



Full length article

## Waterpipe tobacco smoking trends among middle and high school students in the United States from 2011 to 2017

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## ABSTRACT

**Background:** Waterpipe smoking has increased in popularity globally. Despite evidence regarding the harmful effects of waterpipe smoking, there is a common belief that it is less harmful than traditional cigarettes. Little is known about trends in waterpipe use in the U.S. This study examined national trends in waterpipe smoking among middle and high school students.

**Methods:** We used the 2011–2017 National Youth Tobacco Survey data ( $n = 140195$ ). For trend analyses, logistic regression was used for the prevalence of waterpipe ever use and current use. Joinpoint regression analysis was performed to identify where significant changes in trend occurred. Additionally, we examined the correlates of waterpipe smoking.

**Results:** Overall prevalence of adolescent waterpipe ever and current use increased significantly from 7.6% and 2.8% in 2011 to 14.6% and 6.4% in 2014, then decreased significantly to 7.7% and 2.5% in 2017. This trend was consistent in most subgroups including male, female, Hispanic, White, middle school, and high school students. Joinpoint occurred in 2015 for Black adolescents. For example, current waterpipe use increased significantly from 1.4% in 2011 to 4.1% in 2015, declining to 2.5% in 2017. Multivariable analysis showed that cigarette smoking, e-cigarette use, curiosity about waterpipes, and tobacco smoke exposure at home were associated with ever and current waterpipe tobacco use among all participants as well as male and female subgroups.

**Conclusions:** Findings indicate a decreasing trend of ever and current waterpipe tobacco use, which began in 2014 or 2015 for all groups included in the analyses.

### 1. Introduction

Waterpipes, also known by hookahs, shishas, and narghiles, originated in the Middle East and has gained popularity internationally for smoking tobacco (American Lung Association, 2007). In comparison to cigarettes, waterpipe smoking is associated with higher rates of carbon monoxide and more smoke exposure (Eissenberg and Shihadeh, 2009). Additionally, there is evidence that in one waterpipe session, smokers are exposed to significantly more tar than if they smoked one cigarette. (Shihadeh and Saleh, 2005). A single session of waterpipe smoking typically lasts around 45 min and can produce as much smoke as 100 or more cigarettes (World Health Organization, 2005). In addition, waterpipe smoke shares some of the same toxins linked with cancer and cardiovascular diseases (Shihadeh and Saleh, 2005) as cigarette smoke. Although the use of cigarettes is more popular than the use of waterpipes in the U.S. (U.S. Department of Health and Human Services, 2014), the long sessions and concentration of smoke make waterpipe

smoking at least as toxic, if not more so, than cigarettes (American Lung Association, 2007). Waterpipe smoking has been associated with some adverse health outcomes, including cardiovascular and respiratory diseases, oral and lung cancer, and mental health problems (Waziry et al., 2017).

Despite evidence about the health risks of waterpipe smoking, the general perception is that it is less harmful, less addictive, and more socially acceptable than cigarette smoking (Akl et al., 2013). The majority of Western society college freshman respondents believed that there was low or no chance of becoming addicted to waterpipe smoking (Abughosh et al., 2011). Similar results were found among high school students, who commonly reported the belief that waterpipe tobacco is less addictive than cigarettes (Smith et al., 2011). People may be misinformed about the health risks related to waterpipe smoking due to a false belief that the water filters out carcinogens contained in the smoke (Kandela, 2000). One study found that high school students in San Diego County, California believed that waterpipe tobacco was the least

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harmful of all the tobacco products (Smith et al., 2011). The main motives reported for waterpipe smoking in the U.S. include social interaction, relaxation, peer influence, experimentation, and enjoyment of the taste and/or smell (Ahmed et al., 2011; Braun et al., 2012; Griffiths et al., 2011; Lipkus et al., 2011; Smith-Simone et al., 2008).

