



Published in final edited form as:

*Am J Health Behav.* 2013 July ; 37(4): 433–439. doi:10.5993/AJHB.37.4.1.

## The Predictive Utility of Attitudes toward Hookah Tobacco Smoking

Tracey E. Barnett, PhD<sup>a</sup>, Ariel Shensa, MA<sup>b</sup>, Kevin H. Kim, PhD<sup>c</sup>, Robert L. Cook, MD, MPH<sup>d</sup>, Erin Nuzzo, BS<sup>b</sup>, and Brian A. Primack, MD, PhD<sup>b,e</sup>

<sup>a</sup>Department of Behavioral Science and Community Health, College of Public Health and Health Professions, University of Florida, Gainesville, FL, USA

<sup>b</sup>Division of General Internal Medicine, Department of Medicine, University of Pittsburgh School of Medicine, Pittsburgh, PA, USA

<sup>c</sup>Department of Psychology, University of Pittsburgh, Pittsburgh, PA, USA

<sup>d</sup>Department of Epidemiology, College of Public Health and Health Professions, University of Florida, Gainesville, FL, USA

<sup>e</sup>Division of Adolescent Medicine, Department of Pediatrics, University of Pittsburgh School of Medicine, Pittsburgh, PA, USA

### Abstract

**Objective**—To determine associations between positive and negative attitudes and hookah tobacco smoking (HTS) outcomes among college students.

**Methods**—Among a random sample of University of Florida students (N=852), multivariable logistic regression models assessed independent associations between positive and negative attitudes toward HTS.

**Results**—Positive attitudes were associated with adjusted odds of 4.32 (95% CI=3.20, 5.82) for current HTS, while negative attitudes were associated with lower adjusted odds for current smoking HTS (AOR=0.64, 95% CI=0.53, 0.76). Positive attitudes were also associated with adjusted odds of 9.31 (95% CI=6.77, 12.80) for intention for future hookah use.

**Conclusion**—Positive attitudes toward HTS were more strongly associated with HTS outcomes compared to negative attitudes. It may be particularly valuable for future research and interventions to focus on decreasing positive attitudes towards HTS.

### Keywords

Hookah; Waterpipe; Tobacco; Attitude; Intention; University

### Introduction

A hookah (also known as a waterpipe or narghile) is an apparatus increasingly used among adolescents and young adults in the United States to smoke tobacco. Samples of college students indicate 20–40% ever use and 5–20% current (past 30 day) use.<sup>1–4</sup> Moreover, while cigarette smoking often decreases during the course of college,<sup>5</sup> hookah tobacco smoking (HTS) may actually increase during the same time period.<sup>6</sup> HTS is also increasing among

\*Corresponding Author: Brian A. Primack, MD, PhD, 230 McKee Place #600, Pittsburgh, PA 15213, 412-586-9789, bprimack@pitt.edu.

secondary school students (i.e., ages 12–18). Barnett and colleagues<sup>7</sup> reported that 17% of a state-wide sample of Florida adolescents had ever smoked tobacco from a hookah. Similar results among secondary school students have been reported by Primack et al<sup>8</sup> in Arizona and Smith et al<sup>9</sup> in California.

While hookah smokers perceive HTS as having a low potential for harm and addictiveness,<sup>3,10</sup> studies suggest that it exposes the user to high levels of exposure to toxins and carcinogens. In fact, the World Health Organization<sup>11</sup> reports that one HTS session exposes the user to about 100 times the smoke volume of a single cigarette. Other research suggests that, compared with a single cigarette, one hookah session contains substantially more tar, nicotine, carbon monoxide,<sup>12</sup> and heavy metals.<sup>13–15</sup>

Many individuals who smoke tobacco from a hookah may have otherwise been nicotine naïve. Between 30 and 50% of college-aged hookah tobacco smokers do not use cigarettes.<sup>10,16–17</sup> Although the precise nature of the relationship between cigarette and HTS remains unknown, it is possible that those who find HTS to be pleasant and social may eventually try cigarettes as well. Moreover, because hookah tobacco smoke contains nicotine and is thus potentially addictive, it also may lead to increase use of cigarettes or other tobacco products.

