample was not designed to be representative of students who attended school in person or remotely; as such, there may be differences between the two student groups that the current study did not fully assess when examining the impact of survey setting. Relatedly, it is unclear if future research would produce similar findings as this study when conducted outside of the pandemic, as there may be unmeasured characteristics related to the ongoing COVID-19 pandemic at play in this study. Third, data were self-reported and might be subject to recall and response bias. Finally, because data were collected from students who attended US public or private schools, findings from the current study may not be generalizable to youth who are homeschooled, have dropped out of school, are in detention centers or enrolled in alternative schools. Notwithstanding these limitations, this study has important strengths. This study used the latest NYTS data with a sample relatively evenly distributed between the settings to examine the impact of survey setting on self-reported tobacco use measures. In addition, given the students were from a single sample, the associations of survey setting with current use were examined while holding methodological factors (mode, sample design, and question wording) constant.

Conclusions

In this study, the reported prevalence estimates of current use of any tobacco product, e-cigarettes, cigarettes, and cigars were higher among students who completed the survey on school campus than those who completed the survey at home/other place. However, after adjustment for various covariates, the associations persisted only for current use of any tobacco product and e-cigarettes. This is a timely and relevant contribution to the limited literature on how different survey settings impact youth reporting of tobacco use behaviors using the latest NYTS data collected during the COVID-19 pandemic. Findings from this study highlight the observed differences by survey setting could be due to various reasons, such as lack of privacy at home, peer influence in school settings, access sources to tobacco products, and other unmeasured characteristics. Thus, caution should be taken when comparing estimates from the 2021 NYTS with those from previous or future NYTS that

were primarily conducted on school campuses. Furthermore, the impact of survey settings should be considered when planning for future surveys that allow youth to take surveys in different settings or when comparing estimates of youth tobacco use from surveys conducted in various settings.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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IMPLICATIONS AND CONTRIBUTION

This study examined the impact of survey setting on tobacco use reporting using a national sample of youth while other methodological factors were constant. Reporting of current tobacco product use differed by survey setting, which may be due to various reasons, including unmeasured characteristics related to the ongoing COVID-19 pandemic.

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Table 1
Selected sociodemographic characteristics, perceived peer tobacco use, and current tobacco use among middle and high school students, overall and by survey setting: National Youth Tobacco Survey, 2021

Characteristic	Overall	On school campus (n = 10,737)		At home/other place (n = 8,823)		p-value ^a
		Unweighted sample size	% (95% CI)	% (95% CI)	% (95% CI)	
Total	20,413	100.0	50.8 (43.5–58.0)	49.2 (42.0–56.5)		
School level						
Middle school	9,763	43.7 (38.1–49.4)	47.3 (39.8–55.0)	39.2 (32.0–46.9)		.1062
High school	10,515	56.3 (50.6–61.9)	52.7 (45.0–60.2)	60.8 (53.1–68.0)		.1062
Sex						
Female	9,919	47.7 (45.7–49.6)	45.4 (43.2–47.7)	49.5 (47.1–51.9)		.0004
Male	10,368	52.3 (50.4–54.3)	54.6 (52.3–56.8)	50.5 (48.1–52.9)		.0004
Race and ethnicity						
Non-Hispanic White	10,104	53.7 (49.3–58.1)	67.8 (63.1–72.2)	39.7 (34.5–45.2)		<.0001
Non-Hispanic Black	3,446	13.1 (10.9–15.7)	10.9 (8.4–14.0)	15.0 (11.8–18.9)		.0621
Hispanic	5,056	26.3 (23.1–29.8)	16.9 (13.7–20.8)	35.9 (30.5–41.6)		<.0001
Non-Hispanic other races	1,176	6.9 (5.2–9.1)	4.4 (3.5–5.5)	9.5 (6.8–13.1)		.0011
Sexual and gender identity						
Lesbian, gay, bisexual, or transgender	2,586	14.4 (13.4–15.5)	14.8 (13.6–16.1)	14.0 (12.6–15.6)		.4146
Not lesbian, gay, bisexual, nor transgender	12,980	71.5 (70.1–73.0)	71.5 (69.8–73.2)	71.8 (69.8–73.7)		.7812
Unknown	2,659	14.0 (12.9–15.2)	13.7 (12.4–15.1)	14.2 (12.7–15.8)		.5868
Psychological distress						
None	9,358	53.2 (51.8–54.5)	52.9 (51.1–54.6)	53.1 (51.2–55.1)		.8224
Mild/moderate	5,806	34.3 (33.1–35.4)	33.4 (31.8–35.1)	35.4 (34.0–36.8)		.0689
Severe	2,191	12.6 (11.7–13.5)	13.7 (12.5–15.0)	11.4 (10.5–12.5)		.0024
Family affluence						
Low	4,537	25.2 (22.7–27.8)	21.8 (19.7–24.1)	28.5 (24.8–32.5)		.0006
Medium	7,876	44.5 (42.8–46.2)	44.1 (41.7–46.5)	45.2 (43.0–47.4)		.4962
High	5,465	30.4 (28.2–32.7)	34.1 (31.4–37.0)	26.4 (23.5–29.4)		.0001
Past-year grades in school						
Mostly A's or B's	12,847	72.2 (70.1–74.3)	72.8 (70.2–75.3)	71.7 (68.9–74.3)		.4606

