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Short Communication

# Hookah tobacco smoking in a large urban sample of adult cigarette smokers: Links with alcohol and poly-tobacco use

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## HIGHLIGHTS

- To examine effects of alcohol use and age on the association between hookah and poly-tobacco use in adult cigarette smokers
- Poly-tobacco use is common among adult smokers who use hookah.
- The link between hookah and poly-tobacco use was strongest in younger respondents who drank more often.

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## ABSTRACT

Hookah tobacco smoking (HTS) has been increasing, particularly among young adults and has similar health effects compared to cigarette smoking. The link between HTS and poly-tobacco use is well documented, but fewer show an association between HTS and alcohol use. It is essential to identify factors that increase the risk for or addictiveness and consequences of HTS, given its growing prevalence. This study examined whether the association between HTS and poly-tobacco use differed as a function of age and alcohol consumption within in a sample of 1223 adult cigarette smokers. Approximately 20% of participants reported HTS. Compared to non-users, hookah users were more likely to be male, highly educated, and to report drug and alcohol use, binge drinking, and poly-tobacco use but were less likely to be heavy smokers (≥10 cigarettes per day). Regression analyses predicting number of tobacco products used (excluding cigarettes and HTS) indicated a three-way interaction of HTS, frequency of alcohol use, and age such that the association between HTS and number of tobacco products used was strongest for younger respondents who consumed alcohol more frequently. As observed in previous studies, alcohol is an important risk factor in the relationship between HTS and poly-tobacco use, particularly among younger cigarette smokers. The links between alcohol, HTS, and poly-tobacco use should be considered when developing HTS education and prevention materials directed toward younger cigarette smokers. Findings provide information relevant to FDA's interest in the addiction potential of HTS and its link to poly-tobacco use.


## 1. Introduction

Hookah tobacco smoking has been on the rise among men and women over the age of 18 over the last five years (Grinberg & Goodwin, 2016; Salloum, Thrasher, Kates, & Maziak, 2015; Smith, Edland, Novotny, et al., 2011), and has become particularly popular among young adults. (Richardson, Williams, Rath, Villanti, & Vallone, 2014) The increasing prevalence of HTS is concerning. HTS places users at risk for many of the same cancer-causing diseases as cigarette smokers, such as lung cancer and pulmonary and chronic obstructive pulmonary disorder (Akl et al., 2010; Khabour et al., 2012; Rammah, Dandachi, Salman, Shihadeh, & El-Sabban, 2012, 2013; Aoun, Saleh, Waked, Salamé, & Salameh, 2013; Gupta, Boffetta, Gaborieau, & Jindal, 2001; Koul, Hajni, Sheikh, et al., 2011) and may be a catalyst to nicotine dependence, progression to regular tobacco and other health-risk behaviors correlated with increased cancer risk, including alcohol and marijuana use (Griffiths & Ford, 2014; Auf et al., 2012; Neergaard, Singh, Job, & Montgomery, 2007; Cobb, Shihadeh, Weaver, & Eissenberg, 2011; Sterling & Mermelstein, 2011; Berg, Schauer, Asfour, Thomas, & Ahluwalia, 2011; Fielder, Carey, & Carey, 2012a, 2013; Sutfin et al., 2011; Jarrett, Blosnich, Tworek, & Horn, 2012; Cohn, Villanti, Richardson, et al., 2015). HTS is associated with unique acute health effects such as carbon monoxide poisoning (Ashurst, Urquhart, & Cook, 2012; Clarke, Stephens, Farhan, et al., 2012; La Fauci, Weiser, Steiner, & Shavit, 2012; Ozkan, Ozturk, Ozmen, & Durukan, 2013), and

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the spread of communicable diseases like herpes and tuberculosis (American Lung Association, 2011). Failure to respond to the increasing HTS trend could contribute to morbidity and mortality in the U.S.

HTS has been consistently linked to the use of other tobacco products, including poly-tobacco use (≥2 tobacco products). For instance, cigarette smoking is commonly reported among hookah users (Barnett, Smith, He, et al., 2013; Jarrett et al., 2012; Lee, Bahreinifar, & Ling, 2014; Primack, Shensa, Kim, et al., 2013). Among individuals 18 years and older, non-daily and daily smokers show a higher prevalence of lifetime HTS compared to the use of any other type of alternative tobacco product (McMillen, Maduka, & Winickoff, 2012). A number of studies also document an association between alcohol use and HTS (Cohn et al., 2015; Czoli, 2013; Heinz, Giedgowd, Crane, et al., 2013; Sterling & Mermelstein, 2011) and between alcohol use and poly-tobacco use (Bombard, Pederson, Koval, & O'Hegarty, 2009; Cavazos-Rehg, Krauss, Spitznagel, Grucza, & Bierut, 2014; Fix, O'Connor, Vogl, et al., 2014). The association between HTS and alcohol is concerning for several reasons: alcohol use has been shown to increase the likelihood of HTS initiation above and beyond other tobacco-related risk factors (Fielder, Carey, & Carey, 2012b; Fielder et al., 2012a; Shepardson & Hustad, 2015; Soule, Barnett, Curbow, Moorhouse, & Weiler, 2015; Villanti, Cobb, Cohn, Williams, & Rath, 2015) and has been implicated in the use of a variety of other new and alternative tobacco products (Cohn et al., 2015; Fix et al., 2014). Alcohol use is also robustly correlated with more severe nicotine dependence (Grant, Hasin, Chou, Stinson, & Dawson, 2004; Hasin, Stinson, Ogburn, & Grant, 2007), lower desire to quit smoking (Cargill, Emmons, Kahler, & Brown, 2001), and poor tobacco cessation outcomes (Hughes & Kalman, 2006; Kahler, Spillane, & Metrik, 2010; Kahler et al., 2009). Existing studies have found that many hookah users drink alcohol while engaging in HTS (Soule, Barnett, & Curbow, 2012; Soule et al., 2015) and concurrent alcohol use and HTS may enhance the subjective effects of HTS (Soule et al., 2015). However, not all studies have reported an association between HTS and alcohol use (Dugas, O'Loughlin, Low, Wellman, & O'Loughlin, 2013; Sutfin et al., 2011), suggesting further research is needed to tease apart "for whom" and "under what circumstances" alcohol is linked to HTS behavior. Understanding links between HTS and alcohol use is also important, given that the short- and long-term effects of new and alternative tobacco products, like HTS are not well understood.

