

ABSTRACT

Title of Document: DEMOGRAPHIC AND PSYCHOSOCIAL
CORRELATES OF WATERPIPE USE AMONG
COLLEGE STUDENTS

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The primary goal of this study was to characterize the role of demographic and psychosocial factors that influence waterpipe use among college students. Data were gathered in two stages that incorporated mixed methods. A series of 59 in-depth interviews were conducted with college students who were established waterpipe smokers. Participants identified socializing as the main reason to smoke waterpipe. Other reasons included social acceptance of waterpipes compared to cigarettes, peer influence, relaxation, perception of looking “cool” and physiological effects commonly referred to as “buzz.” Perceptions that smoking waterpipe was safer and less addictive than smoking cigarettes were fairly common.

The second stage involved a cross sectional survey (n=378), conducted among college students. The goal of the survey was to examine the association between demographic factors, background variables (involvement in Greek organizations,

participation in athletics, and living arrangements), and psychosocial factors (perceived risks, resistance self efficacy, peer influence) in relation to waterpipe use among college students. Ever use of waterpipe smoking was reported by 59%. Students who had ever smoked cigarettes or cigars and had a best friend who smoked waterpipes were more likely to ever smoke waterpipe. Also, college students with high levels of resistance self-efficacy were less likely to ever smoke waterpipe.

The secondary aim of the study was to develop an instrument that measured the social contexts of smoking waterpipe among college students. A pool of 50 items was administered to a purposive sample of college students (n=274), who were regular waterpipe users. Three factors emerged that accounted for a cumulative variance of 47% and possessed adequate reliability. These factors were labeled “social facilitation”, “family/cultural influence”, and “alternatives to cigarettes.” The summed scores for the three social context subscales were examined across frequencies of waterpipe use. Those who reported smoking waterpipe at least on weekly basis reported significantly higher scores on social facilitation than the other two groups. Similar effects were observed for family/cultural influence; weekly smokers used waterpipe more frequently in a context of family/cultural influence than occasional smokers.

Understanding patterns of correlates of waterpipe use among college students is critical in developing interventions.

DEMOGRAPHIC AND PSYCHOSOCIAL CORRELATES OF WATERPIPE USE
AMONG COLLEGE STUDENTS.

By

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Table of Contents

Acknowledgements	ii
Table of Contents.....	iii
List of Tables.....	v
List of Figures.....	vi
Chapter 1: Introduction	1
1.1 Background of the problem	1
1.2 Specific aims.....	5
1.3 Study rationale.....	8
1.4 Study overview	11
1.5 Dissertation organization.....	13
1.6 Definition of variables and/or terms.....	13
Chapter 2: Literature Review	16
2.1 History and origins of waterpipe.....	16
2.2 Morphology of waterpipe.....	17
2.3 Global prevalence of waterpipe use.....	19
2.4 Prevalence of waterpipe smoking in the US.....	22
2.5 Reasons for popularity.....	25
2.6 Health effects of smoking waterpipe.....	28
2.7 Predictors of Waterpipe Use among college students.....	32
2.8 Theoretical concept of social context	44
Chapter 3: Study 1: “It is a college thing to do....” Hookah smoking among college students: A qualitative exploration	
3.1. Introduction.....	54
3.2 Methods.....	55
3.2.1 <i>Sample and recruitment and data collection</i>	55
3.3 Analysis Plan.....	57
3.4 Results.....	57
3.4.1 <i>Sample characteristics</i>	57
3.4.2 <i>Emergent themes</i>	58
3.5 Discussion	72
Chapter 4: Study II: Social Context of Smoking Hookah: Scale Development and Validation	
4.1 Introduction	82
4.2 Methods	84
4.2.1 <i>Questionnaire development</i>	84
4.2.2 <i>Subjects</i>	85
4.2.3 <i>Materials</i>	87
4.3 Results	88
4.3.1 <i>Exploratory data analysis</i>	89

4.3.2 <i>Reliability Analysis</i>	90
4.3.3. <i>Social desirability bias</i>	91
4.3.4. <i>Group differentiation</i>	91
4.4 Discussion.....	92
Chapter 5: Study 3: Demographic and psychosocial correlates of waterpipe use among college students	
5.1 Introduction	102
5.2 Methods	104
5.2.1 <i>Participants</i>	104
5.2.2 <i>Development of the survey</i>	105
5.2.3 <i>Measures</i>	105
5.3 Data analyses	108
5.4 Results	109
5.4.1 <i>Hookah use by students' characteristics</i>	109
5.4.2 <i>Bivariate relationships between hookah use and predictors</i>	110
5.4.3 <i>Multivariate relationships between hookah use and predictors</i>	111
5.5 Discussion	112
Chapter 6: Conclusion	124
Appendices	128
Appendix I: Interview guide to Understand Psychosocial Aspects of Hookah Smoking among College Students.....	128
Appendix II: Demographic information and smoking history of interview participants.....	131
Appendix III: Informed consent form (Qualitative interviews).....	136
Appendix IV: Informed consent form (Waterpipe use questionnaire).....	138
Appendix V: Smoking Cessation Resources.....	140
Appendix VI: Hookah Use Questionnaire.....	141
Appendix VII: College Tobacco Survey.....	149
Appendix VIII: Informed consent form (College Tobacco Survey).....	158
Bibliography.....	159

List of Tables

Study 1: Table 1: Characteristics of study participants.....	78
Study 2: Table 1: Sample characteristics.....	97
Study 2: Table 2: Rotated factor loadings for the principal components analysis of the Social Context Scale.....	98
Study 2: Table 3: Mean social context scores for demographic and tobacco use variables.....	99
Study 3: Table 1: Characteristics of study sample.....	118
Study 3: Table 2: Unadjusted odds ratios for relationship between waterpipe use and cigarette smoking and psychosocial factors among college students	119
Study 3: Table 3: Adjusted odds ratios for relationship between waterpipe and cigarette smoking and psychosocial factors among college students.....	121

List of Figures

Figure 1: Conceptual framework of the study	14
Figure 2: Overall research design (Studies 1, 2, and 3)	15
Figure 3: Morphology of a waterpipe	18

Chapter 1: Introduction

1.1 Background of the problem

Tobacco use is the most preventable cause of death in the United States (US). It is attributed to an estimated 443,000 deaths in the US every year, resulting in \$96 billion in health care costs annually (Centers for Disease Control and Prevention [CDC], 2010). According to the National Survey on Drug Use and Health, in 2009 an estimated 69.7 million Americans 12 years or older reported use of tobacco, of which 58.7 million smoked cigarettes, 13.3 million smoked cigars, and 8.6 million used smokeless tobacco, confirming that tobacco is one of the most widely abused substances in the US (Substance Abuse and Mental Health Services Administration [SAMHSA], 2010).

Epidemiologic data show that young adults aged 18-25 years have the highest rate of tobacco use (41.6%) compared to adolescents (11.6%) and adults (27.3%) (SAMHSA, 2010). College students represent approximately one third of 18-24 year-old adults (US Bureau of the Census, 1997). Due to a multitude of behavioral and environmental factors, college students are at risk of adopting novel and often harmful health behaviors. Tobacco use is one such problem behavior (Wechsler, Lee, & Rigotti, 2001; Wechsler, Rigotti, Gledhill-Hoyt, & Lee, 1998). College students are known to experiment with a broad range of tobacco products including cigarettes, cigars, and smokeless tobacco (Rigotti, Lee, & Wechsler, 2000). The majority of young adults initiate smoking cigarettes during adolescence and more than a quarter of them start smoking regularly at age 19 or older (Everett et al., 1999; Wechsler et al., 1998). College years are an inherently risky time for smoking initiation and continuation.

The spectrum of tobacco products available to young adults is diverse and escalating. In recent years, even though cigarette smoking rates among young adults have decreased (CDC, 2004), use of alternative tobacco products has been an emerging trend (CDC, 2005). One tobacco product that is rapidly gaining popularity is waterpipe, also known as hookah, narghile, argihle, goza, and shisha (Maziak, Ward, Afifi Soweid, & Eissenberg, 2004). Waterpipe smoking involves heating of tobacco with charcoal, and passage of smoke through water and a hose before it is inhaled by a user. This phenomenon is well established in the Middle East and is rapidly proliferating across continents (Maziak, 2011). It is estimated that more than 100 million men and women around the world smoke waterpipe daily (Wolfram, Chehne, Oguogho, & Sinzinger, 2003). A “fad” that began in Asia hundreds of years ago has now become a global threat (World Health Organization [WHO], 2005). It is speculated that ubiquitous waterpipe establishments, aggressive marketing, availability of multiple flavors of tobacco, and widespread perception of reduced harm are some of the reasons behind the escalating use (Grekin & Ayna, 2008; Khalil, Heath, Nakkash, & Afifi, 2009; Smith-Simone, Curbow, & Stillman, 2008).

