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I, Bradley Fevrier, hereby submit this original work as part of the requirements for the degree of Doctor of Philosophy in Health Education.

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College Students’ Knowledge, Attitudes and Behaviors Regarding Hookah use

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College students’ knowledge, attitudes and behaviors regarding hookah use

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Abstract

AN ABSTRACT OF THE DISSERTATION FOR THE DOCTOR OF PHILOSOPHY DEGREE IN HEALTH PROMOTION AND EDUCATION, PRESENTED ON JULY 19, 2016 AT THE UNIVERSITY OF CINCINNATI, CINCINNATI, OH

TITLE: College Students’ Knowledge, Attitudes and Behaviors Regarding Hookah Use

DOCTORAL COMMITTEE MEMBERS: Dr. Rebecca A. Vidourek (co-chair), Dr. Laura Nabors (co-chair) and Dr. Keith A. King

This dissertation comprises two studies. Study one examined personal and demographic factors’ impact on hookah use among college students. Study two examined recent hookah use, knowledge of health risks, attitudes and perceived reasons for hookah use among college students.

Study One Abstract

Research indicates that a number of college students are at risk of serious health consequences similar to that of cigarette smoking. These health risks may involve certain types of cancers, herpes, and various other infections passed on as a result of using a hookah pipe. These specific behaviors that may place college students at risk, occur predominantly at hookah café’s and bars. Students report smoking hookah most often with friends and acquaintances. The purpose of this study is to identify demographic factors that influence hookah use among college students and to determine the associations among use of other drugs and hookah use. A four-page, 20-item survey was developed to determine participants’ hookah use and the impact of personal and demographic factors on hookah use. Analyses for this study revealed that students
with recent (past 30 days) cigarette, alcohol and marijuana use were more likely than students
who had not used these drugs to have used hookah. Results indicated significant differences in
hookah use based on grade, race/ethnicity, and employment status, however, no significant
results were found based on sex. Study findings should be taken into consideration when
designing interventions to educate students about the dangers of tobacco, particularly hookah use,
among college students.

Study Two Abstract

Notwithstanding the efforts of health educators and other health professionals regarding
tobacco and smoking cessation, research indicates that hookah smoking among college students
remains a health concern. Research indicates an upward trend in college students’ hookah use.
Therefore, the purpose of this study was to identify and describe potential patterns/differences in
college students’ hookah use, and the relations among attitudes toward and knowledge about
hookah use and use of this drug. A four-page, 20-item survey was developed to determine
participants’ recent use, knowledge of health risks, attitudes and reasons for hookah use among
college students. Results indicated lifetime hookah use among participants of this study was
slightly above other previous studies with 53.8% of students using hookah. Participants’ recent
hookah use was consistent with that of current research. Study findings supports current research,
which found that college students have low negative perceptions of the health risks (addictive and
detrimental properties) of hookah use. Analyses also determined that college students’ attitudes
toward hookah was associated with use of this drug. Regarding reasons why students may use
hookah, data analysis indicated statistical significance in lifetime hookah use based on reasons for use. Study provide information for health educators creating hookah risk awareness educational programs aimed at reducing rates of hookah smoking among college students.
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Study One: Personal and Demographic Factors’ Impact on Hookah use among College Students
INTRODUCTION

There has been a significant decline in overall cigarette smoking in the United States (U.S.) during the last two decades (Primack, Fertman, Rice, et al. 2010; Centers for Disease Control and Prevention [CDC], 2008). However, tobacco smoking by means of a hookah pipe, commonly referred to as a water-pipe or narghile, is an emergent trend in the United States, particularly common among college age students (Barnett et al., 2013, Jarrett et al., 2012, Jawad et al., 2013; Smith et al., 2011). This is significant as an increase in hookah use threatens to undo the accomplishments of reducing tobacco use in the U.S. (WHO, 2015; Primack, Sidani, Agarwal, et al. 2008; Maziak, Ward, Soweid, & Eissenberg, 2004). Notwithstanding results that hookah use is linked with negative outcomes, several important areas remain unexamined.

Primack, Walsh, Bryce, and Eissenberg, (2009) suggested that the rise in Hookah use among college students may be attributed to the perception that Hookah use involves lower health risks, when compared to cigarette use. Unfortunately, hookah tobacco smoke comprises significant quantities of toxicants (Katurji et al. 2010). According to the World Health Organization approximations, a single hookah session distributes 50-100 times the smoke produced by a single cigarette, (World Health Organization [WHO], 2015). Other studies have demonstrated that smoke from one hookah session comprises roughly 40 times the tar, 20 times the cancer-causing polycyclic aromatic hydrocarbons, 10 times the carbon monoxide, and 2 times the nicotine levels of a single cigarette (Katurji, et al. 2010; Sepetdjian, Shihadeh, & Saliba, 2008; Shaheed et al, 2005). Researchers have proposed that hookah use is related to considerable dangers and addictiveness (Maziak et al. 2004; Primack, Sidani et al. 2008; WHO, 2015). Expired air analysis due to second-hand smoke exposure has also proved to be an issue, as the expired air concentrations of carbon monoxide from non-smokers at a hookah lounge
tested 3 times higher than normal when compared with that of non-smokers at a regular bar which allowed cigarette smoking (Barnett et al. 2011).

**Hookah Use and Substance Use**

Over the last decade research examining the health effects of hookah use for both casual and persistent smokers has increased. According to Maziak (2008), many factors related to the dangers of hookah smoking are being examined, including the length and regularity of smoking, volume of smoke inhaled, the chemical properties of hookah smoke, and the kinds of tobacco and charcoal in different kinds of hookah. Besides the prospect of lifelong nicotine addiction, smoking a Hookah pipe with others puts smokers at risk of spreading diseases (Morris, 2012). Additionally, hookah use can be a gateway to using other psychoactive substances such as marijuana, (Eissenberg et al., 2008; Prignot et al., 2008). In previous studies, marijuana, alcohol and tobacco have all been considered gateway drugs. The gateway hypothesis theorizes that initial use of alcohol, tobacco and marijuana frequently leads to experimentation with other drugs such as heroin and cocaine (Fergusson Horwood, 2006). Tobacco along with alcohol has oftentimes been reported as the first substance used when tracking the progression of marijuana and other drug use (Kandel & Kandel, 2015). These observations points to a multifaceted interaction between these substances and additional drugs; however, no previous studies have examined this potential association with hookah use.

The proliferation in hookah use among college students, as cigarette use has simultaneously dropped, may be clarified in at least two ways. First, hookah is unregulated in the United States, thus, it is more readily available (Primack et al., 2012) to students who would otherwise be unable to purchase tobacco-based products. Second, many hookah users underestimate the health risks associated with use of this drug (Daniels & Roman, 2013; Jacob et
al., 2013, Nuzzo et al., 2013). Jawad et al. (2013), suggested that hookah users believe that the toxins and other carcinogens are filtered through the water, making hookah smoking less addictive than cigarettes. However, other literature suggests that hookah use may present much of the same -- if not greater health risks -- than cigarette use. Furthermore, as a result of the recreational undertone of hookah, in which numerous users smoke from the same apparatus/water-pipe mouthpiece, increased risks of contracting an orally transmitted disease, such as tuberculosis, herpes, and hepatitis are presented (Morris, 2012).

