Distribution Agreement

In presenting this thesis or dissertation as a partial fulfillment of the requirements for an advanced degree from Emory University, I hereby grant to Emory University and its agents the non-exclusive license to archive, make accessible, and display my thesis or dissertation in whole or in part in all forms of media, now or hereafter known, including display on the world-wide web. I understand that I may select some access restrictions as part of the online submission of this thesis or dissertation. I retain all ownership rights to the copyright of the thesis or dissertation. I also retain the right to use in future works (such as articles or books) all or part of this thesis or dissertation.

Signature:

_____ _____

Shreya Kothari Date

Reasons for Use, Potential Use, or Discontinued Use of Hookah Among US Young Adult College Students

By

Shreya Kothari
MPH

Hubert Department of Global Health

_____

Carla J. Berg
Committee Chair

_____

Shivani Patel
Committee Member

Reasons for Use, Potential Use, or Discontinued Use of Hookah Among US Young Adult College Students

By

Shreya Kothari

Bachelor of Dental Surgery
Jaipur Dental College, Rajasthan
India
2014

Thesis Committee Chair: Carla J Berg, PhD

An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health in
Hubert Department of Global Health
2017

Abstract: Given the increase in hookah use among young adults, this study assessed: 1) differences in sociodemographics and other substance use among current, never, and former users of hookah; 2) hookah use characteristics among current users (e.g., use levels, types of devices/flavors used,); and 3) reasons for use, potential use, and discontinued use among current, never, and former hookah users among young adults. We analyzed data from the third wave of a longitudinal study of students aged 18–25 recruited from seven Georgia colleges/universities. Of 2,865 participants, 56.3% were never users, 12.4% current (past 4-month), and 31.3% former. Correlates of being a current (vs. never) hookah user included being "other race" (vs. White, p=.004), attending an HBCU (vs. a technical college, p<.001), and use of any other tobacco product, marijuana, or alcohol (p's<.001). Correlates of being a former (vs. never) hookah user included being older (p<.001), being "other race" (vs. White, p=.009), attending an HBCU (vs. a technical college, p=.01), and use of any other tobacco product (except LCCs), marijuana, or alcohol (p's<.001; Nagelkerke R-squared=.289). Among current users, 52.5% reported using hookah most frequently at a bar, 89.3% used large hookah, and most commonly used flavors were fruit, menthol/mint, and candy. Two primary factors regarding current hookah use included: 1) instrumentality (e.g., doesn't smell badly, appealing flavors); and 2) social reasons (e.g., I like the image it reflects). Only one primary factor emerged regarding potential use among never users, reflecting influences related to social factors and flavors. Three primary factors regarding discontinued use among former users included: 1) inconvenience (e.g., too messy/expensive); 2) anti-tobacco attitude (e.g., it's unhealthy); and 3) social reasons (e.g., someone asked me not to use). These results may inform policy and interventions to address hookah use in young adults.

Table of Contents

CHAPTER 1: INTRODUCTION

Problem Definition & Justification

Tobacco use is the single most preventable cause of death in the United States (1), causing 438,000 premature deaths annually (71). Although the prevalence of cigarette smoking is on the decline, use of alternate tobacco smoking products have increased popularity (31).

Hookah use has become prevalent among young adults and has gained social acceptability because of its perception of being a safer option than traditional cigarettes (20), its novelty, its availability in appealing flavors, and its relatively low cost (11, 23). However, research has shown the contrary and indicates toxicant yields and adverse health effects equal to or worse than cigarettes (10, 15).

As a result of the growing popularity, hookah use has become a threat to public health. Smokers are potentially exposed to health risks beyond those directly attributable to the tobacco used, like charcoal combustion (63), the spread of infections from sharing the same mouthpiece and hose, and the consequences of consistent or chronic use (62).

Understating perceptions regarding hookah is critical. It is important to understand why nonusers of hookah might choose to initiate use, why current users continue to use, and why former users may quit using hookah. Qualitative research articles have identified main themes for hookah use ranging from facile availability, affordability, innovation, influence of media, relaxation, positive attitude as compared to cigarettes, and the sensory characteristics evoked from smoking it (21, 24, 38, 52). Outside of several qualitative studies, limited quantitative research has been done (17, 20, 23, 35, 36, 48), and no prior research has examined potential reasons for use among nonusers or why former hookah users discontinued use.

To understand what influences people's behavior, Bandura in 1986 developed the social cognitive theory (SCT). This theory posits that people learn from one another through observation, instruction, or modelling. He hypothesizes that self-efficacy is fundamental to any behavior change and that a positive relation exists between self-efficacy and changes in smoking behavior (42). The current study leverages a SCT-based framework and builds on previous qualitative findings (as well as our own) to develop quantitative measures to ascertain reasons for hookah use among current users, potential reasons for use among never users, and reasons for discontinued use among former hookah users. We will also examine these factors in relation to sociodemographics, other substance use, and, among current users, prior quit attempts, and readiness to quit.

Given the high rates of alternate tobacco product use among adolescents and young adults, and the widespread lack of knowledge about its constituents, the purpose of this study is to acquire more information and data regarding why nonusers of hookah might choose to initiate use, why current users continue to use, and why former users may have discontinued using hookah. Increase in use of alternate tobacco products among young adults has made it critical that the tobacco control and prevention strategies for the youth should address all tobacco products including hookahs (5). Identifying the characteristics of hookah smokers may have numerous public health and clinical implications, and the details could provide critical information to inform interventions.

CHAPTER 2: LITERATURE REVIEW

Trends in Hookah Use

In the United States (US), consumption of tobacco products is a globally prevalent health-related problem and the single largest reason of premature death among both men and women (US) (1). Each year more than a million smokers die because of cigarettes smoking worldwide (29). Additionally, cigarette smoking has been estimated to cost the nation $96 billion in direct medical expenses, $97 billion in loss of productivity per year, and over 5.6 million years of potential life loss each year (10). Though over years, public health efforts have successfully decreased its prevalence, but alternative forms of tobacco products like hookahs, e-cigarettes, and cigars are on the rise (3, 6).

Hookah originated in the Eastern Mediterranean region four centuries ago (28), and over the years, it has gained popularity in many western countries including the Australia, UK, Canada, South East Asia, including USA, and has globally become a social activity among the youth (3, 28). Hookah has been labeled differently (e.g., waterpipe smoking) depending on the region and country being used (50). It is called hookah in the Indian subcontinent and Africa, shisha, sheesha, borry, goza in Egypt, Pakistan and Saudi Arabia, narghile, arghile in Jordan, Lebanon, Syria, and Israel, shuiyandai in China, and in other places it is called hubble-bubble, kalian, ghalyan, and mada'A (8, 23, 50). In the US, hookah has steadily become the second most popular form of tobacco use among college students (30).

Hookah or waterpipe use has become a global epidemic among youth and college students with serious repercussions for global health (28). The Global Youth Tobacco Survey

(GYTS), the largest to date surveillance of tobacco use among youth conducted in 95 countries with over half million participants worldwide shows that while cigarette smoking is either stable or declining, other forms of tobacco are on a rise, distinctly hookah (31). Similarly, an analysis from the 2011–2014 National Youth Tobacco Surveys (NYTS) shows statistically significant increases among current users of hookah users and decreases for traditional cigarettes users (5). The CDC MMWR report also reinforces this as an estimated 50 million persons currently use a tobacco product every day, and an estimated 60 million used them on some days (43).

What is Hookah?

Hookah consists of a head to hold 10–20 grams of tobacco preparation over which burning charcoal is placed, separated by a perforated aluminum foil. The charcoal is used to heat the tobacco and is replaced intermittently during the smoking session to maintain the strength of the tobacco (23). The head containing tobacco, foil and charcoal is attached to the body, linking it to a bowl containing fluid. There is a tube connected to the head passing through the body with a hose and mouthpiece, and there can be single or multiple hoses attached to the bowl, allowing multiple people to smoke from the same tobacco source (8, 15).

The commonly used hookah tobacco is a moist paste-like preparation made from tobacco mixed with honey, molasses, and pulp of different fruits to add flavor (8), and variety of fluids including coconut milk, alcohol like vodka, wine, juice, and milk, though water is the most commonly fluid in the bowl (19, 23). When the hookah user inspires from the hose, it creates negative pressure pulling the smoke through the hose along with the burning charcoal's emissions and tobacco smoke to the fluid bowl. From the bowl, the smoke then flows through the hose into the person's mouth, lungs and eventually into the ambient air on expiration (23). This

feature of the passage of smoke through the fluid, underlies the widespread misperception about waterpipe's "reduced" harm and addictiveness (17).