Waterpipe use is popular, especially among college students. In the Middle Eastern countries where it is very popular, the prevalence among college students ranges from 32% to 62.6% (Gadalla et al., 2003; Maziak, Fouad et al., 2004; Tamim et al., 2003). In the US, even though there is no national data to validate prevalence rates, recent university-based studies support the notion of increasing popularity (Eissenberg, Ward, Smith-Simone, & Maziak, 2008; Grekin & Ayna, 2008; Primack et al., 2008; Smith, Curbow, & Stillman, 2007). College students in the US have reported previous month use ranging from 9 to 20%

(Eissenberg et al., 2008; Primack et al., 2008; Smith et al., 2007). While much is known about factors that influence other tobacco products such as cigarettes, very little is known about the determinants of waterpipe use (Byrne, Byrne, & Reinhart, 1995; Steptoe, Wardle, Pollard, Canaan, & Davies, 1996; Von Ah, Ebert, Ngamvitroj, Park, & Kang, 2005).

Social contexts and individual characteristics have been identified as determinants of cigarette smoking among young adults. Socio-demographic factors such as gender and race and environmental correlates like involvement in fraternities and sororities have been associated with cigarette smoking among college students (Emmons, Wechsler, Dowdall, & Abraham, 1998; Gray & Donatelle, 1990; Hestick, Perrino, Rhodes, & Sydnor, 2001; Moskal, Dziuban, & West, 1999; Rigotti et al., 2000). A growing body of literature suggests that living arrangements that include living with parents, living in residence halls or restricted housing, where smoking is not permitted, reduce the likelihood of smoking among college students (Gfroerer, Greenblatt, & Wright, 1997; Jones, Harel, & Levinson, 1992; Wechsler et al., 2001). Psychosocial determinants such as beliefs, peer influence, resistance self efficacy, and sensation seeking tendencies have been strong predictors of cigarette smoking (Choi, Gilpin, Farkas, & Pierce, 2001; Donohew, Clayton, Skinner, & Colon, 1999; Hines, Fretz, & Nollen, 1998; Hu, Davies, & Kandel, 2006; Kopstein, Crum, Celentano, & Martin, 2001). Peer influence has been a consistent predictor of lifetime and current cigarette smoking among college students. Students are more likely to have ever tried smoking or currently smoke if more than 75% of their friends smoke (Morrell, Cohen, Bacchi, & West, 2005). Compared to nonsmokers, smokers are more likely to have low levels of self efficacy (Martinelli, 1999). Self-efficacy refers to expectations that an individual has regarding his or her ability to perform a behavior (Glanz, 1997). Sensation

seekers are more likely to be cigarettes smokers (Kopstein et al., 2001). In addition, situation specific motivators, termed in the literature as “social context”, have been consistent predictors of alcohol abuse among college students (Beck et al., 2008; Beck et al., 2009; Beck, Thombs, Mahoney, & Fingar, 1995). It is not clear what motivational and situational factors actually have an effect on initiation and experimentation of waterpipe use among college students.

Waterpipe smoking is different than using traditional tobacco products. Unlike smoking cigarettes, cigars, and pipes, which are mostly individual experiences, smoking waterpipes is a shared experience. The trend of sharing the hose has been compared to the Native American tradition of passing a peace pipe (Maziak, Eissenberg et al., 2004). College students, especially, are deemed intermittent waterpipe users who mostly smoke in groups (Asfar, Ward, Eissenberg, & Maziak, 2005). For instance, during pilot interviews, students were quoted “It is not something that I would ever do alone. It would just never occur to me. I enjoy it when everyone sits around doing something while smoking hookah”, “it is a social activity; I would never do it alone.” Evidently, the correlates that influence cigarette smoking cannot be extrapolated to waterpipe smoking. It is not known if psychosocial factors that influence cigarette smoking among college students also affect waterpipe use.

The primary goal of this study was to examine factors that influence waterpipe use, bridging the gap in the literature (Figure 1). The second aim of the study was to develop an instrument that measures the social context that influences waterpipe use among college students. Understanding patterns of predictors of waterpipe use among college students is critical in developing effective prevention and treatment interventions. Findings from this

study will contribute to the growing body of literature and help university administrators and public health professionals develop effective prevention programs. The goals of the study were accomplished through a mixed method study of determinants of waterpipe use (Figure 2).

1.2 Specific Aims

The specific aims of this research were to:

1. Characterize the role of demographic and psychosocial factors that influence waterpipe use among college students

Data to address this aim were gathered in two stages that incorporated mixed methods. The first phase (study 1) was a qualitative exploration to gain an understanding of how knowledge, beliefs, peer influence, situational context, culture/tradition, perception of harm, and outcome expectations influence college students' waterpipe smoking behavior. This involved conducting a series of in-depth interviews with college students who were established waterpipe smokers. Qualitative information gained from the interviews helped clarify (1) perceptions associated with waterpipe smoking among college students, (2) situational and motivational influences that encouraged waterpipe smoking among college students, and (3) subjective experiences as they related to waterpipe smoking.

The second phase (study 3) involved a cross sectional survey that was conducted among college students. The purpose of the survey was to quantify themes identified in the qualitative phase and identify differences between waterpipe smokers and non smokers.

The goals of the survey were to:

- 1) examine the association between demographic factors (such as gender, race/ethnicity, and education level) in relation to waterpipe use among college students
- 2) determine the relationship between background variables (such as involvement in Greek organizations, participation in athletics, and living arrangements) in relation to waterpipe use among college students
- 3) examine perceived risks, resistance self efficacy, peer influence, and sensation seeking in relation to waterpipe use among college students.

The following research questions were explored through the survey:

- a. Are demographic characteristics associated with waterpipe use among college students?
- b. Are background variables such as involvement in Greek organizations, participation in athletics, and living arrangements associated with waterpipe use among college students?
- c. Is perceived risk associated with waterpipe use among college students?
- d. Is peer influence associated with waterpipe use among college students?
- e. Is resistance self efficacy associated with waterpipe use among college students?
- f. Is sensation seeking characteristic associated with waterpipe use among college students?

2. Examine the role of social context in influencing college students' use of waterpipe

One of the salient features of waterpipe use is the social context associated with it. Social context is defined as immediate situational, temporal, and motivational factors that influence the behavior (Beck et al., 1995; Thombs, Beck, & Mahoney, 1993). Because of

the historic and popular trend of smoking waterpipe in cafés, the practice of waterpipe smoking has a social undertone to it (Martinasek, McDermott, & Martini, 2011).

Situational factors such as socialization with friends and intimacy associated with smoking in a group have been documented as reinforces of waterpipe use (Maziak, Fouad et al., 2004; Varsano, Ganz, Eldor, & Garenkin, 2003). In addition, elaborate rituals associated with preparing the waterpipe to get it ready to smoke, social ambience, eating, and having a conversation while smoking waterpipe have been documented as motivators of smoking waterpipe (Maziak, Ward, Afifi Soweid et al., 2004; Asfar et al., 2005).

Compared to established waterpipe smokers who smoke on their own, the situational/environmental influence is more pronounced among college students who are intermittent users and mostly smoke in groups (Asfar et al., 2005). The motivators that reinforce waterpipe use among college students depend on the circumstances. For instance, smoking waterpipe in a café might have different motivators such as the ambience, music, and food which may be different from factors that would prompt students to smoke in college dormitories such as socializing with friends, playing video games while smoking, etc. Among college students, waterpipe smoking is not only mediated by intrapersonal factors such as expectations and beliefs, but also interpersonal influences such as having a network of friends who encourage smoking, environmental influences such as easy availability of waterpipe cafés around college premises, living with friends who own waterpipes, and institutional correlates such as living in dormitories without strict policies against indoor smoking.