**Hookah use and demographic factors**

According to Cobb et al. (2010), regular hookah tobacco smokers and regular cigarette smokers had significantly greater levels of carcinoembryonic antigen (CEA), a protein that has been linked with tumor formation. Consequently, it is important to develop prevention messages and interventions to reduce hookah use. Understanding risk factors for use and perceptions of use among college students is important because they have relatively high rates of hookah use (Primack et al., 2008; Smith-Simone et al., 2008). Initial research based on small samples of U.S. university students indicated variable rates of use, indicating that approximately 20-40% of young adults reported having smoked hookah tobacco during the past year, while 5-20% of the same population reported hookah tobacco use within the past 30 days (Primack et al., 2008; Smith et al., 2007; Smith-Simone et al., 2008). Preliminary research has indicated that the typical college age hookah user is most often male, Caucasian, in early college, and residing in fraternity housing. (Primack et al., 2008; Smith et al., 2007; Smith-Simone et al., 2008). The associations between socio-demographic factors and hookah smoking have been assessed within small samples; therefore, a study of these associations in a larger sample is essential. Understanding hookah use among college students will provide information for prevention
efforts. Martinasek and colleagues (2011) recommended that providing information about dangers of hookah smoking, establishing smoke-free environments, and regulation of tobacco use will help curb use of tobacco, such as hookah. Studies, such as the current one, aimed at understanding use, will provide data to inform intervention efforts.

College students spend a lot of their time on campus therefore, the campus setting could be considered a great platform to implement intervention programs such as education programs aimed at empowering students through peer educators (Dahlui, Jahan, Majid, et al., 2015). In spite of current findings which suggests an association between hookah use and detrimental outcomes, several important areas persists unexamined. Primarily, while cigarette smoking has long been viewed as a “gateway” to alcohol and illicit substance use, it is uncertain whether and to what extent hookah use is likely associated with the use of other substances.

**Study Purpose**

The objective of this study is to contribute to current knowledge about factors related to hookah use. Specifically, the present study is aimed at filling gaps in the research by determining potential associations/patterns between hookah smoking and a range of demographic factors and use of other drugs, such as alcohol, tobacco, and marijuana. The following research questions will be investigated:

1) What is the extent of lifetime hookah use among college students?

2) How old were students when first initiating hookah use?

3) Where do students most commonly obtain hookah?

4) To what extent do students use hookah in combination with alcohol, tobacco, and marijuana?

5) Does lifetime hookah use differ based on recent cigarette, alcohol, and marijuana use?
6) Does lifetime hookah use differ based on sex, grade, race/ethnicity, and employment status?

METHODS

Participants

Participants in this study were 18-35 year old college students at a large, urban public university in the Midwestern United States. This study was granted approval by a university-based Institutional Review Board after which students were recruited from undergraduate classes at the university. All student participation was voluntary. If students did not wish to participate, the principal investigator instructed students to sit quietly while the survey was being administered. The minimum targeted number of students for this survey was 381 as calculated by the sample size calculator (Raosoft, 2008). A minimum of 381 participants were recruited as this number consisted of a representative sample size from the current enrollment of the University (academic year) 2014/15 which was 43,691.

Instrument

Participants’ hookah use, understanding of behavioral and perceived patterns, and the impact of co-occurring substances were assessed by data collected from a four-page, 20-item survey instrument developed by the principal investigator after reviewing studies on hookah and cigarette smoking. Brief definitions of the term hookah and the common names by which it is known was provided on the first page of the survey. The survey instrument was reviewed by a three member expert review panel as a way of establishing validity. The survey was divided into four sections: (1) knowledge and perception, (2) attitudes, (3) co-occurring substance use and (4) demographics.
Section one assessed whether students used hookah and their attitudes toward and perceptions about hookah. The first question verified that the participants were currently using hookah. If they answer “yes”, they were instructed to continue to the subsequent question. If they answered “no”, they were directed to question 6, which assessed their overall hookah health knowledge. Question two asked participants to indicate their current hookah use since beginning college by choosing a response from a list of two choices. The choices included (1) “Yes” and (2) No. If participants responded with a yes response, they were also asked to “Please indicate the name by which it was referred” Question three asked participants how old were they at first hookah use and a blank space was provided to input age in number of years. The fourth question asked about students past 30 day hookah use and a blank space was provided to input the number of days they had engaged in hookah use. The fifth question asked students about possible places they received hookah from, with a list of possible options provided. The list consisted of (1) Parents (2) Friends (3) Hookah café (4) Acquaintance, (4) other relative, (5) Internet, (6) Sibling, and (7) Other. They were asked to specify “Other” in option 7. Question six asked participants to check “True or False” from 10 hookah knowledge items. Finally, using a Likert-type scale of 1-5 (1 = strongly disagree; 5 = strongly agree), participants rated their responses to question seven and eight which consisted of nine and six statements, respectively, pertaining to attitudes and perceptions of students towards hookah use.

Section two assessed participants’ knowledge of educational hookah programs and attitudes toward the use of hookah. Participants were asked, using the Likert-type scale of 1-5 (1 = strongly disagree; 5 = strongly agree) to indicate whether they agree or disagree with statements on their knowledge of the availability of hookah education. Question ten asked participants to indicate how strongly they agree or disagree based on twelve statements
addressing the reasons why individuals may choose to use hookah using a Likert-type scale of 1-5 (1 = strongly disagree; 5 = strongly agree).

Section three addressed past 30 day hookah use and co-occurring substance use. Question eleven comprised of three items, which addressed: cigarette use in the past 30 days, marijuana use during the past 30 days and, alcohol use during the past 30 days. Participants’ were asked to select from yes/no responses. For co-occurring substance use and hookah use during the past 30 days, participants were assessed based on four questions e.g., “During the past 30 days, on how many days have you used another drug while smoking Hookah”.

Section four requested participants to complete demographic information. This section comprised nine items: age, sex, grade, current residence, extracurricular involvement, enrollment status, race/ethnicity, grade point average and employment status. Students were asked to check the box next to their response (e.g. employment status: Full-time, Part-time or not employed).

**Procedures**

The researcher’s dissertation committee and the Institutional Review Board (IRB) at the University of Cincinnati approved the research proposal, survey instrument, informational letters, and all consent forms. Content validity was established by distributing the survey to a panel of three experts. Each expert was asked to review the electronic copy of the survey and provide the researchers with any suggested changes. Suggested revisions were reviewed by the research team and those considered appropriate were utilized in the final survey instrument.

During the course of one academic semester, a total of 403 students completed the survey. The primary investigator began data collection in each class by first explaining the purpose of the study and informing students that their responses would be completely anonymous. Students were also told that their participation was voluntary and that by completing
the questionnaire, they were giving their consent to participate in the study. Students were then
given a cover letter (or Information Form) that restated the purpose of the study, that answers
would be kept completely anonymous, that participation was voluntary, and that by completing
the survey they were granting permission for their responses to be used in the study. The time
required to complete the survey was between 10 and 15 minutes.

The researcher maintained participants’ anonymity by instructing them not put their
name, student identification number or any other personal identifiers on the survey. The
researcher then instructed students to place their surveys face down in a box located at the front
of the room. Once all surveys had been placed in the box, it was sealed. After data collection in
each class, the principal investigator opened the box containing the surveys to gain an accurate
count of the number of completed surveys. Surveys were kept secure in the principal
investigator’s locked office file cabinet.