Characteristic	Overall	On school campus (n = 10,737)		At home/other place (n = 8,823)		p-value ^d
		Unweighted sample size	% (95% CI)	% (95% CI)	% (95% CI)	
Total	20,413	100.0	50.8 (43.5–58.0)	49.2 (42.0–56.5)		
Mostly C's or lower	3,702	19.4 (17.9–21.1)	19.4 (17.4–21.5)	19.5 (17.5–21.7)		.9046
None of these grades/not sure	1,569	8.3 (7.5–9.2)	7.8 (6.9–8.8)	8.8 (7.6–10.2)		.2053
Language other than English spoken at home						
Yes	5,058	28.6 (24.9–32.5)	17.9 (15.4–20.7)	40.1 (34.5–45.9)		<.0001
No	13,159	71.4 (67.5–75.1)	82.1 (79.3–84.6)	59.9 (54.1–65.5)		<.0001
Perceived peer e-cigarette use						
Less than 50%	11,663	60.0 (57.1–62.9)	59.1 (54.9–63.2)	60.7 (57.2–64.2)		.5084
50% or more	7,038	40.0 (37.1–42.9)	40.9 (36.8–45.1)	39.3 (35.8–42.8)		.5084
Perceived peer cigarette use						
Less than 50%	14,911	79.5 (77.7–81.2)	80.8 (78.4–82.9)	78.6 (76.2–80.8)		.1366
50% or more	3,838	20.5 (18.8–22.3)	19.2 (17.1–21.6)	21.4 (19.2–23.8)		.1366
Current use of any tobacco product						
Yes	1,849	9.3 (8.3–10.5)	11.7 (10.2–13.4)	6.9 (6.0–7.9)		<.0001
No	18,375	90.7 (89.5–91.7)	88.3 (86.6–89.8)	93.1 (92.1–94.0)		<.0001
Current use of e-cigarettes						
Yes	1,436	7.6 (6.6–8.7)	9.7 (8.2–11.4)	5.5 (4.7–6.4)		<.0001
No	18,701	92.4 (91.3–93.4)	90.3 (88.6–91.8)	94.5 (93.6–95.3)		<.0001
Current use of cigarettes						
Yes	320	1.5 (1.3–1.8)	2.0 (1.6–2.5)	1.0 (0.8–1.4)		.0004
No	19,622	98.5 (98.2–98.7)	98.0 (97.5–98.4)	99.0 (98.6–99.2)		.0004
Current use of cigars						
Yes	303	1.4 (1.2–1.7)	1.8 (1.5–2.1)	1.2 (0.9–1.5)		.0109
No	19,561	98.6 (98.3–98.8)	98.2 (97.9–98.5)	98.8 (98.5–99.1)		.0109
Current use of tobacco products other than e-cigarettes						
Yes	873	4.2 (3.7–4.7)	5.3 (4.6–6.1)	3.0 (2.6–3.5)		<.0001
No	19,120	95.8 (95.3–96.3)	94.7 (93.9–95.4)	97.0 (96.5–97.4)		<.0001
Current use of tobacco products other than cigarettes						
Yes	1,787	9.1 (8.0–10.2)	11.3 (9.8–13.0)	6.7 (5.9–7.8)		<.0001
No	18,436	90.9 (89.8–92.0)	88.7 (87.0–90.2)	93.3 (92.2–94.1)		<.0001

