

Montgomery, S.B., Silva, M.D.B., Singh, P., Santos, H. D., Job, J.S., Brink, T.L. / *Californian Journal of Health Promotion* 2015, Volume 13, Issue 1, 26-37.

## Exploring Demographic and Substance Use Correlates of Hookah Use in a Sample of Southern California Community College Students

Susanne B. Montgomery<sup>1</sup>, Maria De Borba-Silva<sup>1</sup>, Pramil Singh<sup>1</sup>, Hildemar dos Santos<sup>1</sup>, Jayakaran S. Job<sup>1</sup>, and T.L. Brink<sup>2</sup>

<sup>1</sup>*Loma Linda University School of Public Health*

<sup>2</sup>*Crafton Hills College*

### Abstract

**Background and Purpose:** Hookah smoking is a growing young adult phenomenon, particularly among college students. Many users feel that it is safer than other tobacco products, although its health threats are well documented. Little is known about hookah use rates in community colleges that are attended by nearly half of all US college students. This study examined hookah use in a diverse convenience sample of students attending two southern California community colleges. **Methods:** In fall 2011, a cross-sectional, in-classroom survey was administered to 1,207 students. A series of fully adjusted multivariate logistic regressions were conducted to explore demographic, other substance use, and attitudinal correlates of lifetime and current hookah use. **Results:** Lifetime hookah use (56%) was higher than lifetime cigarette use (49%). Gender and personal socioeconomic status were not related to hookah use. Current use (10.8%) was associated with current use of alcohol, cigars, and cigarettes. Compared to African-Americans, Whites were 2.9 times more likely to be current users, and students who perceive hookah to be more socially acceptable were 21 times more likely to currently use. **Conclusion:** Since hookah use rates are high, colleges should offer health education programs to inform incoming students about the health risks of hookah and cessation programs.

© 2015 Californian Journal of Health Promotion. All rights reserved.

*Keywords:* Hookah, waterpipe, tobacco, nicotine, community college, college students

### Introduction

Waterpipe tobacco smoking, most commonly referred to as hookah in the United States, is a growing youth phenomenon, particularly among college students. Because it is used mostly intermittently as a social pastime, its health threats are often minimized, with many perceiving it as safer than cigarette smoking (Abughosh, Wu, Peters, Essien, & Crutchley, 2011; Sutfin, McCoy, Reboussin, Wagoner, Spangler & Wolfson, 2011). Higher A widely-held misperception is that the water in the bowl of the waterpipe removes the nicotine and toxins from the smoke (Aljarrah, Ababneh, & Al-Delaimy, 2009). Briefly, via the sucking power of user inhalation on the hose of the waterpipe, the tobacco smoke enters down the steel body of the waterpipe into the glass decanter bowl, which is filled with water. The hookah user then

inhales cool (water-filtered) smoke via the hose (Prignot, Sasco, Poulet, Gupta, & Aditama, 2008). While it looks as if the hookah “filters” the tobacco which the users inhales, studies have shown that using water as a filter did not change the level of nicotine in the smoke, which was found to actually be about 36 times higher in hookah smoke than in cigarettes (Shihade, 2003; Shihade & Saleh, 2005).

Documented acute and chronic hookah-associated health risks exist, however, even when used infrequently. These include carbon monoxide poisoning (Kesner, Ramaiah, Hemmer, & Koht, 2012; Uyanık, Arslan, Akay, Erçelik, & Tez, 2011), accidental fires (Voyes, 2010), infectious disease (Meleigy, 2007; Munckhof, Konstantinos, Wamsley, Mortlock, & Gilpin, 2003), cancer (Akl, Gaddam, Gunukula, Honeine, Abou-Jaoude & Irnai, 2010;

Maziak, 2013), respiratory disease (Akl et al., 2010; Raad, Gaddam, Schunemann, Irani, Abou, Honeine et al., 2011), heart disease (Jabbour, El-Roueiheb, & Sibai, 2003), and other tobacco-related illnesses (Akl et al., 2010). In addition, a recent study found that second-hand exposure to hookah vapors in children living in homes of hookah smokers was associated with uptake of nicotine and nicotine associated carcinogens, and the ciliotoxic and cardiotoxic agent acrolein (Kassem, Daffa, Liles, Jackson, et al., 2014). Thus evidence on the negative health effects of hookah contradicts the widely held perception that hookah is less harmful than cigarettes (Barnett, Curbow, Soule Jr, Tomar, & Thombs, 2011). In addition, nicotine dependence can also be a long-term consequence (Jackson & Aveyard, 2008) of hookah smoking, as numerous studies indicate significant numbers of students who previously never smoked a cigarette are experimenting with hookah (Jarrett, Blosnich, Tworek, & Horn, 2012; Primack, Shensa, Kim, Carroll, Hoban, et al., 2012; Fielder, Carey & Carey, 2013; Heinz, Giedgowd, Crane, Veilleux, Conrad, Braun, Olejarska & Kassel, 2013).

Numerous studies have been published on four-year U.S. collegiate hookah use. Lifetime use ranges from 15% (Grekin & Ayna, 2008) to 61% (Noonan, Kulbok, & Yan, 2011) and current use from 5% (Fielder, Carey & Carey, 2012) to 30% (Sutfin et al., 2011). Higher use is seen at schools in the West, in cities of all sizes, (Johnston, O'Malley, Bachman, Schulenberg, & Miech, 2014) at schools with fraternities and sororities, (Jarrett et al., 2012, Sidani, Shensa & Primack, 2013) and at schools with nearby off-campus hookah bars/café's (Sutfin et al., 2011). Furthermore longitudinal results from the Monitoring the Future study that is conducted in four-year colleges have shown that annual prevalence rates are increasing among young college-aged adults (Johnston et al., 2014).