Data analysis

Data was analyzed using the Statistical Package for the Social Sciences (SPSS) (Version
23.0). Descriptive statistics (frequencies, means, standard deviations, ranges) were used to
describe the participants’ demographic information. Frequencies were used to determine lifetime
hookah use among college students. Logistic regression was conducted to determine to what
extent students used alcohol, tobacco, or marijuana while using hookah. Lifetime hookah use
based on sex, gender, race/ethnicity and employment status were also analyzed using a logistic
regression analysis. An alpha level of .05 was established prior to analyses.
RESULTS

Demographic Characteristics

A total of 403 students participated in this study. Of the survey participants, 41.9% were female and 58.1% were male. The majority of respondents (58.5%) classified themselves as underclassman (Freshmen/sophomores). Regarding race, the majority of participants were white. Of college students surveyed, majority (96.3%) reported being enrolled fulltime (Table 1). Also, 52.1% of respondents reported being employed on a part-time basis.

Hookah Use among College Students

Results indicated that 53.8% of participants reported having tried hookah. Among participants who engaged in using hookah, a total of 55.3% were male.

Age of First Hookah Use

Results indicated that of participants who reported having used hookah, mean age of initiation was 17.81 years ($SD = 2.125$). The range of initiation was between 14 and 35 years of age. Approximately 35% of participants reported first using hookah at 18 years of age, 19.5% reported initiating hookah use at 17 years old and 17.7% began using hookah at 16 years of age.

Common Locations for Obtaining Hookah

When analyzing the common locations where students obtain hookah, 64.4% of participants reported obtaining hookah from a Hookah café ($n = 216$) (Table 2). Another 51.9% ($n = 110$) reported getting hookah from a friend and 4.6% ($n = 10$) reported obtaining hookah from an acquaintance. Respondents also identified the three least common places for obtaining hookah. Results indicated that 1.4% ($n = 3$) of respondents reported getting hookah from “other relative (e.g., a relative who was not a parent)”, 0.9% ($n = 2$) reported obtaining hookah from a parent and 0.5% ($n = 1$) obtained hookah from the internet.
Extent of Other Drug Use with Hookah

When examining past thirty days hookah use in combination with alcohol use, 1.5% reported having used hookah while consuming alcohol at least once \( (n = 6) \). Results indicated that 1.5% also reported using hookah in combination with alcohol at least 2 times during the past thirty days \( (n = 6) \). When analyzing past thirty days hookah use and cigarette (tobacco) use, 1.2% of respondents indicated they had used cigarette while using hookah at least once \( (n = 5) \). Results further indicated that 0.2% of the students had used hookah while also using cigarettes at least twice during the past thirty days \( (n =1) \). In examining students past thirty day hookah and marijuana use, results indicated 1.2% of respondents reported using marijuana in combination with hookah at least once \( (n =5) \).

Hookah Use Based on Recent Cigarette, Alcohol, and Marijuana Use

In the present study, a logistic regression was used to examine the relationship among recent cigarette, alcohol and marijuana use and lifetime hookah use. When analyzing hookah use by recent cigarette use, 86.0% of recent cigarette users reported recent hookah use (Table 3). Statistical analyses revealed the students with past 30 day cigarette use were 6.1 times more likely than students who had not used cigarettes during the past 30 days to have used hookah. When examining lifetime hookah use by recent alcohol use (past 30 day), 64.4% of those who had reported past 30 day alcohol use also reported hookah use (Table 3). Statistical analyses revealed that students who reported past 30 day alcohol use were 5.9 times more likely to have used hookah than students who had not used alcohol during the same period to have engaged in hookah use. When analyzing lifetime hookah use by recent marijuana use, 83.9% of students who reported past 30 day (recent) marijuana use, also reported using hookah (Table 3). Statistical
analyses revealed the students with past 30 day cigarette use were 6.2 times more likely than students who had not used cigarettes past 30 days to have used hookah.

**Hookah use based on sex, grade, race/ethnicity, and employment status**

When examining lifetime hookah use by sex, 38.7% of females reported never using hookah and 61.3% of males reported never having tried smoking hookah (Table 4). In the current study, 44.7% of females reported having tried hookah, and 55.3% of males reported ever trying hookah (Table 4). Results indicated there was no significant difference in hookah use based on sex. When examining lifetime hookah use by grade, 71.5% of underclassmen (Freshman/Sophomore) reported not using hookah and 28.5% of upper classmen (Junior Senior/Graduate student) reported not having tried hookah. In this study, upperclassmen were more likely to use hookah consistently; 52.5% reported using hookah whereas 47.5% of underclassmen reported having used hookah. Results indicated a significant difference in hookah use based on grade level. Junior, Seniors and Graduate students were more than twice (2.7 times) as likely as underclassmen to have used hookah. When analyzing lifetime hookah use by race, 77.9% of white students reported using hookah and 22.1% of non-white students reported having used hookah. Among those who had not used hookah, 77.4% of white students reported not using hookah and 22.6 % of non-white students reported having never used hookah. Race was not significantly related to hookah use. When examining hookah use by employment status, 51.6% of unemployed participants reported never using hookah whereas 48.4% of employed participants reported not having used hookah. Thirty three point two percent of unemployed participants reported they had tried hookah, and 66.8% of employed participants reported having used hookah (Table 4). Statistical analyses revealed that students who were
employed were more than twice (2.1 times) as likely as unemployed students to have used hookah.

**DISCUSSION**

**Lifetime Hookah use and age of first initiation among college students**

In the present study, approximately 1 in 2 participants had used hookah in their lifetime. The lifetime prevalence of hookah use (53.8%) was higher than estimates reported by Fielder and colleagues (2012) in New York (about 45%) and by Smith and colleagues (2011) in California (about 25%). The higher prevalence rate may be attributed to the urban location of the university and the easy access to a number of local of hookah bars/cafes. Other findings of this study were, however, consistent with those of previous studies, such as the fact that there were higher rates of hookah use among men than among women, a higher prevalence among whites than among other races, and a higher prevalence among smokers than among nonsmokers (Rahman et al. 2012; Smith et al., 2011).

Approximately 2 out of 3 (67.9%) students in this study reported using hookah since beginning college. Many had tried hookah before coming to college, as the number of students who reported having tried hookah at or before age 18 was about 77% of the group of students who reported using hookah. This is in keeping with research studies conducted by Fielder and her colleagues, which suggests that hookah initiation rates are high among college student during the first few months on campus (Fielder et al. 2012). This may be attributed to experimentation of new behaviors by emerging adults (Arnett, 2005) or the social nature of hookah use by groups of students (Ward et al., 2007). An in-depth examination of why students use hookah, perhaps using a semi-structured interview process, will provide information about why students are smoking hookah.
Locations for obtaining hookah and hookah use with alcohol, cigarette and marijuana

Among survey participants’, hookah was most commonly obtained from hookah cafés and bars (64.4%), from a friend (51.9%), or an acquaintance 4.6%. It is important to note that Hookah establishments frequently offer food, alcohol, and popular social activities such as dancing (Primack et al., 2012). This may provide support for the notion that hookah use is a social activity (Ward et al., 2007). If hookah use is a social event, this might explain why hookah cafés are the most popular location for obtaining hookah for students who participated in this study. In the current study, frequency of recent hookah use in combination with other substances was low. Hookah users reported low levels of alcohol (3.4%), cigarettes (.6%) and marijuana (2.2%) when they were using hookah.

Hookah Use and Cigarette, Alcohol, and Marijuana Use

Study results supported the findings of previous literature, which suggests that hookah users used alcohol, tobacco and marijuana at much greater rates than non-hookah users (Heinz et al. 2013). Participants who used hookah were more likely to have reported recent cigarette use (86%), recent alcohol use (64.0%) and recent marijuana use (83.9%) than non-hookah users. Analyses revealed participants who had used hookah were 6 times more likely than students who had not used hookah to have smoked cigarettes within the past 30 days. Likewise, students who reported lifetime hookah use were approximately 6 times more likely to have drank alcohol (5.94) than students who had not used hookah and 6 times more likely to have used marijuana than students who reported they had not used hookah.