Risks Associated with Hookah Use

Past research suggests that adolescents and young adults are generally unaware of the constituents of hookah (9). People believe that hookah is less addictive, less harmful, and less polluting than cigarette smoking (2, 8, 16). However, available epidemiological data suggests that hookah use is associated with cigarette smoking-related diseases. In fact, hookah users absorb nicotine in amounts comparable to cigarette smokers and absorb more carbon monoxide (8). Moreover, hookah users may experience nicotine dependence symptoms earlier than cigarette smokers (35). Both hookah and cigarettes have substances like nicotine, tar, carbon monoxide, and deleterious gases, such as volatile aldehydes, ultrafine particles, and polycyclic aromatic hydrocarbons (33). Increase in excretion of carcinogenic biomarkers after a single waterpipe session has also been noted (8). A 45-minute hookah session produced over 40-fold the smoke volume of that produced from a single cigarette (4), and the amount of smoke inhaled during an hour-long hookah smoking session was about 90,000 mL, compared to 500–600 mL for traditional cigarettes (65). It was also established that smoke from one hookah session produces tar (100-fold), nicotine (10-fold), and CO (30-fold) more than a single cigarette (7), causing widespread organ damage reflecting the high levels of toxicity (10). Hookah use has been shown to be associated with reduced overall health status and wide range of ailments including cancers, cardiovascular, respiratory (62), and periodontal diseases (64) and has led to low birth weight during pregnancy (61). The charcoal used to heat the tobacco also has shown to release high levels of potentially dangerous chemicals such as carbon monoxide, metals, and carcinogenic chemicals (63), and contains carcinogenic PAHs even before lighting it (34).

The practice of sharing of a common waterpipe mouth piece and use of contaminated water poses a risk of transmitting communicable diseases including herpes, chronic bronchitis, tuberculosis, and hepatitis (62). Furthermore, since hookah is commonly served in public places, second-hand smoke exposure from it can be a health risk for non-smokers present these venues (16). It can cause a multitude of disorders including ear and respiratory infections, asthma, and sudden infant death syndrome in children (32). Prolonged exposure to nicotine during adolescence can have lasting adverse consequence for brain development, and lead to sustained tobacco use and addiction (5). In adults second hand smoke can cause heart disorders, strokes, premature death, and lung cancer (32).

Reasons for Hookah Use

Hookah consumption has become a social epidemic world over (28), as it can function to bring people together (17). Historically, it was enjoyed primarily by men, but in the recent years, it has attracted women and young adults alike (23, 47). In the US, hookah use is typically more prevalent among educated youth (30, 44) and consumed in cafes, lounges, restaurants, parties, and homes (16). Emergence of hookah bars and cafes near college/university campuses has increasing concerns regarding the vulnerability of students using hookah (46). Young adults, while transitioning to college, are in a critical phase of engaging in health compromising behaviors, including tobacco consumption, and individuals experimenting with tobacco products in adolescence and young adulthood tend to become regular and addicted users (6).

Past research nationally has shown that hookah use appears trendy and cool (52) and is socially acceptable among friends and peers (11). It has become a situational norm, with use being influenced and encouraged by people belonging to the same social group to adopt the behavior (16). Peer use influences use of hookah, as student hookah users compared to never

users had greater number of friends who tried and approved of hookah (27). Interestingly, hookah smoking has also been associated with dieting, possibly suggesting that individuals perceive waterpipe tobacco has the same effect as cigarette smoking as a method of weight loss (23). People prefer consuming hookah over alcohol (36) as its cost could be split up among friends (24). Additionally, the introduction of customizable home delivery services of waterpipe has also boosted its use (51), as the accessories can be used repeatedly making it more affordable (21).

The tobacco marketplace has also diversified in terms of hookah designs (21) and flavors (19, 53). Creative ideas of using cored pineapple, watermelon, carving an orange or an apple as a bowl to store fluid, or using shiny ornaments and crystal bottles to persuade women in particular, who get lured by aesthetics (21, 38). Flavored tobacco, along with their attractive and seemingly healthy packaging has attracted the youth (17, 38), as the conventional waterpipe tobacco did not contain flavor enhancers or sweeteners (23). In addition to the fruity flavors, tobacco is available in jasmine, clove, spice, alcohol (wine or cognac), passion fruit, vanilla, gummy bear, cappuccino, caramel, mint/ menthol and chocolate flavors, most of which comes from Bahrain and Egypt (23, 30, 50, 53). The smell and taste of flavored tobacco were more enticing and overall experience has been reported to be more pleasant when compared to cigarette smoking (12, 21). Additionally, the scope to personalize hookah, including mixing flavors and performing smoke tricks, allures the youth's personality of creativity and within-group individuality (38, 52).

The sensory qualities evoked after using waterpipe are also key drivers promoting its use. People reported it as a reward to themselves and undergo withdrawal symptoms if they do not consume it (35, 39). Smokers were motivated by its taste, smell, sight of smoke, bubbly sounds

of water and the relaxation it provides after smoking it (12, 21), and for some only the sight or smell of the waterpipe was sufficient to tempt them to use hookah (36).

Media has a strong influence in successful marketing and promoting hookah use among young adults (3, 58). Besides advertisements on televisions (21) and showing waterpipe tobacco smoking in movies (39), the online demand for information on hookah and its products is large and increasing (55), and is also trending on social media, the power of which cannot be underestimated (3). Waterpipe businesses use internet and social media to promote, market and sell the product to public as safer alternatives to conventional tobacco products (37,40). There has been a surge in the availability of waterpipe tobacco and its accessories online (56), out of which most hookah selling websites neither require age verification nor include a health warning (57). It has become a flourishing business for restaurants to offer hookah in response to the increasing demand by the consumers and competitors (49), and has contributed to the transition of hookah from home to the public sphere, and driven people to try it (21).

Traditionally, hookahs were big and would sit on the floor, but now there have been technological advancements in the types and sizes of the hookah apparatus. New variations include table top and electronic nicotine delivery systems (ENDS), which are battery-operated vaping devices that heat flavored or unflavored nicotine liquid, inhaled as vapor (68, 69). They are perceived to be trendier and cooler than e-cigarettes (60), and are gaining popularity across the country (68). These are widely used for harm reduction and smoking cessation over novelty or smoking restrictions (67), and are being advertised with potential benefits while minimizing information about its side effects, and misinforming consumers (66).

Legislation has played an important role in the decline of cigarette smoking, though it does not seem synonymous with hookah use. For instance, there is questionable age verification

at hookah establishments (39), exempt of waterpipe tobacco in places of smoke-free laws for cigarettes (59), and presence of improper health warning labels (18). People rely on the government for protection towards harmful substances**.** Besides legislating policies, subsequent follow up and enforcement to ensure compliance are essential to control use of water pipe.

The Application of Social Cognitive Theory

Considering the rise of hookah use in young adults, it is paramount to understand the individual and sociocontextual characteristics associated with the reasons for its use. To understand what influences the behavior of young adults, Bandura's Social Cognitive Theory (SCT) is helpful (42), according to which an individual's self-efficacy and confidence in performing certain skills and behaviors are facilitators of peer influences on smoking. It also explains how individuals initiate, maintain, and model a given behavior they see in their peers (42). In relation to this study, the reasons for using hookah reflect a key concept in psychosocial studies, namely outcome expectancies, as it is determined by people's belief about the effects of its smoking. Once these positive expectancies are established, they guide an individual's behavior to produce the predicted effects when exposed to hookah. Positive expectancies could be expressed in changes in sensory characteristics, feeling of relaxation and being cool and trendy, and could also encourage starting and maintaining an addictive behavior like hookah (5).

From our research, it is evident that hookah is widely acceptable (11, 16), and there are several factors encouraging people to initiate or try hookah use including its enticing sight or smell (36), perception as safer alternative than cigarette smoking (11), easy access to hookah bars (39), easy availability, affordability, appealing designs, influence of internet and media, dearth of government legislations and the pleasant sensation of relaxation evoked after using hookah (3, 7, 21). We have also seen a strong peer (27, 58) and parental influence (58) in

initiation and imitation of the behavior, as it is a good, affordable way to socialize (24, 48), and that it appears cool and trendy to smoke hookah (16, 39, 52).Therefore it necessary to better understand the reasons of waterpipe tobacco use among young adults. This would enable targeted intervention programs to be directed at specific determinants of hookah use within the young adult population.