Evidence suggests that youth are the target of waterpipe tobacco companies' messaging and products, including those that focus on the social aspect of waterpipe use (Griffiths et al., 2011). Lounges offering waterpipe smoking frequently double as cafés or eateries and thus only rarely have any age restrictions (Griffiths et al., 2011). Although research findings vary, there is concern that waterpipe smoking may be a gateway to other forms of tobacco use, such as initiation of cigarette smoking (Case et al., 2018; Jaber et al., 2015). Among young adults in the U.S., research suggests that current waterpipe smoking is associated with susceptibility to cigarette smoking (Salloum et al., 2016). A study using data from selected colleges reported that the majority of waterpipe users were not current cigarette smokers, suggesting that without the introduction of waterpipe tobacco they may not have initiated tobacco product use (Primack et al., 2013). A possible contributor to this finding may be the appealing flavors that are found in waterpipe tobacco but not cigarettes. Flavored tobacco product use remains highly prevalent in youth populations (Corey et al., 2015; Dai, 2019). Results have indicated that 89% of youth who had used any tobacco product in the past 30 days reported using flavored tobacco, and a majority conveyed they would stop using those tobacco products if flavors were not available (Harrell et al., 2017).

Studies have indicated that waterpipe use is common in U.S. adolescents. A study in 2008 found that 9.7% of New Jersey high school students were current waterpipe users (Jordan and Delnevo, 2010). Similarly, North Carolina high school students had a 6.1% prevalence of current waterpipe use in 2013, a 69% increase in prevalence from 2011 (Huang et al., 2017). However, national surveillance of waterpipe use is limited in the U.S., and therefore research on trends has been restricted. One study suggested that use of all non-cigarette combustible tobacco products, (including waterpipes) among U.S. high school students has increased by 123% (Haddad et al., 2015), and another reported a significant recent decline in waterpipe use among 12<sup>th</sup> graders (Johnston et al., 2018). Given the increasing popularity of the product, the misconceptions on the safety of waterpipe smoking, and the adverse health consequences associated with use, ongoing surveillance of trends related to waterpipe smoking are needed, especially among adolescents. The present study examined national trends in ever and current waterpipe smoking among adolescent students in the U.S. by sex, race, and grade level.

## 2. Method

### 2.1. Data

The National Youth Tobacco Survey (NYTS) was designed to provide comprehensive national data on tobacco-related indicators for middle school (grades 6–8) and high school (grades 9–12) students to support the design, implementation, and evaluation of comprehensive tobacco prevention and control programs. The NYTS uses a stratified three-stage cluster sample design and a weighting factor for each student, which results in nationally representative data for U.S. middle school and high school students. All 50 U.S. states and the District of Columbia are invited to participate; participation is confidential, voluntary, and approved by parents. During a regular class period, participants complete self-administered, machine-readable questionnaires that include questions regarding tobacco-related beliefs, attitudes, behaviors, and exposure to pro- and anti-tobacco influences. Overall response rates from 2011 to 2017 ranged from 63% to 85% for a total of 140195 participants included in the study.

### 2.2. Study participants

All 140195 responses from 2011 to 2017 were included in our study. For each year, the overall response rates ranged from 63% to 85%, and the number of participants ranged from 17711 to 22007. No significant demographic characteristic differences were found among survey waves (Supplement Table 1).

### 2.3. Measures

The main outcome variables of interest are waterpipe ever use and current use. We defined waterpipe ever use using the questions “Have you ever tried smoking tobacco in a hookah or waterpipe, even one or two puffs?” We defined current waterpipe use as smoking tobacco in a waterpipe at least one day during the 30 days before the survey using the question “During the past 30 days, on how many days did you smoke tobacco in a hookah or waterpipe?”

We obtained demographic information from the data (i.e., sex, grade level, and race). We used the 7-level recoded race variable from the data and regrouped non-Hispanic Asian, non-Hispanic American Indian/Alaska Native, non-Hispanic Native Hawaiian/Pacific Islander, and multiple races into the “other” race group due to the small sample size. Additionally, other covariates were derived for multivariable analysis. We defined current cigarette and e-cigarette smokers with a definition similar to that used for current waterpipe users. Curiosity about waterpipes was determined by the question “Have you ever been curious about smoking tobacco in a hookah or waterpipe?” Possible answers included “Definitely yes,” “Probably yes,” “Definitely no,” or “Probably no.” We classified “Definitely yes” and “Probably yes” as being curious about waterpipe smoking and the remaining two answers as not curious due to the small sample size. Exposure to tobacco smoking at home was defined as being exposed to smoke at home at least one day during the 7 days before the survey using the question “During the past 7 days, on how many days did someone smoke tobacco products in your home while you were there?”