These prominent/elevated rates of recent cigarette, alcohol and marijuana use based on lifetime hookah use are consistent with findings from earlier studies (Brockman et al., 2012; Fielder et al., 2012). The negative association between co-occurring substance use and hookah...
use may be aligned with the problem behavior theory, which posits that substance use behaviors often co-occur (Jessor, 1991). Undeniably, involvement in one risk behavior is frequently linked with engagement in several risk behaviors (Fox, McManus, & Arnold, 2010). Consequently, the results of the current study indicated that students who smoked marijuana, drank alcohol and smoked cigarettes were more likely to smoke hookah. Future research studies are needed to help identify whether, and to what extent hookah use catalyzes and or exacerbates other substance use.

Subsequent studies should also assess common factors that trigger substance use, such as social and coping motives, peer norms and approval, and determine whether educational efforts to outline the risks of multiple substance use reduce the use of hookah and other substances.

**Sex, Grade, Race/ethnicity, and Employment Status as Predictors of Hookah Use**

Results indicated that there was a significant difference in males and females’ use of hookah. Approximately 55% of males and 45% of females reported using hookah. Thus, findings are consistent with other research indicating that more males than females use hookah (Grekin & Ayna, 2012; Jarrett et al., 2012). In this study, male was a protective factor as we found that males were at lesser odds of using hookah, a finding that seem to conflict current literature.

This study found that older students (Junior/senior/Grad) were more than twice (2.777) as likely to have smoked hookah in comparison to freshmen/sophomores, a finding that appears to conflict with the literature. For example, studies have found a greater prevalence of hookah use among younger students than older students (Barnett et al., 2013; Fielder et al., 2012).

When analyzing hookah use by race, non-white students reported lower rates of lifetime hookah use than white students. Approximately 77.9% of white participants and 22.1% of non-
white students had ever tried using hookah, thereby placing their health at risk, and these findings were consistent with those of previous research (Grekin et al. 2012; Jarrett et al., 2012).

Lastly, the present analysis found that employment status was significantly associated with hookah use. The study found that students who reported some form of employment (Fulltime, part-time) were approximately 2 times more likely to have used hookah than those who reported they were unemployed. Sixty six point eight percent of employed students reported having used hookah whereas 33.2 % of unemployed students reported hookah use. This can potentially be explained by the fact that students who are employed may have more expendable income and as a result, they can afford to pay the cost of a session of hookah smoking.

**Limitations**

Several factors may have limited the generalizability of study findings. First, participants were predominantly undergraduate students at a large Midwestern University, and therefore results may not be generalizable to other populations. Second, a social desirability bias may have resulted in participants under-reporting their use of hookah or other substances. The current study was cross-sectional in nature and those change in hookah use over time or during college cannot be examined. Moreover, the use of a survey limited opportunities to examine why students used hookah and a semi-structured interview or a qualitative design may provide further information about why students were using hookah and why they perceived or did not perceive risks associated with hookah use. Finally, given the sensitive nature of the study, some participants might have been reluctant to answer questions about their drug use history.

**Conclusions**

The use of hookah by college students in this study and initiation rates at or before starting college indicate that preventive efforts at the university are warranted. There is a need for health
promotion and education policies and programs in an effort to help reduce and prevent hookah use among college students. Currently, there are very few public health initiatives aimed at reducing rates of hookah use among college students. A lack of information regarding the dangers and potential harms of hookah use may be misinterpreted as a sign of “safety” which inadvertently may imply a suggestion of no need for safety measures. Future research studies are needed to help identify whether, and to what extent hookah use leads to the initiation of other substance use and why rates of substance use among hookah users are high. Further qualitative studies may also provide increased knowledge about students’ understanding of the health risks associated with hookah use and information about whether they view their experimentation with hookah as a risky health behavior.
References


Daniels, K. E., & Roman, N. V. (2013). A descriptive study of the perceptions and behaviors of waterpipe use by university students in the Western Cape, South Africa. Tobacco Induced Diseases, 11(1), 4.


Table 1. Demographic Characteristics of Students

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<thead>
<tr>
<th>Demographic Variable</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>169</td>
<td>41.9</td>
</tr>
<tr>
<td>Male</td>
<td>234</td>
<td>58.1</td>
</tr>
<tr>
<td><strong>Grade level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freshman</td>
<td>150</td>
<td>37.2</td>
</tr>
<tr>
<td>Sophomore</td>
<td>86</td>
<td>21.3</td>
</tr>
<tr>
<td>Junior</td>
<td>89</td>
<td>22.1</td>
</tr>
<tr>
<td>Senior</td>
<td>76</td>
<td>18.9</td>
</tr>
<tr>
<td>Graduate student</td>
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<td>.5</td>
</tr>
<tr>
<td><strong>Race/Ethnicity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>313</td>
<td>77.7</td>
</tr>
<tr>
<td>Non-White</td>
<td>90</td>
<td>22.3</td>
</tr>
<tr>
<td><strong>Enrollment Status</strong></td>
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<td></td>
</tr>
<tr>
<td>Full time</td>
<td>388</td>
<td>96.3</td>
</tr>
<tr>
<td>Part time</td>
<td>15</td>
<td>3.7</td>
</tr>
<tr>
<td><strong>Employment Status</strong></td>
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<td></td>
</tr>
<tr>
<td>Full time</td>
<td>25</td>
<td>6.2</td>
</tr>
<tr>
<td>Part time</td>
<td>210</td>
<td>52.1</td>
</tr>
<tr>
<td>Not employed</td>
<td>168</td>
<td>41.7</td>
</tr>
</tbody>
</table>

*Note: N = 403*
Table 2. Common Locations Students Obtain Hookah

<table>
<thead>
<tr>
<th>Locations Students Obtain Hookah</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hookah Cafe</td>
<td>139</td>
<td>64.4</td>
</tr>
<tr>
<td>Friend</td>
<td>112</td>
<td>51.9</td>
</tr>
<tr>
<td>Acquaintance</td>
<td>10</td>
<td>4.6</td>
</tr>
<tr>
<td>Sibling</td>
<td>7</td>
<td>3.2</td>
</tr>
<tr>
<td>Other</td>
<td>7</td>
<td>3.2</td>
</tr>
<tr>
<td>Other relative</td>
<td>3</td>
<td>1.4</td>
</tr>
<tr>
<td>Parent</td>
<td>2</td>
<td>.9</td>
</tr>
<tr>
<td>Internet</td>
<td>1</td>
<td>.5</td>
</tr>
</tbody>
</table>

*Note: N = 403*
Table 3. Lifetime Hookah Use based on Recent Cigarette, Alcohol, and Marijuana Use

<table>
<thead>
<tr>
<th>Item</th>
<th>Never Used Hookah N (%)</th>
<th>Have Used Hookah N (%)</th>
<th>OR</th>
<th>CI</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recent Cigarette Use</strong>a</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>180 (50.0%)</td>
<td>6 (14.0%)</td>
<td>6.167</td>
<td>(2.540, 14.971)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Yes</td>
<td>180 (50.0%)</td>
<td>37 (86.0%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Recent Alcohol</strong>b</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>77 (77.0%)</td>
<td>109 (36.0%)</td>
<td>5.959</td>
<td>(3.537, 10.037)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Yes</td>
<td>23 (23.0%)</td>
<td>194 (64.0%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Recent Marijuana Use</strong>a</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>172 (54.4%)</td>
<td>14 (16.1%)</td>
<td>6.228</td>
<td>(3.373, 11.499)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Yes</td>
<td>144 (45.6%)</td>
<td>73 (83.9%)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*N = 403*
Table 4. Lifetime Hookah Use based on Demographic Characteristics

