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Awareness and Use of Heated Tobacco Products Among Middle School and High School Students, United States, 2019–2020

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Abstract

Purpose: Heated tobacco products (HTP) heat-processed tobacco leaf into an aerosol inhaled by the user. This study assessed prevalence and correlates of HTP awareness, ever use, and current use among US middle and high school students.

Methods: Data came from the 2019 and 2020 National Youth Tobacco Survey, a cross-sectional survey of US public and private, middle and high school students. HTP awareness, ever use, and current (past 30-day) use were assessed. Weighted prevalence estimates and adjusted prevalence ratios (aPR) were assessed overall and by sex, school level, race/ethnicity, and current other tobacco product use.

Results: In 2019, 12.8% (3.44 million) of all students reported HTP awareness, increasing to 19.3% (5.29 million) in 2020 ($p < .01$). Ever [2019: 2.6% (630 000); 2020: 2.4% (620 000)] and current [2019: 1.6% (420 000); 2020: 1.4% (370 000)] HTP use did not significantly change from 2019 to 2020. Current e-cigarette users were more likely to report ever (2020 aPR = 1.79, 95% CI:1.23, 2.62) or current HTP use (2019 aPR = 5.16, 95% CI: 3.48, 7.67; 2020 aPR = 3.39, 95% CI: 2.10, 5.47) than nonusers. In both years, ever and current HTP use was more likely among current combustible (aPR range = 3.59–8.17) and smokeless tobacco product (aPR range = 2.99–4.09) users than nonusers.

Conclusions: HTP awareness increased 51% among US students during 2019–2020; however, HTP use did not significantly change during this period. Students who used other tobacco products were more likely to currently use HTPs. Estimates of HTP awareness and use provided serve as a baseline as future monitoring of these products is warranted.

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Declaration of Interests

None declared.

Supplementary Material

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Implications: Awareness of heated tobacco products (HTPs) increased among US youth from 2019 to 2020; however, HTP use did not change. These estimates of HTP awareness and use serve as a baseline for future surveillance of these products as their availability in the US increases.

Introduction

Heated tobacco products (HTPs), also referred to as "heat-not-burn" products, heat-processed tobacco leaf to create a nicotine-containing aerosol that is inhaled by the user. Although they contain lower levels of harmful constituents than cigarettes, they may contain many of the same harmful constituents, as well as other harmful constituents not present in regular cigarettes.[1]

In the US, HTPs were first marketed in the late 1980s, but did not achieve commercial success.[2] As of December 2020, *IQOS* and *Eclipse* are currently the only HTPs authorized for marketing in the US; *Eclipse* is available in limited distribution as of 2018,[3] whereas *IQOS* had been introduced in two cities (Atlanta, Georgia, and Richmond, Virginia) as of November 2019. In July 2020, the FDA further authorized *IQOS*'s marketing as a "modified risk tobacco product" indicating that it reduces exposure to harmful and potentially harmful chemicals compared to cigarette smoke.[4] While HTPs have only recently been reintroduced in the US, HTPs have become more prevalent internationally. *IQOS* was first launched in 2014 in Japan and Italy and *glo* in 2016 in Japan; as of October 2020, *IQOS* was available in over 50 countries[5] and *glo* in 17 countries.[6] Authorizations in the US and international experience of patterns of use,[7] including among young people, suggest HTPs have potential to change the US tobacco product landscape.

Little is known about the prevalence of HTP awareness or use in US youth,[8–10] young adult,[11] or adult[12–14] populations. Data from the Tobacco Products and Risk Perceptions Survey showed that HTP awareness and use increased among US adults from 2016 to 2017.[12] US[12,14] and international studies[15,16] have shown that awareness or use of HTPs was higher among people aged < 40 years. In a 2017 study, approximately 9% of US youth reported specific awareness of *IQOS*, and 41% of *IQOS*-aware youth expressed interest in trying *IQOS*.[8] Perceptions that HTPs are associated with lower risks of tobacco-related health outcomes and use of specialized packaging resembling high-end smartphones may make these products more appealing to younger audiences.[17,18] Taken together, these data suggest that HTPs have the potential to become a public health concern if they become popular within the US The use of any tobacco product—including heated tobacco products—is harmful, especially for youth, young adults, and pregnant women, as well as adults who do not currently use tobacco products.[19]

In this study we describe nationally representative prevalence estimates of HTP awareness, ever use, and current use among US middle and high school students and changes in prevalence between 2019 and 2020 overall and by demographic and tobacco use characteristics. We also present correlates of awareness and use of HTPs in both 2019 and 2020. Given HTPs' limited presence in the US market, we also examine including HTPs in estimates of overall tobacco product use to assess the impact of HTPs on this measure.

These baseline findings could inform future surveillance of HTP awareness and use, as well efforts to prevent and reduce the use of these tobacco products among youth.