### 2.4. Statistical analysis

We generated national estimates of the prevalence of waterpipe ever use and current use for each year of data independently. Also, estimates were calculated for key demographic characteristics (sex, race, and grade level). For trend analyses, we used logistic regression for the prevalence of waterpipe ever use and current use. We included quadratic time and linear variable in the logistic regression model and adjusted for sex, race, and grade. If the quadratic term was not significant, we removed the quadratic term and tested the linear term. Time variables were modeled as continuous variables. We selected the models with significant highest-order time variable as the final model. If the selected model included the quadratic time variable, we used the selected model to estimate the adjusted prevalence and standard error by year in order to determine the Joinpoint (Centers for Disease Control and Prevention, 2018).

Joinpoint is the point where a significant change in trend occurs. We set the minimum number of join points to 0 and the maximum number of join points to 1 based on the number of data points (National Cancer Institute, 2019a, 2019b). The analysis starts hypothesis testing for 0 and 1 Joinpoint. In each test, a grid search method was used to estimate the parameters in the null and alternative models, and the Monte Carlo permutation method was used to approximate the significance of each test. Bonferroni correction was used to adjust the overall significance level of multiple hypothesis tests (Kim et al., 2000). The same procedures were repeated for the sex, race, and grade level based subgroup analyses. Additionally, multivariable logistic regressions were performed for the most recent data set (2017) to examine key correlates of waterpipe smoking in the full sample as well as perform an analysis stratified by gender to assess the relationship between risk of waterpipe

**Table 1**

Results of segmented trend regression analyses resulting from the significant Joinpoint for all adults and sex, race, middle and high school subgroups.

Ever Use							
	Joinpoint	Segment 1			Segment 2		
		$\beta$	SE( $\beta$ )	p-value	$\beta$	SE( $\beta$ )	p-value
All	2014	0.262	0.028	< .0001	-0.257	0.025	< .0001
Male	2014	0.316	0.032	< .0001	-0.250	0.027	< .0001
Female	2014	0.214	0.034	< .0001	-0.264	0.031	< .0001
White	2014	0.178	0.034	< .0001	-0.291	0.032	< .0001
Black	2015	0.505	0.049	< .0001	-0.207	0.095	< .0001
Hispanic	2014	0.358	0.041	< .0001	-0.249	0.034	< .0001
Other	2014	0.295	0.057	< .0001	-0.316	0.058	< .0001
Middle School	2014	0.293	0.055	< .0001	-0.145	0.042	< .0001
High School	2014	0.253	0.030	< .0001	-0.276	0.028	< .0001
Current Use							
	Joinpoint	$\beta$	SE( $\beta$ )	p-value	$\beta$	SE( $\beta$ )	p-value
All	2014	0.286	0.036	< .0001	-0.341	0.034	< .0001
Male	2014	0.334	0.044	< .0001	-0.316	0.042	< .0001
Female	2014	0.246	0.046	< .0001	-0.366	0.040	< .0001
White	2014	0.242	0.046	< .0001	-0.403	0.048	< .0001
Black	2015	0.352	0.060	< .0001	-0.253	0.103	0.01
Hispanic	2014	0.354	0.051	< .0001	-0.327	0.050	< .0001
Other	2015	0.270	0.058	< .0001	-0.636	0.132	< .0001
Middle School	2014	0.275	0.062	< .0001	-0.189	0.053	< .0001
High School	2014	0.288	0.041	< .0001	-0.378	0.038	< .0001