Very little is known about these social contexts that contribute to waterpipe use among college students. An understanding of the social contexts could help explain why,

where, when, and with whom students smoke waterpipe. Research in the field has been hindered mostly due to lack of reliable and validated instruments that measure these predictors. The instrument developed as a part of this study was intended to bridge that gap. Additional knowledge regarding social/environmental contexts that reinforce the behavior may help explain and predict waterpipe use and ultimately inform successful interventions. This aim was fulfilled by developing an instrument that measured the social context of waterpipe smoking and establishing its psychometric properties.

The following research questions were examined using the proposed instrument:

1. What situational factors are associated with waterpipe use among college students?
2. What motivational factors are associated with waterpipe use among college students?
3. What temporal factors are associated with waterpipe use among college students?
4. What environmental factors are associated with waterpipe use among college students?

Psychometric properties of the instrument were determined by examining dimensionality, internal consistency, and construct validity of the scale.

1.3 Study Rationale

Tobacco use among college students represents a significant public health concern. One of the goals of Healthy People 2020 is to prevent tobacco use and assist cessation to improve the health and quality of life of individuals of all ages (United States Department of Health and Human Services [USDHHS], Healthy People 2020, 2012). In order to achieve this goal, thoughtful consideration has to be given to the plethora of tobacco products college students are using. The majority of research on college students and

smoking so far has revolved around smoking cigarettes. Moreover, the studies conducted on waterpipe use have mostly focused on establishing the prevalence (Primack et al., 2008; Sutfin et al., 2011). Despite the escalating use, very few studies have examined determinants of waterpipe use in this vulnerable population.

The need for examining factors that influence waterpipe use on college campuses is immediate for several reasons. First, the prevalence of waterpipe use among college students is high. Surveys have reported current waterpipe use prevalence ranging from 25% to as high as 40% among college students (Eissenberg et al., 2008; Primack et al., 2008; Smith-Simone et al., 2008; Smith et al., 2007). If immediate action is not taken, consequences similar to cigarette smoking are likely to occur. Among cigarette smokers, initiation of cigarette smoking in early years resulted in prolonged use and addiction in adulthood (Escobedo, Marcus, Holtzman, & Giovino, 1993; Taioli & Wynder, 1991). Students who experiment with waterpipe in college could transition into dependent users as adults, increasing the burden of morbidity and mortality related to tobacco use.

Second, available evidence suggests that health risks associated with waterpipe smoking are similar to those of cigarette smoking such as lung cancer, respiratory illness, low birth-weight, and periodontal diseases (Akl et al., 2010). An analysis of mainstream waterpipe found large amounts of carcinogens, hydrocarbons, and heavy metals including arsenic, lead, and chromium which are known carcinogens (Shihadeh, 2003). One session of waterpipe smoking could be equivalent to smoking 100 or more cigarettes (WHO, 2005), making it an efficient nicotine delivery process. Compared to smoking cigarettes, which involves combustion of approximately 1 gm of tobacco, smoking waterpipe consists of 10-20 gm of tobacco, delivering higher nicotine levels (Shihadeh & Saleh, 2005). Such a

dosage of nicotine can arguably cause chemical addiction among waterpipe users, transforming social smokers to regular users (Maziak, 2008). Despite the health risks, perception that waterpipe smoking is safer and less addictive than cigarette smoking is common (Primack et al., 2008; Smith et al., 2007; Varsano et al., 2003). Contrary to popular belief, hookah smoking may be equally if not more harmful than smoking cigarettes (Eissenberg et al., 2008; Shafagoj, Mohammed, & Hadidi, 2002; Shihadeh, 2003). The extent to which these perceptions influence use among college students is not known.

Third, several anecdotal reports have shown increases in the number of waterpipe establishments around college campuses (Smith-Simone et al., 2008). The ubiquitous growth of settings like “hookah cafés” can encourage initiation among young college students. These settings are generally exempt from clean indoor air ordinances, which make them a suitable place for smoking and socializing (Noonan, 2010). In the absence of substantial legislation, hookah bars may continue to grow around college campuses, targeting more and more students. In addition, a growing number of students are also purchasing waterpipe paraphernalia via the internet. Such an easy availability could further attract more students (Smith-Simone et al., 2008).

Smoking is a result of an intricate mix of individual and contextual factors. The current study is one of the first attempts to understand the role of such factors in explaining initiation and use of waterpipe among college students. Acquiring an understanding of demographic and psychosocial determinants could help health educators and policy makers in designing more informed prevention and treatment strategies targeted to college students. In the absence of effective programs, the “social/intermittent” aspect associated

with waterpipe smoking can lead to gradual escalation and development of dependence in later years.

College years represent a crucial period in transitioning from adolescence to adulthood. Because of the risks associated with consolidation of unhealthy behaviors developed from college into adult life, it is important to understand factors that might influence waterpipe use among students. This study attempted to understand the dynamics of the predictors in association with waterpipe smoking behavior in college students. Colleges and universities in the US enroll more than 12 million students (National Center for Education Statistics, 2011). They provide a unique platform for researchers and policy makers to reach out to this vulnerable population that has legal access to tobacco products such as waterpipes. Novel approaches that include behavioral change strategies along with policy changes that discourage tobacco use and reinforce educational messages to young adults need to be developed. The result of this study may provide directions for future research and policy recommendations.

1.4 Study overview

The main purpose of the present study was two-fold: 1) to characterize the role of demographic and psychosocial factors that influence waterpipe use among college students; and 2) to examine the role of social context that influences college students to smoke waterpipe. This study was implemented in three phases to accomplish the overall goal of the study using mixed methods.

Study 1 (chapter 3) was a qualitative exploration to gain an understanding of how knowledge, beliefs, peer influence, situational context, culture/tradition, perception of

harm, and outcome expectations influence college students' waterpipe smoking behavior. In-depth interviews with 59 college students, who were established waterpipe smokers, were conducted.

Study 2 (chapter 4) involved development of an instrument that measured the social context of smoking waterpipe among college students. Qualitative data collected through in-depth interviews in study 1 were used to generate an item pool for scale development. An initial item pool of 50 items was administered to 274 college students who were regular waterpipe smokers. Smokers were included in the study if they were 18 or older, had smoked waterpipe at least three times in the past six months and at least once in the past 30 days. Social smokers, waterpipe owners, smokers belonging to different ethnicities, etc. were included in the study to understand the range of factors that influenced waterpipe smoking. An understanding of the social context could help explain and predict waterpipe use

Study 3 (chapter 5) involved a cross sectional survey (n=378) that was administered to undergraduate students at the University of Maryland, College Park, between March and May 2012. The survey helped in quantifying themes identified in study 1 and exploring factors that predicted waterpipe smoking among college students. The study 1) examined the association between demographic factors such as gender, race/ethnicity, and education level, 2) determined the relationship between background variables such as involvement in Greek organizations, participation in athletics, and living arrangements 3) examined perceived risks, resistance self efficacy, peer influence, and sensation seeking in relation to waterpipe use among college students.

1.5 Dissertation organization

This dissertation is written in the three-manuscript format and is organized into six chapters. Chapter 2 includes review of the literature and the three manuscripts are included as chapters 3,4, and 5. Chapter 6 presents the summary of findings and policy implications as they relate to waterpipe use.

1.6 Definition of variables and/or terms

Waterpipe/hookah: Method in which tobacco smoke passes through water before inhalation (Maziak, Ward, Afifi Soweid, & Eissenberg, 2005)

College students- Respondents one to four years past high school registered as full time students at the University of Maryland

Main stream smoke: Smoke generated during puffing

Side stream smoke: Smoke released from the burning end of a cigarette

Refusal self efficacy: One's perception of his/her ability to resist using tobacco products

Sensation seeking behavior: Varied, novel, and complex experiences, and the willingness to take physical, social, legal, and financial risks for the sake of such experiences (Zuckerman, 1994)

Perception of risk: Beliefs regarding harm associated with waterpipe smoking

Social context: Immediate situational, temporal, and motivational factors that influence the behavior (Beck et al., 1995; Thombs et al., 1993)

Convergent Validity: The operationalization's ability to distinguish between groups it should theoretically be able to distinguish between (Trochim, 2001).