Characteristic	Overall		On school campus (n = 10,737)		At home/other place (n = 8,823)		p-value ^a
	Unweighted sample size	% (95% CI)	% (95% CI)	% (95% CI)			
Total	20,413	100.0	50.8 (43.5–58.0)	49.2 (42.0–56.5)			
Current use of tobacco products other than cigars							
Yes	1,760	8.9 (7.9–10.1)	11.4 (9.8–13.1)	6.4 (5.6–7.4)			<.0001
No	18,464	91.1 (89.9–92.1)	88.6 (86.9–90.2)	93.6 (92.6–94.4)			<.0001

CI = confidence interval. Significant differences by survey setting ($p < .05$) are indicated in bold type.

^ap-values were from two-sided t-tests and not adjusted for multiplicity.

Table 2

Prevalence of current use of any tobacco product, e-cigarettes, cigarettes, and cigars among US middle and high school students, by survey setting, selected sociodemographic characteristics, perceived peer tobacco use, and current use of other tobacco products: National Youth Tobacco Survey, 2021

Characteristic	Any tobacco use			E-cigarette use			Cigarette use			p-value		
	On school campus (n = 1,173)	At home/ other place (n = 607)	p-value ^a	On school campus (n = 933)	At home/ other place (n = 456)	p-value	On school campus (n = 226)	At home/ other place (n = 84)	p-value			
All students	11.7 (10.2–13.4)	6.9 (6.0–7.9)	<.0001	9.7 (8.2–11.4)	5.5 (4.7–6.4)	<.0001	2.0 (1.6–2.5)	1.0 (0.8–1.4)	.0004	1.8 (1.5–2.1)	1.2 (0.9–1.5)	.0109
School level												
Middle school	5.2 (4.4–6.2)	2.2 (1.6–3.0)	<.0001	3.7 (3.0–4.7)	1.4 (1.0–2.0)	<.0001	1.3 (0.9–1.8)	0.7 (0.4–1.1)	.0237	0.8 (0.6–1.1)	<i>b</i>	-
