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Prevalence and harm perceptions of hookah smoking among U.S. adults, 2014–2015

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HIGHLIGHTS

- Hookah smoking is prevalent among users of other alternative tobacco products.
- A knowledge gap regarding the harmfulness of hookah smoking was identified.
- Young, college-educated, and never smokers perceive hookah as less harmful.

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ABSTRACT

This study aimed to determine the prevalence and factors associated with hookah smoking and perceptions of harm among U.S. adults. Data were pooled from the Tobacco Products and Risk Perceptions Surveys conducted separately in the summers of 2014 and 2015, among a probability sample selected from an online research panel. Descriptive, logistic regression, and multinomial logistic regression analyses were conducted. In 2014/2015, prevalence of ever and past 30-day hookah smoking among U.S. adults were 15.8% (95% C.I.: 15.0%, 16.7%) and 1.5% (95% C.I.: 1.2%, 1.8%), respectively. Adults who used other alternative tobacco products had a higher odds of hookah smoking than those who did not. Adults with some college education (AOR, 1.53) and with a college degree or more (AOR, 2.21), those identified as non-Hispanic other (AOR, 1.38) were more likely to be ever hookah smokers. Being a young adult (AOR, 2.7), college-educated (AOR, 2.3), never smoker (AOR, 2.1), and an ever hookah smoker (AOR, 2.8) were associated with lower perceptions of harm. Findings suggest that young college students are at higher risk of smoking hookah and that hookah smoking is more prevalent among individuals who use other tobacco products, such as little cigars and cigarillos, traditional cigars, and e-cigarettes, indicating a distinct group of users of alternative tobacco products. Regarding potential harm of hookah, the study highlights a knowledge gap and misperception especially among young, college-educated, and never smokers. Public health interventions should target these subpopulations to provide them with accurate information on hookah smoking.

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1. Introduction

Hookah tobacco smoking, also known as waterpipe, narghile and shisha (Pepper & Eissenberg, 2014; Shihadeh et al., 2015), is rising in popularity (Soule, Lipato, & Eissenberg, 2015), especially among youth and college students (Lauterstein et al., 2014; Pepper & Eissenberg, 2014). Males, young adults aged 18–24 years, those who self-identify as non-Hispanic other (American Indian or Alaska Native, Asian, Native Hawaiian or Other Pacific Islander, and multiple race individuals), those who have college education, and current smokers are more likely to smoke hookah (Cavazos-Rehg, Krauss, Kim, & Emery, 2015; Haddad, El-Shahawy, Ghadban, Barnett, & Johnson, 2015; Villanti, Cobb, Cohn, Williams, & Rath, 2015). Hookah relies on charcoal combustion to heat a moist sweetened flavored tobacco to generate an aerosol that travels through the water-filled hookah body, then passes through a hose to be inhaled by the hookah smoker via a mouthpiece (Soule et al., 2015). Hookah smoking is commonly considered as a "social ritual" (Carroll et al., 2014), typically smoked with friends in sessions, lasting 45–60 min (Montazeri, Nyiraneza, El-Katerji, & Little, 2016), at hookah establishments that usually provide food, alcohol, and some sort of entertainment (Carroll et al., 2014).

Similar to cigarettes, hookah generates smoke that contains nicotine and other toxicants, such as tar and carbon monoxide (CO), associated with smoking-related diseases (Ramoa, Shihadeh, Salman, & Eissenberg, 2015). Yet, compared to cigarette smoking, hookah is commonly misperceived by users to be less harmful and less addictive and viewed as socially more acceptable (Akl et al., 2013; Barnett, Shensa, et al., 2013). Relative to one cigarette, a single hookah smoking session exposes users to higher levels of smoke, nicotine, tar, and CO (Primack

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et al., 2016). A recent meta-analysis documented that hookah smoking was associated with higher risk of cancer, particularly, lung and esophageal cancers (Montazeri et al., 2016). However, consumers, especially young and college educated adults, tend to consider hookah as less risky than cigarettes (Lipkus, Eissenberg, Schwartz-Bloom, Prokhorov, & Levy, 2014; Wackowski & Delnevo, 2015). Correcting this misperception is important to combat the rise in hookah smoking.

In May 2016, after reviewing the evidence supporting the risk associated with hookah smoking, the Food and Drug Administration (FDA) deemed tobacco products (including tobacco smoking using hookah) to be subject to the agency's regulatory authority as amended by the Family Smoking Prevention and Tobacco Control Act. This rule prohibits the sale of deemed tobacco products to minors (under age of 18 years) and mandates display of health warning statements on the products and in advertisements (Deeming Tobacco Products To Be Subject to the Federal Food, Drug, and Cosmetic Act, as Amended by the Family Smoking Prevention and Tobacco Control Act; Restrictions on the Sale and Distribution of Tobacco Products and Required Warning Statements for Tobacco Products. Final rule, 2016). The decision to regulate hookah tobacco smoking was rooted in the concern pertaining to the use of hookah with other tobacco products, known as dual and polytobacco use; the rise in hookah smoking prevalence; the potential of nicotine dependence and smoking-related diseases; and the misperceptions regarding the actual toxicity and health risks associated with hookah smoking (Deeming Tobacco Products To Be Subject to the Federal Food, Drug, and Cosmetic Act, as Amended by the Family Smoking Prevention and Tobacco Control Act; Restrictions on the Sale and Distribution of Tobacco Products and Required Warning Statements for Tobacco Products. Final rule, 2016). To inform the policy and public health programs, continuous monitoring of hookah smoking uptake and perception is warranted.