Common correlates of hookah use at four-year schools included the concurrent use of other substances like alcohol, marijuana, cigars/cigarillos, and/or other illegal drugs (Braun, Glassman, Wohlwend, Whewell & Reindl, 2012; Jarrett et al., 2012, Rath et al.,

2012). Although cigarette smokers may already be using hookah (Braun et al., 2012; Jarrett et al., 2012), users perceived hookah smoke to contain less nicotine, and therefore saw it as less addictive and harmful than cigarette smoke (Heinz, et al, 2013; Griffith & Ford, 2014; Noonan & Patrick, 2012). This belief may have increased its acceptance, including on social media outlets such as Facebook, with more than 5% of college students displaying profile pictures referencing its use (Brockman et al, 2012). Others found that over time, more hookah bars and cafés are located near college campuses (Noonan & Patirck, 2013; Holtzman, et al 2013) resulting in easy access to hookah in social settings that are appealing to students.

Many studies have shown that hookah users are more likely to be males (Jarrett et al., 2012; Primack et al., 2010). However, Barnett et al. (2013), found that on the University of Florida campus, males and females used hookah at similar rates; similarly Johnson et al. (2014) reported that there are less gender differences in use of hookah than other tobacco products. The use of hookah appeals to those of younger age, generally college freshmen or 18-19 year olds (Jarrett et al., 2012; Sutfin et al., 2011), with 23% of females initiating hookah during their freshman year (Fielder et al., 2012) and an overall decline in hookah use by age 29 and older (Johnston, 2014). Hookah use in younger persons may be related to cost as hookah is inexpensive and relatively easy to purchase online, increasing accessibility (Grekin & Ayna, 2012). Whites are much more likely to be users (Blosnich, Jarrett, & Horn, 2011; Primack, Sidani, J., Agarwal, Shadel, Donny, & Eissenberg, 2008) as are Arabs (Abughosh, Wu, Peters, Essien & Crutchley, 2011), while African-Americans are significantly less likely (Blosnich et al., 2011; Jarrett et al., 2012) to use hookah.

### **The Present Study**

Understanding who is a hookah user in the collegiate setting is an important first step for intervening to curtail its growth in popularity. To date, however, what we know comes from students enrolled at four-year universities. However, according to the American

Association of Community Colleges (2014) 45% of enrolled US students study at two-year community colleges. In general, these students tend to be more ethnically diverse and come from families of lesser economic means than those at four-year schools. Over half (56%) of all Hispanic undergraduates, 44% of all Asian-Pacific Islanders, 48% of all African-Americans, and 59% of all Native Americans study at community colleges.

The purpose of this study was to explore hookah use in an ethnically diverse group of community college students in southern California to see if user characteristics differ from those attending four-year universities, according to previous research. Specifically, we hypothesized that as in four-year colleges non-White students, and older students attending community colleges would be less likely to use hookah and that students who use tobacco and alcohol would be more likely to use also use hookah. We anticipated however that in community college students we would find higher levels of social acceptance, high rates of use in females, and given its low cost, high overall use rates compared to students in four-year colleges.

## Methods

### Participants and Procedures

In fall 2011, a cross-sectional in-classroom survey with 67 questions on hookah and other substance use behaviors and attitudes was administered to a convenience sample of adult (aged 18+) community college students enrolled in a required general education class in one of two participating community colleges in the Inland Empire region of southern California. An IRB trained instructor teaching at the college, but not teaching the classes in which the survey was conducted administered the survey. The survey took between fifteen and twenty minutes to complete and was voluntary and anonymous. A tear-off passive consent form with contact information was the front page of the survey and the Loma Linda University Institutional Review Board approved all aspects of the study.

Completed surveys (N=1,207) were scanned into the Scannable Office software and

systematically verified by comparing scanned data to the original surveys. The resulting Access file was then exported into SPSS for analysis.

### Dependent Variable Measures

Our dependent variables were lifetime and current hookah use. Lifetime (“ever”) hookah use was asked three ways. If a student answered affirmatively to any of the three questions, he or she was considered an “ever” user. The questions and answers read as follows: 1. “Have you ever smoked hookah (waterpipe, shisha, narghile), even one or two puffs?” a) Yes, I have smoked hookah within the last year, b) Yes, but the last time I smoked hookah was over a year ago, c) No, I have never smoked hookah, and d) I do not know what hookah is. Options a) or b) indicated “ever” use. 2. “How old were you when you first tried hookah?” with two boxes to write in an age as a continuous variable. Any age written in constituted “ever” use. And 3. “Within the last 30 days, on how many TOTAL days did you use hookah?” a) Never used, b) Have used, but not in the last 30 days, c) 1-2 days, d) 3-5 days, e) 6-9 days, f) 10-19 days, g) 20-29 days, h) Used daily. Current use was assessed by “Within the last 30 days, on how many TOTAL days did you use hookah?” Substance use related question were adapted from the National College Health Assessment (NCHA) II (American College Health Association, 2008). Other questions were identified from prior studies (see below) and some were developed based on qualitative data we collected in preparation for this research. The resulting survey was then pilot tested and minor revisions made as indicated, before it was used for the study.