All denotes all included adolescents in our analyses.  $P < .05$  is considered significant. For all models, we adjusted for sex, race, and grade. For sex subgroup, we adjusted for race and grade. For race subgroup, we adjusted for sex and grade. For high/middle school subgroup, we adjusted for sex and race. Segment 1 included all years from the first available year up to and including the first Joinpoint year. Segment 2 included all years from first Joinpoint year up to and including the last year.

ever use, current use, and covariates. Covariates included sex, race, grade level, curiosity about waterpipe smoking, exposure to tobacco smoke at home, cigarette smoking, and e-cigarette use. All tests were two-sided and a P-value of  $< 0.05$  was considered significant. Joinpoint analyses were performed using the NCI Joinpoint software (National Cancer Institute, 2019a, 2019b). All other analyses were performed in SAS, version 9.4 (SAS Institute Inc., Cary, NC) and took into account the complex sample design of the national NYTS.

### 3. Results

#### 3.1. Ever waterpipe tobacco use

Table 1 reports the results from the Joinpoint analysis, which found a significant current and ever waterpipe smoking trend in 2014. The Joinpoint column shows the point where a significant change in trend occurs. The overall prevalence of ever waterpipe use increased significantly from 7.6% in 2011 to 14.6% in 2014, and then decreased significantly to 7.7% in 2017. Similar trends were found for both male and female adolescents. In race subgroups, the prevalence of ever waterpipe tobacco use in White, Hispanic, and the other race group increased significantly between 2011 (8.7%, 8.2%, and 7.6%, respectively) and 2014 (13.8%, 19.7%, and 15.1%, respectively), followed by a significant reduction to 6.6%, 10.5%, and 7.2%, respectively, in 2017.

Black adolescents experienced a slight variation of this trend, Joinpoint occurred in 2015 rather than 2014, with prevalence of ever waterpipe tobacco use increasing significantly from 2011 to 2015, and decreasing in 2017 (Fig. 2). Fig. 3 presents national prevalence estimates (and 95% confidence interval) of current and ever waterpipe tobacco use in middle and high school students in the U.S. from 2011–2017. Overall, the prevalence of current and ever waterpipe tobacco use is higher in high school students than middle school students, but the trends of prevalence were similar. The prevalence of ever waterpipe tobacco use in middle school increased significantly from 2.1% in 2011 to 5.1% in 2014, then fell to 3.2% in 2017. Similarly, high school students experienced the same increase from 2011 to 2014, followed by a significant decline in 2017.

#### 3.2. Current waterpipe tobacco use

Similar trends were found between ever waterpipe tobacco use and current use: prevalence of current use increased significantly from 2.8% in 2011 to 6.4% in 2014 and then decreased to 2.5% in 2017. Males and female adolescents were found to follow a similar trend (Fig. 1). The prevalence of current waterpipe tobacco use in the White and Hispanic groups increased significantly from 2.8% and 3.5% in 2011, respectively, to 5.9% and 9.6% in 2014, then declined significantly to 1.9% and 4.0% in 2017. In the Black and other race groups, Joinpoint occurred in 2015, as the prevalence of current waterpipe tobacco use increased significantly from 2011 to 2015 before dropping significantly in 2017 (Fig. 2). The prevalence of current waterpipe tobacco use in middle school also increased significantly, from 1.0% in 2011 to 2.5% in 2014 before falling to 1.4% in 2017. In high school students, the prevalence of current waterpipe tobacco use increased significantly from 2011 to 2014, and then declined significantly in 2017 (Fig. 3).

#### 3.3. Multivariable results of correlates of waterpipe smoking

Table 2 presents the results of the multivariable regression analysis of ever and current waterpipe tobacco use among middle and high school students in 2017. Results showed that students who were male (OR: 1.39; 95% CI 1.13–1.71), currently used cigarettes (OR: 2.47; 95% CI 1.77–3.45) or e-cigarettes (OR: 2.42; 95% CI 1.86–3.14), had curiosity about waterpipes (OR: 28.28; 95% CI 22.64–35.33), and those who were exposed to tobacco smoke at home (OR: 2.32; 95% CI 1.89–2.85) were significantly associated with ever waterpipe tobacco use. In male and female subgroups, Hispanic students, current cigarette smoking, e-cigarette smoking, curiosity about waterpipes, and exposure to tobacco smoke at home were significantly associated with higher odds of ever waterpipe tobacco use. In the full sample, covariates associated with ever waterpipe tobacco use were also associated with current use except for the odds between male and female students were no longer significant. Most of the associations remained in the male and female subgroup analysis; however, the odds ratio was not significant for Black male students.