The majority of studies to date on HTS have focused on youth and young adult users, particularly college students (Enofe, Berg, & Nehl, 2014; Heinz et al., 2013; Jarrett et al., 2012; Primack et al., 2013), but not the full spectrum of tobacco users who may also be engaging in HTS. As a result, little is known about the HTS risk profiles in older age groups. While hookah use, and to some extent poly-tobacco use (Fix et al., 2014), are concentrated among youth and young adults, alcohol is robustly associated with tobacco use across the age spectrum (Falk, Yi, & Hiller-Sturmhöfel, 2006; Grant et al., 2004; Kahler, Strong, Papandonatos, et al., 2008; Kahler et al., 2010). Taken together, these studies argue for inclusion of alcohol use as an important risk factor linking HTS to poly-tobacco use, but suggest there may also be different important age differences. This study examined the moderating effects of both age and alcohol use on the association between HTS and poly-tobacco use in a large sample of adult cigarette smokers.

## 2. Method

### 2.1. Participants and procedure

This is a secondary analysis of data that were combined from the screening measures of two NIH-funded studies (data collected from January 2014 to December 2015). The first study was a naturalistic assessment of the longitudinal smoking change outcomes of risky drinking adult smokers. The second was an administrative supplement to this project, designed to examine motivations for alcohol use and cigarette smoking in adult smokers with and without a history of risky drinking. Both studies included the same battery of questionnaires at baseline (described below). Eligibility for both studies was nearly identical and included: 1) 18–65 years old; 2) smoke >10 cigarettes per day; and 3) desire to quit smoking in the next 6 months. Exclusion criteria were 1) suicidal, homicidal, or severe psychiatric disturbance; 2) substance dependence (excluding nicotine and caffeine); 3) current use of psychotropic medication; and 4) potential for severe alcohol withdrawal. Additionally, individuals eligible for the parent grant drank at risky levels [>2 drinks a day for men; >1 for women and >14 drinks per week for men; 7 for women, according to the guidelines of the National Institute on Alcoholism and Alcohol Abuse] and were excluded if they were pregnant or planning to become pregnant in the next 6 months. For the administrative supplement, a sampling method was employed to recruit 50% risky drinkers and 50% non-risky drinkers (consume at least 1 drink/week in the last 30 days but less than risky drinking levels). Participants included in the current analysis completed the screening for these studies but did not have to meet eligibility criteria, therefore not all participants who took the screening measure were risky drinkers. Participants in the parent grant were eligible to receive up to $178 for their participation over 6 months, and participants in the administrative supplement were eligible to receive up to $50 for completing two experimental sessions.

Participants were recruited from a large Northeastern US city via web or print advertisements, or through word-of-mouth. Advertisements asked for "smokers who are regular drinkers." Participants were directed to complete an initial online screening survey or call a telephone number to determine eligibility; final eligibility was determined over the phone by a trained research assistant. A total of 1405 individuals completed the screening questionnaires; 171 had missing other tobacco use data and 11 indicated smoking 0 cigarettes, so they were excluded from analyses. A final sample size of 1223 adult (18+) cigarette smokers were included.[1]

## 3. Measures

Participants provided demographic information on age, race (White, African American, other), gender, education (<high school, high school graduate or GED, some college education or higher), and employment status (employed, unemployed, other).

Data were collected on number of drinks consumed per drinking episode (quantity) and number of days in a typical week alcohol was consumed (frequency). A binge drinking variable (yes/no) was computed from quantity/frequency measurements based on established measures (4+ drinks for women/5+ drinks for men) (Wechsler & Austin, 1998; Wechsler & Nelson, 2001). Participants were also queried "Have you used any drugs in the past 90 days?" (yes/no).

Use of other tobacco products, exclusive of cigarettes, was assessed by asking participants "Do you use any other tobacco products other than cigarettes?" with response options for e-cigarettes, cigars, little cigar/cigarillos, hookah, chew, and "other." A variable capturing the total number of tobacco products was created by summing the number of 'yes' responses for each product (excluding hookah). For the parent grant, participants were asked if they smoked >10 cigarettes per day (yes/no). However, for the administrative supplement study participants were asked how many cigarettes they smoke per day. Thus, to be consistent and examine cigarette smoking across both studies, participants were categorized into light smokers (≤10 cigarettes per day) versus heavy smokers (>10 cigarettes per day), consistent with the literature (Choi, Okuyemi, Kaur, & Ahluwalia, 2004).

[1] It is possible that some participants may have completed the screening questionnaire for both studies. We were unable to detect duplicates.