<table>
<thead>
<tr>
<th>Item</th>
<th>Never Used Hookah N (%)</th>
<th>Have Used Hookah N (%)</th>
<th>OR</th>
<th>CI</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>72 (38.7%)</td>
<td>97 (44.7%)</td>
<td>.781</td>
<td>(.525, 1.164)</td>
<td>.224</td>
</tr>
<tr>
<td>Male</td>
<td>114 (61.3%)</td>
<td>120 (55.3%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Grade level</strong>&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freshman/Sophomore</td>
<td>133 (71.5%)</td>
<td>103 (47.5%)</td>
<td>2.777</td>
<td>(1.834, 4.207)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Junior/Senior/Grad</td>
<td>53 (28.5%)</td>
<td>114 (52.5%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Race/ethnicity</strong>&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>144 (77.4%)</td>
<td>169 (77.9%)</td>
<td>.974</td>
<td>(.609, 1.558)</td>
<td>.912</td>
</tr>
<tr>
<td>Non White</td>
<td>42 (22.6%)</td>
<td>48 (22.1%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Employment Status</strong>&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td>96 (51.6%)</td>
<td>72 (33.2%)</td>
<td>2.148</td>
<td>(1.435, 3.215)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Employed</td>
<td>90 (48.4%)</td>
<td>145 (66.8%)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*N = 403*
Study Two: Recent Use, Knowledge of Health Risks, Attitude and Reasons for Hookah Use among College Students
INTRODUCTION

Tobacco, alcohol, and marijuana are frequently used by college students (Nichter, et al. 2010). Within this population, these substances are considerable causes of morbidity and mortality (Fiestas, et al. 2010; Hingson, Zha, & Weitzman 2009). There have been various public health interventions intended to address substance use among university students (Mc Cambridge, Hunt, Jenkins, et al. 2011; Logan & Marlatt 2010). Many of these intervention efforts are often geared towards a specific group of individuals; for example, white male fraternity students, who are often at higher risk for substance use (Park, Sher, Krull, 2008; Barry 2007). Nevertheless, many individuals may choose to use one of these substances but not the other (Fiestas, et al. 2010 & Baldwin, et al. 2011). Although there have been recent declines in cigarette use (Kilmer, et al. 2008 & Primack, et al. 2010), hookah smoking (waterpipe, narghile, or shisha-pipe) is an emergent trend predominantly among college students (Smith, Curbow, & Stillman, 2007; Smith-Simone, et al. 2008; Primack, et al. 2008).

In an upward and increasingly disturbing trend, college students comprise a greater percentage of the at-risk population in regards to hookah use (Noonan, & Patrick, 2013). College students are faced with the prospect of participating in hookah smoking since a greater number of hookah cafes/bars are being introduced throughout most college cities in the United States. According to an analysis conducted by Primack et al. (2013), students’ reports of hookah use in the past 30 days and having ever tried hookah were 10% and 33% respectively.

There is a growing body of research which indicates that hookah use is linked with nicotine dependence and other negative health consequences (Heinz et al. 2013; Knishkowy, & Amitai, 2005). Specifically, smoking (tobacco) is causally correlated to coronary diseases, stroke, and lung disease (Roskin, & Aveyard, 2009; Tavafian, 2009). Regarding additional
health risks, hookah tobacco smoking is associated with increased heart rate, elevated blood pressure, weakened pulmonary function, and carbon monoxide intoxication (El-Zaatari, Chami, & Zaatari, 2015). There are also serious concerns over the long-term effects of hookah smoking, which include chronic bronchitis, emphysema and coronary artery disease. (El-Zaatari, et al. 2015). Additionally, 440,000 deaths and 5.6 million years of life are estimated to be lost resulting from tobacco smoking in the United States every year (Fromme, et al. 2009; Tavafian, Aghamolaei, & Zare, 2009).

While hookah tobacco smoking is perceived as less detrimental to health in comparison to cigarette smoking (Heinz et al., 2013), increasing evidence suggest that hookah users in the United States are more likely to face the same health risks and similar dangerous agents comparable to that of cigarettes (Akl, Gaddam, et al., 2010; El-Nachef, & Hammond, 2008; Neergaard, Singh, Job,& Montgomery, 2007; Shihadeh, 2003). Hookah tobacco smoking has been linked to various forms communicable disease, e.g. tuberculosis, herpes, and hepatitis (Morris, 2012). Research also suggests links between hookah use and use of other psychoactive substances (Prignot, Sasco, Poulet, Gupta, & Aditama, 2008; Tamim, Al-Sahab, Akkary, Ghanem, Tamim, et al.2007). Fielder, Carey, and Carey (2012) stated that 34% of female college students reported having used hookah during their first year of being on campus. In addition, Jarrett, Blosnich, Tworek, and Horn (2012), reported that 8% of female college women surveyed in the National College Health Assessment II indicated having used hookah during the last 30 days. Previous studies have found that there are greater prevalence rates of hookah use among younger students (freshmen, sophomores) in comparison to older students (juniors, seniors) (Barnett et al., 2013; Fielder et al., 2012). As a result freshmen and sophomores may be at greater risks of negative consequences from engaging smoking as are juniors and seniors.
In light of study findings that illustrate tobacco smoking use/patterns, it is important to examine specific reasons students may use hookah. One reason for hookah’s popularity may be that use of this drug occurs in groups at cafes, making hookah use an inherently social activity. Moreover, students may not perceive using hookah as related to health risks. Research seems to indicate that hookah users hold the belief that smoking a hookah is safer than using cigarettes (Heinz et al. 2013). Several researchers have recommended assessment of students’ knowledge and attitudes toward hookah use are important for informing the design of prevention messages (Branstetter, Blosnich, Dino, Nolan, & Horn 2012; Rigotti, Le, & Wechsler 2000).

**Study Purpose**

The purpose of this study was to identify and describe potential patterns/differences in college students’ hookah use, and attitudes, knowledge and perceived reasons for use. Study results provided key information about college students’ knowledge and attitudes about hookah use to inform health educators and other health professionals about factors related to use of this drug. The following research questions were investigated:

1. What is the extent of lifetime and recent hookah use (past 30 days) among college students?
2. How knowledgeable are students regarding the health effects and risks of hookah use?
3. What are student attitudes toward hookah?
4. What are the most commonly reported perceived reasons students may use hookah?
5. Does lifetime hookah use differ based on knowledge?
6. Does lifetime hookah use differ based on attitudes, and perceived reasons for use?
METHODS

Participants

Participants in this study were 18-35 years old and enrolled at a large public Midwestern university. Participants were recruited from undergraduate classes at the university. All student participation was voluntary. If students did not wish to take part in the study, they were instructed to remain seated while the other participants’ complete the survey questionnaire. A university-based Institutional Review Board granted approval for the current study.

Instrumentation

For this study, the research team utilized a four-page 20-item survey that was developed based on a comprehensive review of current literature and discussions with substance abuse professionals and college students. The term hookah use and other common terminologies by which hookah is known were provided on page one of the survey. The survey instrument was divided in four sections: (1) knowledge and perceptions, (2) attitudes/reasons for hookah use, (3) Past thirty days and co-occurring substance use and (4) demographics.