Methods

Study Sample

Data came from the 2019 and 2020 National Youth Tobacco Survey (NYTS), an annual cross-sectional survey electronically administered to grade 6–12 students attending US public and private schools. NYTS uses a 3-stage cluster sampling design to provide a nationally representative sample. The sample sizes and overall response rates were 19 018 (66.3%) in 2019 and 14 531 (43.6%) in 2020. In 2019, surveys were administered from February to May. In 2020, surveys were administered from January-March as survey administration was terminated early due to the COVID-19 pandemic; however, estimates are still nationally representative.[20] A more detailed description of NYTS methodology is published elsewhere.[20,21] As a secondary analysis of deidentified public use data, this study was not subject to human subjects review.

Measures

Three separate outcomes—HTP awareness, HTP ever use, and HTP current use—were assessed in this study. HTP awareness and ever use were assessed among all participants, while current use was only asked of those who reported ever use.

HTP Awareness—Awareness of HTPs, was defined as a “Yes” response to the question, “Before today, have you ever heard of ‘heated tobacco products’?” Other responses were “No” and “Don’t know/ Not Sure”.

HTP Ever Use—Ever use of HTPs was defined as a “Yes” response to the question, “Have you ever tried a heated tobacco product, even just once?” Other responses were “No” and “Don’t know/ Not Sure”.

HTP Current Use—Students who responded “Yes” or “Don’t know/ Not Sure” to HTP ever use were then asked, “During the past 30 days, on how many days did you use a heated tobacco product?” Respondents who responded within the range of 1–30 days were considered current users of HTPs.

In addition to an image of nonbranded HTPs to aid in identification (Supplementary Figure 1), the survey included the following text prior to the three above questions on HTP awareness and use: “The next section is about ‘heated tobacco products’. Some people refer to these products as ‘heat-not-burn’ tobacco products. ‘Heated tobacco products’ heat tobacco sticks or capsules to produce a vapor. They are different from e-cigarettes, which heat a liquid to produce a vapor. Some brands of ‘heated tobacco products’ include iQOS [sic], glo, and Eclipse.”

Statistical Methods

Weighted prevalence estimates and 95% confidence intervals (CIs) for each outcome were estimated overall and by selected demographic and tobacco-related variables. Weighted chi-square tests (with $\alpha = .05$) were used to test differences in prevalence between 2019 and 2020. Covariates included sex (male/female), school level (middle school/high school), race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, and non-Hispanic Other [non-Hispanic American Indian, non-Hispanic Asian, non-Hispanic multiple race, and non-Hispanic Native Hawaiian or other Pacific Islander]), current (i.e., past 30-day) e-cigarette use, current combustible tobacco product use (cigarettes, cigars, hookah, pipe tobacco, or bidis), and current smokeless tobacco product use (chewing tobacco, snuff, dip, snus, or dissolvable tobacco). Noncurrent users included those who had never used the specified tobacco products in addition to those who had not used the specified tobacco products over the past 30 days. Prevalence ratios (aPR) adjusted for the above stated demographic and tobacco-related variables and 95% CIs for each outcome were estimated using multivariable logistic regression.

To assess the impact of including heated tobacco products in estimates of overall tobacco product use, weighted prevalence estimates of current tobacco product use were calculated with and without the inclusion of HTPs overall and by school level, race/ethnicity, and sex, similar to methods used in other NYTS publications.[22,23]

All analyses were conducted using SAS-callable SUDAAN (version 11.0.3). Data are not shown for estimates where the unweighted denominator was < 50 or relative standard error of the estimate was ≥ 30%.

Results

Overall, approximately 12.8% of students reported being aware of HTPs in 2019; in 2020, significantly more students reported being aware of HTPs (19.3%, $p < .01$) (Table 1). Awareness increased among both females (11.9% vs. 19.5%, $p < .01$) and males (13.6% vs. 19.2%, $p < .01$) and both middle school (14.2% vs. 20.6%, $p < .01$) and high school students (11.7% vs. 18.4%, $p < .01$). Awareness also significantly increased among all race and ethnic groups except for Non-Hispanic Other race students (Non-Hispanic White: 12.8% vs. 20.0%, $p < .01$; Non-Hispanic Black: 12.2% vs. 17.8%, $p < .01$; Hispanic: 13.0% vs. 19.9%, $p < .01$). HTP awareness increased among current nonusers (12.5% vs. 19.5%, $p < .01$) and users of e-cigarettes (14.1% vs. 18.2%, $p < .02$). HTP awareness significantly increased among students who did not currently use combustible tobacco products (12.2% vs. 18.9%, $p < .01$) and those who did not currently use smokeless tobacco products (12.4% vs. 19.0%, $p < .01$). Prevalence of reported awareness in both years was higher among middle school vs. high school students, non-Hispanic White and Hispanic students vs. non-Hispanic Black students, and students currently using either combustible or smokeless tobacco products vs. noncurrent users of either product.