This study was based on the Theory of Reasoned Action<sup>18</sup> which proposes that behaviors are predicted by attitudes and normative beliefs towards the behavior. An important concept in this conceptual model is that attitudes lead to intention to perform a behavior, which then results in the actual behavior. Previous hookah research has supported this conceptual model as applicable to youth hookah use. For instance, one reason for the increase in popularity in HTS, even among populations that do not otherwise use tobacco, may be due to *lack* of negative attitudes toward the practice. Primack et al<sup>3</sup> surveyed a random sample of 647 college students and found that, in fully adjusted multivariable models, 1-year waterpipe smoking was associated with low perceived harm (OR=2.54, 95% CI=1.68, 3.83) and low perceived addictiveness (OR=4.64, 95% CI=3.03, 7.10). This suggested that effective health programs increasing negative attitudes toward HTS may be valuable. These results were consistent with what would be expected according to the theory of reasoned action, often employed when describing youth tobacco use, which predicts that more positive attitudes toward and normative beliefs regarding a behavior increase likelihood of intending to perform, and ultimately performing, a given behavior.<sup>18</sup>

However, less is known about the *positive* attitudes toward the practice of HTS among young adults. This represents an important gap in the literature because positive perceptions and attitudes have been found to be more influential than negative with regard to other substances.<sup>19</sup> For example, cigarette smoking has been associated with endorsement of positive statements about tobacco use (such as “smoking is cool” or “smoking makes people look sexy”) compared with negative (such as “smoking is bad for you” or smoking is harmful”). Barnett et al<sup>7</sup> showed that positive attitudes for smoking cigarettes (such as feeling relaxed) predicting a higher likelihood of hookah tobacco use. To our knowledge, however, no study to date examined the association between positive and negative attitudes toward HTS.

Therefore, the purpose of this study was to assess various positive and negative attitudes toward HTS in the same cohort of individuals. We hoped to gain information that may help guide educational interventions to most effectively reduce HTS among college students.

## Methods

### Participants and Procedures

We obtained from the registrar of the University of Florida a random sample of 2400 email addresses for first- and second-year undergraduate and graduate students for the 2010–11 school year. In September, 2010 we invited all of these individuals to participate in an online study for a \$10 Amazon.com gift card. Of the 2339 individuals who received the invitation (61 emails were returned), 852 (36%) responded to the survey. The process and survey were IRB approved by both the University of Florida and the University of Pittsburgh.

### Measures

We assessed demographic data, HTS behavior, susceptibility to hookah use, positive and negative attitudes toward hookah tobacco use, and normative beliefs related to hookah use.

**Demographics**—Demographic items assessed age, sex, race, enrollment status (undergraduate vs. graduate), and residence type. Categories for residence included campus residence hall, fraternity/sorority housing, other university housing, off-campus housing, parent/guardian housing, or “other.”

**Hookah Tobacco Smoking**—The survey contained the following instructions in bold type: “The following questions ask about smoking tobacco from a hookah (also known as a water-pipe or narghile). These questions only ask about smoking tobacco, not marijuana.” The first item then asked, “Have you ever smoked tobacco from a hookah, even a puff?” with yes or no responses. Those who responded “yes” then received the question, “Have you smoked tobacco from a hookah in the past year, even a puff?” with yes or no responses. Finally, those who responded “yes” to this item were asked “Within the past 30 days, on how many days did you smoke tobacco from a hookah?” Response choices were none; 1–2 days; 3–5 days; 6–10 days; 11–20 days; and 21–30 days. Our primary outcome was current smoking of hookah tobacco, defined as having smoked at least 1 day in the past 30. Although we also assessed ever use of hookah tobacco, 30-day (current) measures are considered more clinically relevant in this population.

**Intention to Smoke Hookah Tobacco**—Because our conceptual framework was the theory of reasoned action, we selected intention to smoke hookah tobacco as our secondary outcome. It was assessed using the item “Do you intend to smoke tobacco from a hookah sometime in the rest of your life?” with response categories including definitely yes; probably yes; probably no; and definitely no. We created a dichotomous variable defining participants as “not intending” if they marked “definitely no” and “intending” if they marked any other response. Similar measures of intention (also sometimes described as susceptibility) have been validated for cigarette smoking and are commonly utilized in the literature.<sup>20–21</sup>

**Attitudes Toward Hookah Tobacco Use**—In order to assess attitudes, participants were presented with a table and instructed to “Please check one box in each row to describe how you think HTS seems” followed by each of the terms “attractive,” “romantic,” “fun,” “harmful,” “addictive,” and “relaxing.” For each term, Likert-type responses included definitely no; probably no; don’t know; probably yes; and definitely yes. Furthermore, we developed two summary scales, averaging responses for attractive, romantic, fun, and relaxing into “positive attitudes” and combining harmful and addictive for “negative attitudes.”