Gaps in the Literature and Specific Aims

Over the course of this literature review, it is demonstrated that there are several qualitative studies done, but there lies a dearth of quantitative research examining the reasons for hookah use, particularly the reasons for its use among the current users and potential reasons for hookah use among never users. Moreover, very little research has examined reasons that former users have quit using hookah. The results of this literature review show that the purpose of this study is sound and needed to fill the gap in research.

Given the aforementioned literature and the gaps in the research, the aims of this study were to: 1) assess differences in sociodemographics and other substance use among current, never, and former users of hookah; 2) characterize hookah use among current users (e.g., use levels, places of use, types of devices used, flavors most frequently used, quit intentions and confidence); and 3) assess reasons for use, potential use, and discontinued use among current, never, and former hookah users among young adults.

CHAPTER 3: METHODS

Study Design

The current study is an analysis of data from Project DECOY: Documenting Experiences with Cigarettes and Other tobacco in Young adults. This study was approved by Emory University and ICF International Institutional Review Boards as well as those of the participating colleges. The methods employed in Project DECOY are documented in detail elsewhere (13). In short, the parent study involved a two-year longitudinal cohort study involving 3,418 racially/ethnically diverse young adults attending seven Georgia colleges/universities. Data collection began in Fall 2014 and consisted of individual assessments every four months for two years (Fall, Spring, Summer).

Participants

The primary sampling frame includes seven Georgia campuses, including two public universities, two private colleges/universities, two community/technical colleges, and a historically black university with representation from rural and urban settings. The rationale for sampling from these institutions was to obtain a broad range of young adults in terms of sociodemographic backgrounds and to contextualize study findings within campus-related factors and campus tobacco control policies and activities. Inclusion criteria for participants were: 1) age ≥18 and ≤25 (to include the broad range of young adult ages but reduce overall age variability); and 2) ability to read English.

College email addresses were obtained from the registrar's office from each college/university for students meeting eligibility criteria. Three thousand 18-25 year old adults were randomly selected from one private and two public universities. The remainder of the

schools had 18-25 year old student populations of fewer than 3,000; thus, the entire student population of that age range at those schools was included in recruitment. Response rates ranged from 15.4% to 27.6% at the technical colleges; 12.0% and 19.2% at the public colleges/universities; 18.8% and 59.4% at the private universities; and 23.1% at the historically black university. Thus, our total response rate of 22.9% (N=3,574/15,607), albeit low, was over a very short time frame and met our sampling targets. Seven days after initial recruitment and completion of the baseline survey, we asked participants to confirm their participation by clicking a "confirm" button included in an email sent to them. The email reiterated the tasks involved in the study and its timeline. Once participants clicked "confirm", they were enrolled into the study and sent their first incentive in the form of a $30 gift card via email. The confirmation rate was 95.6% (N=3,418/3,574). We employed a graduated compensation schedule ($30 for the first two assessments, $40 for the second two, $50 for the final two), with an additional $100 incentive for participating in all assessments. The current analyses examined data from the Wave 3 assessment of the study, which was conducted during July/August 2015. The sample size during Wave 3 was 2,865 (83.8% retention rate).

Measures

The current analyses focused on factors related to hookah use (e.g., types used, reasons for use, potential use, discontinued use), other tobacco and substance use behaviors, and sociodemographics.

Hookah Use. The hookah users have been characterized into never users, current users (using hookah at least 1 day in the past 4 months) and former users (had used in their lifetime, but not in past 4 months). We created new items to assess places of hookah use, types of hookah apparatus used, and flavors most frequently used. To assess places ever using hookah, we asked,

"In the past 4 months, where have you used hookah?", with response options of: at a hookah bar or other public establishment, at someone else's home, at your home or other. To assess places most frequently used, we asked, "In the past 4 months, where have you used hookah more often?", with the same response options. Types of hookah apparatus used was assessed by asking, "Which of the following types of hookah pipes have you used in the past 4 months?", with response options of: a larger hookah pipe that sits on the table, a personal handheld hookah device that can be easily carried with you, or other. To assess flavors most frequently used, we asked, "What flavors of tobacco (shisha) from a hookah or water pipe do you use most of the time, and asked to check up to 3 most commonly used. The response options were: tobacco; menthol or mint; fruit flavors; coffee or tea; alcoholic drink flavors (for example mojitos and daquiris); caramel, vanilla, chocolate, and cream; candy flavors (for example licorice, gummy bears, or bubble gum); other food flavors (for examples cupcakes or muffin) or other.

Hookah Quitting-Related Factors. We adapted items used for cigarettes to examine confidence in quitting hookah use, importance of quitting, readiness to quit, and prior quit attempts. We asked participants, "On a scale of 1 being not at all confident and 10 being extremely confident, how confident are you that you could quit using hookah if you wanted to?" and "On a scale of 1 being not at all important and 10 being extremely important, how important is it to you that you quit using hookah?" (14). To assess readiness to quit, we asked, "Are you seriously thinking about quitting the use of hookah?", with response options of: Yes, within the next 30 days; Yes, within the next 6 months; Yes, in more than 6 months; I am not thinking about quitting the use of hookah. We dichotomized this variable as intending to quit in the next 30 days versus not. To assess quit attempts, we asked, "During the past 12 months, how many times did you stop using hookah for one day or longer because you were trying to quit using

hookah for good?" with a dropdown box from 0 to 31 or more times. This variable was dichotomized as made at least one quit attempt in the past 12 months versus no attempt.

Reasons for Hookah Use. Items regarding reasons for hookah use, potential use, and discontinued use were based on qualitative interviews conducted at Wave 2 and developed and refined by our research team (manuscripts currently under review). Participants reporting past 4-month use of hookah were instructed, "You indicated that you have used hookah at least once in the past 4 months. Below are some reasons for why you might use hookah." Items are listed in Table 2. Participants reporting no use of hookah in their lifetime were instructed, "You indicated that you have never used hookah. Below are some reasons for why you might use hookah." Items are listed in Table 3. Participants reporting lifetime but not past 4-month use of hookah were instructed, "You indicated that you have used hookah at least once in your lifetime but have not used hookah in the past 4 months. Below are some reasons for why you might have quit using hookah." Items are listed in Table 4. All participants were instructed, "Please indicate how true each of these reasons are for you using the scale below" (response options of 0=not at all true to 6=extremely true).

Other Tobacco and Substance Use. Participants were first asked to report the number of days they used each product in the past 4 months (to cover the duration of time between each wave of assessment): cigarettes; LCCs; smokeless tobacco; e-cigarettes; alcohol; and marijuana (Centers for Disease Control and Prevention, 2014). Those who reported any use in the past 4 months were then asked to report the number of days they used the respective product in the past 30 days. Given the distributions of use, alcohol use was used as a continuous variable, while tobacco and marijuana use was dichotomized as current (past 30-day) users vs. nonusers.

Sociodemographics. We assessed age, sex, sexual orientation, race/ethnicity, and type of school attended.

Data Analyses

First, we characterized our sample using descriptive statistics. We then conducted bivariate analyses to examine differences in sociodemographics and other substance use among never, current, and former hookah users. We then compared current users and former users to never users (referent group) using multinomial logistic regression. Next, for each of the subpopulations (current, never, former hookah users), we conducted an exploratory factor analysis on the respective sets of items assessing reasons for use among current users, potential reasons for use among never users, and reasons for discontinued use among former users, respectively, using Promax rotation. We used eigenvalues of greater than 1 as the criterion for number of factors. Then, we then conducted bivariate analyses examining subscale scores in relation to correlates of interest (e.g., sociodemographics, substance use, and hookah quitting-related factors among current hookah users and in relation to sociodemographics and other substance use among never and former hookah users). Analyses were conducted in SPSS 23.0, and alpha was set at .05.

CHAPTER 4: RESULTS

Participant Characteristics

Among the 2,865 participants who participated in the study, the average age was 20.53 (SD=1.93), 64.4% (n=1846) were female, 1,823 (63.6%) were White, 645 (22.5%) Black, 192 (6.7%) Asian, 205 (7.2%) Other, and 218 (7.6%) Hispanic. In our sample, never users comprised 56.3%, current (past 4 month) users 12.4%, and former users (those who had used in their lifetime but not in the past 4 months) 31.3%.