### Independent Variable Measures

*Demographics* Five standard questions were asked: gender (M/F), age (continuous), school (urban/suburban), living situation (categorical), and race/ethnicity (categorical) and four personal economic questions: receipt of financial aid (Y/N), first generation to attend college (Y/N), number of hours worked per week, and dollars spent on entertainment per week, both handwritten continuous variable answers. Because hookah use was so prevalent among

club and intramural sports participants in one study (Primack et al., 2010), we decided to ask “Do you currently participate in organized athletics?”(Y/N)

#### *Substance Use*

Age of initiation, indicating “ever” use, and current 30-day use questions were asked for four substances: alcohol, cigarettes, marijuana, and smokeless tobacco. Current use was also asked about cigars, illegal drugs, and use of two or more substances at a time. Students were asked how many drinks they had last time they “partied”/socialized to gauge binge drinking (American College Health Association, 2008).

#### *Hookah Beliefs*

Hookah beliefs (perceived harm, perceived social acceptability, perceptions about use) were assessed using five point Likert scales. Perceived harm of hookah use was adapted from Primack (Primack et al., 2008): “Would you say that smoking tobacco from a hookah is less harmful or more harmful than smoking cigarettes?” “Would you say that smoking tobacco from a hookah is less addictive or more addictive than smoking cigarettes?” Social desirability was assessed by two questions: “Among your peers, how socially acceptable is it to smoke hookah?” and “Approximately what percent of college students do you think has ever smoked hookah?” A third question was, “Of your *closest friends*, approximately what percent do you think has ever smoked hookah?” These last two questions were answered categorically from 0% to 100% (American College Health Association, 2008).

Primack (2010) found that club and intramural athletes used hookah more than cigarettes because they associated it more with alcohol. We therefore asked: “When you think of hookah, what do you tend to associate it with?” with the choices of alcohol, marijuana, tobacco, or multiple answers.

#### **Statistical Analysis**

Once descriptive frequencies, means (SDs), and medians were computed, the relationship between hookah use (ever and current) and demographic variables was analyzed via fully

adjusted multiple logistic regression models; the same was done for the relationship between hookah (ever and current) and other substance use (ever and/or current). Hookah belief variables were regressed on hookah use (ever and current) via bivariate multiple logistic regression models. Criterion for significance was  $p < 0.05$ .

## **Results**

Relationships between the demographic variables and “ever” and current hookah use are described in Table 1. The following is a brief summary of the main results.

#### **Hookah Use**

A majority (55.5%) of the 1,207 students surveyed used hookah at least once and more than one-third (34.1%) in the past year (not tabled); 10.8% were current users. The average age of first use was 18.2 ( $SD = 4.0$ ).

#### **Significant Demographic Associations**

Whites (AOR = 2.4,  $p < 0.01$ ), Latinos (43%; AOR = 2.2,  $p < 0.01$ ) and persons identifying as “Multi-race” (14%; AOR = 1.81,  $p < 0.05$ ) were more likely than African-Americans to be lifetime (ever) users. Whites were the only group significantly more likely (AOR = 2.9,  $p < 0.05$ ) than African-Americans to be current hookah users.

There was no difference in current use between 18–19 year olds, the reference group, and students age 20–24. However, 25–29 year olds were less likely (AOR = 0.32,  $p < 0.05$ ) to be current users and those ages 30+ were much less likely (AOR = 0.097,  $p < 0.001$ ). When exploring “ever” use, 25–29 year olds were twice as likely as 18–19 year olds to have “ever” used (AOR = 1.98,  $p < 0.05$ ), and 20–24 year olds 1.6 times more likely (AOR = 1.63,  $p < 0.01$ ); only those ages 30+ had greatly diminished odds (AOR = 0.36,  $p < 0.001$ ). Students living with a boyfriend, girlfriend, and/or friends were twice as likely (AOR = 2.07,  $p < 0.05$ ) as those living with parents/other family to be current users. With regard to students entertainment budget, those who spend relatively little, (\$1-\$20 per week), were about

35% less likely (AOR = 0.66,  $p < 0.05$ ) to have “ever” used hookah than those who indicated they spent \$0, but spending more was not associated with either “ever” or current use. Of note, being involved in organized sports, receiving financial aid, or working hours per

week were not associated with “ever” and current use. Also, school (two schools were surveyed) was not significantly different for both “ever” and current use. Thus, the subsequent analyses presented here were conducted with all students combined.

