



Water pipe tobacco smoking in the United States: Findings from the National Adult Tobacco Survey



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ABSTRACT

Objective. To report prevalence and correlates of water pipe tobacco smoking (WTS) use among U.S. adults.
Methods. Data were from the 2009–2010 National Adult Tobacco Survey, a nationally representative sample of U.S. adults. Estimates of WTS ever and current use were reported overall, and by sex, age, race/ethnicity, educational attainment, annual household income, sexual orientation, and cigarette smoking status. State-level prevalence rates of WTS ever were reported using choropleth thematic maps for the overall population and by sex.

Results. The national prevalence of WTS ever was 9.8% and 1.5% for current use. WTS ever was more prevalent among those who are male (13.4%), 18–24 years old (28.4%) compared to older adults, non-Hispanic White (9.8%) compared to non-Hispanic Black, with some college education (12.4%) compared to no high school diploma, and reporting sexual minority status (21.1%) compared to heterosexuals. States with highest prevalence included DC (17.3%), NV (15.8%), and CA (15.5%).

Conclusion. WTS is now common among young adults in the US and high in regions where cigarette smoking prevalence is the lowest and smoke-free policies have a longer history. To reduce its use, WTS should be included in smoke-free regulations and state and federal regulators should consider policy development in other areas, including taxes, labeling, and distribution.

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Introduction

Water pipe tobacco smoking (WTS) is a centuries-old form of tobacco use endemic to the Middle East (Maziak et al., 2014) that has been rising in popularity across the world and within the United States (Maziak, 2013; Salloum et al., 2014). This type of smoking (also known as *hookah*, *shisha*, and *narghileh*) uses a flavored tobacco mixture that is sweetened with molasses that, when smoked, is heated with charcoal (Martinasek et al., 2011; Rastam et al., 2004). A typical WTS session lasts longer than smoking a cigarette and involves larger volumes of inhaled smoke that contain many of the same carcinogens and toxic heavy metals found in cigarette smoke (Akl et al., 2010). Smokers and nonsmokers in the vicinity are exposed to significant toxic emissions arising from the tobacco mixture as well as the burning charcoal (Maziak et al., 2008; Monzer et al., 2008). Despite the evidence that WTS potentially carries similar health risks as cigarettes and is associated with nicotine dependence (Akl et al., 2010; Cobb et al.,

2011; Eissenberg and Shihadeh, 2009; Maziak et al., 2008, 2009; Monzer et al., 2008; Neergaard et al., 2007), the general perception among water pipe smokers is that it is less harmful than cigarettes (Maziak et al., 2004a; Roskin and Aveyard, 2009).

The limited data on the spread of WTS in the US point to college students as the population at greatest risk for use, mostly due to targeting by near-campus hookah establishments and intensive marketing through the Internet and social media (Brockman et al., 2012; Heinz et al., 2013; Maziak et al., 2004b; Noonan, 2013; Primack et al., 2013; Sutfin et al., 2011). Among this population, WTS is the second most popular method of tobacco use after cigarettes (Primack et al., 2013). Up to half of current WTS users have never smoked cigarettes, suggesting that WTS delivers nicotine to many who otherwise would have been nicotine-naïve (Primack et al., 2013). Therefore, WTS can serve as a gateway to cigarettes and other tobacco use methods among youth, as well as thwart tobacco control efforts among this sensitive population (Maziak, 2014). Despite the alarming trends of WTS among US adolescents and young adults, evidence about WTS use in older adults has been primarily from non-representative samples (Braun et al., 2012; Heinz et al., 2013; Primack et al., 2013; Sutfin et al., 2011). Recent nationally representative surveys of tobacco use in the US have included WTS (King et al., 2012; Lee et al., 2014; Rath et al., 2012),

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but to date, no published reports have focused on the epidemiology of WTS. Furthermore, preliminary evidence suggests that WTS has been growing in states with the longest histories of smoke-free policies (Noonan, 2010). This also warrants examination with population-based data both nationally and across jurisdictions.

The National Adult Tobacco Survey (NATS) is the first survey in the US to establish a comprehensive standard for assessing the prevalence of tobacco use and its correlates among adults at the national and state levels. Indeed, it is the first nationally representative survey to capture the use of non-cigarette tobacco products, such as WTS (King et al., 2012), at a time when the Food and Drug Administration is only beginning to develop regulations for these products (Department of Health and Human Services: Food and Drug Administration, 2014). These data therefore provide a unique opportunity to examine the epidemiology and correlates of WTS among US adults.

Methods

Sample

The 2009–2010 NATS is a stratified, national telephone survey of non-institutionalized adults aged ≥ 18 years who reside in the 50 US states and the District of Columbia (King et al., 2012). The sample was developed from two separate overlapping sampling frames (landlines and cell phones) to generate representative data at both national and state levels. One adult respondent was randomly selected from each eligible household for the landline sample, while adults were included in the cell phone sample if that was the only method to reach them by telephone at home. Each state was allocated a target sample of 1863 for landline phones to ensure adequate precision for state-level estimates; cell phone allocation size was in proportion to population size (range = 255–24,100). The final sample included 118,581 respondents, consisting of 110,634 landline and 7947 cell phone interviews conducted between October 2009 and February 2010. The response rate (number of completed interviews divided by the number of eligible respondents in the sample) was 37.6% (40.4% for landline and 24.9% for cell phone respondents). The cooperation rate (number of completed interviews divided by the number of eligible respondents who were successfully reached by the interviewer) was 62.3% (61.9% for landline and 68.7% for cell phone respondents). Additional detail about the survey methodology can be found elsewhere (King et al., 2012).