High school	17.5 (15.1–20.1)	9.9 (8.6–11.5)	<.0001	15.0 (12.9–17.4)	8.1 (6.8–9.6)	<.0001	2.6 (2.0–3.4)	1.3 (0.9–1.8)	.0016	2.6 (2.2–3.2)	1.7 (1.2–2.3)	.0131
Sex												
Female	11.4 (9.5–13.6)	8.1 (6.9–9.3)	.0035	9.5 (7.6–11.8)	6.8 (5.7–8.0)	.0134	2.0 (1.6–2.7)	0.9 (0.6–1.5)	.0032	1.3 (0.9–1.7)	0.9 (0.6–1.5)	.2927
Male	11.9 (10.4–13.6)	5.8 (4.5–7.3)	<.0001	9.8 (8.3–11.4)	4.2 (3.2–5.4)	<.0001	2.0 (1.5–2.6)	1.1 (0.7–1.7)	.0088	2.2 (1.8–2.7)	1.4 (1.0–1.9)	.0102
Race and ethnicity												
Non-Hispanic White	12.1 (10.2–14.3)	9.2 (7.5–11.2)	.0134	10.5 (8.6–12.7)	8.1 (6.6–9.8)	.0212	1.9 (1.5–2.5)	1.5 (1.0–2.1)	.2232	1.5 (1.2–2.0)	1.3 (0.8–2.0)	.5324
Non-Hispanic Black	10.6 (7.3–15.2)	6.5 (5.2–8.1)	.0445	6.2 (3.9–9.8)	3.0 (2.0–4.5)	.0456	1.8 (1.0–3.2)	<i>b</i>	-	4.0 (2.7–5.8)	2.6 (1.7–3.7)	.1212
Hispanic	11.8 (9.4–14.6)	5.3 (4.4–6.4)	<.0001	9.7 (7.5–12.4)	4.3 (3.4–5.4)	.0001	2.4 (1.6–3.6)	1.0 (0.6–1.5)	.0097	1.6 (1.0–2.6)	0.6 (0.4–1.0)	.0151
Non-Hispanic other races	8.0 (5.1–12.4)	4.5 (2.6–7.7)	.0848	5.9 (3.8–9.2)	<i>b</i>	-	<i>b</i>	<i>b</i>	-	<i>b</i>	<i>b</i>	-
Sexual and gender identity												
Lesbian, gay, bisexual, or transgender	19.3 (15.7–23.5)	9.1 (6.9–11.8)	<.0001	15.4 (12.4–19.0)	7.7 (5.6–10.3)	.0003	4.6 (3.2–6.5)	2.3 (1.2–4.0)	.0236	3.8 (2.7–5.4)	<i>b</i>	-
Not lesbian, gay, bisexual, nor transgender	9.5 (8.2–11.0)	6.1 (5.1–7.2)	<.0001	7.9 (6.6–9.4)	4.9 (4.0–5.9)	<.0001	1.3 (1.0–1.7)	0.7 (0.5–1.0)	.0076	1.3 (1.0–1.7)	1.1 (0.7–1.5)	.3133
Unknown	7.4 (5.4–10.2)	5.4 (4.1–7.1)	.1196	5.7 (3.9–8.3)	3.6 (2.4–5.4)	.0844	1.2 (0.7–2.0)	<i>b</i>	-	<i>b</i>	<i>b</i>	-
Psychological distress												