**Table 1.**

Demographic		n		Ever use: 55.5%		Current use: 10.8%	
				AOR <sup>a</sup>	95% CI	AOR <sup>a</sup>	95% CI
Demographic Frequencies and Correlates to Hookah Use (N=1,207)							
School							
Valley, San Bernardino (Urban)		726	60.1%	1.00		1.00	
Crafton Hills, Yucaipa (Suburban)		481	39.9%	0.94	.71, 1.25	1.07	.70, 1.65
Gender							
Female		711	58.9%	1.00		1.00	
Male		469	38.9%	1.15	.88, 1.50	1.10	.74, 1.65
Race/Ethnicity							
African-American		112	9.3%	1.00		1.00	
Latino		521	43.2%	2.24	** 1.38, 3.64	1.90	.72, 5.03
White		300	24.9%	2.37	** 1.40, 4.01	2.89	* 1.05, 7.94
Asian		49	4.1%	1.41	.67, 3.00	1.467	.36, 5.94
Multirace		168	13.9%	1.81	* 1.05, 3.13	1.889	.66, 5.44
Other		36	3.0%	5.08	1.98, 13.03	3.43	.88, 13.34
Age <sup>b</sup>							
18-19		482	39.9%	1.00		1.00	
20-24		420	34.8%	1.63	** 1.21, 2.19	0.71	.46, 1.10
25-29		101	8.4%	1.98	* 1.15, 3.42	0.32	* .13, 0.81
30+		167	13.8%	0.36	*** .21, .60	0.097	*** .03, 0.31
Living situation							
Parents and/or other family		848	70.3%	1.00		1.00	
Spouse and/or children		177	14.7%	0.65	.41, 1.04	1.52	.68, 3.38
Boy/girl/friend//friends		77	6.4%	1.60	.93, 2.76	2.07	* 1.00, 4.28
Live alone		71	5.9%	0.90	.50, 1.64	1.71	.67, 4.40
Other		14	1.2%	10.6	* 1.32, 85.47	2.54	.63, 10.26
Receive financial aid (Y)		640	53.0%	0.96	.74, 1.24	0.78	.52, 1.16
1st generation college (Y)		530	43.9%	1.00		1.00	
Organized sports (Y)		256	21.2%	0.10	.73, 1.37	0.63	.37, 1.05
No. of hours worked/week <sup>c</sup>							
0		567	47.0%	1.00		1.00	
1-20		223	18.5%	1.04	.74, 1.48	0.99	.58, 1.68
21-40		332	27.5%	1.09	.78, 1.52	1.00	.60, 1.68
41+		41	3.4%	0.77	.37, 1.61	0.70	.20, 2.50
Weekly entertainment budget <sup>d</sup>							
\$0		202	16.7%	1.00		1.00	
\$1-\$20		258	21.4%	0.66	* .45, .96	0.62	.34, 1.11
\$21-\$50		300	24.9%	1.16	.797, 1.69	0.67	.37, 1.20
\$51-\$100		236	19.6%	1.22	.80, 1.85	0.88	.47, 1.63
\$101 +		119	9.9%	1.14	.69, 1.89	0.73	.33, 1.60

<sup>a</sup>Fully adjusted odds ratio, multiple logistic regression.

<sup>b</sup>Mean (SD) = 23.53 (8.4), Median (Range) = 20.0 (18-68).

<sup>c</sup>Mean (SD) = 13.8 (16.2), Median (Range) = 4.00 (0-72).

<sup>d</sup>Mean (SD) = \$56.70 (\$70), Median (Range) = \$40.00 (\$0-\$600).

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

**Table 2.**

**Substance Use Frequencies and Correlates to Hookah Use (N=1,207)**

Substance	n	%	Ever use			Current use		
			AOR <sup>a</sup>	p value	95% CI	AOR <sup>a</sup>	p value	95% CI
Cigarettes								
Ever use	589	48.8%	2.06	***	1.49, 2.85	0.991		.57, 1.73
Current use	225	18.6%	0.89		.56, 1.40	1.82	*	1.09, 3.05
Alcohol								
Ever use	1014	84.0%	3.06	***	1.89, 4.96	0.66		.26, 1.68
Current use	539	44.7%	1.89	***	1.39, 2.58	2.83	***	1.59, 5.02
Male binge drinker (5+), last time	184	39.2%	0.99		.63, 1.55	1.08		.60, 1.95
Female binge drinker (4+), last time	258	35.9%	1.24		.87, 1.78	1.76	*	1.06, 2.92
Smokeless tobacco								
Ever use	194	16.1%	2.42		1.49, 3.94	1.10		.65, 1.86
Current use	29	2.4%	2.12		.61, 7.32	2.33		.87, 6.25
Marijuana								
Ever use	678	56.2%	2.12	***	1.55, 2.91	1.25		.69, 2.28
Current use	203	16.8%	1.55		.94, 2.55	0.996		.59, 1.69
Cigars								
Current use	63	5.2%	0.86		.56, 1.40	2.45	**	1.27, 4.70
Illegal drugs								
Current use	55	4.6%	1.85		.57, 6.03	1.03		.51, 2.08
Two or more substances, same time								
Current use	172	14.3%	2.53	**	1.34, 4.78	3.94	***	2.28, 6.82

<sup>a</sup>Fully adjusted odds ratio, multiple logistic regression.  
\*p < .05, \*\*p < .01, \*\*\*p < .001.

**Associations with Other Substance Use**

Details on substance use frequencies and their relationship to hookah use can be found in Table 2. The following is a summary of the main findings.

Current use of two or more substances at the same time, which can include hookah, was the most significant correlate of current use, (AOR = 3.94, *p* < 0.001), followed by current alcohol use (AOR = 2.83, *p* < .001). Female binge drinking (35.9% of females; four plus drinks in one setting) was associated with current use (AOR = 1.76, *p* < 0.05) but male binge drinking (39.2%; five+ drinks) was not. Current cigarette use (AOR = 1.82, *p* < 0.05) and current cigar use (AOR=2.45, *p* < 0.01) were also associated.

Lifetime (ever) Hookah Use was associated with current (AOR = 1.89, *p* < .001) and “ever” alcohol use (AOR = 3.06, *p* < 0.001). “Ever” cigarette (AOR = 2.06, *p* < .001) and “ever” marijuana use (AOR = 2.12, *p* < .001) were correlated with “ever” hookah use. Of note,

current marijuana use was not significantly associated with “ever” or current use of hookah, nor was current illegal drug use and current or “ever” smokeless tobacco use.