Estimates of ever and current use of heated tobacco products are presented in Table 2. Overall, 2.6% and 2.4% of students reported ever use of HTPs in 2019 and 2020, respectively. The overall prevalence of current HTP use was 1.6% in 2019 and 1.4% in 2020.

Ever and current HTP use did not statistically significantly change between years, overall and within covariate strata. In 2020, compared to noncurrent users, ever use of HTP was higher among current users of e-cigarettes (8.0% vs. 1.7%). In both years, ever HTP use was higher in current users of combustible tobacco products (2019: 15.4% vs. 1.5%; 2020: 15.9% vs. 1.6%, or smokeless tobacco products (2019: 22.4% vs. 2.0%; 2020: 20.3% vs. 2.0%) compared to noncurrent users. The same patterns were observed for current use of HTPs.

Table 3 presents multivariable-adjusted estimates of associations between covariates and HTP awareness, ever and current use in 2019 and 2020. Middle school students were more likely to be aware of HTPs compared to high school students in both 2019 (aPR = 1.33, 95% CI:1.10, 1.59) and 2020 (aPR = 1.22, 95% CI: 1.10, 1.35). In 2019, there were no significant differences in HTP awareness by race, but in 2020, non-Hispanic Other race students were less likely to be aware of HTPs (aPR = 0.74, 95% CI: .62, .89) compared to non-Hispanic White students. Also, in 2020, current e-cigarette users were less likely to have HTP awareness compared to noncurrent users (aPR = 0.83, 95% CI: .72, .94). In both years, current users of combustible tobacco products or smokeless tobacco products had a higher likelihood of HTP awareness (aPR range = 1.39–1.73) compared to not current users of these products.

In both 2019 and 2020, Hispanic students were more likely than non-Hispanic White students to be ever users of HTPs (2019 aPR = 1.49, 95% CI: 1.14, 1.95; 2020 aPR = 1.50, 95% CI: 1.08–2.09). Current users of e-cigarettes had higher likelihood of being ever HTP users in 2020 (aPR = 1.79, 95% CI:1.23, 2.62) compared to nonusers. In both years, ever HTP use was more likely among current users of combustible tobacco (2019 aPR = 3.59, 95% CI: 2.41, 5.33; 2020 aPR = 5.58, 95% CI: 3.81, 8.19) and smokeless tobacco products (2019 aPR = 3.29, 95% CI: 1.85, 5.88; 2020 aPR = 2.99, 95% CI: 1.95, 4.60) compared to nonusers of those products.

Non-Hispanic Black students (2019 aPR = 1.83, 95% CI:1.31, 2.56) and Hispanic students (2019 aPR = 1.84, 95% CI:1.35, 2.52; 2020 aPR = 1.76, 95% CI: 1.13, 2.72) had higher likelihood of reporting current HTP use compared with non-Hispanic White students. Middle school students were more likely to report current use of HTPs compared to high school students in both 2019 (aPR = 1.62, 95% CI:1.27, 2.07) and 2020 (aPR = 1.71, 95% CI:1.20, 2.44). Compared to noncurrent users of their respective products, current users of e-cigarettes (2019 aPR = 5.16, 95% CI: 3.48, 7.67; 2020 aPR = 3.39, 95% 2.10, 5.47), combustible tobacco (2019 Apr = 4.69, 95% CI: 2.77, 7.95; 2020 aPR = 8.17, 95% CI: 5.17, 12.92) and smokeless tobacco products (2019 aPR = 4.09, 95% CI: 2.70, 6.18; 2020 aPR = 3.20, 95% CI: 2.06, 4.97) had higher likelihood of being current users of HTPs.

The impact of the inclusion of HTPs in estimates of current tobacco use is presented in Table 4. During both years, due to relatively low prevalence at the time, inclusion of HTPs minimally impacted estimates of current tobacco use overall or, by school status, race/ethnicity, or sex; the differences in prevalence estimates were all less than one percentage point.

Discussion

Between 2019 and 2020, the prevalence of self-reported awareness of heated tobacco products significantly increased among US middle and high school students. In 2020, 1 in 5 US students (5.29 million) reported HTP awareness vs. 1 in 8 (3.44 million) in 2019. In contrast, estimates of ever and current use did not significantly change during 2019–2020, but some use was still noted. In both 2019 and 2020, approximately 1 in 40 students reported ever using HTPs and 1 in 70 reported current use of HTPs. Hispanic students had higher likelihood of being ever or current HTP users compared to non-Hispanic White students. We also found that youth who used any other type of tobacco product had higher likelihood of using HTPs compared to those who had not used tobacco.