Characteristic	Any tobacco use			E-cigarette use			Cigarette use			Cigar use		
	On school campus (n = 1,173)	At home/ other place (n = 607)	p-value ^a	On school campus (n = 933)	At home/ other place (n = 456)	p-value	On school campus (n = 226)	At home/ other place (n = 84)	p-value	On school campus (n = 195)	At home/ other place (n = 98)	p-value
None	6.6 (5.7–7.7)	4.3 (3.3–5.7)	.0015	5.0 (4.1–6.1)	3.2 (2.5–4.3)	.0045	1.2 (0.8–1.7)	0.5 (0.3–0.9)	.0092	1.0 (0.7–1.4)	1.0 (0.6–1.6)	.8580
Mild/moderate	12.6 (10.1–15.5)	7.7 (6.4–9.2)	.0013	10.9 (8.5–13.9)	6.6 (5.3–8.2)	.0034	1.8 (1.3–2.6)	1.3 (0.9–1.8)	.1865	1.4 (1.0–1.9)	1.4 (0.9–2.1)	.9357
Severe	16.8 (13.6–20.6)	11.2 (8.7–14.3)	.0082	13.5 (10.7–17.1)	9.4 (7.0–12.4)	.0275	2.9 (1.9–4.4)	2.2 (1.2–4.0)	.4936	3.1 (2.1–4.7)	<i>b</i>	-
Family affluence												
Low	12.8 (10.6–15.4)	6.3 (4.9–8.1)	<.0001	10.3 (8.2–12.8)	4.9 (3.5–6.7)	.0002	3.0 (2.1–4.3)	<i>b</i>	-	2.2 (1.5–3.3)	<i>b</i>	-
Medium	9.4 (8.0–11.0)	6.1 (5.2–7.3)	<.0001	7.9 (6.4–9.6)	5.1 (4.1–6.3)	.0007	1.3 (0.9–1.8)	0.9 (0.5–1.4)	.1871	1.1 (0.8–1.5)	1.0 (0.6–1.6)	.6938
High	10.2 (8.5–12.1)	6.7 (5.3–8.6)	.0018	8.0 (6.4–9.9)	5.3 (4.1–6.8)	.0050	1.5 (1.0–2.1)	0.9 (0.5–1.4)	.0446	1.5 (1.0–2.2)	1.3 (0.8–2.0)	.5767
Grades in school												
Mostly A's or B's	8.8 (7.5–10.2)	5.4 (4.5–6.6)	<.0001	7.3 (6.0–8.8)	4.4 (3.6–5.4)	<.0001	1.1 (0.8–1.5)	0.8 (0.5–1.1)	.1490	1.2 (0.9–1.7)	0.9 (0.6–1.3)	.2131
Mostly C's or lower	18.1 (15.5–21.0)	10.6 (8.6–12.9)	<.0001	14.6 (12.1–17.5)	8.2 (6.3–10.5)	.0003	4.1 (2.8–5.9)	1.8 (1.1–3.1)	.0159	2.9 (2.0–4.1)	2.1 (1.3–3.3)	.2464
None of these grades/not sure	10.2 (7.5–13.7)	4.1 (2.7–6.3)	.0015	7.1 (5.1–9.8)	3.0 (1.8–4.9)	.0066	2.4 (1.4–4.0)	<i>b</i>	-	2.1 (1.2–3.7)	<i>b</i>	-
Language other than English spoken at home												
Yes	9.9 (8.3–11.7)	4.8 (3.8–6.0)	<.0001	7.0 (5.6–8.7)	3.7 (2.8–4.9)	.0003	1.9 (1.3–2.9)	0.8 (0.6–1.2)	.0081	2.0 (1.4–3.0)	0.7 (0.4–1.1)	.0022
No	10.6 (9.0–12.3)	7.4 (6.2–8.7)	.0009	8.8 (7.3–10.5)	5.9 (5.0–7.1)	.0008	1.7 (1.3–2.2)	1.0 (0.7–1.4)	.0107	1.5 (1.2–2.0)	1.4 (0.9–2.0)	.6207
Perceived peer e-cigarette use												
Less than 50%	4.7 (3.9–5.6)	3.0 (2.4–3.9)	.0009	3.1 (2.4–4.0)	2.0 (1.5–2.6)	.0172	-	-	-	-	-	-
50% or more	19.7 (17.6–22.0)	11.4 (9.9–13.1)	<.0001	17.2 (15.0–19.7)	9.6 (8.0–11.4)	<.0001	-	-	-	-	-	-
Perceived peer cigarette use												
Less than 50%	8.9 (7.5–10.5)	5.6 (4.5–6.8)	.0001	-	-	-	1.2 (0.9–1.6)	0.8 (0.5–1.1)	.0501	-	-	-
50% or more	19.2 (17.0–21.6)	9.0 (7.4–10.9)	<.0001	-	-	-	4.6 (3.6–5.8)	1.5 (0.9–2.2)	<.0001	-	-	-
Current use of other tobacco products												