Discriminant Validity: The degree to which an operationalization is not similar to other operationalizations that it theoretically should not be similar to (Trochim, 2001).

Construct Validity: The degree to which inferences can legitimately be made from the operationalizations to the theoretical constructs on which the operationalizations are based (Trochim, 2001).

Figure 1: Conceptual framework of the study

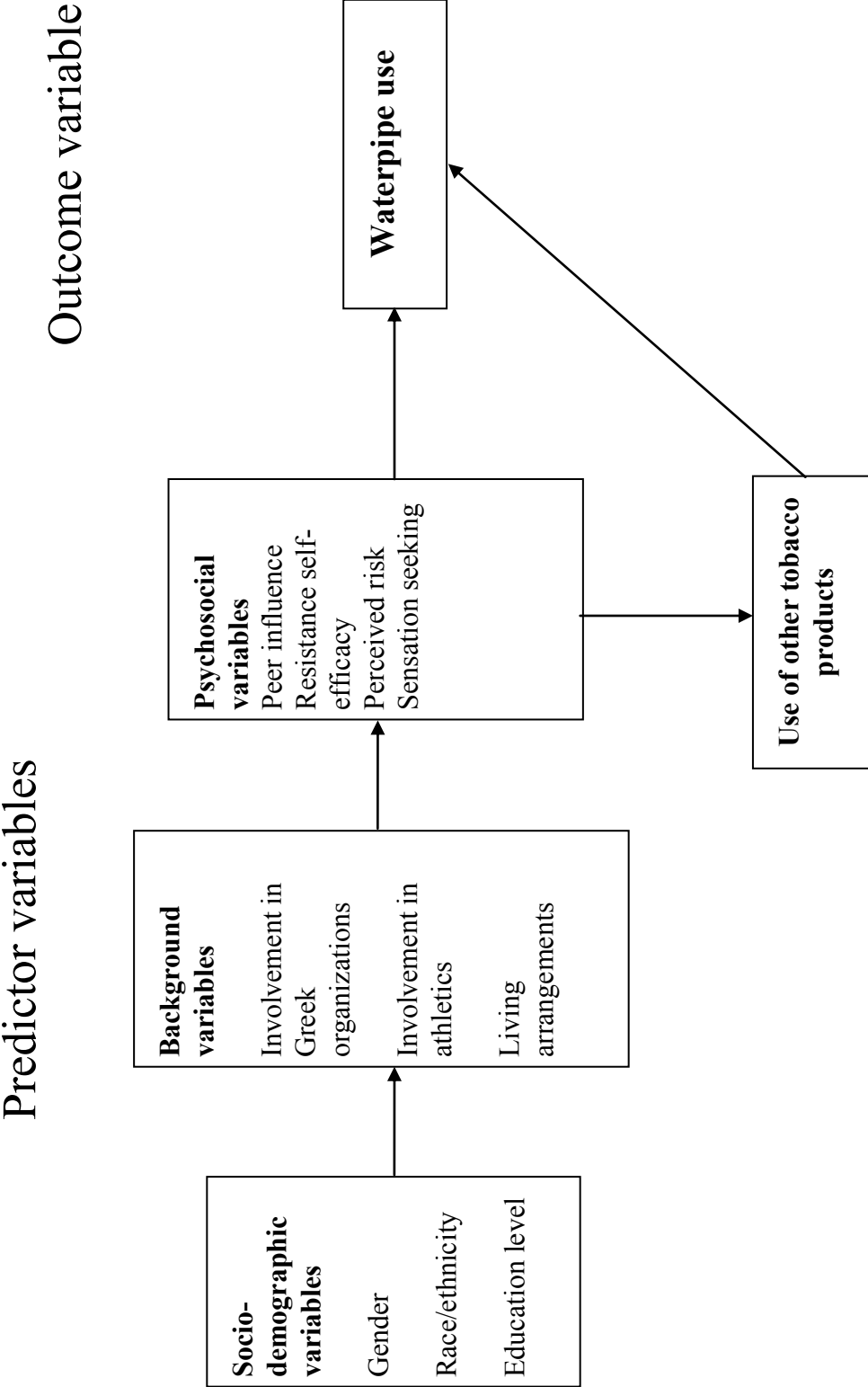
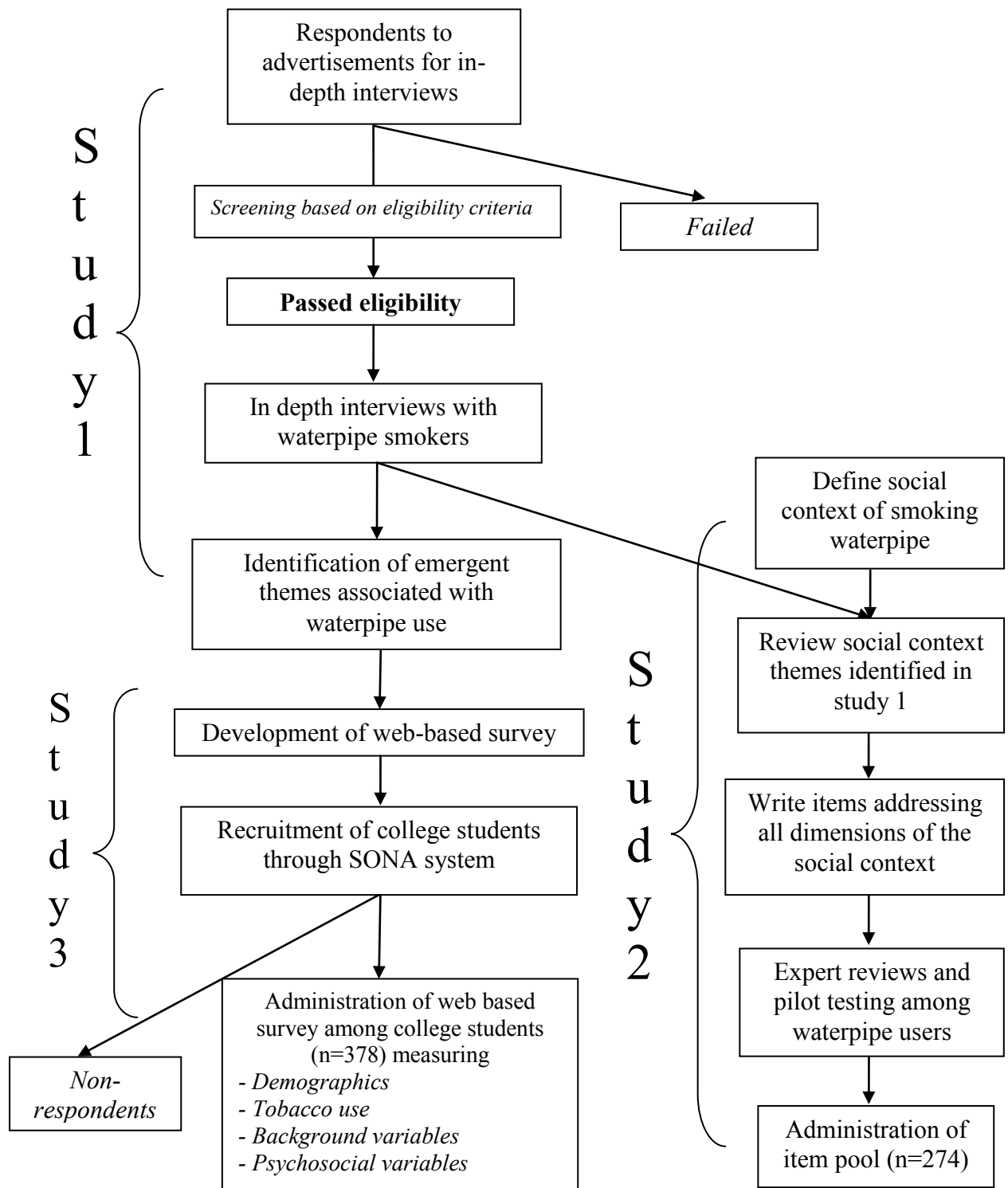


Figure 2: Overall research design (Studies 1, 2, and 3)



Chapter 2: Literature Review

The purpose of this literature review was to discuss what is currently known about waterpipe and identify gaps in the literature regarding factors associated with waterpipe use, especially among college students. The review reflected the dearth of information about determinants of waterpipe use in this population. The first part of the review provides a brief history and description of the morphology of a waterpipe. The second part is an extensive summary of the prevalence of waterpipe, both nationally and globally. This chapter also provides a brief overview of the social context that influences drug and alcohol use among college students and highlights the need for establishing an instrument that measures the construct of social context. The next section provides description of psychosocial correlates that are associated with cigarette smoking and discusses the significance of examining the role of the determinants of waterpipe use.