Section one assessed participant’s hookah use and other knowledge factors. Question one verified the participants’ current hookah use. Participants who answered “yes”, to this question were instructed to continue to the next questions before moving to question 6. If the participants answered “no”, they were directed to question 6, which assessed their overall hookah health knowledge. Each section was further divided by knowledge of participants’ hookah use, where participants indicated “true”, or “false” or “I don’t know” in response to ten statements. Participants were then asked to indicate how strongly they “agree” or “disagree” with the nine statements about their perceptions of potential barriers and benefits of hookah use. Following this, participants rated six statements concerning hookah use dynamics, such as using hookah
because it is legal, easy to obtain and fun activity with friends, using a Likert-type scale of 1-5, (1 = strongly disagree; 5 = strongly agree).

Questions in section two assessed cues to action, university education efforts, and reasons for hookah use. Participants were asked to select from statements about available university educational hookah programs and materials. Participants were asked 12 Likert-scale type questions (1-5, 1 = strongly disagree; 5 = strongly agree) to assess participants’ understanding of the reasons for hookah use. Section three focused on participants past thirty day cigarette, marijuana and alcohol use. Participants’ were given the option of selecting from “yes” or “no” responses to each question. For co-occurring substance use and hookah use during the past 30 days, participants completed four questions requesting information about hookah use in combination with alcohol, marijuana, cigarettes. Participants were also asked to list any other drug used while they were smoking hookah. For section four, participants provided demographic information, such as age, sex, grade, current residence, extracurricular involvement, enrollment status, race/ethnicity, grade point average and employment status (e.g. employment status: Full-time, Part-time or not employed).

**Procedures**

Prior to survey implementation, the researcher’s dissertation committee and the Institutional Review Board (IRB) at the university where the research was collected approved the study, survey instrument, and research information sheets. In an effort to establish content validity the survey instrument was distributed to a panel of three experts. Each expert was asked to review an electronic copy of the survey instrument and offer the researcher feedback on suggested changes. Recommended adjustments were reviewed by the research team and those considered suitable were applied in the final survey instrument.
During one academic semester, a sample of 403 students from selected classes completed the survey. The researcher initiated data collection in each class by first explaining the purpose of the study and informing students that their responses would be completely anonymous. Students were informed that their participation in the study was completely voluntary and that by completing the questionnaire, they were granting consent to being in the study. Students were given a research information sheet that restated the purpose of the study, ensured that responses would be kept entirely anonymous, that involvement in the study was voluntary, and that by completing the survey, they were granting permission for their responses to be used in the study. The required time for survey completion was approximately 10 to 15 minutes.

The researcher ensured participants’ anonymity by requesting that they refrain from putting their names or any other identifiers, including student identification numbers on the survey. The researcher then instructed students to place their surveys face down in a box located at the front of the room upon completion. After all surveys had been placed in the box, it was sealed. After data collection in each class, the researcher opened box containing the surveys to count of the number of completed surveys. Completed surveys were kept secure at a designated location in the principal investigator’s office.

**Data analysis**

Survey data was analyzed using the IBM Statistical Package for the Social Sciences (SPSS) (Version 23.0). Descriptive statistics (frequencies, means, standard deviations, ranges) were used to describe participants’ demographic information. A chi-square test of association was conducted to examine the relationship between lifetime hookah use and knowledge. A Multivariate Analysis of Variance (MANOVA) was conducted to examine the relationship between lifetime hookah use and attitudes and perceived reasons for use.
RESULTS

Demographic and Background Characteristics

A total of 403 students ages 18-35 completed the survey. Of the survey participants, slightly more than half were male (58.1%) and slightly less than half were female (41.9%). Concerning grade level, 37.2% were freshman, 21.3% were sophomores, 22.1% were juniors, 18.9% were seniors and 0.5% identified a graduate students. Regarding enrollment status, the overwhelming majority (96.3%) of student were full-time students, whereas 3.7% reported being part time students. Regarding race/ethnicity 1.2% were American Indian or Alaska Native, 77.7% were white, 0.7% were Native Hawaiian or other Pacifica Islander, 10.7% were black or African American, 5.5% were Asian, 2.7% were Multiracial and 1.5% were Hispanic or Latino. Of participants, 38.5% resided on campus, 44.2% resided in off campus apartment and 1.4% resided off campus with parents. Concerning whether or not participants were involved in extracurricular activities, 13.8% were involved in a fraternity, 9.8% were involved in a sorority, 11.2% were intercollegiate athletes, 19.9% participated in intramural sports, 1.4% were involved in student government, 37.7% were part of a club and 6.2% reported being involved in some “other” extracurricular activity.

Lifetime and Recent Hookah Use

Regarding lifetime hookah use (ever tried smoking hookah), 53.8% reported having smoked hookah and 46.2% had never tried hookah. In the past 30 days, 4.6% of participants had used hookah at least 1 time, 2.3% used hookah 2 times, 0.5% used hookah 3 times, 0.5% used hookah 4 times and 0.9% used hookah 20 times. Concerning hookah use since beginning college, 67.9% of respondents reported using hookah since beginning college and 32.1% had not used hookah since starting college.
Knowledge of Health Effects and Risks of Hookah Use

In the present study, every participant (100%) entered responses to the knowledge questions. Participants’ mean score was 5.65 out of a maximum knowledge score of 9 with a standard deviation of 2.65, indicating students had some knowledge of hookah use. The expected range of students’ hookah knowledge was 0 to 9, which was the same as the actual rage of 0 to 9. Participants responded that, “Infections may be passed to other smokers through hookah pipe” (81.9%; n=330), “Hookah carries the same health risk as smoking” (76.9%; n=310) and “Hookah is a safe alternative to cigarettes” (70.2%; n=283), were the top three health risk knowledge items (Table 1). The lowest health risk knowledge items were “Hookah smoking is addictive” (51.4%; n=207), “I can get Herpes by sharing hookah” (50%; n=203) and “Hookah smokers absorb less harmful chemicals than cigarette smokers” (44.4%; n=179; see Table 1).

Attitudes towards Hookah Use

Participants who had tried using hookah reported, “I think hookah is enjoyable” $M = 3.45$ ($SD = .957$), “I think hookah helps me deal with stress” $M = 3.35$ ($SD = .854$), and “I think people who use hookah are more likely to use regular cigarettes” $M = 3.20$ ($SD = .960$). Mean scores were relatively lower for the following items: “I think hookah is healthier than smoking cigarettes” $M = 2.3$ ($SD = 1.100$), “I think hookah makes me sleep better” $M = 2.00$ ($SD = .986$), and “I think hookah makes a person look more mature” $M = 1.82$ ($SD = .822$).

Perceived Reasons for Hookah Use

Higher mean scores for reasons for hookah use were found for the following three questions: “Using hookah at a party with friends” $M = 4.04$ ($SD = .802$), “friends use hookah” $M = 4.01$ ($SD = .779$), and “to have fun” $M = 4.00$ ($SD = .771$). Mean scores were lower for these questions about reasons for hookah use: “to improve academic performance” $M = 2.06$ ($SD = .
to manage/improve sleep” $M = 2.70$ ($SD = 1.049$), and “their parents have used it” $M = 2.89$ ($SD = .965$).