**Hookah Beliefs**

Hookah beliefs and correlates are summarized in Table 3. Students who perceived hookah as definitely less harmful and addictive than cigarettes were significantly more likely to be “ever” and current users than those who perceived it as definitely more harmful. The more a student believed hookah to be socially acceptable, the more likely he or she was to be an “ever” or current user. When asked approximately what percent of college students had “ever” used hookah, the median perceived answer was 70% (mean 60%). When asked what percent of close friends had “ever” used hookah, the median and mean were both 50%. Students answering with high percentages to these social acceptability questions had significantly higher odds of being “ever” and current users. Those who said 90-100% had used hookah were almost

25 times as likely ( $p < .001$ ) to be an “ever” user and 11 times ( $p < .001$ ) a current user than

someone who answered that only 0-10% of their friends had used hookah.

**Table 3.**

Hookah Belief Frequencies and Correlates to Hookah Use (N=1,207)						
Belief	Ever use			Current use		
	OR	<i>p</i> value	95% CI	OR	<i>p</i> value	95% CI
Less/more harmful than cigarettes, Likert scale of 5 <sup>a</sup>						
1) Definitely less (24.4%)	3.17	***	2.19, 4.59	4.56	***	2.19, 9.49
2) Less (18.0%)	3.50	***	2.35, 5.22	4.89	***	2.31, 10.38
3) Not sure (34.1%)	1.55	*	1.11, 2.18	1.70		.79, 3.65
4) More (6.1%)	1.04		.61, 1.79	0.94		.25, 3.58
5) Definitely more (15.2%)	1.00			1.00		
No response (2.2%)						
Less/more addictive than cigarettes, Likert scale of 5 <sup>b</sup>						
1) Definitely less (31.3%)	6.24	***	4.18, 9.32	4.59	***	2.16, 9.77
2) Less (16.1%)	3.69	***	2.38, 5.72	2.62	*	1.14, 6.03
3) Not sure (31.6%)	1.47	*	1.00, 2.16	1.02		.44, 2.38
4) More (7.4%)	2.18	**	1.29, 3.70	1.93		.70, 5.32
5) Definitely more (11.3%)	1.00			1.00		
No response (2.3%)						
Social acceptability among peers, Likert scale of 5 <sup>c</sup>						
1) Definitely not (22.2%)	1.00			1.00		
2) Not acceptable (7.4%)	2.37	**	1.43, 3.94	1.06		.11, 10.33
3) Not sure (17.9%)	3.56	***	2.42, 5.24	7.97	**	2.31, 27.57
4) Acceptable (17.8%)	9.23	***	6.13, 13.91	17.53	***	5.31, 57.93
5) Definitely acceptable (33.5%)	10.90	***	7.60, 15.64	21.28	***	6.64, 68.21
No response (1.2%)						
Perceived % of college students who ever used waterpipe, 11 categories 0%-100% <sup>d</sup>						
0-30% (16.4%)	1.00			1.00		
40-50% (19.0%)	1.66	*	1.11, 2.48	1.09		0.49, 2.41
60-70% (29.2%)	4.40	***	3.04, 6.37	2.21	*	1.13, 4.30
80% (21.4%)	5.60	***	3.76, 8.34	2.72	**	1.38, 5.37
90-100% (12.9%)	10.88	***	6.60, 17.91	3.53	***	1.73, 7.22
No response (1.3%)						
Perceived % of close friends who ever used, 11 categories 0%-100% <sup>e</sup>						
0%-10% (27.2%)	1.00			1.00		
20-50% (22.7%)	3.43	***	2.29, 5.14	1.60		.57, 4.49
60-80% (22.5%)	10.35	***	6.97, 15.35	4.60	***	2.02, 10.48
		***	17.03,		***	
90-100% (26.6%)	24.83		36.21	10.82		5.17, 22.62
No response (1.0%)						

<sup>a</sup>Mean = # 2.63 (*SD* = 1.4), between less and not sure.

<sup>b</sup>Mean = # 2.44 (*SD* = 1.4) between less and not sure.

<sup>c</sup>Median = # 4 "acceptable," Mean = # 3.29 (*SD* = 1.6) between "not sure" and "acceptable."

<sup>d</sup>Median = 70%, Mean = 60% (*SD* = 2.5).

<sup>e</sup>Median = 50%, Mean = 50% (*SD* = 3.6).

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

As described in Table 4, when asked what came to mind (Top of Mind) when thinking about hookah, a majority of respondents (56%)

associated hookah with tobacco use. For 15% of respondents, marijuana was their “top of mind” association, and for 6.7% it was alcohol. Those

who associated hookah with alcohol were significantly more likely to be “ever” ( $OR = 3.85, p < .001$ ) and current ( $OR = 3.07, p < .001$ ) users. Conversely, those who associated hookah with marijuana were less likely to be “ever” ( $OR = 0.45, p < .001$ ) and current ( $OR = 0.51, p < .05$ ) users. This was not the case for “athletes” however. Their ‘top of mind’ responses had no bearing on actual use, although those who answered associating hookah with multiple categories of substances were two times more likely to be “ever” users ( $OR = 2.01, p < .05$ ).

### Discussion

This is the first known hookah use study in community college settings, adding an important perspective to the hookah discussion, since nearly half of all college students attend a community college (American Association of Community Colleges, 2014). It is also the first study conducted solely in the West with an ethnically diverse sample: 43% Latino, 25% White, 14% Multirace and 9% African-American.

We found that across our two schools the participating community college students have one of the highest hookah use rates in the U.S. with the majority (55.5%) reporting they have

used hookah sometime in their lifetime. Only one study at a large public university in the Southeast reported a higher lifetime use rate (61%) (Noonan et al., 2011). Notably, more community college students have tried hookah than a cigarette (48.8%), also only found in the literature at that Southeastern public university (Noonan et al., 2011).