When compared to findings from earlier studies, our results suggest that awareness of HTPs may be increasing among US youth, and has doubled between 2017 and 2020. Of US youth interviewed by the International Tobacco Control Youth Tobacco and E-cigarette Survey in 2017, 9.1% reported being aware of *IQOS*.[8] A study of young adults (mean age = 21.6 years) in Southern California in 2018–2019 found that 12% were aware of HTPs.[11] Our results show that HTP awareness in 2019 was close to 13%, as has been reported previously,[9] and that it increased to 19% in 2020. Continued monitoring of HTP awareness will determine if there is an increasing trend in this measure among US youth.

Results among high school students from 2019 were similar to those reported for US 16–19 year olds for *IQOS* alone in the 2019 cross-sectional International Tobacco Control Policy Evaluation Project (ITC) Youth Tobacco and Vaping Survey.[10] We did not observe a significant change in HTP use among US students between 2019 and 2020. This may be because HTPs are only available in select markets within the US However, use was not negligible, reinforcing the importance of continued efforts to prevent and reduce youth use of all tobacco products, including heated tobacco products. Although cross-country comparisons are difficult due to varying regulation of different tobacco products, HTPs have become more prevalent internationally, with *IQOS* available in over 50 countries[5] and *glo* in 17 countries.[6] Moreover, one year after HTPs were introduced in South Korea, ever use of HTPs among adolescents 12–18 years old was 2.8%.[24] While still relatively less common than other tobacco products available, sales in Italy have increased overall[25] and HTP use has increased in Japan.[26,27] As with HTP awareness, continued surveillance of HTP use is important to prevent and reduce the use of these products among youth.

Use of other tobacco products was associated with both awareness and use of HTPs in our study and several others,[8,11,12,15,24] suggesting that youth who use other tobacco products are more likely to use HTPs. Findings from the International Tobacco Control Youth Tobacco and E-cigarette Survey noted that over 90% of US youth who were current smokers reported being interested in trying *IQOS*.[8] Further, though we see that HTP use is generally higher among those who use a tobacco product, it is important to note that a considerable proportion (approximately 1 in 5) of nontobacco users were aware of HTPs in 2020. A study conducted with adults in Italy three years after HTPs were available showed that the absolute number of never smokers who had tried *IQOS* was similar to that of smokers, suggesting that these products may be appealing to those who had previously

not smoked cigarettes.[28] Youth interest in *IQOS* and other heated tobacco products could be intensified by smartphone evocative packaging[18] or through misunderstanding exposure reduction claims.[17] Given the interest in HTPs among youth nonsmokers in other studies,[8,11] monitoring the use of HTPs will be important in informing efforts aimed at preventing potential initiation of new tobacco products among all youth, particularly who had never used tobacco.

Heated tobacco product use was first assessed in NYTS in 2019, and in 2020, current use of heated tobacco products were incorporated into reported estimates of any current tobacco product use among US middle and high school students.[23] This study indicates that during 2019 and 2020, inclusion of HTPs minimally impacted overall estimates of any current tobacco product use among US youth. This may be due to the fact that although HTPs have been available internationally for several years, including in Canada, and can be purchased online, their availability in the US is currently limited. *Eclipse* and *IQOS* were the only HTPs with marketing authorization in the US during the survey period; *IQOS* was only available in two metropolitan areas (Atlanta and Richmond) during the study period. However, based on trends in countries where HTPs are more prominently available, it is possible that HTPs could become a larger part of the US tobacco landscape in the future. Therefore, continued surveillance of all forms of tobacco product use among youth, including emerging products such as HTPs, is important to inform strategies to prevent and reduce use among this population.

This study provides baseline estimates of awareness and use of these tobacco products among a nationally representative sample of US middle and high school students. However, this study is subject to some limitations. First, as NYTS is a cross-sectional survey, we cannot make any conclusions about causation. The NYTS was administered to middle and high school students who attended public or private schools so results may not be generalizable to all school-aged US youths. As with all self-reported data, results may be subject to recall and response bias. Finally, misclassification of HTP awareness and use by students is a possibility, particularly since HTPs resemble e-cigarettes; are similar in product design, accessories, and packaging features to other tobacco products; and had limited availability in the US during the survey period. Thus, these findings may represent overestimates due to misclassification if students confused HTPs with nicotine or marijuana containing e-cigarettes. This may explain our finding of increased awareness and use of HTPs by middle school students relative to high school students. To reduce potential for confusion between HTPs and e-cigarettes, NYTS provided a preamble at the beginning of the HTP section of the survey differentiating HTPs from e-cigarettes along with images of HTPs. Continued surveillance and cognitive testing could help discern whether students accurately report awareness and use of these tobacco products, particularly as the availability of HTPs increases in the US marketplace.