Characteristic	Any tobacco use		E-cigarette use			Cigarette use			Cigar use			
	On school campus (n = 1,173)	At home/ other place (n = 607)	p-value ^a	On school campus (n = 933)	At home/ other place (n = 456)	p-value	On school campus (n = 226)	At home/ other place (n = 84)	p-value	On school campus (n = 195)	At home/ other place (n = 98)	p-value
Yes	-	-	-	61.1 (54.4–67.4)	51.4 (42.3–60.4)	.0620	15.1 (12.4–18.3)	13.9 (10.1–18.8)	.6423	13.2 (11.1–15.8)	11.3 (7.8–16.0)	.4188
No	-	-	-	6.4 (5.2–7.8)	3.7 (3.1–4.4)	<.0001	0.4 (0.3–0.6)	<i>b</i>	-	0.4 (0.2–0.6)	0.5 (0.3–0.8)	.3290

n = unweighted sample size; CI = confidence interval; - = not applicable. Significant differences by survey setting ($p < .05$) are indicated in bold type.

^a p-values were from two-sided t-tests and not adjusted for multiplicity.

^b Data were statistically unreliable because of an unweighted denominator <50 or a relative standard error >30%.

Table 3

Unadjusted and adjusted odds ratios of survey setting and other covariates associated with current use of any tobacco product, e-cigarettes, cigarettes, and cigars: National Youth Tobacco Survey, 2021

Characteristic	Any tobacco use ^a		E-cigarette use ^b		Cigarette use ^c		Cigar use ^d	
	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Survey setting								
On school campus	1.78 (1.47–2.16)	1.57 (1.28–1.91)	1.85 (1.49–2.29)	1.43 (1.20–1.71)	1.93 (1.34–2.79)	1.02 (0.63–1.65)	1.54 (1.09–2.17)	0.88 (0.59–1.32)
At home/other place	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
School level								
Middle school	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
High school	3.73 (2.92–4.75)	2.83 (2.23–3.59)	4.46 (3.43–5.80)	3.17 (2.46–4.09)	1.83 (1.28–2.61)	0.70 (0.44–1.13)	3.63 (2.43–5.41)	1.88 (1.15–3.09)
Sex								
Female	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Male	0.93 (0.80–1.07)	1.11 (0.91–1.35)	0.88 (0.76–1.02)	0.86 (0.69–1.07)	1.03 (0.78–1.36)	1.58 (1.06–2.33)	1.65 (1.26–2.15)	2.05 (1.36–3.09)
Race and ethnicity								
Non-Hispanic White	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Non-Hispanic Black	0.72 (0.53–0.98)	0.74 (0.54–1.03)	0.42 (0.28–0.64)	0.27 (0.18–0.42)	0.58 (0.36–0.93)	0.59 (0.29–1.16)	2.26 (1.61–3.18)	4.32 (2.72–6.85)
Hispanic	0.65 (0.53–0.79)	0.72 (0.56–0.93)	0.60 (0.48–0.75)	0.71 (0.53–0.97)	0.84 (0.61–1.16)	0.86 (0.56–1.31)	0.65 (0.46–0.92)	0.79 (0.49–1.28)
Non-Hispanic other races	0.46 (0.30–0.72)	0.73 (0.46–1.16)	0.42 (0.25–0.70)	0.64 (0.39–1.07)	0.64 (0.32–1.29)	1.31 (0.61–2.81)	0.40 (0.17–0.92)	0.65 (0.21–1.98)
Sexual and gender identity								
Lesbian, gay, bisexual, or transgender	Reference	1.43 (1.16–1.77)	Reference	1.96 (1.60–2.41)	3.59 (2.51–5.14)	2.56 (1.62–4.04)	2.05 (1.48–2.84)	**
Not lesbian, gay, bisexual, nor transgender	Reference	Reference	Reference	Reference	Reference	Reference	Reference	**
Unknown	0.81 (0.65–1.01)	0.98 (0.74–1.30)	0.73 (0.65–0.95)	**	0.85 (0.50–1.43)	0.81 (0.38–1.75)	0.97 (0.53–1.79)	**
Psychological distress								
None	Reference	Reference	Reference	Reference	Reference	Reference	Reference	**
Mild/moderate	1.97 (1.66–2.33)	1.59 (1.32–1.91)	2.23 (1.84–2.70)	1.83 (1.45–2.30)	1.89 (1.30–2.76)	1.15 (0.77–1.73)	1.41 (0.99–2.02)	**
Severe	2.86 (2.28–3.58)	1.90 (1.51–2.40)	3.05 (2.43–3.83)	1.92 (1.54–2.39)	3.24 (2.11–4.98)	1.37 (0.82–2.29)	2.15 (1.31–3.53)	**
Family affluence								
Low	Reference	**	Reference	**	Reference	Reference	Reference	**