We found many similarities between community college and four-year college students. Community college student’s current use (10.8%) and past year use (34.1%) are within the range of most four-year college study findings. As seen in four-year studies those who identified as White were most likely to use hookah and those identifying as African-Americans were least likely. In this study, Whites have almost three times higher odds of current use. Community college students who live with friends are more likely to be current users than those who live with parents/family. This is similar to four-year school findings that students living in fraternity/sorority or on-campus housing, in other words those who live among peers, are most likely to use (Jarrett et al., 2012). “Ever” and concurrent use of alcohol and cigarettes were also common correlates.

**Table 4**

"Top of Mind" Responses to Substances with Hookah Use (N=1,207)

Substance use	Ever use			Current use		
	OR	p value	95% CI	OR	p value	95% CI
Overall study population						
Tobacco (56.0%)	1.00			1.00		
Marijuana (15.2%)	0.45	***	.33, .63	0.51	*	0.26, 1.00
Alcohol (6.7%)	3.85	***	2.13, 6.96	3.07	***	1.79, 5.30
Multiple answers and/or other/comments (19.0%)	2.20	**	1.32, 3.64	1.36		0.70, 2.67
No response (3.1%)						
Athletes (n = 248, 21.2%)						
Tobacco (56.5%)	1.00			1.00		
Marijuana (15.3%)	0.74		.42, 1.28	0.62		.141, 2.75
Alcohol (6.5%)	1.61		.87, 2.97	0.71		.092, 5.41
Multiple answers and/or other/comments (18.1%)	2.01	*	1.13, 3.57	2.14		.607, 7.56
No response (3.6%)						

\*p < .05, \*\*p < .01, \*\*\*p < .001.



Adolescent cigar use appears to be on the rise in the U.S. and current use is associated with hookah use in this study similar to some studies in four-year colleges (Abughosh et al., 2011; Eissenberg, Ward, Smith-Simone, & Maziak, 2008). Low perceived health and addiction risks and high perceived social acceptability and popularity are common beliefs in our participants as had been reported in four-year colleges.

We also found some distinct differences. Four-year college studies have found the highest odds of use among 18–19 year olds, referring to this as “freshmen experimentation,” but this study found no significant difference in current use between 18–19 and 20–24 year olds, although once age 25 is reached, the likelihood of hookah use goes down. This may be the case, as most community college students take longer to complete their studies with many working part time, thus possibly prolonging this experimentation effect relative to four-year college students.

We were surprised that at the community college a student’s personal economic status was not associated with use. The only significant economic finding was that students who spend relatively little on weekly entertainment, compared to those who spend either nothing, or more than \$20 per week, were less likely to “ever” use hookah, although no difference was found in current (or past year) use. This finding underscores the low cost, “easy access” of hookah that should be considered by policy makers, especially given the many misperceptions about health risk we found. Hookah and associated paraphernalia are extremely easy and inexpensive to purchase at local smoke shops or online. Indeed, home get-togethers in the garage or backyard, known as “kick-backs” in southern California, frequently involve hookah (Wilson, 2011).

### **Limitations**

Our study, while pointing to some clear hookah risk patterns in this community college student population, has some limitations. First, we surveyed a convenience sample of students taking general education classes at two southern

California Inland Empire community colleges. However, while our respondents were slightly younger and more female, our demographic participant profile aligned well with both school’s published overall attendance for the school year we surveyed suggesting that our respondents are fairly representative of their peers. Secondly, we used a cross-sectional design; hence it was not possible to examine longitudinal associations among the variables of interest. Third, we relied on self-reported data, which may be subject to socially desirable responding and recall bias.

### **Conclusion**

We found that more than half of our participating community college students had used hookah and that users believed it to be less harmful and addictive than cigarettes. Users felt that it was highly socially acceptable and males and females used hookah alike, regardless of income. These high use rates, coupled with the fact that monitoring studies found that hookah use across the US continues to increase (Johnston et al., 2014), point to an urgent need for hookah health education and cessation programs that clarify its negative health effects. While use diminishes when students are older, we should not wait for this natural decrease, as risks during use can be substantial. In addition, a recently published study found that with a brief online intervention collegiate hookah users who received information on its dangers were likely to wish to quit and actually quit (Lipkus, Eissenberg, Schwartz-Bloom, Prokhorov, & Levy 2011), suggesting that even low cost health education efforts can be effective. To combat increasing rates of hookah use colleges should implement these types of brief interventions to their incoming classes in order to educate their students about hookah risks and motivate them to not engage in this seemingly safe and fun pastime.

### **Acknowledgments**

The authors thank the instructors and students of Valley College and Crafton Hills College who gave freely of their time for the survey. The research was funded in part by a Loma Linda University (LLU) Hulda Crooks Dissertation

Award and LLU Center for Health Disparities  
Research Grant # 1P20MD006988.