Correlates of Never, Current, and Former Hookah Users

Differences in hookah use status were found between the never, current, and former users in age ($p<.001$), sex ($p=.034$), race/ethnicity ($p<.001$), type of school attended ($p<.001$), and use of each tobacco product, marijuana, and alcohol use ($p's<.001$; Table 1). In the multinomial logistic regression examining differences between never, current, and former users (not shown in tables), correlates of being a current (vs. never) hookah user included being "other race" (vs. White, $p=.004$), attending an HBCU (vs. a technical college, $p<.001$), and use of any other tobacco product, marijuana, or alcohol ($p's<.001$). Correlates of being a former (vs. never) hookah user included being older ($p<.001$), being "other race" (vs. White, $p=.009$), attending an HBCU (vs. a technical college, $p=.01$), and use of any other tobacco product (except LCCs), marijuana, or alcohol ($p's<.001$; Nagelkerke R-squared=.289).

Characteristics of Hookah Use Among Past 4-Month Users

Out of the 354 past 4-month hookah users, average number of days of use in the past 4 months was 4.53 (SD=12.43). (Of the 226 past 30-day hookah users, the average number of days of use was 3.04 [SD=4.46].) Among past 4-month users, 186 (52.5%) said they have used the

hookah most frequently at a bar, followed by 116 (32.8%) who used it at someone else's home and 48 (13.6 %) who used it at their own home. Of the hookah users, 316 (89.3%) used the larger hookah, whereas 35 (9.9%) participants used the handheld type. When asked to select three most commonly used hookah flavors, 310 (87.6%) chose fruit flavors, 107 (30.2%) selected menthol mint flavor, and 100 (28.2%) chose candy flavors. On average, participants were confident in quitting hookah (M=8.48, SD=3.25); however, they reported low importance of quitting hookah on average (M=2.61, SD=3.41). When asked about how seriously they are thinking about quitting hookah, 261 (73.7%) said they are not thinking about quitting hookah use, and 58 (16.4%) said they want to quit using hookah in the next 30 days. Among past 4-month users, 93 (26.2%) reported attempting to quit use of hookah in the past 12 months.

Reasons for Hookah Use among Current Users

The reasons for hookah use among current users that we assessed are listed in Table 2. Two primary factors emerged: 1) instrumentality (e.g., doesn't smell badly, comes in appealing flavors; Cronbach's alpha=.89); and 2) social reasons (e.g., people who are important to me use hookah, I like the image it reflects; Cronbach's alpha=.81). The reason most highly rated on average was because it comes in appealing flavors (M=3.39, SD=1.91), followed by liking to experiment with the flavors (M=2.93, SD=1.97). The lowest rated reason was liking the image using hookah reflects (M=1.61, SD=1.30).

Bivariate analyses indicated that reasons for use did not differ by sex, race/ethnicity, sexual orientation, or type of school attended; current (past 30-day) use of cigarettes, LCCs, smokeless tobacco, or alcohol; or past 12-month hookah quit attempts. However, instrumentality scores were found to be higher among current e-cigarette (M=3.25, SD=1.61 vs. M=2.62, SD=1.51 in nonusers, p=.006) and marijuana users (M=2.99, SD=1.51 vs. M=2.59, SD=1.54 in

nonusers, p=.024). E-cigarette users also had higher social reasons scores (M=2.51, SD=1.38 vs. M=2.10, SD=1.23 in nonusers, p=.027). Importantly, greater likelihood of reporting readiness to quit using hookah in the next 30 days was associated with lower scores on both instrumentality (M=2.32, SD=1.41 vs. M=2.80, SD=1.55 in those not ready to quit, p=.030) and social reasons (M=1.83, SD=1.13 vs. M=2.23, SD=1.28 in those not ready to quit, p=.029).

Reasons for Potential Hookah Use among Never Users

The reasons for hookah use among never users that we assessed are listed in Table 3. Only one primary factor emerged (Cronbach's alpha=.80). The reason most highly rated on average was because it comes in appealing flavors (M=1.37, SD=1.00), followed by liking to socialize with other hookah users (M=1.29, SD=0.88). The lowest rated reason was the people in the media or other public figures use hookah. (M=1.32, SD=0.62).

Bivariate analyses indicated that reasons for potential use did not differ by sex, sexual orientation, or type of school attended; past 30-day use of cigarettes, LCCs or smokeless tobacco. However, scores in Whites were found to be higher that Blacks and Asians (M=1.93, SD=0.51 vs. M=1.41, SD=0.84 in Blacks and M=1.43, SD=0.75 in Asians, p<.001). Instrumentality scores were found to be higher among current alcohol (M=1.30, SD=0.67 vs. nonusers M=1.20, SD=0.56, p=.001) and marijuana users (M=1.47, SD=0.86 vs. M=1.25, SD=0.61 in nonusers, p=.002). E-cigarette users also had higher social reasons scores (M=1.46, SD=0.92 vs. M=1.25, SD=0.62 in nonusers, p=.048).

Reasons for Discontinued Hookah Use in Former Users

The reasons for discontinued hookah use among former hookah users that we assessed are listed in Table 4. Three primary factors emerged: 1) inconvenience (e.g., too messy/expensive, didn't like smell, flavor, buzz; Cronbach's alpha=.91); 2) anti-tobacco attitude

(e.g., quit tobacco/nicotine all together, it's unhealthy, Cronbach's alpha=.83); and 3) social reasons (e.g., didn't like the image it projected, someone asked me not to use; Cronbach's alpha=.83). The reason most highly rated on average was because they just didn't think about it (M=3.84, SD=2.15), followed by thinking it's unhealthy (M=3.64, SD=2.20). The lowest rated reasons were someone asked them not to use it (M=2.04, SD=1.81) and thinking it was weird or socially unacceptable (M=2.04, SD=1.71).

Bivariate analyses indicated that reasons for use did not differ by sex, race/ethnicity, sexual orientation, or type of school attended; current (past 30-day) use of cigarettes, LCCs, smokeless tobacco, or alcohol; or past 12-month hookah quit attempts. However, females had higher scores in relation to anti-tobacco attitudes or health concerns (M=3.72, SD=1.84 vs. M=3.18, SD=1.73 in males, p<.001), social reasons (M=2.61, SD=1.55 vs. M=2.27, SD=1.43 in males, p=.024), and inconvenience (M=2.48, SD=1.72 vs. M=2.24, SD=1.49 in males, p<.001).. Greater likelihood of discontinued use has been reported in heterosexuals (M=3.55, SD=1.81 vs M=3.bien, SD=1.75 in others, p=.440). Social reasons were found to be higher among current marijuana users vs. nonusers (M=2.24, SD=1.39 vs. M=2.54, SD=1.54 in nonusers, p=.021). Current LCC use also had higher anti-tobacco reasons (M=2.72, SD=1.38 vs. M=3.56, SD=1.82 in nonusers, p=.001) and social reasons (M=2.09, SD=1.31 vs. M=2.51, SD=1.52 in nonusers, p=.046). Current smokeless tobacco users also had higher anti-tobacco reasons (M=2.29, SD=1.22 vs. M=3.57, SD=1.82 in nonusers, p=.001) and social reasons (M=1.91, SD=1.71 vs. M=2.51, SD=1.52 in nonusers, p=.014). Current e-cigarette users also had higher anti-tobacco reasons (M=2.97, SD=1.58 vs. M=3.56, SD=1.83 in nonusers, p=.009). Current alcohol users also had higher anti-tobacco reasons (M=3.56, SD=1.77 vs. M=3.24, SD=1.94 in nonusers,

p=.014), and current binge drinkers scored higher on social reasons on average (M=2.34, SD=1.38 vs. M=2.61, SD=1.61 in nonusers, p=.006).

CHAPTER 5: DISCUSSION

The purpose of this study was to identify correlates of never, current, and former hookah use and to enhance our understanding of how young adults use hookah, as well as their reasons for use, potential use, or discontinued use. In our sample, 12.4% were current hookah users, and 31.3% were former hookah users. This is in congruence with other studies that mention increased popularity in using hookah among young adults (2, 9, 38, 52).