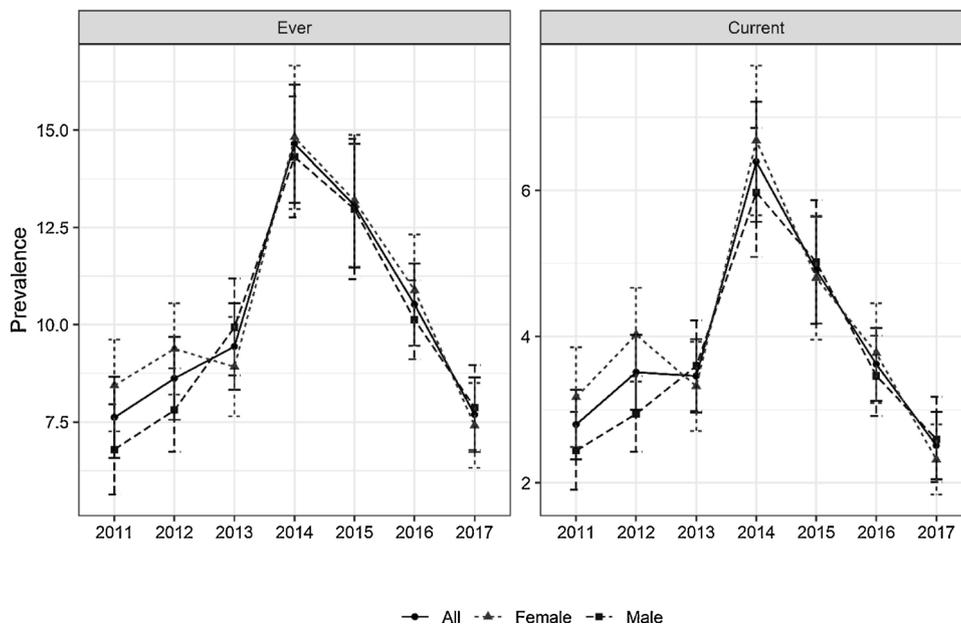


Fig. 1. National estimate of the prevalence (and 95% confidence interval) of ever and current waterpipe tobacco use in middle school and high school students, by sex, in the United States, 2011–2017.

4. Discussion

The popularity of waterpipe smoking has increased in the United States and internationally. It is commonly perceived as less harmful and less addictive than cigarette smoking (Akl et al., 2013), and is enticing to users due to the attractive flavors (Smith-Simone et al., 2008), the social aspect (Braun et al., 2012), and the misconception that the water filters carcinogens from the smoke (Kandela, 2000). However, at a minimum waterpipe smoking is as dangerous as cigarette smoking (e.g., similar toxins linked with cancer and cardiovascular diseases) (Shihadeh and Saleh, 2005). The present study examined national trends in ever and current waterpipe smoking among adolescent students in the U.S. by sex, race, and grade level.

The trend analysis indicated that the overall prevalence of

waterpipe ever use and current use increased significantly from 2011 to 2014, then decreased significantly in 2017. Most subgroups in the analyses had similar trends in both ever and current waterpipe tobacco use including male, female, Hispanic, White, middle school and high school students. Black students’ ever and current use peaked in 2015, and the other race group saw a spike for current use in 2015 while ever use peaked in 2014. For most years, Hispanic students displayed the highest rates of ever and current use compared to their peers, which is in keeping with a previous study that found Hispanic students had higher odds of ever using waterpipe tobacco compared to other racial groups for certain periods (Roods et al., 2018). The same study found that Hispanic student waterpipe use had increased significantly since 2008 (Roods et al., 2018). In 2011 and 2012, females reported greater ever and current use than males. The two groups subsequently had very