## References

- Abughosh, S., Wu, I. H., Peters, R. J., Essien, E. J., & Crutchley, R. (2011). Predictors of persistent waterpipe smoking among university students in the United States. *Epidemiology*, *1*(102), 2161-1165. doi: 10.4172/2161-1165.1000102
- Akl, E., Gaddam, S., Gunukula, S. K., Honeine, R., Abou 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. doi: 10.1093/ije/dyq002
- Aljarrah, K., Ababneh, Z., & Al-Delaimy, W. (2009). Perceptions of hookah smoking harmfulness: Predictors and characteristics among current hookah users. *Tobacco Induced Diseases*, *5*(1), 16.
- American Association of Community Colleges. (2012). 2012 Community college fact sheet. Retrieved June 14, 2012, Available from <http://www.aacc.nche.edu/AboutCC/Pages/fastfactsfactsheet.aspx>
- American College Health Association. (2008). National College Health Assessment II Sample Survey. Available from [http://www.acha-ncha.org/sample\\_survey.html](http://www.acha-ncha.org/sample_survey.html)
- Barnett, T. E., Curbow, B. A., Soule Jr, E. K., Tomar, S. L., & Thombs, D. L. (2011). Carbon monoxide levels among patrons of hookah cafes. *American Journal of Preventive Medicine*, *40*(3), 324-328. doi: 10.1016/j.amepre.2010.11.004
- Barnett, T. E., Smith, T., He, Y., Soule, E. K., Curbow, B. A., Tomar, S. L., & McCarty, C. (2013). Evidence of emerging hookah use among university students: A cross-sectional comparison between hookah and cigarette use. *BMC Public Health*, *13*(1), 302.
- Blosnich, J. R., Jarrett, T., & Horn, K. (2011). Racial and ethnic differences in current use of cigarettes, cigars, and hookahs among lesbian, gay, and bisexual young adults. *Nicotine & Tobacco Research*, *13*(6), 487-491. doi: 10.1093/ntr/ntq261
- Braun, R., Glassman, T., Wohlwend, J., Whewell, A., & Reindl, D. (2012). Hookah use among college students from a Midwest university. *Journal of Community Health*, *37*(2), 294-298. doi: 10.1007/s10900-011-9444-9
- 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), e001709.
- Eissenberg, T., Ward, K. D., Smith-Simone, S., & Maziak, W. (2008). Waterpipe tobacco smoking on a US college campus: Prevalence and correlates. *Journal of Adolescent Health*, *42*(5), 526-529.
- Fielder, R. L., Carey, K. B., & Carey, M. P. (2012). Prevalence, frequency, and initiation of hookah tobacco smoking among first-year female college students: A one-year longitudinal study. *Addictive Behaviors*, *37*(2), 221-224.
- Fielder, R. L., Carey, K. B., & Carey, M. P. (2013). Hookah, cigarette and marijuana use: A prospective study of smoking behavior among first year college women. *Addictive Behaviors*, *38*(2), 2729-2735
- Grekin, E. R., & Ayna, D. (2012). Waterpipe smoking among college students in the United States: A review of the literature. *Journal of American College Health*, *60*(3), 244-249.
- Griffiths, M. A., & Ford, E. W. (2014). Hookah smoking: Behaviors and beliefs among young consumers in the United States. *Social Work in Public Health*, *29*(1), 17-26
- Heinz, A. J., Giedgowd, G. E., Crane, N. A., Veilleux, J. C., Conrad, M., Braun, A. R., ... & Kassel, J. D. (2013). A comprehensive examination of hookah smoking in college students: Use patterns and contexts, social norms and attitudes, harm perception, psychological correlates and co-occurring substance use. *Addictive Behaviors*, *38*(11), 2751-2760.
- Holtzman, A. L., Babinski, D., & Merlo, L. J. (2013). Knowledge and attitudes toward hookah usage among university students. *Journal of American College Health*, *61*(6), 362-370.