Water pipe tobacco smoking

Two questions were used to define the use of water pipe tobacco: “The next question asks you about smoking tobacco in a water pipe. A water pipe is also called a hookah. Have you ever tried smoking tobacco in a water pipe in your entire life, even one or two puffs?” and “During the past 30 days, on how many days did you smoke tobacco in a water pipe?” We classified respondents who reported smoking tobacco in a water pipe in their lifetime as *ever* water pipe smokers and those who reported smoking tobacco in a water pipe on at least 1 day within the past 30 days as *current* water pipe smokers.

Respondent characteristics

The following characteristics of survey respondents were assessed: sex, age in years (18–24, 25–44, 45–64, or ≥ 65), race/ethnicity (non-Hispanic White, non-Hispanic Black, non-Hispanic Asian, non-Hispanic Other, or Hispanic), education (0–12 years [no diploma], high school graduate [or GED recipient], some college [no degree], associate degree, undergraduate degree, or graduate degree), annual household income (<\$20,000, \$20,000–\$49,999, \$50,000–\$99,999, \geq \$100,000, or unspecified), and sexual minority status (heterosexual/straight or lesbian/gay/bisexual/transgender [LGBT]). For race/ethnicity, “non-Hispanic Other” included respondents who were American Indian or Alaska Native, Native Hawaiian or Pacific Islander, multiracial, or some other race. We also classified respondents based on cigarette use (current smokers [everyday or some days], former smokers [at least 100 cigarettes in their lifetime, but not current], or never smokers [< 100 cigarettes in their lifetime]).

Analysis

Data were analyzed during May 2014 using Stata 12 (StataCorp, College Station, TX) and weighted to adjust for the differential probability of selection

and response. Landline data were weighted according to the selection probability of the telephone number, the number of adults in each household, and the number of telephone numbers per household. Cell phones were assumed to be used exclusively by the respondent and were weighted only according to the selection probability of the phone number. Final weights were adjusted for under-coverage by sex, age, race/ethnicity, marital status, educational attainment, and telephone type (i.e., landline vs. cell). The national-level weights were used when all respondents were analyzed. The state-specific weights assign a non-zero weight for states with 200 or more cell phone respondents and zero in states with less than 200. State-level prevalence rates of ever water pipe tobacco smokers (overall and gender-specific) were mapped in ArcGIS 10.2 (ESRI, Redlands, WA), using choropleth thematic maps. Prevalence rates for WTS *ever* and *current* users were calculated. Demographics and smoking characteristics were summarized using weighted percentages and confidence intervals. We used multivariate logistic regression to examine the relationship between WTS *ever* and *current* use and respondent characteristics. This study was deemed exempt from institutional review board approval because it uses publicly available data.

Results

National rates of water pipe tobacco smoking

The overall prevalence of *ever* WTS was 9.8% (Table 1). Prevalence was significantly higher among males (13.4%) compared with females (6.3%). Among all age groups, young adults (18–24 years) had the highest prevalence rates (28.6%). By race/ethnicity, prevalence was lowest among non-Hispanic Blacks (3.6%) and highest among non-Hispanic Other (17.6%). By education, those with some college education (but no degree) had the highest rate of *ever* use (12.4%). Adults with annual household income \geq \$100,000 had the highest rates of *ever* use (12.0%) among all income groups. By sexual minority status, prevalence was higher among LGBT respondents (21.1%) compared with heterosexual-straight respondents (9.8%). Finally, current smokers of cigarettes had higher prevalence rates of *ever* WTS (17.7%) relative to never smokers of cigarettes (7.0%).

The overall prevalence for *current* WTS was 1.5%. Current prevalence was significantly higher among males (2.3%) compared with females (0.9%). Young adults (between 18 and 24 years) had the highest rates of *current* WTS (7.8%). Non-Hispanic Blacks had the lowest prevalence of *current* WTS (0.7%) by race/ethnicity, and non-Hispanic Other had the highest (4.0%). High school graduates (no college) had the highest rate of *current* use (2.1%) by education. Prevalence did not vary across income groups (1.6%) with the exception of those with an annual household income between \$20,000 and \$49,999 (1.3%). Prevalence of *current* WTS was higher among LGBT respondents (6.1%) compared with heterosexual respondents (1.5%), and current cigarette smokers had higher prevalence (4.0%) compared with never smokers (1.0%).

Prevalence rates by state

The weighted percentage of adults who have ever tried WTS are presented in Fig. 1. Overall, the District of Columbia (DC) had the highest rate of *ever* WTS use (17.3%), followed by Nevada (NV; 15.8%), California (CA; 15.5%), Colorado (CO; 14.0%), and New Mexico (NM; 13.4%). The lowest rates were found in West Virginia (3.8%), Alabama (3.8%), North Dakota (3.5%), Mississippi (3.1%), South Carolina (3.1%), and Nebraska (3.0%). Among males, the highest prevalence rates of *ever* WTS were encountered in CA (21.4%), followed by DC (19.9%), NV (19.4%), CO (19.1%), and NM (18.0%). The highest rates among females were in DC (15.0%), NV (12.1%), NM (10.2%), CA (9.8%), and Oregon (9.6%).

Correlates of water pipe tobacco smoking

In the adjusted logistic regression model for *ever* WTS, adult males were more likely than females to smoke water pipe tobacco (odds

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