**Normative Beliefs**—Because the focus of this study was on attitudes and not normative beliefs, we did not utilize comprehensive measures of this construct. However, because our study was based on the theory of reasoned action, which includes normative beliefs, we included a simple summary measure: all respondents were also asked “how socially acceptable do you think hookah is?” with the available response not; somewhat; moderately; and very.

## Analysis

We described demographics of the whole sample by computing overall counts and percentages. We then summarized demographic data according to each of our primary outcome measures: current HTS and intention to use hookah tobacco in the future. For this latter outcome, we only included non-smokers, because the concept of intention/susceptibility has been validated and is generally utilized among non-users. We assessed statistical significance for these bivariable analyses using chi-square tests. We then used multivariable logistic regression models to assess independent associations between each of our attitudinal measures and HTS outcomes (current use and intention to use in the future) while controlling for all measured covariates. Covariates included demographics that have been shown to be associated with HTS patterns. These covariates included: age, sex, race/ethnicity, graduate student status and housing. Although not all covariates were associated with outcomes in bivariable analyses, we had determined *a priori* to include all covariates in analyses. Analyses were conducted in Stata version 11.1.

## Results

Because of confidentiality issues related to survey implementation, comparisons were available only between respondents ( $n = 852$ ) and the entire population to which invitations were sent ( $N = 2400$ ). Compared with the entire population, respondents were younger (20.6 vs. 21.1,  $p = .04$ ), more commonly female (46.8% vs. 40.0%,  $p < .001$ ), and more commonly Caucasian (71.0% vs. 58.7%,  $p < .001$ ).

Our sample was roughly one-third age 18, one-third age 19, and one-third age 20 or more (Table 1). Slightly more males (53%) than females (47%) completed the survey. Most respondents predominantly self-identified as white (71%), followed by Asian (13%), Black (9%), and other race (7%). About three-fourths (76%) were undergraduate students. Most students lived off-campus, but not with a parent or guardian (57%) or in a campus residence hall (36%, Table 1).

Ever HTS was reported by 39% of the sample while 14% smoked tobacco from a hookah in the past 30 days. Among the 725 non-smokers for whom intention data were available, 369 (51%) were defined as intending to smoke tobacco from a hookah at some point in their lifetime.

In bivariable analyses, current HTS was associated with younger age ( $P = .004$ ) and undergraduate student status ( $P = .007$ ). Although intention to use hookah tobacco was not significantly different among individuals of various demographic backgrounds, there were non-significant trends indicating higher intention among older students ( $P = .06$ ) and those in off-campus housing ( $P = .07$ , Table 1).

The scales were internally consistent. For positive attitudes, Cronbach's alpha = 0.82, and for negative attitudes Cronbach's alpha = 0.70.

### Current hookah tobacco use

In fully-adjusted models, for which all covariates are included as predictors (Table 2), all positive perceptions were significantly associated with current hookah tobacco use, with adjusted odds ratios in a relatively narrow range (2.36–2.62). Overall positive perceptions were associated with adjusted odds of 4.32 (95% CI=3.20, 5.82) for current smoking. “Hookah seems addicting” was associated with lower adjusted odds of current HTS (AOR=0.56, 95% CI=0.47, 0.66). However, “Hookah seems harmful” only exhibited a non-significant trend toward lower adjusted odds for smoking tobacco from a hookah (AOR=0.86, 95% CI=0.74, 1.01). Overall negative perceptions were associated with lower adjusted odds for current smoking (AOR=0.64, 95% CI=0.53, 0.76). Our measure of normative beliefs, “hookah is socially acceptable,” was associated with increased odds for being a current smoker (AOR=1.89, 95% CI=1.45, 2.46).

### Intention to smoke tobacco from a hookah

In fully-adjusted models, all positive perceptions were significantly associated with intention to smoke in the future, with the strongest associations for “hookah seems attractive” (AOR=6.49, 95% CI=4.65, 9.05) and “hookah seems romantic” (AOR=4.56, 95% CI=3.21, 6.47). Overall positive perceptions were associated with adjusted odds of 9.31 (95% CI=6.77, 12.80) for intention to smoke. “Hookah seems addicting” was associated with lower adjusted odds of intention to smoke (AOR=0.71, 95% CI=0.63, 0.80). However, “Hookah seems harmful” was not associated with intention to use hookah tobacco (AOR=0.98, 95% CI=0.87, 1.10). However, overall negative perceptions were associated with lower adjusted odds for intention to smoke (AOR=0.79, 95% CI=0.69, 0.90). Our measure of normative beliefs, “hookah is socially acceptable,” was associated with increased odds of intending to smoke in the future (AOR=2.12, 95% CI=1.76, 2.54).