- Jabbour, S., El-Roueiheb, Z., & Sibai, A. M. (2003). Nargileh (water-pipe) smoking and incident coronary heart disease: A case-control study. *Annals of Epidemiology*, 13(8), 570. doi: 10.1016/s1047-2797(03)00165-0
- Jackson, D., & Aveyard, P. (2008). Waterpipe smoking in students: Prevalence, risk factors, symptoms of addiction, and smoke intake. Evidence from one British university. *BMC Public Health*, 8(1), 174. doi:10.1186/1471-2458-8-174
- Jarrett, T., Blossnich, J., Tworek, C., & Horn, K. (2012). Hookah use among u.s. college students: Results from the National College Health Assessment II. *Nicotine & Tobacco Research*, 14(10), 1145-1153. doi: 10.1093/ntr/nts003
- Johnston, L. D., O'Malley, P. M., Bachman, J. G., Schulenberg, J. E. & Miech, R. A. (2014). Monitoring the Future National Survey results on drug use, 1975–2013: Vol. 2, College students and adults ages 19–55. Ann Arbor: Institute for Social Research, U of Michigan.
- Kassem, N.O., Daffa, R.M., Liles, S., Jackson, S.R., Kassem, N.O., Younis, M.A., Mehta, S., Chen, M., Jacob, P., Carmella, S.G., Chatfield, D.A., Benovitz, N.L., Matt, G.E., Hecht, S.S., Hovell, M.F. (2014) Children's exposure to secondhand and thirdhand smoke carcinogens and toxicants in homes of hookah smokers. *Nicotine & Tobacco Research; Advance published March 3, 2014.*
- Kesner, K. L., Ramaiah, V. K., Hemmer, L. B., & Koht, A. (2012). Anesthesia implications of waterpipe use. *Journal of Clinical Anesthesia*, 24(2), 137-140. doi: 10.1016/j.jclinane.2011.05.005
- Lipkus, I. M., Eissenberg, T., Schwartz-Bloom, R. D., Prokhorov, A. V., & Levy, J. (2011). Affecting perceptions of harm and addiction among college waterpipe tobacco smokers. *Nicotine & Tobacco Research*, 13(7), 599-610. doi: 10.1093/ntr/ntr049
- Maziak, W. (2013). The waterpipe: An emerging global risk for cancer. *Cancer Epidemiology*, 37(1), 1-4. doi: 10.1016/j.canep.2012.10.013
- Meleigy, M. (2007). Waterpipe and communicable diseases link, says WHO. *The Lancet Infectious Diseases*, 7(7), 448. doi: 10.1016/S1473-3099(07)70150-0
- Munckhof, W., Konstantinos, A., Wamsley, M., Mortlock, M., & Gilpin, C. (2003). A cluster of tuberculosis associated with use of a marijuana water pipe. *International Journal of Tuberculosis and Lung Disease*, 7(9), 860.
- Noonan, D., Kulbok, P., & Yan, G. (2011). Intention to smoke tobacco using a waterpipe among students in a southeastern US college. *Public Health Nursing*, 28(6), 494-502. doi: 10.1111/j.1525-1446.2011.00945.x
- Noonan, D., & Kulbok, P. A. (2012). Beliefs and norms associated with smoking tobacco using a waterpipe among college students. *Journal of Addictions Nursing*, 23(2), 123-128. doi:10.3109/10884602.2012.669420
- Noonan, D., & Patrick, M. E. (2013). Factors associated with perceptions of hookah addictiveness and harmfulness among young adults. *Substance Abuse*, 34(1), 83-85.
- Primack, B. A., Fertman, C. I., Rice, K. R., Adachi-Mejia, A. M., & Fine, M. J. (2010). Waterpipe and cigarette smoking among college athletes in the United States. *Journal of Adolescent Health*, 46(1), 45-51.
- Prignot, J. J., Sasco, A. J., Poulet, E., Gupta, P. C & Aditama, T. Y. (2008). Alternative forms of tobacco use. *International Journal of Tuberculosis and Lung Disease*, 12, 718–727.
- Primack, B. A., Shensa, A., Kim, K. H., Carroll, M. V., Hoban, M. T., Leino, E. V., et al. (2012). Waterpipe smoking among US university students. *Nicotine & Tobacco Research*, 15(1), 29-35. doi: 10.1093/ntr/nts076
- 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 US university students. *Annals of Behavioral Medicine*, 36(1), 81-86.
- Rath, J. M., Villanti, A. C., Abrams, D. B., & Vallone, D. M. (2012). Patterns of tobacco use and dual use in US young adults: The missing link between youth prevention and adult cessation. *Journal of Environmental and Public Health*, 2012, 679134-679134.

- Raad, D., Gaddam, S., Schunemann, H., Irani, J., Abou, J. P., Honeine, R., et al. (2011). Effects of water-pipe smoking on lung function: A systematic review and meta-analysis. *Chest*, 139(4), 764.
- Shihadeh, A. Investigation of mainstream smoke aerosol of the narghile water pipe. *Food and Chemical Toxicology*, 2003 41(1): 143-152.
- Shihadeh, A. & Saleh, R. Polycyclic aromatic hydrocarbons, carbonmonoxide, "tar", and nicotine in the mainstream smoke aerosole of the narghile water pipe. *Food and Chemical Toxicology*, 2005 43(5): 655-661.
- Scannable Office. Available from <http://autodata.com/products/scannable-office/>
- Sidani, J. E., Shensa, A., & Primack, B. A. (2013). Substance and hookah use and living arrangement among fraternity and sorority members at US colleges and universities. *Journal of Community Health*, 38(2), 238-245.
- 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
- Uyanik, B., Arslan, E. D., Akay, H., Erçelik, E., & Tez, M. (2011). Narghile (hookah) smoking and carboxyhemoglobin levels. *The Journal of Emergency Medicine*, 40(6), 679. doi: 10.1016/j.jemermed.2009.05.032
- Voyes, K. (2010). Fire at fraternity house blamed on hookah pipe. *The Gainesville Sun*. Retrieved from <http://www.gainesville.com/article/20101117/ARTICLES/101119499>
- Wilson, S. (2011). UC scientists discover the obvious: Young educated white men in California can't stop smoking hookah. *LA Weekly.com* (Wed, August 24, 2011)

Author Information

\*Susanne B. Montgomery, PhD, MPH  
Professor and Associate Dean of Research  
Loma Linda University, School of Behavioral Health  
[smontgomery@llu.edu](mailto:smontgomery@llu.edu)

Maria De Borba-Silva, DrPH, MPH  
26203 Town Green Drive  
Elmsford, NY 10523  
[mdeborbasilva@yahoo.com](mailto:mdeborbasilva@yahoo.com)  
Cell: 310/409-7576, Phone/Fax: 914/592-1573

Pramil Singh, DrPH, MPH  
Director, Center for Health Research  
Loma Linda University School of Public Health  
[psingh@llu.edu](mailto:psingh@llu.edu)

Hildemar dos Santos, MD, DrPH  
Assistant Professor, Preventive Care Program  
Loma Linda University School of Public Health  
[hdossantos@llu.edu](mailto:hdossantos@llu.edu)

Jayakaran S. Job, MD, DrPH  
Professor and Chair, Global Health Department  
Loma Linda University School of Public Health  
[jjob@llu.edu](mailto:jjob@llu.edu)

T.L. Brink, PhD, MBA  
Professor of Psychology, Crafton Hills College  
[tbrink@craftonhills.edu](mailto:tbrink@craftonhills.edu)  
\* corresponding author