In terms of correlates of hookah use status, being older was associated with being a current or former hookah user, as found in other studies of hookah uses in young adulthood (23). Men were more likely than women to report current or former hookah use, consistent with other research (20, 22, 60). Nevertheless, there is a growing concern about hookah use among women globally, especially because majority of them are of reproductive age (22, 24). Evidence suggests that positive attributes associated with hookah smoking has encouraged women to use it and that the tobacco industry is targeting them to recruit new users and replace those who will quit or die prematurely from tobacco-related ailments (22). Current findings also show that there was no difference seen in its consumption according to sexual orientation. In terms of race/ethnicity, Blacks were more likely to be current or former hookah users compared to other races. Hookah use is common among racial/ethnic groups where it is a cultural pastime, like the Arab populations, but it is on the rise among other racial groups in the United States (74). Disparities

among hookah use require further study with particular attention to culture, race, and ethnicity, and consequently, tailor smoking interventions. Nearly 30% of public school and 20% of HBCU students were current hookah smokers, and 30% and 10% were former users, respectively. Finally, current use of any other tobacco product, marijuana, or alcohol was associated with increased odds of current or former hookah use, which aligns with prior findings (3, 75)

Regarding characteristics of hookah use, the majority of the participants consumed the larger floor/table top, at a bar most frequently. Findings from this study are consistent with the literature indicating that people predominantly prefer using hookah in a social setting, as it is a shared communal experience (15) and that hookah cafes and bars are becoming popular places to socialize (48).

Many current hookah smokers also mentioned of not thinking about quitting hookah, as they found it to be of low importance. This could be because some believe using tobacco in a waterpipe is seemingly healthier, less addictive (17) than cigarettes, and believe they could quit anytime (12). The majority of respondents used characterizing flavored tobacco products out of which fruit flavor was dominant. Their cartons are often packaged with fruit displays, making it seem as a healthy option for hookah consumers (23), along with advertisements that have made flavored tobacco products popular.

Overall, current hookah user responses reflected consistency with previous research on reasons for hookah use (19, 21, 23, 53), highlighting that instrumentality (e.g., doesn't smell badly, comes in appealing flavors) as the most significant reason, followed by social reasons (e.g., people who are important to me use hookah, I like the image it reflects). The availability of various flavors along with experimenting with them was a primary reason for hookah use among current users. Never users mentioned the appeal of different flavors along with socializing with

hookah users as their main reasons for potential use. Social reasons have been explained in past research as hookah smokers have a strong peer influence in initiation and imitation of the behavior (27, 58), and students who smoke hookah have greater number of friends who approve of hookah compared to never users (27). Additionally, it is an affordable way to socialize (24, 48), and appears cool and trendy (16, 39, 52).

Discontinued or former hookah users mentioned inconvenience of mess, cost, smell, flavor, or buzz and anti-tobacco attitudes like they quit tobacco and nicotine all together, and found it unhealthy. Another emergent reason to discontinue smoking was social reasons – people didn't like the image it projected or were influenced by someone askeing them not to use it. This finding is congruent with past research, when family and friend's disapproval is a reason to stop smoking, and form the majority of waterpipe smokers interested in quitting (72, 73).

Findings from this study have implications for future research and practice. In terms of research, studies should focus on ways to effectively deliver messages to correct misperceptions about hookah, taking into account the acute/immediate and chronic/delayed consequences of using these products. There is a need to assess the impact of availability of various tobacco flavors within this population as well as its role in hookah experimentation and progression to established use over time. Regarding practice, the findings of this study have implications for FDA regulations regarding hookah use. Since majority of the participants liked the variety of tobacco flavors for hookah, flavor bans similar to those implemented for cigarettes under the Family Smoking Prevention and Tobacco Control Act may reduce the appeal of these products for them. Increasing minimum pack sizes as well its cost could potentially reduce its appeal for young adults, who may have less spending money than adults. University and college campuses health promotion initiatives should seek to promote positive health behaviors, and anti-hookah

smoking initiatives. Examples of policy implications for the reduction of hookah smoking among the young adult population could include: raising hookah bar age limits, restrictions for indoor smoking, and limiting the density of hookah cafes surrounding areas with college campuses.

Limitations

Limitations to this study include limited generalizability of the findings due to its recruitment from colleges and universities in the Southeast region of the United States. Additionally, given the self-report nature of the assessments, findings are subject to bias. Finally, it is possible that we failed to tap some dimensions of reasons for hookah use, potential use, and discontinued use; further research is needed to ensure exhaustive assessments of such dimensions.

Conclusions

The results from this study illustrate the widespread use of hookah among young adults. In particular, some young adults (those who are older, male, and Black) are at increased risk for hookah use. Moreover, young adults using other tobacco products, marijuana, or alcohol are more likely to use hookah. Among current users, there was low motivation to quit use. We also documented reasons for using hookah among the current users and potential reasons for use among never users. Instrumentality and social reasons were the main factors for using hookah, mainly it does not smell bad, they enjoy experimenting with the variety of flavors, people close to them smoke hookah and because of the image it reflects. Particularly novel, we documented reasons for discontinued use among former hookah users. Discontinued or former users quit hookah use because they quit tobacco and nicotine all together, find it unhealthy or expensive and due to inconvenience of mess, smell, taste, or buzz. The variety of appealing flavors and socializing motivated the never users to potentially use hookah.

FUNDING

This research was supported by the National Cancer Institute (1R01CA179422-01; PI: Berg). The funders had no role in the study design, collection, analysis, or interpretation of the data, writing the manuscript, or the decision to submit the paper for publication.

DECLARATION OF INTERESTS

The authors declare no conflicts of interest.

ACKNOWLEDGMENTS

We would like to thank our Campus Advisory Board members across the state of Georgia in developing and assisting in administering this survey. We also would like to thank ICF Macro for their scientific input and technical support in conducting this research.

REFERENCES

1. U.S. Department of Health and Human Services. The Health Consequences of Smoking: 50 Years of Progress. 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, 2014. Printed with corrections, January 2014.
2. Nelson, R. (2015). Hookah smoking seduces US young adults. *Lancet Respir Med*, *3*(4), 277. doi:10.1016/s2213-2600(15)00117-4
3. Brockman, L. N., Pumper, M. A., Christakis, D. A., & Moreno, M. A. (2012). Hookah's new popularity among US college students: a pilot study of the characteristics of hookah smokers and their Facebook displays. *BMJ Open*, *2*(6). doi:10.1136/bmjopen-2012-001709
4. Eissenberg, T., &Shihadeh, A. (2009). Waterpipe Tobacco and Cigarette Smoking Direct Comparison of Toxicant Exposure. American Journal of Preventive Medicine, 37(6), 518–523. http://doi.org/10.1016/j.amepre.2009.07.014
5. Arrazola RA, Singh T, Corey CG, et al. Tobacco use among middle and high school students - United State, 2011–2014. MMWR Morb Mortal Wkly Rep. 2015;64(14):381–385. www.cdc.gov/mmwr/preview/mmwrhtml/mm6414a3.htm?s_cid=mm6414a3_w
6. Berg, C. J., Stratton, E., Schauer, G. L., Lewis, M., Wang, Y., Windle, M., & Kegler, M. (2015). Perceived harm, addictiveness, and social acceptability of tobacco products and marijuana among young adults: marijuana, hookah, and electronic cigarettes win. *Substance Use and Misuse*, *50*(1), 79-89. doi:10.3109/10826084.2014.958857

7. Schubert J, Hahn J, Dettbarn G, Seidel A, Luch A, Schulz TG. Mainstream smoke of the waterpipe: Does this environmental matrix reveal as significant source of toxic compounds? Toxicol Lett. 2011; 205:279–84. [PubMed: 21712083]
8. Jacob, P., 3rd, Abu Raddaha, A. H., Dempsey, D., Havel, C., Peng, M., Yu, L., &Benowitz, N. L. (2011). Nicotine, carbon monoxide, and carcinogen exposure after a single use of a water pipe. *Cancer Epidemiology, Biomarkers and Prevention, 20*(11), 2345-2353. doi: 10.1158/1055-9965.epi-11-0545
9. Wiseman, K. D., Cornacchione, J., Wagoner, K. G., Noar, S. M., Moracco, K. E., Teal, R., . . . Sutfin, E. L. (2016). Adolescents' and Young Adults' Knowledge and Beliefs About Constituents in Novel Tobacco Products. *Nicotine Tob Res*. doi:10.1093/ntr/ntw009
10. Centers for Disease Control and Prevention (CDC). Annual smoking-attributable mortality, years of potential life lost, and productivity losses—United States, 1997–2001. Morbidity and Mortality Weekly Report. 2005a; 54:625–628. [PubMed: 15988406]
11. Primack, B. A., Sidani, J., Agarwal, A. A., Shadel, W. G., Donny, E. C., &Eissenberg, T. E. (2008). Prevalence of and Associations with Waterpipe Tobacco Smoking among U.S. University Students. *Annals of Behavioral Medicine: A Publication of the Society of Behavioral Medicine*, *36*(1), 81–86. http://doi.org/10.1007/s12160-008-9047-6
12. Smith-Simone, S., Maziak, W., Ward, K. D., &Eissenberg, T. (2008). Waterpipe tobacco smoking: Knowledge, attitudes, beliefs, and behavior in two U.S. samples. *Nicotine & Tobacco Research: Official Journal of the Society for Research on Nicotine and Tobacco*, *10*(2), 393–398. http://doi.org/10.1080/14622200701825023