Most available studies on hookah smoking in the United States have been conducted among subgroups such as college students (Barnett, Smith, et al., 2013; Enofe, Berg, & Nehl, 2014; Gathuru, Tarter, & Klein-Fedyshin, 2015; Shepardson & Hustad, 2015), youth (Lauterstein et al., 2014; Wang, King, Corey, Arrazola, & Johnson, 2014), and young adults (Rezk-Hanna, Macabasco-O'Connell, & Woo, 2014; Sutfin, Song, Reboussin, & Wolfson, 2014). Few recent studies have documented the prevalence of hookah smoking and examined the factors associated with it among a nationally representative sample of U.S. adults (Agaku et al., 2014; McMillen, Maduka, & Winickoff, 2012). The proportion of U.S. adults who have ever smoked hookah in 2009–2010 ranged from 8.8% to 9.8% (Salloum, Thrasher, Kates, & Maziak, 2015). In 2010, prevalence of current use of hookah among U.S. adults, defined as smoking tobacco in a hookah on at least one day within the past 30 days, was 1.5% (Salloum et al., 2015). Data from the 2012–2013 National Adult Tobacco Survey estimated that 0.5% were "every day" or "some day" and 3.9% were "every day," "some day," or "rarely" hookah smokers (Agaku et al., 2014).

To our knowledge, no recent study has examined the risk perceptions of hookah among a representative sample of adults. To fill this research gap, we sought to examine the prevalence and the perceived harm of hookah smoking in a national probability sample of adults. The current study's objectives were to estimate the prevalence of ever and current hookah smoking among U.S. adults, aged 18 years and older, examine factors associated with being ever and current hookah smokers, and determine the prevalence and factors associated with perceptions of risk of hookah smoking.

2. Method

2.1. Sample

Data were from the cross-sectional 2014 (June–November) and 2015 (August–September) Tobacco Products and Risk Perceptions Surveys. These were online surveys among a probability sample from an online research panel designed to represent the English and Spanish speaking, non-institutionalized U.S. adults, known as *KnowledgePanel*. Panel members are recruited using address-based sampling method (ABS). Households at the randomly selected addresses are invited to join *KnowledgePane*l by mail. Recruited households that are without internet service are provided with a web-enabled device and free internet. Upon joining the panel, members who are eligible to participate in surveys receive invitation by email with a link to survey questionnaire. In 2014, 5717 adults and in 2015, 6051 adults completed the surveys, yielding final stage completion rates of 74.1% in 2014 and 76.0% in 2015. Details about the study methods have been published elsewhere (Weaver et al., 2016). The GSU Institutional Review Board approved the data collection for both 2014 and 2015 surveys. Data from the two surveys were pooled to improve the accuracy of the estimates.

2.2. Measures

Demographic and other characteristics included in this study were sex, age, race/ethnicity (Hispanic, non-Hispanic White, non-Hispanic Black, non-Hispanic other: multiple race individual, Asian, American Indian, Alaskan Native, and Hawaiian), educational attainment, annual household income, U.S. census region, perceived physical health status, and sexual orientation (heterosexual and non-heterosexual). Data on respondent characteristics were obtained from the profile survey among all members of the online research panel, *KnowledgePanel*.

Respondents who indicated that they have heard of hookah prior to the survey were defined as being aware of hookah. Survey participants who have ever smoked hookah, even one or two puffs, were considered ever hookah smokers. Current hookah smoking was defined as having used hookah in the past 30 days. Survey respondents were also asked whether they have ever tried or used little cigars and cigarillos (LCCs), traditional cigars (TC), and electronic vapor products (e-cigarettes) in the past 30 days. In this paper, the term "other tobacco products" is used to refer to LCCs, TCs, and e-cigarettes. Perceived harm of hookah relative to cigarette smoking was assessed using this question: "Is smoking hookah less harmful, about the same, or more harmful than smoking regular cigarettes?" Respondents could select one of these three response options or "I don't know."

Adults who reported smoking at least 100 cigarettes in their lifetime and were currently smoking every day or somedays were categorized as current smokers. Adults who have smoked 100 cigarettes in their lifetime and responded *not at all* to the "smoke now" question were classified as former smokers. Never smokers were adults who reported not having smoked at least 100 cigarettes in their lifetime.

2.3. Statistical analysis

Data were analyzed during March–April 2016, using Stata 13.0 (StataCorp, College Station, TX). All analyses were weighted to account for the complex survey design and survey non-response. Survey sample weights were computed in several stages. The entire *KnowledgePanel* is weighted to the benchmarks from the latest March supplement of the Current Population Survey (CPS) along multiple dimensions: age, race/ethnicity, education, census region, household income, home ownership status, metropolitan area, and internet access. These weights are used to measure the size for each panel member in a probability proportional to size sampling procedure to select the study specific sample. After conducting the study, a post-stratification weights are computed to adjust for non-response and oversampling of smokers. Demographic characteristics of U.S. adults aged 18 and older from the most recent CPS were used as benchmarks.

Overall and by adult characteristics, we computed the point estimates and 95% confidence interval (CI) of the proportions of ever and current hookah smoking. Crude odds ratios (OR) and 95% CI were computed for bivariate associations with ever and current hookah smoking. To identify factors associated with ever and current hookah smoking,

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