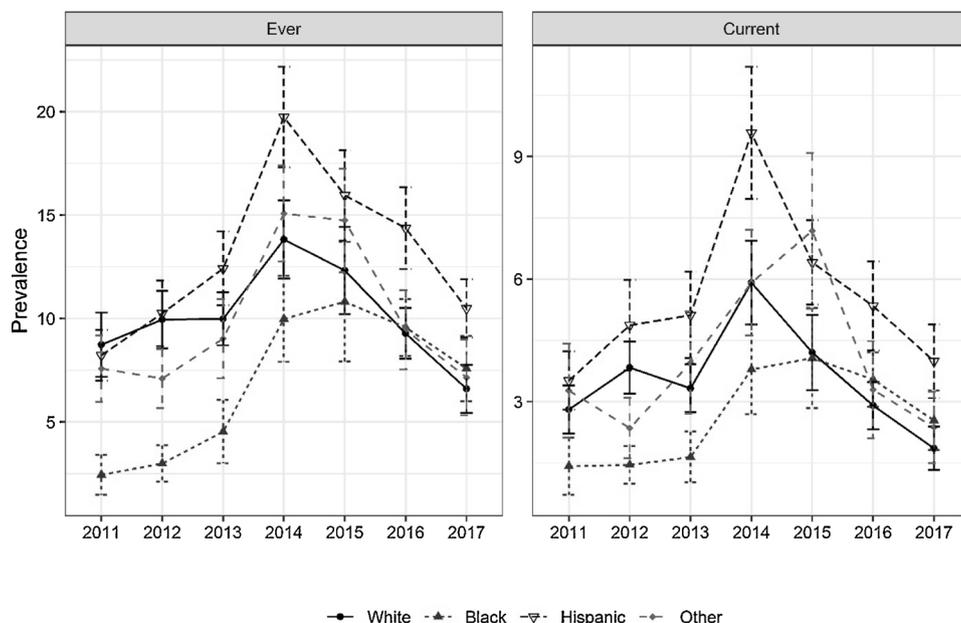


Fig. 2. National estimate of the prevalence (and 95% confidence interval) of ever and current waterpipe tobacco use in middle school and high school students, by race, in the United States, 2011–2017.

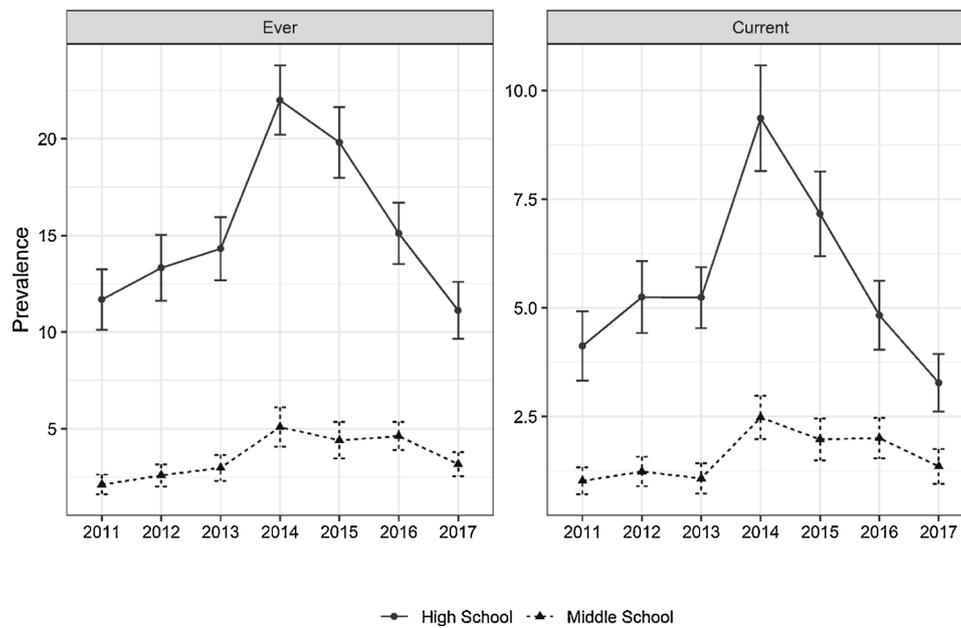


Fig. 3. National estimate of the prevalence (and 95% confidence interval) of ever and current waterpipe tobacco use in middle school and high school students, by grade level, in the United States, 2011–2017.