2.1 History and origins of waterpipe

Waterpipe is identified throughout the world by different terminologies including narghile, arghile, hookah, goza, shisha, and hubble-bubble among others. The generic name “waterpipe” refers to the method in which tobacco smoke passes through water before inhalation (Maziak et al., 2005). It has been used as a method for smoking tobacco for almost 400 years (Knishkowsky & Amitai, 2005).

Waterpipe smoking is a global phenomenon. Although consensus regarding the actual country of origin is still ambiguous, it is speculated that it started from regions surrounding India, China and Pakistan (Maziak, Ward, Afifi Soweid et al., 2004). It is then believed to have spread to Persia, Egypt and other Mediterranean countries (Aljarrah, Ababneh, & Al-Delaimy, 2009). Since then it has been used extensively in many regions

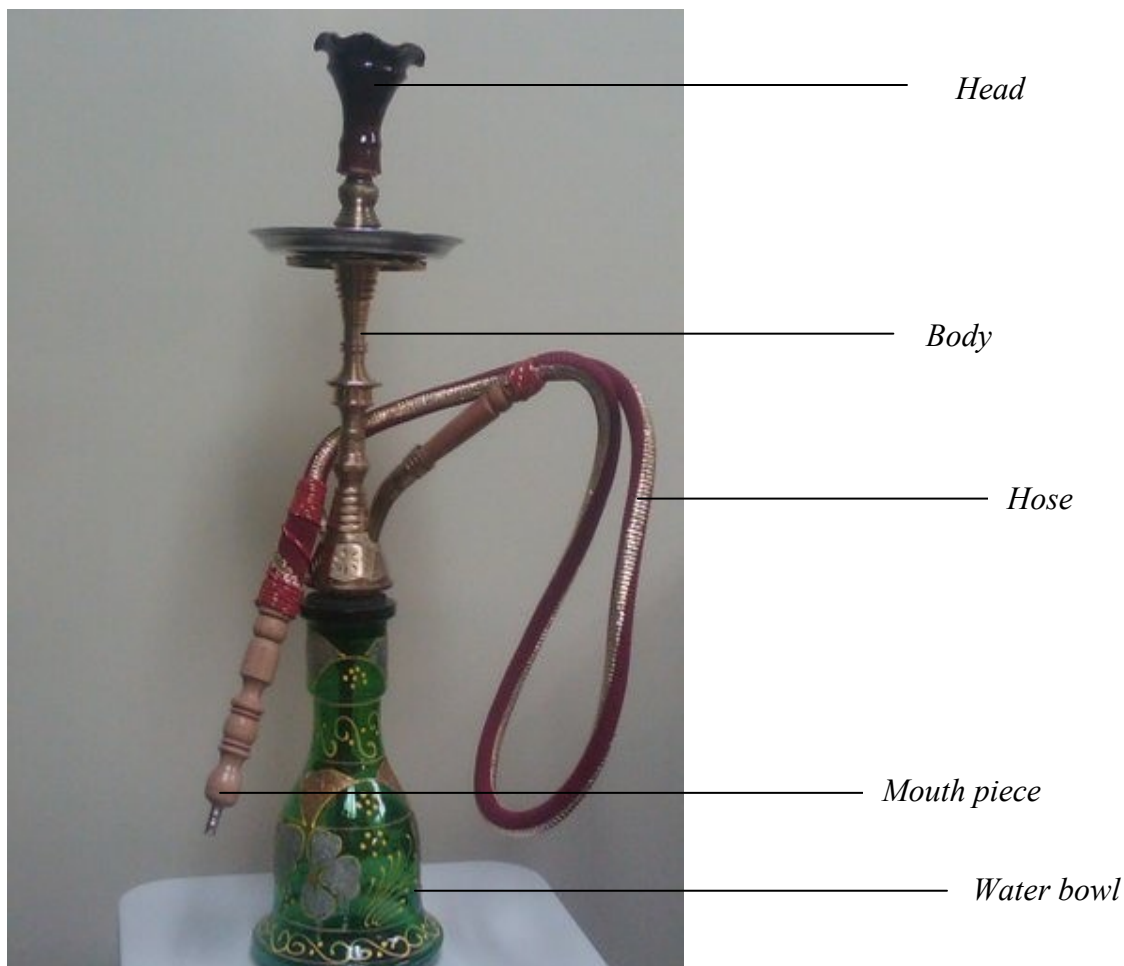
across the world over centuries, especially in the past few decades. In some areas, it is more prevalent than cigarette smoking (Knishkowsky & Amitai, 2005). It is believed that waterpipe was invented during the reign of emperor Akbar by one of his trusted physicians, Hakim Abu Fath (Chattopadhyay, 2000). It was Abu Fath who came up with the idea of passing the smoke through water to minimize harmful effects of the smoke (Chattopadhyay, 2000). This indicates that since the very beginning, waterpipe has been perceived and promoted as a product for harm reduction among tobacco users.

2.2 Morphology of the waterpipe

Waterpipes are manufactured in various sizes, materials and colors, but the typical structure consists of a head, body, bowl, and a hose. The head, typically made of clay, consists of holes at the bottom. Moist tobacco is loaded on the head. Tobacco used in a waterpipe is either non flavored, commonly known as jurak, or flavored, typically known as *maassel*. The top of the head holds a sheet of perforated foil on which a charcoal can be placed. Charcoal is the heat source in the assembly. Typically, the maximum temperature in the head is approximately 450°C, which is much lower than the maximum temperature of approximately 900°C in cigarettes (Bacha, Salameh, & Waked, 2007). The holes on the bottom of the head allow for the smoke to pass into the conduit of the body of the waterpipe. The bowl is partially filled with water, in which the conduit is submerged (Maziak, Ward, Afifi Soweid et al., 2004). In addition to water, other fluids such as milk, alcohol and ice are also used to make the smoke thicker and more pleasurable. A hose extends to the outside through which a waterpipe user inhales the smoke. Waterpipes with more than one hose are also available for multiple users.

When a smoker inhales through the hose, a vacuum is created in the space above the water in the bowl. This draws the tobacco smoke through the moist and flavored tobacco, which is heated by the lit charcoal. The smoke along with the combustion produced from the charcoal forms the mainstream smoke aerosol (Shihadeh, Azar, Antonios, & Haddad, 2004). By the time the smoke passes through the conduit, water and the hose, it is cooled to room temperature, which the smoker then inhales (WHO, 2005).

Figure 2: Morphology of a waterpipe



2.3 Global prevalence of waterpipe use

Despite its long history and recent global resurgence, information regarding waterpipe use has been limited to a few studies. Among the ones that have been published, the majority are from the Middle Eastern countries. In recent years waterpipe use has been very popular, especially among youth in the Eastern Mediterranean Region. Results from the Global Youth Tobacco Survey (GYTS), a school-based survey that collects data from students aged 13–15 years across 95 countries, suggested that in the Eastern Mediterranean Region across 16 countries, current waterpipe use ranged from 6-34% in the target population (Maziak, 2011; Warren et al., 2009). This is much higher compared to use of traditional tobacco products such as cigarettes among 13- 15 year olds (Warren et al., 2009). It is evident that a phenomenon that began in Asia hundreds of years ago has now become a global “fad.”

A study conducted in secondary schools in Egypt indicated that out of 635 students (416 males and 219 females) 19% (26% among males and 5% among females) had ever tried smoking waterpipes (Gadalla et al., 2003). Another Egyptian study conducted among university students (n=687) showed prevalence of 20.4% for life time use and 11% for current use (Refaat, 2004).