Characteristic	Any tobacco use ^a		E-cigarette use ^b		Cigarette use ^c		Cigar use ^d	
	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Medium	0.82 (0.69–0.97)	**	0.87 (0.71–1.07)	**	0.53 (0.34–0.84)	0.61 (0.37–1.01)	0.64 (0.38–1.09)	**
High	0.95 (0.78–1.16)	**	0.95 (0.75–1.20)	**	0.64 (0.40–1.02)	0.68 (0.38–1.21)	0.88 (0.55–1.39)	**
Grades in school								
Mostly A's or B's	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Mostly C's or lower	2.21 (1.92–2.56)	1.90 (1.62–2.23)	2.08 (1.76–2.46)	1.65 (1.29–2.11)	3.33 (2.33–4.74)	1.58 (1.02–2.46)	2.40 (1.64–3.51)	1.22 (0.78–1.93)
None of these grades/not sure	1.01 (0.80–1.28)	1.35 (1.03–1.79)	0.86 (0.67–1.11)	1.21 (0.87–1.69)	1.68 (1.04–2.70)	1.26 (0.73–2.16)	1.47 (0.88–2.45)	1.32 (0.74–2.36)
Language other than English spoken at home								
Yes	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
No	1.50 (1.25–1.79)	1.25 (1.00–1.55)	1.67 (1.37–2.05)	1.37 (1.06–1.76)	1.15 (0.82–1.61)	**	1.31 (0.93–1.84)	0.69 (0.43–1.11)
Perceived peer e-cigarette use								
Less than 50%	Reference	Reference	Reference	Reference	-	-	-	-
50% or more	4.43 (3.71–5.28)	2.89 (2.34–3.57)	5.70 (4.68–6.95)	3.40 (2.77–4.19)	-	-	-	-
Perceived peer cigarette use								
Less than 50%	Reference	Reference	-	-	Reference	Reference	-	-
50% or more	2.09 (1.75–2.50)	1.14 (0.96–1.35)	-	-	3.13 (2.28–4.28)	1.79 (1.23–2.60)	-	-
Current use of other tobacco products								
Yes	-	-	24.99 (19.64–31.80)	22.87 (16.69–31.35)	59.49 (38.84–91.12)	40.44 (21.75–75.19)	32.29 (22.14–47.08)	36.13 (21.26–61.40)
No	-	-	Reference	Reference	Reference	Reference	Reference	Reference

OR = odds ratio; CI = confidence interval; - = not applicable;

** = not included in the final model. Significant ORs ($p < .05$) are indicated in bold type.

Adjusted for school level, sex, and race/ethnicity as well as other variables selected through the purposeful covariate selection process.

^aThe multivariable analysis included a total of 15,796 students without missing data on any variable considered to specify the final model; included were 1,263 current users of any tobacco product. The final model adjusted the following covariates based on the purposeful selection process: school level, sex, race/ethnicity, sexual or gender identity, psychological distress, grades in school, language other than English spoken at home, perceived peer e-cigarette use, and perceived peer cigarette use.

^bThe multivariable analysis included a total of 15,777 students without missing data on any variable considered to specify the final model; included were 1,005 current users of e-cigarettes. The final model adjusted the following covariates based on the purposeful selection process: school level, sex, race/ethnicity, psychological distress, grades in school, language other than English spoken at home, perceived peer e-cigarette use, and current use of tobacco products other than e-cigarettes.