similar patterns of use. High school students had higher rates of ever and current use compared to middle school students. All significant joint points occurred in either 2014 or 2015.

The peak of waterpipe use in 2014 or 2015 followed by a significant decrease through the end of the study period was consistent through all analyses. It remains unknown whether this trend is related to the Food and Drug Administration’s (FDA) involvement in tobacco public education. In February of 2014, the FDA conducted its first national

tobacco education program, which disseminated tobacco education advertising targeted at youths 12 to 17 years of age (U.S. Department of Health and Human Services, 2019). Estimates are that this campaign prevented approximately 348398 youths from initiating cigarette smoking between February 2014 to March 2016 (Farrelly et al., 2017). In 2016, the FDA finalized a rule regulating waterpipe tobacco and giving them the authority to regulate the manufacture, import, packaging, labeling, advertising, promotion, sale, and distribution of

Table 2

Regression analysis of ever and current waterpipe tobacco use in middle school and high school students in the United States in 2017 (n = 17872).

	Ever waterpipe tobacco use			Current waterpipe tobacco use		
	Full sample	Male	Female	Full sample	Male	Female
n	17872	8815	8881	17872	8815	8881
Grade						
6th	ref	ref	ref	ref	ref	ref
7th	1.18(0.69, 2.02)	0.97(0.45, 2.12)	1.34(0.65, 2.75)	1.57(0.78, 3.18)	0.71(0.24, 2.06)	3.46(1.07, 11.15)
8th	1.94(1.27, 2.96)	1.56(0.75, 3.25)	2.33(1.15, 4.74)	1.59(0.71, 3.55)	0.86(0.30, 2.46)	3.37(1.04, 10.94)
9th	2.38(1.47, 3.87)	2.60(1.33, 5.08)	2.01(1.02, 3.95)	1.85(0.92, 3.74)	1.38(0.60, 3.15)	2.62(0.82, 8.41)
10th	2.87(1.80, 4.57)	3.06(1.60, 5.85)	2.53(1.29, 4.97)	1.64(0.86, 3.12)	1.35(0.57, 3.19)	2.07(0.56, 7.72)
11th	3.58(2.18, 5.86)	3.15(1.46, 6.77)	3.90(2.14, 7.11)	1.84(0.92, 3.68)	0.97(0.38, 2.52)	3.96(1.48, 10.62)
12th	4.73(2.87, 7.78)	4.27(1.97, 9.26)	5.02(2.89, 8.72)	2.26(1.15, 4.42)	1.66(0.72, 3.86)	3.50(0.96, 12.78)
Sex						
Female	ref	–	–	ref	–	–
Male	1.39(1.13, 1.71)	–	–	1.07(0.75, 1.52)	–	–
Race						
White	ref	ref	ref	ref	ref	ref
Black	1.52(1.07, 2.17)	1.47(0.88, 2.46)	1.61(1.07, 2.41)	2.01(1.24, 3.25)	2.00(1.06, 3.77)	2.31(1.25, 4.28)
Hispanic	1.85(1.38, 2.47)	1.97(1.35, 2.87)	1.74(1.20, 2.54)	2.20(1.52, 3.19)	2.97(1.82, 4.85)	1.68(0.98, 2.87)
Other	1.16(0.81, 1.66)	1.34(0.81, 2.22)	0.96(0.56, 1.64)	1.62(0.96, 2.75)	2.07(0.99, 4.31)	1.26(0.63, 2.54)
Current cigarette smoking						
No	ref	ref	ref	ref	ref	ref
Yes	2.47(1.77, 3.45)	2.22(1.46, 3.37)	2.82(1.87, 4.26)	2.64(1.74, 4.00)	3.10(1.94, 4.95)	2.31(1.26, 4.23)
Current e-cigarette use						
No	ref	ref	ref	ref	ref	ref
Yes	2.42(1.86, 3.14)	2.25(1.57, 3.22)	2.56(1.76, 3.72)	3.60(2.41, 5.39)	3.28(2.12, 5.07)	4.06(2.16, 7.62)
Curiosity about waterpipes						
No	ref	ref	ref	ref	ref	ref
Yes	28.28(22.64, 35.33)	29.12(20.18, 42.02)	27.80(19.73, 39.17)	24.48(14.84, 40.36)	24.08(13.38, 43.34)	25.82(10.89, 61.23)
Exposure to tobacco smoke at home						
No	ref	ref	ref	ref	ref	ref
Yes	2.32(1.89, 2.85)	2.35(1.77, 3.13)	2.32(1.76, 3.06)	2.42(1.69, 3.45)	2.26(1.51, 3.39)	2.76(1.71, 4.48)