**Hookah Use based on Knowledge, Attitudes and Perceived Reasons for Use**

Regarding lifetime hookah use based on student knowledge, a total knowledge score was computed. Subsequently, the knowledge score was dichotomized based on the median split into low knowledge and high knowledge. Low knowledge about hookah was indicated by 49.5% of the students who “never used hookah” $n = 109$ and 50.5% of the students who used “used hookah” $n = 111$. In contrast, 42.1% of students ($n = 77$) with high knowledge about hookah reported “never used hookah” and 57.9% ($n = 106$) with high knowledge reported they had “used hookah.” A chi-square analysis indicated no statistically significant difference between knowledge levels (low, high) and lifetime hookah use, ($X^2 = 2.242, p = .134$) (see Table 2).

Concerning the influence of students attitudes on lifetime hookah use, MANOVA analyses indicated lifetime hookah use significantly differed based on student attitudes $F = (1,401) 20.265, p < .001$. Regarding perceived reasons why students may use hookah, MANOVA analysis indicated a statistically significant difference in lifetime hookah use based on students’ reasons for hookah use, $F = (1,401) 4.073, p < .001$. Information about significance for different questions and means and standard deviations are presented in Tables 3 and 4.

**DISCUSSION**

Results of the current study presented information about college students’ hookah use trends, as well as information about their knowledge, attitudes, and reasons for hookah use and lifetime hookah use among a diverse sample of students attending an urban Midwestern University. Slightly more than half of the students in the sample reported lifetime hookah use (53.8%) and 8.8% reported recent (past 30 days) use. The rate of lifetime hookah use in this
study were above average and recent use was about equal to the reported averages for national samples (e.g., Sidani, Shensa, & Primack, 2013, 33% lifetime, 10% current; Primack, Shensa, et al., 2013, 30.5% lifetime, 8.4% current). Relatively higher rates of hookah use among our study sample may be explained by the composition of our sampling (predominantly undergraduate students) and the urban study location (increased access to hookah cafés). Moreover, rates of hookah use have been growing over the past few years, which may be reflected in rates of use determined for this study (Smith et al., 2011). Frequency of recent hookah use (i.e., how often students used hookah) seemed low as the majority of recent users (53%) reported using only once.

Study findings support current research which found that college students have low perceptions of the addictive and detrimental properties of hookah use on their health (Eissenberg et al., 2008; Primack et al., 2008). In the current study, irrespective of lifetime use, students exhibited low overall knowledge as to the harmful effects of hookah smoking (e.g., 44.4% of respondents answered false to “hookah smokers absorb less harmful chemicals”, 50.4% reported that they can get Herpes by sharing a hookah and only 51.4% believed that hookah smoking was addictive). These findings suggest that students may underestimate the health risks associated with hookah smoking; therefore, health promotion education and public health initiatives may increase student awareness of the dangers associated with hookah smoking.

One important aspect of the current study is the descriptive nature of student attitudes towards hookah use, which may propose directions for prevention efforts. Two of the top three attitudes reported by students towards hookah use were positive (I think hookah is enjoyable, I think hookah helps me deal with stress). Also, many hookah users believe there are benefits to using hookah as an alternative to regular cigarettes (Rankin, 2011). It may also be the case that
students like using hookah and this is related to them ignoring risks or avoiding learning about health risks related to hookah use. Intervention efforts aimed at addressing the myth that it is a safer alternative than cigarettes may be a vital approach for health education efforts in this current study population.

The most prominent reason why students reported using hookah was because their friends smoked hookah. Students also smoked hookah to, “to have fun,” which may pose a challenge when implementing health education programs. It may be warranted to propose additional fun, social activities that student can engage in to replace hookah smoking as a social event.

Numerous challenges have not been previously addressed by antismoking campaigns. (Rahman et. al. 2013). Antismoking campaigns have been previously successful in preventing and reducing tobacco use. Specifically, such campaigns are successful by addressing the social aspect of using tobacco and reducing the perception of fun. Incorporating such strategies into hookah prevention campaigns may also be successful.

Results of the current study suggested that a substantial knowledge gap existed among this sample of college students. The majority of individuals were either unaware or neutral in regards to the dangers associated with smoking hookah. Lifetime hookah use based on student knowledge was dichotomized into low knowledge and high knowledge. The present study indicated a low knowledge of the dangers associated with hookah smoking. This is consistent with previous research that found hookah smoking is often viewed by most individuals as being less harmful and/or less addictive in comparison to regular cigarettes (Nuzzo et.al 2013; Braun et.al. 2012). Nevertheless, findings did not reveal a significant association between knowledge levels (low, high) and lifetime hookah use. Although the study findings indicated no association between knowledge (low, high) and hookah use, it has been reported in previous studies, that
current users (hookah) view hookah smoking as less harmful/addictive than those who do not smoke hookah (Nuzzo et.al 2013; Braun et.al. 2012). Further research is needed to understand the relations between reasons for smoking hookah, knowledge about health risks of hookah, previous experiences with hookah, and hookah use.

The study results indicated positive attitudes toward hookah use were associated with lifetime use of this drug. This findings is consistent with previous research (Barnett et al., 2013). When comparing the means for students who reported having used hookah, versus those who had not reported hookah use, the most commonly reported student attitudes toward hookah use were, “I think hookah is enjoyable” ($M=3.45$), “I think hookah helps me deal with stress” ($M=3.35$) and “I think people who use hookah are more likely to use regular cigarettes” ($M=3.20$). Based on these results, there may be some value in reducing positive attitudes and increasing negative attitudes toward hookah use. Specifically reducing positive attitudes such as enjoyment, stress relief, and relaxation currently associated with hookah use may be beneficial in reducing overall use. Also, scientific studies have determined that hookah use has been considered a more socially acceptable activity than engaging in regular cigarette smoking (Heinz et.al. 2013; Nuzzo et.al. 2013). Additionally, findings from this study may be further explained by the Theory of Reasoned Action (Ajzen & Fishbein, 1980), which posits that behaviors and intention are predicted by attitudes and normative beliefs about the behavior. Perhaps, future interventions may use the Theory of Reasoned Action to develop intervention messages to encourage accurate knowledge and therefore promote information about the dangers of using hookah.

Regarding reasons why students may use hookah, study findings indicated that lifetime hookah use differed based on perceived reasons for use. The most commonly reported perceived
reasons why students considered using hookah were “at a party with friends”, “my friends smoke hookah” and “to have fun”. Based on these commonly reported reasons, hookah smoking appears to be a socially acceptable behavior. Reducing social acceptability may be a method of reducing overall use. It may also be possible that as a result of the relatively intermittent use of hookah along with the social appeal of this behavior, that students in this study tended to underestimate the overall risk that could be associated with hookah smoking.

Limitations

Several factors may have limited the generalizability of study findings. A possible limitation to this study was the relatively low frequency (8.8%) of recent hookah use (i.e., in the past 30 days use). In addition to the previously noted limitation, participants were predominantly undergraduate students at a large Midwestern urban university, hence it may not be prudent to generalize current findings to other populations. Also, participants’ honesty and self-reporting accuracy of their hookah use may have been overly positive, indicating a social desirability bias that may have limited the information gained from this study. Moreover, this study was cross-sectional in nature and longitudinal studies might provide more knowledge about hookah use and how attitudes and reasons for use change over time.