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The multivariable analysis included a total of 15,815 students without missing data on any variable considered to specify the final model; included were 215 current users of cigarettes. The final model adjusted the following covariates based on the purposeful selection process: school level, sex, race/ethnicity, sexual or gender identity, psychological distress, family affluence, grades in school, perceived cigarette use, and current use of tobacco products other than cigarettes.

The multivariable analysis included a total of 15,912 students without missing data on any variable considered to specify the final model; included were 209 current users of cigars. The final model adjusted the following covariates based on the purposeful selection process: school level, sex, race/ethnicity, grades in school, and current use of tobacco products other than cigars

Table 4

Access to tobacco products among middle and high school students who reported current use of any tobacco product, by survey setting: National Youth Tobacco Survey, 2021

Access source	On school campus		At home/other place		p-value ^b		
	Weighted population number ^d	%	95% CI	Weighted population number		%	95% CI
How you got your tobacco product used in the past 30 days							
I got them from a friend	500,000	34.5	(30.9–38.4)	250,000	30.2	(23.9–37.4)	.2881
I bought them myself	450,000	30.6	(26.5–35.1)	280,000	34.5	(29.7–39.5)	.3108
I had someone else buy them for me	470,000	32.0	(28.6–35.6)	200,000	25.0	(20.3–30.3)	.0223
Someone offered them to me	410,000	27.9	(23.8–32.3)	200,000	24.2	(20.3–28.5)	.1929
I asked someone to give me some	350,000	23.8	(20.5–27.3)	90,000	11.3	(7.8–16.2)	<.0001
I got them from a family member	220,000	15.4	(12.9–18.4)	90,000	11.8	(8.7–15.7)	.0805
I took them from a store/another person	100,000	7.2	(5.4–9.6)	30,000	4.2	(2.6–6.6)	.0327
I got them in some other way	290,000	20.3	(17.6–23.4)	170,000	21.3	(17.8–25.2)	.6685
Where you bought your tobacco product used in the past 30 days							
I did not buy them	700,000	47.6	(43.4–52.0)	390,000	48.9	(43.4–54.3)	.7581
Bought them from another person (friend, family member, someone else)	380,000	25.9	(22.0–30.1)	130,000	17.2	(13.2–22.1)	.0021
A vape shop or tobacco shop	280,000	19.5	(15.1–24.7)	180,000	23.4	(18.1–29.7)	.3155
A gas station, convenience store	310,000	21.0	(17.7–24.6)	150,000	18.8	(14.7–23.8)	.4213
A drug store	80,000	5.8	(4.0–8.5)	20,000	3.4	(1.9–5.9)	.1114
A grocery store	80,000	5.7	(4.2–7.9)	20,000	3.6	(2.0–6.3)	.1082
Through the mail	60,000	4.2	(2.7–6.5)	c	c	c	-
A mall or shopping center kiosk/stand	60,000	4.1	(2.6–6.5)	c	c	c	-
On the internet	50,000	3.9	(2.8–5.5)	c	c	c	-
A vending machine	50,000	3.6	(2.4–5.3)	c	c	c	-
Through a delivery service	40,000	3.0	(1.9–4.7)	c	c	c	-
Some other place	240,000	16.5	(13.6–19.8)	110,000	14.1	(11.5–17.1)	.1870

CI = confidence interval; – = not applicable. Significant differences by survey setting ($p < .05$) are indicated in bold type.

^aRounded down to 10,000 persons.

d values were from two-sided t-tests and not adjusted for multiplicity; t-tests were used to compare percentages of current tobacco users who reported getting or buying any tobacco product from a given access source by survey setting.

q Data were statistically unreliable because of unweighted denominator <50 or a relative standard error >30%.

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