Ref represents reference category.

waterpipes and related products (U.S. Department of Health and Human Services, 2018). Beginning in August 2018, a requirement was made for waterpipe tobacco products to display the nicotine addictiveness warning statement on both packages and advertisements (U.S. Department of Health and Human Services, 2018). The potential impact of warning statements on waterpipe use should be investigated in future research.

The multivariable analysis in this study showed that current cigarette smoking is significantly associated with both ever and current waterpipe smoking. This finding is supported by prior research, which has also found that waterpipe use is significantly more common among cigarette smokers (Grinberg and Goodwin, 2016; Huang et al., 2017). Similar to previous findings (Maziak et al., 2015), our results showed that males had higher odds of ever waterpipe use compared to females. The finding that current e-cigarette use is associated with both ever and current waterpipe use is not surprising as both products are becoming increasingly popular in the United States, especially among youth (Pepper and Eissenberg, 2014). Additionally, Hispanic students were found to be associated with current waterpipe tobacco use and had higher odds of ever use compared to White students, keeping with previous findings that Hispanic students have seen a disproportionate increase in use since 2008 (Roods et al., 2018).

Limitations of this study include the self-reporting nature of the survey; it is possible that respondents recalled events inaccurately. Another limitation of this study is the inability to investigate the reasons behind changes in trend due to the nature of the study. Additionally, our study is not generalizable to youth that are not attending schools, such as home-schooled adolescents or youth who have dropped out of school. Lastly, the survey asked about smoking tobacco and excluded information on herbal shisha, potentially underestimating the prevalence of waterpipe use. Even given the limitations, this study provides insight into differences in trends of waterpipe use that may have implications for policy targeted toward specific subgroups.

## 5. Conclusion

This study used data from a nationally representative survey to examine trends in adolescent ever and current waterpipe tobacco use. We found that the overall prevalence of waterpipe tobacco use among all adolescents increased significantly from 2011 to 2014, then decreased significantly through 2017. This trend was consistent throughout all analyses, with few deviations. Hispanic adolescents reported consistently high rates of waterpipe ever and current use. High school students displayed ever and current use at higher rates than middle school students. Overall, our results indicate a decreasing trend of ever and current waterpipe tobacco use, which began in either 2014 or 2015 for all groups included in the analyses.

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None

## Contributors

Sunday Azagba conceptualized and designed the study, supervised all aspects of the study, contributed to the drafting of the manuscript, critically reviewed the manuscript, and approved the final manuscript as submitted.

Keely Latham contributed to the drafting of the manuscript, critically reviewed the manuscript, and approved the final manuscript as submitted.

Lingpeng Shan conducted the data analysis. Contributed to the drafting of the manuscript, critically reviewed the manuscript, and approved the final manuscript as submitted.

## Conflict of interest

No conflict declared.

## Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.drugalcdep.2019.04.005>.

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