## Discussion

We found that, among a random sample of college students, positive attitudes toward HTS were strongly associated with increased odds of being a current user and of intending to use hookah tobacco in the future. However, results were mixed for negative attitudes; in fact, agreement with the statement “hookah seems harmful” was not significantly associated with either outcome.

These results suggest that there may be some value to increasing negative attitudes toward HTS, especially with regard to its addictive potential. However, effective health programs may not be achieving their full potential if they do not simultaneously attempt to decrease positive attitudes toward HTS, such as that it is an attractive, romantic, fun, and relaxing behavior. In fact, the magnitude of associations discovered here suggest that addressing positive attitudes may be even more valuable than addressing negative ones. This may seem counterintuitive, as intervention programs often focus on increasing negative perceptions of substance use.<sup>22</sup> However, these results are consistent with other literature on cigarettes, for which many of the more successful intervention programs focus on dispelling popular myths regarding tobacco use, such as that it is primarily done by successful, wealthy, and/or powerful individuals.<sup>23–24</sup>

Positive perceptions were strongly associated with the intention to use hookah tobacco in the future. Intention is a construct that has been validated and shown to be related to uptake of substance use.<sup>20–21</sup> However, it might be of value for future studies to follow groups of students longitudinally and verify that those who intend to use do so over time. In either case, this consistent scale predicts intention to use and may be valuable in future research (AOR=9.31, 95% CI=6.77, 12.80).

Although our primary aim was to study associations between attitudinal measures and HTS outcomes, we also assessed normative beliefs using a summary item. We did so in order to compare the potential associations of attitudes vs. normative beliefs, because each is predicted to be associated with intention and behavior according to our underlying conceptual model, the theory of reasoned action. While associations were stronger for positive perceptions compared with normative beliefs, the results do suggest that social acceptability may be an important predictor of intentions and behaviors. Thus, it may also be valuable for effective health programming to address normative beliefs.

Our study was limited by its cross-sectional design which in turn limits our ability to make causal inferences. For example, the theory of reasoned action suggests that attitudes and normative beliefs predict later intentions and behaviors. Due to the cross-sectional nature of these data, it is also possible that people who begin to use hookah tobacco subsequently develop increased positive perceptions, decreased negative perceptions, and more favorable normative beliefs. It will be valuable to confirm findings such as these in longitudinal samples in order to determine directionality of these associations. It also was noted above that we used relatively simple measures, especially to assess normative beliefs. It may be valuable for future research in this area to include a more comprehensive set of items capturing these complex constructs.

This study was also limited in that our email survey had a response rate of 36%. Systematic reviews have demonstrated 36% is an average response rate for this type of study.<sup>25-26</sup> The sample respondents were slightly younger, more often female, and more often white than the sample frame provided, as is indicated in the results section. Prior research has indicated that white youth are more likely to be hookah tobacco users, whereas mixed results have been reported for age and sex of hookah tobacco users. Some studies indicate more males use hookah, while more recent studies have indicated females are closing the gap. Similarly, early studies indicated an increasing chance of smoking tobacco from a hookah as age increased, whereas more recent studies indicate younger ages using hookah tobacco. Given the changing trends with respect to hookah tobacco use all were included as covariates. The results of this study do not represent all college students. However, we are able to assert that the positive attitudes and normative beliefs toward HTS are associated with actual use and intention for non-hookah smokers to use in the future.

In conclusion, compared with negative perceptions, positive perceptions and normative beliefs of HTS were associated with important HTS outcomes in this sample of college students. While educational health programs to reduce HTS should be multifaceted, it may be particularly important to emphasize dispelling of positive attitudes toward the practice of hookah tobacco use.