As youth use of tobacco in any form is unsafe,[19] it is critical to prevent and reduce youth use of all tobacco products, including heated tobacco products. Quantifying current uptake and awareness of HTPs among youth provides an early baseline for the changing tobacco landscape, which in turn could influence future youth tobacco prevention and control activities, including adding content to address HTPs. Moreover, given trends in HTP use

in countries where these products are more established, continued monitoring of youth HTP awareness and use is important to help inform public health practice.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Data Availability

The data underlying this article are available at: https://www.cdc.gov/tobacco/data_statistics/surveys/nyts/data/index.html

References

1. World Health Organization. Heated Tobacco Products A Brief. 2020; https://www.euro.who.int/__data/assets/pdf_file/0008/443663/Heated-tobacco-products-brief-eng.pdf?ua=1. Accessed December 9, 2020.
2. Dutra LM, Grana R, Glantz SA. Philip Morris research on precursors to the modern e-cigarette since 1990. Tob Control. 2017;26(e2):e97–e105. [PubMed: 27852893]
3. Craver R Reynolds' Tobaccoville plant could get boost from FDA authorization of company's latest heat-not-burn cigarette. 2018; https://journalnow.com/business/reynolds-tobaccoville-plant-could-get-boost-from-fda-authorization-of-companys-latest-heat-not-burn/article_afd376fc-90ca-11e8-8b89-57086961b4a3.html. Accessed December 18, 2020.
4. U.S. Food and Drug Administration. Philip Morris Products S.A. Modified Risk Tobacco Product (MRTP) Applications. 2020; https://www.fda.gov/tobacco-products/advertising-and-promotion/philip-morris-products-sa-modified-risk-tobacco-product-mrtp-applications. Accessed December 18, 2020.
5. Philip Morris Products S.A. Our tobacco heating system IQOS. https://www.pmi.com/smoke-free-products/iqos-our-tobacco-heating-system. Accessed September 3, 2020.
6. Nicoventures Trading Limited. https://www.discoverglo.com/. Accessed October 13, 2020.
7. Stoklosa M, Cahn Z, Liber A, Nargis N, Drope J. Effect of IQOS introduction on cigarette sales: evidence of decline and replacement. Tob Control. 2020;29(4):381–387. [PubMed: 31209129]
8. Czoli CD, White CM, Reid JL, O'Connor RJ, Hammond D. Awareness and interest in IQOS heated tobacco products among youth in Canada, England and the USA. Tob Control. 2020;29(1):89–95. [PubMed: 30696783]
9. Dai H Heated tobacco product use and associated factors among U.S. youth, 2019. Drug Alcohol Depend 2020;214:108150. [PubMed: 32645682]
10. East KA, Reid JL, Rynard VL, Hammond D. Trends and patterns of tobacco and nicotine product use among youth in Canada, England, and the United States from 2017 to 2019. Journal of Adolescent Health 2021;69(3):447–456.
11. Dunbar MS, Seelam R, Tucker JS, et al. Correlates of awareness and use of heated tobacco products in a sample of US young adults in 2018–2019. Nicotine Tob Res 2020; 22(12):2178–2187. [PubMed: 32047910]
12. Nyman AL, Weaver SR, Popova L, et al. Awareness and use of heated tobacco products among US adults, 2016–2017. Tob Control. 2018;27(Suppl 1):s55–s61. [PubMed: 30158204]