13. Berg CJ, Haardörfer R, Lewis M, et al. (2016) DECOY: Documenting Experiences with Cigarettes and Other Tobacco in Young Adults. *American Journal of Health Behavior* 40: 310-321.
14. Biener, L., & Abrams, D. B. (1991). The Contemplation Ladder: Validation of a measure of readiness to consider smoking cessation. Health Psychology, 10(5), 360-365. doi:10.1037//0278-6133.10.5.360
15. Calvanese, A. V., Bingham, M. V., Martinasek, M. P., & Friesen, B. K. (2015). Understanding Attitudes, Beliefs, and Information Seeking Regarding Hookah Smoking in Parents of College Students: An Exploratory Qualitative Pilot Study. Respiratory Care, 60(7), 959-966. doi:10.4187/respcare.03726
16. Wong, L., Alias, H., Aghamohammadi, N., Aghazadeh, S., & Hoe, V. (2016). Shisha smoking practices, use reasons, attitudes, health effects and intentions to quit among Shisha smokers in Malaysia. International Journal of Environmental Research and Public Health, 13(7), 726. doi:10.3390/ijerph13070726
17. Jennifer Cornacchione, Kimberly G. Wagoner, Kimberly D. Wiseman, Dannielle Kelley, Seth M. Noar, Margaret H. Smith & Erin L. Sutfin (2016) Adolescent and Young Adult Perceptions of Hookah and Little Cigars/Cigarillos: Implications for Risk Messages, Journal of Health Communication, 21:7, 818-825, DOI: 0.1080/10810730.2016.1177141
18. Jawad, M., Bakir, A., Ali, M., & Grant, A. (2015). Impact of Waterpipe tobacco pack health warnings on Waterpipe smoking attitudes: A qualitative analysis among regular users in London. *BioMed Research International, 2015*, 1–6. doi:10.1155/2015/745865
19. Hammal, F., Wild, T. C., &Finegan, B. A. (2015). Knowledge about the Waterpipe (Hookah), a qualitative assessment among community workers in a Major Urban center

in Canada. *Journal of Community Health, 41*(4), 689–696. doi:10.1007/s10900-015-0143-9

20. Rahman, S., Chang, L., Hadgu, S., Salinas-Miranda, A. and Corvin, J. (2014). Prevalence, Knowledge, and Practices of Hookah Smoking Among University Students, Florida, 2012. Preventing Chronic Disease, 11.
21. Nakkash, R. T., Khalil, J., & Afifi, R. A. (2011). The rise in narghile (shisha, hookah) waterpipe tobacco smoking: A qualitative study of perceptions of smokers and non smokers. *BMC Public Health, 11*(1), 315. doi:10.1186/1471-2458-11-315
22. World Health Organization (2013). WHO calls for protection of women and girls from tobacco. http://www.who.int/mediacentre/news/releases/2010/women_tobacco_20100528/en/
23. Martinasek, M., McDermott, R., & Martini, L. (2011). Waterpipe (Hookah) Tobacco Smoking Among Youth. Current Problems In Pediatric And Adolescent Health Care, 41(2), 34-57. http://dx.doi.org/10.1016/j.cppeds.2010.10.001
24. Baheiraei, A., ShahbaziSighaldeh, S., Ebadi, A., Kelishadi, R., &Majdzadeh, R. (2015). The Role of Family on Hookah Smoking Initiation in Women: A Qualitative Study. Global Journal Of Health Science, 7(5). http://dx.doi.org/10.5539/gjhs.v7n5p1
25. Borland, R., Owen, N., Hill, D., & Schofield, P. (1991). Predicting attempts and sustained cessation of smoking after the introduction of workplace smoking bans. Health Psychology, 10(5), 336-342. doi:10.1037/0278-6133.10.5.336
26. Kerr, S., Lawrence, M., Middleton, A. R., Fitzsimmons, L., &Darbyshire, C. (2016). Tobacco and Alcohol Use in People With Mild/Moderate Intellectual Disabilities: Giving

Voice to Their Health Promotion Needs. Journal of Applied Research in Intellectual Disabilities. doi:10.1111/jar.12255

27. Noland, M., Ickes, M. J., Rayens, M. K., Butler, K., Wiggins, A. T., & Hahn, E. J. (2016). Social influences on use of cigarettes, e-cigarettes, and hookah by college students. Journal of American College Health, 64(4), 319-328. doi:10.1080/07448481.2016.1138478

28. Maziak, W., Taleb, Z. B., Bahelah, R., Islam, F., Jaber, R., Auf, R., &Salloum, R. G. (2015). The global epidemiology of waterpipe smoking. *Tobacco Control*, *24*(Suppl 1), i3–i12. http://doi.org/10.1136/tobaccocontrol-2014-051903

29.Maziak, W. (2013). The waterpipe: An emerging global risk for cancer. Cancer Epidemiology, 37(1), 1-4. http://dx.doi.org/10.1016/j.canep.2012.10.013

30. Primack, B. A., Shensa, A., Kim, K. H., Carroll, M. V., Hoban, M. T., Leino, E. V., … Fine, M. J. (2013). Waterpipe Smoking Among U.S. University Students. *Nicotine & Tobacco Research*, *15*(1), 29–35. http://doi.org/10.1093/ntr/nts076

31. Warren CW, Lea V, Lee J, Jones NR, Asma S, McKenna M. Change in tobacco use among 13–15 year olds between 1999 and 2008: findings from the Global Youth Tobacco Survey. Glob Health Promot. 2009; 16(Suppl 2):38–90. [PubMed: 19770234]

32. CDC - Fact Sheet - Secondhand Smoke - Smoking & Tobacco Use. (2017). Smoking and Tobacco Use. Retrieved 16 April 2017, from https://www.cdc.gov/tobacco/data_statistics/fact_sheets/secondhand_smoke/general_facts/ts/

33. Elsayed, Y., Dalibalta, S., & Abu-Farha, N. (2016). Chemical analysis and potential health risks of hookah charcoal. Science Of The Total Environment, 569-570, 262-268. http://dx.doi.org/10.1016/j.scitotenv.2016.06.108

34. Sepetdjian, E., Saliba, N., Shihadeh, A., 2010. Carcinogenic PAH in waterpipe charcoal products. Food Chem. Toxicol. 48 (11), 3242–3245. http://dx.doi.org/10.1016/j.fct.2010.08.033.

35. Bahelah, R., DiFranza, J., Fouad, F., Ward, K., Eissenberg, T., &Maziak, W. (2016). Early symptoms of nicotine dependence among adolescent waterpipe smokers. Tobacco Control, 25(e2), e127-e134. http://dx.doi.org/10.1136/tobaccocontrol-2015-052809

36. Roskin, J., & Aveyard, P. (2009). Canadian and English students' beliefs about waterpipe smoking: a qualitative study. BMC Public Health, 9(1). http://dx.doi.org/10.1186/1471-2458-9-10

37. Salloum RG, Osman A, Maziak W, Thrasher JF. How popular is waterpipe tobacco smoking? Findings from internet search queries. Tobacco control. 2015;24(5):509-513. doi:10.1136/tobaccocontrol-2014-051675.