Conclusion

In conclusion, although there was a definite gap in college students’ knowledge of the health risks associated with hookah smoking, knowledge was not significantly related to hookah use, which was surprising. Additional exploration of the role of knowledge in hookah use may be warranted. While educational interventions may eventually have value, the current study findings propose that concentrating exclusively on improving knowledge related to health risks may not greatly change important hookah use behaviors. Alternatively, a multidimensional approach that
takes into account student attitudes and environmental factors, in conjunction with knowledge, may prove to be more beneficial. The results of this study may be incorporated into future campus educational programs addressing social norms. Researchers have established that college students tend to overestimate the number of their peers who engage in high risk behaviors. This misconception is believed to influence students’ behaviors in participating in these high risk behaviors. Campus media campaigns such as newspaper ads, flyers and electronic bulletin boards can be used to display positive statistics about college students, which will illustrate that most students make low-risk choices with respect to smoking. These social norm interventions may, over time, produce a verified decrease in hookah use and improve overall health levels, by reducing exposure to transmittable infections. Additionally, hookah campaigns may wish to model strategies after previous campaigns addressing cigarette use, which were successful in reducing smoking across the US (Rahman et.al.2013). Finally, given the rising prevalence of hookah use among college students in the US coupled with the comparative dearth of research on long-term health consequences, future research concentrating on long-term use, risk factors, and related consequences will provide critical information to enhance knowledge in the field.
References


among college students from a Midwest University. *Journal of Community Health, 37*(2), 294-298.


Shihadeh, A. (2003). Investigation of mainstream smoke aerosol of the argileh water pipe. *Food and Chemical Toxicology, 41*(1), 143-152.


college freshmen. *Nicotine & Tobacco Research, 9*(9), 977-982.


<table>
<thead>
<tr>
<th>Knowledge Item</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hookah carries the same health risk as smoking</td>
<td>310</td>
<td>76.9</td>
</tr>
<tr>
<td>Harmful chemicals are removed by passing through water</td>
<td>208</td>
<td>51.6</td>
</tr>
<tr>
<td>Nicotine poisoning is a health risk of smoking</td>
<td>211</td>
<td>52.4</td>
</tr>
<tr>
<td>Hookah smoking can cause cancer</td>
<td>251</td>
<td>62.3</td>
</tr>
<tr>
<td>Hookah smoking is addictive</td>
<td>207</td>
<td>51.4</td>
</tr>
<tr>
<td>Hookah is a safe alternative to cigarettes</td>
<td>283</td>
<td>70.2</td>
</tr>
<tr>
<td>Infections may be passed to other smokers through hookah pipe</td>
<td>330</td>
<td>81.9</td>
</tr>
<tr>
<td>Second hand smoke from hookah can be a health risk to non-smokers</td>
<td>220</td>
<td>54.6</td>
</tr>
<tr>
<td>Hookah smokers absorb less harmful chemicals than cigarette smokers</td>
<td>179</td>
<td>44.4</td>
</tr>
<tr>
<td>I can get herpes by sharing hookah</td>
<td>203</td>
<td>50.4</td>
</tr>
</tbody>
</table>

*Note: N = 403*
Table 2. Lifetime Hookah Use based on Student Knowledge

<table>
<thead>
<tr>
<th>Knowledge Score (Dichotomized(^a))</th>
<th>Never Used Hookah</th>
<th>Used Hookah</th>
<th>$\chi^2$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Knowledge</td>
<td>109(49.5%)</td>
<td>111(50.5%)</td>
<td>2.242</td>
<td>.134</td>
</tr>
<tr>
<td>High Knowledge</td>
<td>77(42.1%)</td>
<td>106(57.9%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) = knowledge score dichotomized based on median split
<table>
<thead>
<tr>
<th>Item</th>
<th>Have not Used Hookah</th>
<th>Have Used Hookah</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>I think hookah may help a person feel more comfortable at a social gathering</td>
<td>2.63 (1.059)</td>
<td>3.12 (.891)</td>
<td>26.003</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>I think Hookah is healthier than smoking cigarettes</td>
<td>2.23 (1.006)</td>
<td>2.43(1.100)</td>
<td>3.491</td>
<td>.062</td>
</tr>
<tr>
<td>I think it would be hard for a person to stop using hookah if they used it regularly</td>
<td>3.26 (1.014)</td>
<td>2.83(1.090)</td>
<td>16.927</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>I think hookah causes bad breath</td>
<td>3.45 (.771)</td>
<td>3.10(.833)</td>
<td>18.959</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>I think hookah is enjoyable</td>
<td>2.22 (1.043)</td>
<td>3.45 (.957)</td>
<td>153.857</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>I think hookah helps deal with stress</td>
<td>3.05 (.955)</td>
<td>3.35 (.854)</td>
<td>11.226</td>
<td>.001</td>
</tr>
<tr>
<td>I think hookah makes a person look more mature</td>
<td>1.51 (.787)</td>
<td>1.82 (.822)</td>
<td>14.772</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>I think people who use hookah are more likely to use regular cigarettes</td>
<td>3.41 (.939)</td>
<td>3.20 (.960)</td>
<td>4.700</td>
<td>.031</td>
</tr>
<tr>
<td>I think hookah makes me sleep better</td>
<td>1.92 (.944)</td>
<td>2.00 (.986)</td>
<td>.607</td>
<td>.436</td>
</tr>
</tbody>
</table>

N=403; Means based on a 5-point scale (1 = Strongly Disagree; 5 = Strongly Agree).
Table 4. Lifetime Hookah Use based on Perceived Reasons for Use

<table>
<thead>
<tr>
<th>Item</th>
<th>Have not Used Hookah</th>
<th>Have Used Hookah</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M (SD)</td>
<td>M (SD)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>To feel high</td>
<td>3.35 (.993)</td>
<td>2.87 (1.074)</td>
<td>21.727</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Curious about how it would make them feel</td>
<td>3.92 (.734)</td>
<td>3.70 (.828)</td>
<td>8.099</td>
<td>.005</td>
</tr>
<tr>
<td>To try something adventurous</td>
<td>3.91 (.773)</td>
<td>3.80 (.675)</td>
<td>2.415</td>
<td>.121</td>
</tr>
<tr>
<td>To try to fit in with others</td>
<td>3.98 (.863)</td>
<td>3.75 (.851)</td>
<td>7.049</td>
<td>.008</td>
</tr>
<tr>
<td>Their parents have used it</td>
<td>2.95 (.899)</td>
<td>2.84 (1.017)</td>
<td>1.246</td>
<td>.265</td>
</tr>
<tr>
<td>The advertisements about Hookah are “cool”</td>
<td>3.01 (1.027)</td>
<td>2.84 (1.017)</td>
<td>2.895</td>
<td>.090</td>
</tr>
<tr>
<td>To improve academic performance</td>
<td>2.11 (.938)</td>
<td>2.02 (.943)</td>
<td>1.011</td>
<td>.315</td>
</tr>
<tr>
<td>To help manage/ improve sleep</td>
<td>2.88 (1.045)</td>
<td>2.55 (1.031)</td>
<td>10.001</td>
<td>.002</td>
</tr>
<tr>
<td>Their friends have used Hookah</td>
<td>4.10 (.758)</td>
<td>3.94 (.791)</td>
<td>4.329</td>
<td>.038</td>
</tr>
<tr>
<td>To cope with problems</td>
<td>3.60 (.896)</td>
<td>3.10 (.988)</td>
<td>28.531</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>To use with others at a party</td>
<td>4.13 (.822)</td>
<td>3.97 (.778)</td>
<td>4.086</td>
<td>.044</td>
</tr>
<tr>
<td>To have fun</td>
<td>4.05 (.822)</td>
<td>3.96 (.706)</td>
<td>1.225</td>
<td>.269</td>
</tr>
</tbody>
</table>

N=403; Means based on a 5-point scale (1 = Strongly Disagree; 5 = Strongly Agree).