Compared to these studies, the prevalence was found to be much higher in Israel among middle and high school students ages 12-18. Among the 388 students that filled out a survey, 41% had ever smoked a waterpipe at varying frequencies. At least 22% smoked every weekend and girls were found to be heavier smokers of waterpipe than boys. It was interesting to note that, of the students who smoked waterpipe every weekend, 40% of their parents were current or ex- waterpipe smokers (Varsano et al., 2003). Similarly, a cross

sectional study conducted in Beirut among 1964 public and private university students consisted of 21.1% waterpipe smokers and 11.3% dual users who smoked both cigarettes and waterpipes (Tamim et al., 2003). Gender (male) and drinking excessive amounts of alcohol were some of the predictors that were associated with waterpipe use. Another study conducted among 1461 adolescents in Lebanon found a prevalence of 24% regular (more than once a week) and 14.4% occasional waterpipe smokers with a male predominance, similar to other Middle Eastern studies. At least 28% of them reported being influenced by a family member and 58.2% had initiated smoking with a user friend (Zoughaib, Adib, & Jabbour, 2004). Another sample of 416 university students in Beirut showed a prevalence of 43% ever-smokers and 28% current smokers (Chaaya et al., 2004).

In a representative sample of 587 Syrian university students, almost 63% of men and 30% of women had ever smoked a waterpipe; while almost all men were current smokers, only 5% of the women were regular users (Maziak, Fouad et al., 2004). Waterpipe smoking was related to being older, male, smoking cigarettes, and having friends and family members who smoked waterpipe. Another Syrian survey divided a representative sample of waterpipe smokers into 4 birth cohorts (≤ 1960 , 1961-1970, 1971-1980, >1980) and plotted age of initiation of waterpipe and cigarette smoking in the population. The results indicated that waterpipe smoking started around the 1990's implying this time period as the beginning of the waterpipe epidemic in Syria (Rastam, Ward, Eissenberg, & Maziak, 2004).

Among Jordanian university students, of the 36.8% waterpipe smokers, 61.9% and 10.7% comprised of male and female students, respectively. Parental smoking status was associated with the students' smoking status (Najla et al., 2010). A school based Omani

study revealed that 26.6% of respondents (n=1962) reported ever smoking waterpipe while 9.6% reported current use (Al-Lawati, Muula, Hilmi, & Rudatsikira, 2008). Students were more likely to smoke waterpipe if they had a parent or a friend who smoked and were less likely to smoke if they believed that smoking was harmful to health.

Taha and colleagues (2010) surveyed 371 male students in Saudi Arabia and found an overall waterpipe smoking prevalence rate of 13%. The majority of them (63.8%) had started smoking waterpipe between the ages of 16 and 18 years. Only 15% of smokers smoked it on a daily basis (Taha et al., 2010). Another study found much higher rates of smoking waterpipe (44.1%) among medical students (Al-Turki, 2006). A common reason reported for smoking was the influence of friends. Khader and colleagues (2009) compared waterpipe use among Palestine refugee students living across Jordan, Lebanon, Syria, the West Bank and Gaza Strip and students in the general population. Results showed that smoking waterpipe was higher among host site students (21.6%) compared to students in refugee camps (14.1%) in Jordan. Among students living in camps, the prevalence was lowest among those in Gaza Strip (12.6%) compared to those living in Lebanon (33.5%), Syria (33.5%) and the West Bank (31.2%) (Khader et al., 2009).

A cross-sectional survey of students aged 14-19 years in Pakistan (n=646) across high, middle and lower socioeconomic strata showed that 27% of the students had ever smoked waterpipe (Anjum, Ahmed, & Ashfaq, 2008). The prevalence however, was significantly different across the socioeconomic strata. Students in high socioeconomic class reported highest prevalence for smoking waterpipe (65%), followed by the middle class (13.5%), and the low income group (3%). Another study in Pakistan conducted among 273 medical and dental students, 22.7% (41.2% male and 16.8% female) indicated

that they smoked waterpipe (Khan et al., 2008). The study also depicted rapidly increasing trend of waterpipe smoking as a way of socializing among affluent young professionals.

It is noteworthy that most studies across Arab countries were conducted in the 2000s. Studies on waterpipe use in the 80s and 90s seem to be almost nonexistent. Because of this, unfortunately, even though waterpipe has been around for few centuries, examining trends of waterpipe use over time is challenging.

2.4 Prevalence of Waterpipe Smoking in the U.S.

In the U.S., although smoking rates among young adults are generally decreasing (CDC, 2004), use of alternative tobacco products such as waterpipe is rapidly gaining popularity. The current estimation of prevalence of waterpipe use in the US is not exactly clear due to lack of national level data. However, there is evidence that highlights the growing prevalence of waterpipe, particularly among college students. So far, only a handful of studies have focused on U.S. college students, almost all of them in the past few years.

In a cross sectional survey of freshmen students (n=411), current waterpipe use was reported by 15.3% of the students (Smith et al., 2007). A total of 37% of the respondents perceived waterpipe to be less harmful than regular cigarettes. In another study, of the 647 college students who responded to an online survey, 41% reported ever smoking waterpipe, 30.6% reported smoking waterpipe in the past year while 9.5% reported smoking in the past month (Primack et al., 2008). The rate was much higher compared to cigarette smoking with only 39% reporting ever smoking cigarettes. In another cross-sectional survey conducted among college students (n=744), it was seen that 48% had ever smoked a waterpipe, 43% had used it in the past year and 20% had smoked it in the past month

(Eissenberg et al., 2008). The perception of lower risk associated with waterpipe compared to smoking cigarettes may have contributed to the high prevalence of regular waterpipe use. The researchers also observed that those who had engaged in smoking waterpipe within the past 30 days were more likely to be men, younger than 20 years of age, and of white ethnicity. Grekin and colleagues (2008) examined the prevalence and predictors of waterpipe use at a large, ethnically diverse university in Michigan (Grekin & Ayna, 2008). Almost 15% of the sample (n=602) reported having smoked waterpipe at least once in their lifetime; 12.4% had used it in the past year; 4.7% had used it more than 10 times in the past year; and 2% had used it more than 40 times in the past year. Arab ethnicity and cigarette use were found to be strong predictors of waterpipe use.

All of these studies were conducted in a single institution in small samples. A recent study included data from multiple academic institutions, providing data regarding waterpipe use from a larger sample of college students for the first time. Primack and colleagues analyzed data from 8,745 college students at eight institutions as part of the National College Health Assessment (Primack, Fertman, Rice, Adachi-Mejia, & Fine, 2010). Overall, 29.5% reported ever smoking waterpipe and 7.2% reported smoking at least once in the past 30 days. Of those individuals who had used waterpipe tobacco in the past 30 days, 17.3% had used waterpipe three to five times, 7.1% had done so 6–9 days, 1.2% 10–19 days, 1.4% 20–29 days, and .8% every day. Results showed that students involved in varsity sports had lower odds of smoking waterpipe.

Another recent multi-institutional study estimated the prevalence and assessed correlates associated with waterpipe smoking, such as demographics, other health-risk behaviors, and availability of commercial waterpipe establishments (Sutfin et al., 2011). A

total of 40% of the cross sectional sample (n=3770) reported ever having smoked waterpipe, and 17% reported using it in the past 30 days. Almost 40% of those who smoked regularly reported smoking waterpipe at home, 63% at a friend's house, 34% at a party, 32% at a café or restaurant, and 9% reported smoking in other locations in the past 30 days.

Data from larger random samples are needed to better understand the factors associated with waterpipe smoking among college students. Apart from studies conducted among college students, there have been few others that assessed waterpipe smoking among adults. Smith-Simone and colleagues studied two convenience samples of young adults, one from a waterpipe café (n=101) and the other from an Internet forum (n=100). A total of 19% of those surveyed were daily users, 41% were weekly users and 29% were monthly users of waterpipe (S. Y. Smith-Simone et al., 2008). Another study that examined the characteristics of waterpipe users surveyed waterpipe smokers in two cities, Richmond and Memphis (Ward et al., 2007). The majority of the smokers in both of the cities reported smoking waterpipe at least once a month, 72% in Richmond and 50% in Memphis. More smokers in Richmond reported smoking one or more times per week compared to those in Memphis, 28% versus 6%. Daily use of waterpipe was also higher among smokers in Richmond (13% versus 3%), compared to those in Memphis.