38. Castañeda, G., Barnett, T., Soule, E., & Young, M. (2016). Hookah smoking behavior initiation in the context of Millennials. Public Health, 137, 124-130. http://dx.doi.org/10.1016/j.puhe.2016.02.013

39. Hammal, F., Wild, T., Nykiforuk, C., Abdullahi, K., Mussie, D., &Finegan, B. (2015). Waterpipe (Hookah) Smoking Among Youth and Women in Canada is New, not Traditional: Table 1. Nicotine & Tobacco Research, 18(5), 757-762. http://dx.doi.org/10.1093/ntr/ntv152

40. Sterling, K. L., Fryer, C. S., Majeed, B., & Duong, M. M. (2014). Promotion of waterpipe tobacco use, its variants and accessories in young adult newspapers: a content analysis of message portrayal. Health Education Research, 30(1), 152-161. doi:10.1093/her/cyu035

41. Ajzen, I. (1991). The theory of planned behavior. Organizational Behavior And Human Decision Processes, 50(2), 179-211. http://dx.doi.org/10.1016/0749-5978(91)90020-t

42. Locke, E., & Bandura, A. (1987). Social Foundations of Thought and Action: A Social-Cognitive View. The Academy Of Management Review, 12(1), 169. http://dx.doi.org/10.2307/258004

43. Tobacco Product Use Among Adults — United States, 2012–2013. (2017). Cdc.gov. Retrieved 16 March 2017, from https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6325a3.htm

44. Sutfin, E. L., Mccoy, T. P., Reboussin, B. A., Wagoner, K. G., Spangler, J., & Wolfson, M. (2011). Prevalence and correlates of waterpipe tobacco smoking by college students in North Carolina. Drug and Alcohol Dependence, 115(1-2), 131-136. doi: 10.1016/j.drugalcdep.2011.01.018

45. Salloum, R. G., Thrasher, J. F., Kates, F. R., &Maziak, W. (2015). Waterpipe Tobacco Smoking in the United States: Findings from the National Adult Tobacco Survey. Preventive Medicine, 71, 88–93. http://doi.org/10.1016/j.ypmed.2014.12.012

46. Kates, F., Salloum, R., Thrasher, J., Islam, F., Fleischer, N., &Maziak, W. (2016). Geographic Proximity of Waterpipe Smoking Establishments to Colleges in the U.S. American Journal Of Preventive Medicine, 50(1), e9-e14. http://dx.doi.org/10.1016/j.amepre.2015.07.006

47. Fielder, R. L., Carey, K. B., & Carey, M. P. (2013). Hookah, Cigarette, and Marijuana Use: A Prospective Study of Smoking Behaviors among First-Year College Women. Addictive Behaviors, 38(11), 2729–2735. http://doi.org/10.1016/j.addbeh.2013.07.006

48. Gilreath, T. D., Leventhal, A., Barrington-Trimis, J. L., Unger, J. B., Cruz, T. B., Berhane, K., … McConnell, R. (2016). Patterns of Alternative Tobacco Product Use: Emergence of Hookah and E-cigarettes as Preferred Products Amongst Youth. *The Journal of Adolescent Health: Official Publication of the Society for Adolescent Medicine*, *58*(2), 181–185. http://doi.org/10.1016/j.jadohealth.2015.10.001

49. Kates, F. R., Salloum, R. G., Thrasher, J. F., Islam, F., Fleischer, N. L., &Maziak, W. (2016). Geographic Proximity of Waterpipe Smoking Establishments to Colleges in the U.S. *American Journal of Preventive Medicine*, *50*(1), e9–e14. http://doi.org/10.1016/j.amepre.2015.07.006

50. Salvi, S. (2016). The Perils of Waterpipe or Hookah Smoking: Time for Action. American Journal Of Respiratory And Critical Care Medicine, 194(5), 532-534. http://dx.doi.org/10.1164/rccm.201605-0940ed

51. SOWEID, R. (2005). News analysis. Lebanon: water pipe line to youth. Retrieved from http://www.tobaccocontrol.com. *Tobacco Control*, *14*(6), 363–364.

52. Barnett, T., Lorenzo, F. and Soule, E. (2016). Hookah Smoking Outcome Expectations Among Young Adults. *Substance Use & Misuse*, 52(1), pp.63-70.

53. Villanti, A., Johnson, A., Ambrose, B., Cummings, K., Stanton, C., Rose, S., Feirman, S., Tworek, C., Glasser, A., Pearson, J., Cohn, A., Conway, K., Niaura, R., Bansal-Travers, M. and Hyland, A. (2017). Flavored Tobacco Product Use in Youth and

Adults: Findings From the First Wave of the PATH Study (2013–2014). *American Journal of Preventive Medicine*.

54. Jawad, M. and McIver, C. (2017). Waterpipe tobacco smoking prevalence and illegal underage use in waterpipe-serving premises: a cross-sectional analysis among schoolchildren in Stoke-on-Trent. Public Health, 146, pp.32-38.
55. Salloum, R. G., Osman, A., Maziak, W., & Thrasher, J. F. (2015). How popular is waterpipe tobacco smoking? Findings from internet search queries. Tobacco Control, 24(5), 509–513. http://doi.org/10.1136/tobaccocontrol-2014-051675
56. Sterling, K. L., Fryer, C. S., Majeed, B., & Duong, M. M. (2015). Promotion of waterpipe tobacco use, its variants and accessories in young adult newspapers: a content analysis of message portrayal. Health Education Research, 30(1), 152–161. http://doi.org/10.1093/her/cyu035
57. Primack, B. A., Rice, K. R., Shensa, A. S., Carroll, M. V., DePenna, E. J., Nakkash, R., & Barnett, T. (2012). U.S. Hookah Tobacco Smoking Establishments Advertised on the Internet. American Journal of Preventive Medicine, 42(2), 150–156. http://doi.org/10.1016/j.amepre.2011.10.013
58. Akl, E. A., Ward, K. D., Bteddini, D., Khaliel, R., Alexander, A. C., Lotfi, T., … Afifi, R. A. (2015). The allure of the waterpipe: a narrative review of factors affecting the epidemic rise in waterpipe smoking among young persons globally. Tobacco Control, 24(Suppl 1), i13–i21. http://doi.org/10.1136/tobaccocontrol-2014-051906
59. M. Jawad, “Legislation enforcement of the waterpipe tobacco industry: a qualitative analysis of the london experience,” Nicotine & Tobacco Research, vol. 16, no. 7, pp. 1000–1008, 2014.

60. Wagoner, K., Cornacchione, J., Wiseman, K., Teal, R., Moracco, K. and Sutfin, E. (2016). E-cigarettes, Hookah Pens and Vapes: Adolescent and Young Adult Perceptions of Electronic Nicotine Delivery Systems: Table 1. Nicotine & Tobacco Research, 18(10), pp.2006-2012.

61. Hackshaw, A., Rodeck, C., & Boniface, S. (2011). Maternal smoking in pregnancy and birth defects: a systematic review based on 173 687 malformed cases and 11.7 million controls. Human Reproduction Update, 17(5), 589–604. http://doi.org/10.1093/humupd/dmr022

62. Blachman-Braun, R., Mazo-Rodríguez, R. L., López-Sámano, G., &Buendía-Roldán, I. (2014). Hookah, is it really harmless? Respiratory Medicine, 108(5), 661-667. doi: 10.1016/j.rmed.2014.01.013

63. Sepetdjian, E., Saliba, N., &Shihadeh, A. (2010). Carcinogenic PAH in waterpipe charcoal products. Food and Chemical Toxicology : An International Journal Published for the British Industrial Biological Research Association, 48(11), 3242–3245. http://doi.org/10.1016/j.fct.2010.08.033

64. Akl, E., Gaddam, S., Gunukula, S., Honeine, R., Jaoude, P., &Irani, J. (2010). The effects of waterpipe tobacco smoking on health outcomes: a systematic review. International Journal Of Epidemiology, 39(3), 834-857. http://dx.doi.org/10.1093/ije/dyq002

65. Kim, K., Kabir, E., & Jahan, S. (2016). Waterpipe tobacco smoking and its human health impacts. Journal Of Hazardous Materials, 317, 229-236. http://dx.doi.org/10.1016/j.jhazmat.2016.05.075

66. Klein, E. G., Berman, M., Hemmerich, N., Carlson, C., Htut, S., & Slater, M. (2016). Online E-cigarette Marketing Claims: A Systematic Content and Legal Analysis. Tobacco Regulatory Science, 2(3), 252–262. http://doi.org/10.18001/TRS.2.3.5

67. Berg, C. J., Haardoerfer, R., Escoffery, C., Zheng, P., & Kegler, M. (2015). Cigarette Users' Interest in Using or Switching to Electronic Nicotine Delivery Systems for Smokeless Tobacco for Harm Reduction, Cessation, or Novelty: A Cross-Sectional Survey of US Adults. Nicotine & Tobacco Research, 17(2), 245–255. http://doi.org/10.1093/ntr/ntu103

68. Notes from the Field: Calls to Poison Centers for Exposures to Electronic Cigarettes — United States, September 2010–February 2014. (2017). Cdc.gov. Retrieved 16 April 2017, from https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6313a4.htm

69. Dube, S. R., Pathak, S., Nyman, A. L., & Eriksen, M. P. (2015). Electronic Cigarette and Electronic Hookah: A Pilot Study Comparing Two Vaping Products. Preventive Medicine Reports, 2, 953–958. http://doi.org/10.1016/j.pmedr.2015.10.012

70. Bohon, L., Cotter, K., Kravitz, R., Cello, P. and Fernandez y Garcia, E. (2016). The Theory of Planned Behavior as it predicts potential intention to seek mental health services for depression among college students. Journal of American College Health, 64(8), pp.593-603.