## Acknowledgments

This project was funded by the National Institutes of Health (R01-CA140150 to BP) and the Steven Manners Memorial Fund at the University of Pittsburgh Center for Social and Urban Research

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**Table 1**

Sample Characteristics by Ever and Recent Hookah Tobacco Use

Characteristic	Whole sample <sup>a</sup> N = 852		Current Hookah Tobacco User <sup>b</sup> N = 852			Non-Hookah User Intend to Use Hookah Tobacco <sup>c</sup> N = 725 <sup>d</sup>			p <sup>e</sup>
	%	n	Yes <sup>a</sup>	No <sup>a</sup>	p <sup>e</sup>	Yes <sup>a</sup>	No <sup>a</sup>	p <sup>e</sup>	
Age									
18	37		39	36	.004	33	40		.06
19	30		40	29		32	26		
20	6		8	6		7	4		
21 and above	27		14	29		28	30		
Sex					.29				.84
Female	47		42	47		48	48		
Male	53		58	53		52	52		
Race					.65				.28
White	71		75	70		73	67		
Black	9		5	9		9	10		
Asian/Pacific Islander	13		12	13		12	15		
Other	7		8	7		7	7		
Enrollment status					.007				.55
Undergraduate	76		86	75		75	73		
Graduate	24		14	25		25	27		
Residence					.21				.07
Campus Residence Hall	36		40	35		34	36		
Greek Housing	2		3	1		2	1		
Other University Housing	0		1	0		1	0		
Off Campus Housing	57		53	58		61	55		
Parent/Guardian Housing	3		3	2		2	3		
Other	2		0	3		1	5		

<sup>a</sup> Cells represent column percentages. Data do not always sum to total sample sizes because of missing data. Percentages are based on the total for each category and may not total 100 due to rounding.

<sup>b</sup> Defined as having smoked tobacco from a hookah in the last 30 days at least once.

<sup>c</sup> Defined as all participants who did not state that they were definitely not planning on smoking hookah tobacco in the future.

<sup>d</sup> Only hookah non-smokers were included in these analyses. The overall N was 725 instead of 736 because 11 non-smokers had missing data for the intention item.

<sup>e</sup> For chi-square analyses.

**Table 2**  
 Bivariable and Multivariable Associations between Independent Variables and Hookah Tobacco Smoking.

Participant Characteristic	Current Hookah Tobacco User <sup>a</sup> N = 852		Non-Hookah User Intend to Use Hookah Tobacco <sup>b</sup> N = 725 <sup>c</sup>	
	OR (95% CI)	AOR <sup>d</sup> (95% CI)	OR (95% CI)	AOR <sup>d</sup> (95% CI)
<b>Positive Perceptions</b>				
Hookah Seems Attractive	2.33 (1.92–2.84)	2.62 (2.11–3.24)	5.77 (4.24–7.86)	6.49 (4.65–9.05)
Hookah Seems Romantic	2.15(1.75–2.63)	2.36 (1.90–2.94)	3.87 (2.82–5.31)	4.56 (3.21–6.47)
Hookah Seems Fun	2.56 (2.08–3.14)	2.59 (2.09–3.21)	3.38 (2.88–3.97)	3.46 (2.91–4.10)
Hookah Seems Relaxing	2.41 (1.91–3.04)	2.42 (1.90–3.09)	2.66 (2.28–3.10)	2.67 (2.27–3.14)
Overall Positive Perceptions	3.91 (2.96–5.17)	4.32 (3.20–5.82)	8.62 (6.40–11.61)	9.31 (6.77–12.80)
<b>Negative Perceptions</b>				
Hookah Seems Harmful	0.89 (0.77–1.04)	0.86 (0.74–1.01)	0.99 (0.88–1.11)	0.98 (0.87–1.10)
Hookah Seems Addicting	0.55 (0.47–0.65)	0.56 (0.47–0.66)	0.71 (0.63–0.79)	0.71 (0.63–0.80)
Overall Negative Perceptions	0.65 (0.55–0.77)	0.64 (0.53–0.76)	0.79 (0.70–0.90)	0.79 (0.69–0.90)
Hookah is socially acceptable	1.99 (1.54–2.55)	1.89 (1.45–2.46)	2.15 (1.81–2.55)	2.12 (1.76–2.54)

<sup>a</sup>Defined as having smoked tobacco from a hookah at least once in the past 30 days.

<sup>b</sup>Defined as all participants who did not state that they were definitely not planning on smoking hookah tobacco in the future.

<sup>c</sup>Only hookah non-smokers were included in these analyses.

<sup>d</sup>AOR = Adjusted odds ratio, adjusted for age, sex, race/ethnicity, graduate student status and housing.