13. Marynak KL, Wang TW, King BA, et al. Awareness and ever use of “heat-not-burn” tobacco products among U.S. Adults, 2017. Am J Prev Med 2018;55(4):551–554. [PubMed: 30033025]
14. Miller CR, Sutanto E, Smith DM, et al. Awareness, trial and use of heated tobacco products among adult cigarette smokers and e-cigarette users: findings from the 2018 ITC Four Country Smoking and Vaping Survey. Tob Control. 2020; 31:11–18. [PubMed: 32994299]
15. Hwang JH, Ryu DH, Park SW. Heated tobacco products: Cigarette complements, not substitutes. Drug Alcohol Depend 2019;204:107576. [PubMed: 31586808]
16. Igarashi A, Aida J, Kusama T, et al. Heated tobacco products have reached younger or more affluent people in Japan. J Epidemiol 2020; 31(3):187–193. [PubMed: 32224597]
17. McKelvey K, Baiocchi M, Halpern-Felsher B. PMI’s heated tobacco products marketing claims of reduced risk and reduced exposure may entice youth to try and continue using these products. Tob Control. 2018;29:e18–e24.
18. McKelvey K, Popova L, Kim M, et al. Heated tobacco products likely appeal to adolescents and young adults. Tob Control. 2018;27(Suppl 1):s41–s47. [PubMed: 30352843]
19. U.S. Department of Health and Human Services. E-Cigarette Use Among Youth and Young Adults. A Report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2016.
20. Office on Smoking and Health. 2020 National Youth Tobacco Survey: Methodology Report. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2020.
21. Office on Smoking and Health. 2019 National Youth Tobacco Survey: Methodology Report. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2019.
22. Wang TW, Gentzke AS, Creamer MR, et al. Tobacco product use and associated factors among middle and high school students—United States, 2019. MMWR Surveill Summ 2019;68(12):1–22.
23. Gentzke AS, Wang TW, Jamal A, et al. Tobacco product use among middle and high school students—United States, 2020. MMWR 2020;69(50):1881–1888. [PubMed: 33332300]
24. Kang H, Cho SI. Heated tobacco product use among Korean adolescents. Tob Control. 2020;29(4):466–468. [PubMed: 31164491]
25. Liu X, Lugo A, Spizzichino L, et al. Heat-Not-Burn Tobacco Products Are Getting Hot in Italy. J Epidemiol 2018;28(5):274–275. [PubMed: 29657258]
26. Tabuchi T, Gallus S, Shinozaki T, Nakaya T, Kunugita N, Colwell B. Heat-not-burn tobacco product use in Japan: its prevalence, predictors and perceived symptoms from exposure to secondhand heat-not-burn tobacco aerosol. Tob Control. 2018;27(e1):e25–e33. [PubMed: 29248896]
27. Tabuchi T, Kiyohara K, Hoshino T, et al. Awareness and use of electronic cigarettes and heat-not-burn tobacco products in Japan. Addiction 2016;111(4):706–713. [PubMed: 26566956]
28. Liu X, Lugo A, Spizzichino L, et al. Heat-not-burn tobacco products: concerns from the Italian experience. Tob Control. 2019;28(1):113. [PubMed: 29374094]

Table 1.

Prevalence of Awareness of Heated Tobacco Products Among US Middle and High School Students, National Youth Tobacco Survey, 2019 and 2020

Characteristic	2019		2020		p-value[a]
	Unweighted N[b]	Weighted % (95% CI)	Unweighted N[b]	Weighted % (95% CI)	
Overall	2390	12.8 (11.7, 14.0)	2784	19.3 (18.2, 20.5)	<.01
Sex					
Female	1084	11.9 (11.1, 12.8)	1409	19.5 (18.0, 21.0)	<.01
Male	1285	13.6 (11.8, 15.7)	1365	19.2 (17.8, 20.6)	<.01
School level					
Middle school (grades 6–8)	1275	14.2 (13.2, 15.3)	1461	20.6 (19.1, 22.1)	<.01
High school (grade 9–12)	1105	11.7 (9.9, 13.8)	1315	18.4 (16. 9, 19.9)	<.01
Race/ethnicity					
Non-Hispanic White	1189	12.8 (11.6, 14.1)	1410	20.0 (18.4, 21.7)	<.01
Non-Hispanic Black	290	12.2 (10.9, 13.6)	288	17.8 (15.5, 20.5)	<.01
Hispanic	700	13.0 (10.9, 15.3)	831	19.9 (18.5, 21.3)	<.01
Non-Hispanic Other	145	12.4 (10.2, 15.0)	180	15.4 (13.2, 17.9)	.09
Current e-cigarette use					
No	1848	12.5 (11.3, 13.7)	2451	19.5 (18.2, 20.7)	<.01
Yes	532	14.1 (12.2, 16.2)	322	18.2 (16.2, 20.4)	.02
Current combustible tobacco product use [c]					
No	2085	12.2 (11.2, 13.3)	2548	18.9 (17.7,20.1)	<.01
Yes	305	19.4 (15.9, 23.3)	236	25.2 (22.2, 28.4)	.05
Current smokeless tobacco product use [d]					
No	2229	12.4 (11.3, 13.5)	2683	19.0 (17.9, 20.2)	<.01
Yes	159	25.1 (20.0, 31.0)	100	31.2 (24.4, 39.0)	.07

CI: Confidence Interval.

[a] p-value from chi-square test comparing 2019 and 2020 estimates.

[b] Unweighted number of students reporting awareness of heated tobacco products.

[c] Current combustible tobacco product use was defined as any use of cigarettes, cigars, hookahs, pipe tobacco, or bidis in the past 30 days.

[d] Current smokeless tobacco product use was defined as use of chewing tobacco, snuff, dip, snus, or dissolvable tobacco products in the past 30 days.

Table 2.