Another study (Baker & Rice, 2008) examined waterpipe use in a sample of American Arab Yemeni adolescents (n=297; mean age=15.7 years). Experimentation with waterpipe smoking was found among 51 (17.2%) adolescents, which is a common trait among Arab children. Older Yemeni American adolescents who had their closest five friends using tobacco were found to be more likely to have experimented with it. Jordan

and colleagues (2010) recently conducted another study using New Jersey Youth Tobacco Survey data to explore factors associated with waterpipe use among adolescents (Jordan & Delnevo, 2010). The prevalence of current waterpipe use among high school students in the state was 9.7% (n=3010). Some of the predictors of waterpipe use included ethnicity (Asians), current cigarette use, current use of other tobacco products, and belief that smoking makes one look cool or helps someone to fit in.

2.5 Reasons for popularity

Because waterpipe smoking is a fairly recent phenomenon in the US, research is still underway to determine predictors and correlates of use among college students. Several factors may have contributed to the rising popularity of waterpipe. Some of the factors that have been documented are availability of flavored tobacco, easy access to establishments that offer waterpipes, and media influence (The BACCHUS Network, 2007). Other reasons that have been reported are low costs associated with waterpipe use, perception of waterpipe use as a social activity and belief that waterpipe smoking is safer than cigarette smoking (Grekin & Ayna, 2008).

Flavored tobacco Originally, the tobacco used in waterpipe, commonly known as jurak, ajami or tumbak was unflavored (Martinasek et al., 2011). Flavored tobacco “*maassel*”, was later introduced in the early 1990s, and contains ~30% tobacco and 70% honey or molasses and fruit flavors (Knishkowsky & Amitai, 2005). Popular flavors include apple, strawberry, rose, mango, cappuccino, banana, peach, lemon, orange, mint, and licorice. When flavored tobacco is heated with burning charcoal, it releases an aroma of caramelizing sugar (Shihadeh, 2003), which is perceived as more pleasant than smoking traditional tobacco. The use of *maassel* may be responsible for the surge of popularity of

waterpipe smoking across the world (Rastam et al., 2004; Shihadeh, 2003). In addition, attractive packaging of *maassel* in cartons with fruit displays on the cover might portray an image that it is healthy (Khalil et al., 2009; Martinasek et al., 2011). Studies across the world support the notion of strong preference of flavored tobacco and belief that waterpipe is safer due to the fruity flavors (Aljarrah et al., 2009; Roskin & Aveyard, 2009). The trend of using flavors to attract smokers seems to be similar to the trend of adding flavored additives in cigarettes. Despite the claims from cigarette companies that flavored cigarette varieties were intended for adult established smokers, young smokers were found to be more attracted to flavoring that masked the harshness of regular cigarettes (Klein et al., 2008). Currently, increasing numbers of waterpipe smokers use flavored tobacco rather than traditional tobacco.

Hookah Bars and Cafés There is an emerging trend of increasing availability of waterpipes in cafés, hookah bars, lounges, and other such social settings. It has been estimated that approximately 200-300 new waterpipe cafés opened between 1999 and 2004, mostly around college campuses (Smokeshop Magazine, 2004). The BACCHUS Network report (2007) indicated an upsurge in the number of waterpipe establishments in states like Colorado and California in the past few years. In addition, there have been several anecdotal reports that highlight the growth of waterpipe establishments; no substantial national market survey has yet been conducted.

One of the reasons why these establishments are increasing around college areas could be related to attracting young adults who are not of legal age to drink to these settings. College students who are between the ages of 18 and 21 can go to hookah bars and cafés that do not serve alcohol and still enjoy the experience of a “bar scene” (Martinasek

et al., 2011) without going to bars that serve alcohol. This is the usual age range of college freshmen and sophomores. In addition, hookah bars, cafés, and restaurants may lure young customers by making the interior décor, music and the setting exotic and by displaying visually appealing paraphernalia such as colorful waterpipes.

Marketing techniques Promotion of waterpipe smoking through various media channels such as internet sites, magazines, TV, radio, etc. has played a significant role in the rapid proliferation of waterpipe across borders (Martinasek et al., 2011). College students are mostly targeted through sponsorship of musical events at college bars, advertising in college newspapers, and free sample availability in college fraternities (Smith-Simone et al., 2008). Messages printed on waterpipe paraphernalia are used as marketing strategies to seize attention of young users. Khalil and colleagues studied health messages promoted by manufacturers and found slogans such as “untouched by hands”, symbolizing purity of the waterpipe tobacco. In addition, charcoal was being sold as “natural”, made of “100% coconut shell”, “free of chemicals.” Some claimed that no trees were cut to produce the charcoal and some used a prefix such as “eco” giving an impression to the user that charcoal is environment friendly. Moreover, using striking pictures of fruits to indicate flavor of tobacco is fairly common. Sometimes, actual fruits like pineapples and watermelons are also used to hold water in a waterpipe, making the waterpipe more attractive (Khalil et al., 2009). Marketing techniques like these often conceal potential dangers associated with smoking waterpipe.

Affordable cost In addition to wide availability, waterpipes are available at affordable prices ranging from \$5 to \$12 per session (Martinasek et al., 2011). Compared to the average cost of a pack of cigarette, which costs close to \$4.5, a box of waterpipe tobacco,

which costs \$2.50 on average, is more affordable (Grekin & Ayna, 2008). One box of waterpipe tobacco could last for several smoking sessions, which makes it cost effective for those with low economic level. A study conducted in Lebanon among college students reported smoking waterpipe as “an inexpensive way to hang out with friends” (Chaaya et al., 2004). British and Canadian waterpipe smokers also reported lower cost associated with waterpipe smoking compared to smoking cigarettes as one of the reasons they preferred smoking waterpipe to smoking cigarettes (Roskin & Aveyard, 2009).

2.6 Health effects of smoking waterpipe

Tobacco smoking is a known cause of cancer; the overall rates of death from cancer are twice as high among smokers as nonsmokers (CDC, 1982). Foremost among the cancers caused by tobacco use is lung cancer; cigarette smoking has been linked to about 90 percent of all lung cancer cases (USDHHS, 1989). It is estimated that approximately 440,000 persons die of a cigarette smoking-attributable illness (CDC, 2002). Even though a perception that waterpipe smoking is safer than smoking cigarettes is fairly common, studies conducted on health effects of waterpipe have shown quite the contrary. A number of studies have documented that waterpipe contains similar harmful agents as cigarettes, suggesting potential health risks similar to cigarette smoking.

Shihadeh (2003) analyzed the mainstream smoke from a smoking machine and found that a single waterpipe smoking session produces as much “tar” as 20 low-tar cigarettes, and high levels of heavy metals such as arsenic, chromium and lead. Another study examined levels of nicotine and cotinine in body fluids such as plasma, saliva, and urine in habitual waterpipe smokers (Shafagoj et al., 2002). The result demonstrated a rise of plasma nicotine levels from 1.11 ng/ml at baseline to 60.31 ng/ml (250 percent increase).

Similarly cotinine levels increased from 0.79 ng/ml at baseline to its highest concentration of 51.95 ng/ml (120 percent increase) suggesting that waterpipe smoking is not a safe habit as perceived by many.

Waterpipe smoking requires heating of tobacco leaves. This incomplete combustion produces gaseous component and particular matter. The gaseous component consists of carbon monoxide (CO), nitrosamine, acetaldehyde, formaldehyde, volatile hydrocarbons and hydrogen cyanide, and the particulate phase includes an aerosol of tar and nicotine particles (Al Mutairi, Shihab-Eldeen, Mojiminiyi, & Anwar, 2006). Most of these products are commonly found in main stream and side stream cigarette smoke. It is estimated that inhalation during waterpipe smoking could lead to as much as 100 times more smoke compared to that from a cigarette (Eissenberg et al., 2008).

Waterpipe smoking requires larger puff volumes and longer duration of exposure. While cigarette smoking involves about 12, approximately 50 ml puffs to inhale around 0.5 L of smoke over a 5-to7-minute period (Djordjevic, Stellman, & Zang, 2000), waterpipe smoking could consist of 171, 530-ml puffs of 2.6-s duration at a frequency of 2.8 puffs/min (Shihadeh et al., 2004). Therefore, a waterpipe smoker may inhale as much smoke as a cigarette smoker may inhale from 100 or more cigarettes (WHO, 2005). Inhalation of large puffs and long duration of smoking sessions could expose smokers to more carcinogens compared to smoking cigarettes (Fromme et al., 2009). Contrary to popular belief, waterpipe smoking may be equally, if not more harmful, than smoking cigarettes.