71. CDC - Fact Sheet - Fast Facts - Smoking & Tobacco Use. (2017). Smoking and Tobacco Use. Retrieved 1 May 2017, from https://www.cdc.gov/tobacco/data_statistics/fact_sheets/fast_facts/

72. Ward, K., Hammal, F., VanderWeg, M., Eissenberg, T., Asfar, T., Rastam, S., &Maziak, W. (2005). Are waterpipe users interested in quitting?. Nicotine & Tobacco Research, 7(1), 149-156. http://dx.doi.org/10.1080/14622200412331328402

73. Borgan, S., Marhoon, Z., &Whitford, D. (2013). Beliefs and Perceptions Toward Quitting Waterpipe Smoking Among Cafe Waterpipe Tobacco Smokers in Bahrain. Nicotine & Tobacco Research, 15(11), 1816-1821. http://dx.doi.org/10.1093/ntr/ntt064

74. Jamil, H., Elsouhag, D., Hiller, S., Arnetz, J., & Arnetz, B. (2010). Sociodemographic risk indicators of hookah smoking among White Americans: A pilot study. Nicotine & Tobacco Research, 12(5), 525-529. http://dx.doi.org/10.1093/ntr/ntq026

75. Villanti, A., Cobb, C., Cohn, A., Williams, V. and Rath, J. (2015). Correlates of Hookah Use and Predictors of Hookah Trial in U.S. Young Adults. American Journal of Preventive Medicine, 48(6), pp.742-746.

Table 1. Participant characteristics and bivariate analyses examining differences between hookah never users, past 4-month users, and former users (lifetime users, but not in past 4 months)

	Total sample M (SD) or N (%) N=2865	Never users M (SD) or N (%) N=1614	Past 4-month users M (SD) or N (%) N=354	Former users M (SD) or N (%) N=897	p
Sociodemographics					
Age (SD)	20.53 (1.93)	20.31 (1.89)	20.43 (1.77)	20.97 (2.00)	<.001
Sex (%)					.034
Female	1846 (64.4)	1073 (66.5)	219 (61.9)	554 (61.8)	
Male	1019 (35.6)	541 (33.5)	135 (38.1)	343 (38.2)	
Sexual Orientation (%)					.383
Heterosexual	2607 (91.0)	1479 (91.6)	318 (89.8)	810 (90.3)	
Other	258 (9.0)	135 (8.4)	36 (10.2)	87 (9.7)	
Race (%)					<.001
White	1823 (63.6)	1091 (67.6)	170 (48.0)	562 (62.7)	
Black	645 (22.5)	319 (19.8)	121 (34.2)	205 (22.9)	
Asian	192 (6.7)	107 (6.6)	31 (8.8)	54 (6.0)	
Other	205 (7.2)	97 (6.0)	32 (9.0)	76 (8.5)	
Hispanic (%)	218 (7.6)	111 (6.9)	34 (9.6)	73 (8.1)	.166
Type of School (%)					<.001
Public	804 (28.1)	429 (26.6)	120 (33.9)	255 (28.4)	
Private	1224 (42.7)	711 (44.1)	142 (40.1)	371 (41.4)	
Technical college	516 (18.0)	326 (20.2)	29 (8.2)	161 (17.9)	
HBCU	321 (11.2)	148 (9.2)	63 (17.8)	110 (12.3)	
Current Other Tobacco Use					
Cigarettes	334 (11.7)	78 (4.8)	90 (25.4)	166 (18.5)	<.001
Smokeless tobacco	81 (2.8)	13 (0.8)	27 (7.6)	41 (4.6)	<.001
E-cigarettes	158 (5.5)	35 (2.2)	53 (15.0)	70 (7.8)	<.001
LCC	156 (5.4)	33 (2.0)	69 (19.4)	54 (6.0)	<.001
Current Other Substance Use					
Marijuana	357 (12.5)	74 (4.6)	111 (31.4)	172 (12.5)	<.001
Alcohol	1844 (64.4)	865 (53.6)	287 (81.1)	692 (77.1)	<.001
Binge drinking	891 (31.1)	295 (18.3)	179 (50.6)	417 (46.5)	<.001

Table 2. Reasons for use of hookah among past 4-month hookah users

	Instrumentality	Social	M (SD)
Hookah doesn't smell badly.	**.83**	.45	2.59 (1.81)
Hookah comes in appealing flavors.	**.91**	.48	3.39 (1.91)
I like experimenting with the various flavors.	**.90**	.53	2.93 (1.97)
I like the buzz I get from nicotine but do not like regular cigarettes.	**.70**	.57	2.15 (1.73)
Hookah helps me relax.	**.78**	.65	2.53 (1.81)
People who are important to me use hookah.	.52	**.78**	2.06 (1.57)
I use hookah because I think they are cool or intriguing.	.57	**.81**	2.16 (1.59)
I like socializing with other hookah users.	.58	**.72**	2.82 (1.81)
I like the image of me it reflects.	.37	**.86**	1.61 (1.30)
Cronbach's alpha	.89	.81	--

Note: On a scale of 1 = not at all true for me to 6 = extremely true for me.
Extraction Method: Principal Component Analysis. Rotation Method: Promax with Kaiser Normalization.

Table 3. Reasons for potential use of hookah among never users of hookah

	Factor	M (SD)
Hookah doesn't smell badly.	.73	1.19 (0.70)
Hookah comes in appealing flavors.	.82	1.37 (1.00)
I like the buzz I get from nicotine but do not like regular cigarettes.	.73	1.11 (0.55)
I would like socializing with other hookah users.	.82	1.29 (0.88)
People in the media or other public figures use hookah.	.65	1.32 (0.98)
Cronbach's alpha	.80	--

Note: On a scale of 1 = not at all true for me to 6 = extremely true for me.
Extraction Method: Principal Component Analysis. 1 component extracted.

Table 4. Reasons for discontinued use of hookah among former users of hookah

	Inconvenience	Anti-tobacco	Social	M (SD)
I didn't like the buzz.	**.85**	.55	.42	2.57 (2.01)
I didn't like the flavor.	**.91**	.48	.46	2.29 (1.90)
It was messy.	**.86**	.42	.53	2.26 (1.86)
It was too expensive.	**.78**	.44	.54	2.55 (1.92)
I didn't like the smell.	**.89**	.50	.56	2.28 (1.86)
I just don't think about it.	.39	**.62**	.31	3.84 (2.15)
I quit tobacco/nicotine all together.	.42	**.83**	.51	3.11 (2.30)
I don't like the idea of using any kind of nicotine or tobacco.	.49	**.89**	.56	3.46 (2.30)
I think it's unhealthy.	.50	**.86**	.56	3.64 (2.20)
My friends don't use tobacco.	.45	.65	**.76**	2.66 (2.03)
Someone important to me asked me not to use it.	.41	.33	**.77**	2.04 (1.81)
It hasn't come up in social situations.	.30	.52	**.69**	3.06 (2.13)
I think it is weird or socially unacceptable.	.64	.47	**.84**	2.04 (1.71)
I didn't like the image it projected about me.	.60	.60	**.78**	2.61 (2.07)
Cronbach's alpha	.91	.83	.83	--

Note: On a scale of 1 = not at all true for me to 6 = extremely true for me.
Extraction Method: Principal Component Analysis. Rotation Method: Promax with Kaiser Normalization.