Prevalence of Use of Heated Tobacco Products Among US Middle and High School Students, National Youth Tobacco Survey, 2019 and 2020

Characteristic	Ever use					Current use				
	2019		2020		p-value[a]	2019		2020		p-value[a]
	Unweighted N[b]	Weighted % (95% CI)	Unweighted N[b]	Weighted % (95% CI)		Unweighted N[c]	Weighted % (95% CI)	Unweighted N[c]	Weighted % (95% CI)	
Overall	398	2.6 (1.8, 3.8)	317	2.4 (2.0, 2.9)	.71	291	1.6 (1.3, 2.0)	202	1.4 (1.1, 1.7)	.37
Sex										
Female	249	1.8 (1.4, 2.2)	161	2.4 (1.9, 2.9)	.30	118	1.4 (1.1, 1.9)	101	1.4 (1.1, 1.8)	.95
Male	147	3.4 (2.0, 5.6)	156	2.4 (1.9, 3.1)	.05	171	1.7 (1.3, 2.2)	101	1.3 (1.0, 1.8)	.21
School level										
Middle school (grades 6–8)	155	1.8 (1.4, 2.3)	131	1.9 (1.4, 2.5)	.81	125	1.4 (1.1, 1.8)	92	1.3 (0.9, 1.8)	.66
High school (grade 9–12)	238	3.2 (2.0, 5.2)	185	2.8 (2.3, 3.4)	.60	163	1.7 (1.3, 2.2)	107	1.4 (1.1, 1.9)	.29
Race/ethnicity										
Non-Hispanic White	192	2.5 (1.7, 3.7)	147	2.2 (1.7, 2.7)	.53	114	1.3 (1.0, 1.8)	79	1.1 (0.7, 1.6)	.37
Non-Hispanic Black	46	2.3 (1.6, 3.5)	27	2.1 (1.3, 3.2)	.69	46	1.8 (1.3, 2.5)	20	1.1 (0.7, 2.0)	.14
Hispanic	136	3.2 (1.9, 5.4)	118	3.2 (2.5, 4.2)	.99	114	2.1 (1.5, 2.7)	86	2.1 (1.6, 2.7)	.98
Non-Hispanic Other	**	**	**	**		**	**	**	**	
Current e-cigarette use										
No	**	**	191	1.7 (1.4, 2.0)	**	82	0.5 (0.4, 0.6)	82	0.6 (0.5, 0.8)	.71
Yes	242	8.1 (6.4, 10.3)	125	8.0 (6.5, 9.8)	.89	209	6.0 (4.6, 7.8)	120	6.4 (5.0, 8.1)	.21
Current combustible tobacco use [d]										
No	213	1.5 (1.0, 2.4)	188	1.6 (1.3, 1.9)	.98	114	0.7 (0.5, 0.9)	77	0.6 (0.4, 0.8)	.51
Yes	185	15.4 (11.3, 20.6)	129	15.9 (13.0, 19.4)	.85	177	11.2 (8.4, 14.7)	125	12.4 (9.7, 15.7)	.58
Current smokeless product use [e]										
No	284	2.0 (1.2, 3.1)	258	2.0 (1.7, 2.4)	.88	191	1.1 (0.8, 1.3)	143	1.0 (0.8, 1.3)	.82
Yes	114	22.4 (17.6, 28.1)	58	20.3 (14.9, 26.9)	.59	100	16.3 (12.2, 21.4)	59	16.9 (11.7, 23.8)	.88

[a] p-value from chi-square test comparing 2019 and 2020 estimates.

[b] Unweighted number of respondents reporting ever use of heated tobacco products.

[c] Unweighted number of respondents reporting current use of heated tobacco products.

[d] Current combustible tobacco product use was defined as any use of cigarettes, cigars, hookahs, pipe tobacco, or bidis in the past 30 days.

[e] Current smokeless tobacco product use was defined as use of chewing tobacco, snuff, dip, snus, or dissolvable tobacco products in the past 30 days.

[**] Data not shown due to unweighted denominator < 50 or relative standard error ≥ 30%.

Table 3.

Correlates of Awareness and Use of Heated Tobacco Products Among US Middle and High School Students, National Youth Tobacco Survey, 2019 and 2020

Characteristic	Awareness		Ever Use		Current Use	
	2019	2020	2019	2020	2019	2020
	aPR (95% CI)	aPR (95% CI)	aPR (95% CI)	aPR (95% CI)	aPR (95% CI)	aPR (95% CI)
Sex						
Female	Reference					
Male	1.09 (0.94, 1.25)	0.95 (0.86, 1.04)	1.50 (0.84, 2.67)	0.91 (0.68, 1.23)	0.84 (0.60, 1.17)	0.82 (0.60, 1.11)
School level						
High school (grades 9–12)	Reference					
Middle school (grade 6–8)	1.33 (1.10, 1.59)	1.22 (1.10, 1.35)	0.93 (0.54, 1.59)	0.99 (0.77, 1.26)	1.62 (1.27, 2.07)	1.71 (1.20, 2.44)
Race/ethnicity						
Non-Hispanic White	Reference					
Non-Hispanic Black	1.01 (0.89, 1.15)	0.89 (0.76, 1.03)	1.12 (0.74, 1.70)	1.01 (0.64–1.60)	1.83 (1.31, 2.56)	1.27 (0.68, 2.38)
Hispanic	1.08 (0.94, 1.25)	1.03 (0.94, 1.13)	1.49 (1.14, 1.95)	1.50 (1.08, 2.09)	1.84 (1.35, 2.52)	1.76 (1.13, 2.72)
Non-Hispanic Other	1.04 (0.86, 1.25)	0.74 (0.62, 0.89)	**	**	**	**
Current e-cigarette use						
No	Reference					
Yes	0.96 (0.82, 1.12)	0.83 (0.72, 0.94)	**	1.79 (1.23, 2.62)	5.16 (3.48, 7.67)	3.39 (2.10, 5.47)
Current combustible tobacco use [a]						
No	Reference					
Yes	1.49 (1.26, 1.77)	1.39 (1.22, 1.58)	3.59 (2.41, 5.33)	5.58 (3.81, 8.19)	4.69 (2.77, 7.95)	8.176 (5.17, 12.92)
Current smokeless tobacco product use [b]						
No	Reference					
Yes	1.73 (1.44, 2.07)	1.39 (1.07, 1.80)	3.29 (1.85, 5.88)	2.99 (1.95, 4.60)	4.09 (2.70, 6.18)	3.20 (2.06, 4.97)

[a] Current combustible tobacco product use was defined as any use of cigarettes, cigars, hookahs, pipe tobacco, or bidis in the past 30 days.

[b] Current smokeless tobacco product use was defined as use of chewing tobacco, snuff, dip, snus, or dissolvable tobacco products in the past 30 days.

** Data not shown due to unweighted denominator < 50 or relative standard error ≥ 30%.

APR: Adjusted prevalence ratio (all models adjusted for all variables presented in table); CI: Confidence Interval.

Table 4.

Prevalence of Current Tobacco Use[a] Among US Middle and High School Students Without and With Heated Tobacco Products in the Definition, National Youth Tobacco Survey, 2019 and 2020

	Current tobacco use (without HTPs)		Current tobacco use (with HTPs)	
	Weighted N[b]	Weighted %	Weighted N[b]	Weighted %
2019				
Overall	6 200 000	23.0 (21.4, 24.6)	6 240 000	23.2 (21.6, 24.8)
School level				
Middle school (grades 6–8)	1 470 000	12.5 (11.2, 13.9)	1 500 000	12.7 (11.4, 14.1)
High school (grade 9–12)	4 690 000	31.2 (29.1, 33.5)	4 710 000	31.4 (29.2, 33.6)
Sex				
Female	2 900 000	22.5 (20.8, 24.3)	2 910 000	22.7 (20.9, 24.5)
Male	3 270 000	23.5 (21.6, 25.4)	3 290 000	23.6 (21.8, 25.6)
Race/ethnicity				
Non-Hispanic White	3 750 000	25.3 (23.2, 27.6)	3 750 000	25.4 (23.2, 27.7)
Non-Hispanic Black	680 000	19.6 (17.0, 22.4)	700 000	20.0 (17.4, 22.9)
Hispanic	1 440 000	22.0 (20.1, 24.0)	1 450 000	22.2 (20.3, 24.2)
Non-Hispanic Other	220 000	15.3 (12.3, 18.9)	220 000	15.8 (12.7, 19.4)
2020				
Overall	4 380 000	15.9 (14.0, 18.0)	4 470 000	16.2 (14.3, 18.4)
School level				
Middle school (grades 6–8)	760 000	6.4 (5.2, 7.8)	800 000	6.7 (5.5, 8.2)
High school (grade 9–12)	3 600 000	23.3 (20.8, 26.0)	3 650 000	23.6 (21.1, 26.4)
Sex				
Female	2 110 000	15.6 (13.6, 17.8)	2 140 000	15.8 (13.8, 18.1)
Male	2 260 000	16.3 (14.1, 18.7)	2 310 000	16.6 (14.5, 19.1)
Race/ethnicity				
Non-Hispanic White	2 510 000	17.5 (15.2, 20.1)	2 550 000	17.8 (15.4, 20.3)
Non-Hispanic Black	420 000	12.9 (11.0, 15.0)	440 000	13.2 (11.3, 15.4)
Hispanic	1 190 000	16.7 (13.9, 19.9)	1 220 000	17.2 (14.3, 20.4)
Non-Hispanic Other	200 000	9.8 (6.7, 14.1)	210 000	10.1 (6.9, 14.6)

[a] Current tobacco use was defined as use of any tobacco product (e-cigarettes, cigarettes, cigars, smokeless tobacco, hookahs, pipe tobacco, or bidis, in the past 30 days.

[b] Rounded down to nearest 10 000 persons.