Another potential source of health hazard in a waterpipe is the commonly used heat source, like charcoal or wood cinders. These heating sources may increase health risks by

producing toxicants, such as CO and polyaromatic hydrocarbons. These agents are considered to be causative factors of cardiovascular diseases and lung cancer (Hoffmann, Djordjevic, & Hoffmann, 1997). CO is a colorless, odorless gas which causes toxicity by combining with hemoglobin in the blood by displacing oxygen to form carboxy hemoglobin (COHb). Studies have shown that it is reasonable to speculate that charcoal is the major source of these compounds in mainstream waterpipe smoke. Monzer and colleagues (2008) studied charcoal emissions such as CO in comparison with an electric heating source. It was found that approximately 90% of the CO and 75-92% of polyaromatic hydrocarbons compounds were emitted from the charcoal (Monzer, Sepetdjian, Saliba, & Shihadeh, 2008). There have been a number of studies demonstrating high expired-air peak CO and CO boost after smoking waterpipe. The results have clearly shown that emissions from waterpipe smoking are much higher compared to that from cigarette smoke. In a sample of 31 smokers who smoked both waterpipe and cigarettes, the CO boost was reported to be 2.7 parts per million (ppm) and 24.0 ppm after smoking cigarettes and waterpipe respectively (Eissenberg & Shihadeh, 2009). The peak CO was reported to be 28.7 ppm after smoking waterpipe and 7.8 ppm after smoking cigarettes in the same study. Similarly, in another study conducted among 61 Syrian waterpipe smokers, the CO boost was found to be 31.5 ppm, and the peak CO level being 35.5 ppm (Maziak et al., 2009). Another study conducted in Beirut, comparing CO level between nonsmokers, cigarette smokers and waterpipe smokers, reported CO boost of 22.4 ppm and peak CO of 38.5 ppm among waterpipe smokers, CO boost of 10.8 ppm and peak CO of 33.9 ppm among cigarette smokers after smoking (Bacha et al., 2007). These findings were similar to another study conducted in the US that studied CO levels among 21 students. The study

found a significant CO boost of 32 ppm with a CO peak of 38 ppm after smoking waterpipe (El-Nachef & Hammond, 2008). Another study reported CO levels of 32.9 ppm 50 minutes after smoking waterpipe and 31.1 ppm at 60 minutes compared to 4.9 ppm at baseline (Cobb, Ward, Maziak, Shihadeh, & Eissenberg, 2010). The CO levels after smoking waterpipe were significantly higher than cigarette smoking, which was reported to be 7.4 ppm at 50 and 7.1 ppm at 60 min.

Chronic health hazards- Of the few studies that have been conducted, long term health effects among waterpipe smokers have been documented by some studies. In a case-control study conducted among miners in China, use of waterpipe was associated with a twofold risk for lung cancer compared to tobacco abstainers and a dose-response relation was observed with increasing waterpipe use (Qiao et al., 1989). Other documented studies on lung cancer cases and waterpipe use have been reported in China and India (Gupta, Boffetta, Gaborieau, & Jindal, 2001; Lubin et al., 1990). Other types of cancers associated with waterpipe use include oesophageal cancer, gastric carcinoma, and lip carcinoma (El-Hakim & Uthman, 1999; Gunaid et al., 1995; Nasrollahzadeh et al., 2008). However, smoking and bladder cancer risk in a case-control study in Egypt showed no difference in rates between waterpipe smokers and nonsmokers (Bedwani et al., 1997).

Waterpipe smoking has been linked with respiratory problems in which pulmonary function was lower among waterpipe smokers compared to non smokers (Al-Fayez, Salleh, Ardawi, & Zahran, 1988; Kiter, Ucan, Ceylan, & Kilinc, 2000). Other health risks include infectious diseases like tuberculosis, which is speculated to be the result of sharing the same mouthpiece, a common custom in many cultures (Munckhof, Konstantinos, Wamsley, Mortlock, & Gilpin, 2003). Some other health effects that have been

documented are low birth weight, infertility and cardiovascular disorders, like elevated heart rate and systolic and diastolic blood pressure, among habitual waterpipe smokers (Inhorn & Buss, 1994; Nuwayhid, Yamout, Azar, & Kambris, 1998; Shafagoj & Mohammed, 2002).

Despite the use of waterpipe for many centuries by millions across the world, the availability of information regarding the health effects has been scant compared to that of cigarettes. Some of the reasons that are documented for the dearth of information are unavailability of standardized waterpipe, lack of research in the regions where waterpipe is commonly smoked and complications associated with isolating waterpipe smokers from dual smokers of waterpipes and cigarettes (Knishkowsky & Amitai, 2005).

2.7 Predictors of Waterpipe Use among college students

2.7.1 Demographics

Race/ethnicity- Waterpipe smoking has been a part of traditional culture in many Middle Eastern and some Asian countries for centuries. In some cultures, it is common to share waterpipe with family members to the extent that it is socially acceptable for a father to offer his teenage children a puff of waterpipe (El-Roueiheb et al., 2008). A Lebanese study conducted among intermediate and secondary students reported that 28% of initiation of waterpipe smoking took place with an immediate family member, signifying the role of cultural influence in relation to waterpipe use (Zoughaib et al., 2004). While the role of race/ethnicity is yet to be examined in the US, it can be speculated that when families emigrate from the Middle East and Asian countries to the US, they still practice smoking waterpipe with family members which is an inherent part of their culture. The University of

Maryland is a diverse campus with students representing multiple races and ethnicities.

This study will examine if smoking waterpipe differs by race and ethnicity.

Gender- Waterpipe smoking is deeply rooted in Arab culture, especially among men. It is mostly perceived as a sign of masculinity as men are often engaged in physically strenuous jobs and are thought to have stronger lungs compared to women (Baker & Rice, 2008).

Low rates of waterpipe smoking among women in Middle Eastern countries have been documented in several studies. Felimban (1993) studied waterpipe smoking among female university students in Saudi Arabia. The smoking prevalence was 8.6% and 11.6% for medical and non-medical students, respectively (Felimban, 1993). In another study, Hasim (2000) found similar rates among women, which was much lower than smoking rates among men (Hasim, 2000). These low rates among women may be related either to actual small number of female smokers due to social unacceptability or under-reporting due to shame (Haddad & Malak, 2002). However, even though smoking among women is perceived as a stigma in these cultures, Arab women are more likely to smoke waterpipe than use other tobacco products such as cigarettes (Soweid, 2005). It is not known if the same is true in the US especially among college students.

Religion- Religion also plays an important role in determining waterpipe smoking behavior especially in Middle Eastern countries (Islam & Johnson, 2003). Unlike behaviors such as alcohol consumption, smoking is not forbidden in Islam. Jurists have historically regarded tobacco smoking as an acceptable sociable activity that is discouraged (mukrooh) but not prohibited (haram) according to their religious beliefs (Ghouri, Atcha, & Sheikh, 2006). It may be one of the reasons why waterpipe smoking is so popular in Middle Eastern countries. However, smoking is still a behavior that is discouraged due to its detrimental

health effects. Some Middle Eastern countries, such as Egypt and Saudi Arabia, have recently issued Fatwa (religious statements that are agreed upon by religious leaders) against smoking (Islam & Johnson, 2003). A high degree of religiosity has been associated with lower cigarette smoking levels among adolescents. Sperber and colleagues (2001) found religiosity associated with lower smoking rates among adolescents, in a prospective cohort study in Israel (Sperber, Peleg, Friger, & Shvartzman, 2001). Sutherland and Shephard (2001) found similar results for substance use and religious beliefs in a sample of adolescents (Sutherland & Shepherd, 2001).

2.7.2 Background variables

Athletics and tobacco use- Athletic involvement and tobacco use among college students has been documented by some studies. Females who competed at an international level were more prone to smoking cigarettes than smoking cannabis or drinking alcohol (Peretti-Watel et al., 2003). Male baseball players had the highest rate of smokeless tobacco use among college varsity athletes (Walsh, Hilton, Ernster, Masouredis, & Grady, 1994). On the contrary, according to a web based survey, college students were more likely to be lifetime smokers if they did not participate in intercollegiate sports (Morrell et al., 2005). However, the students were more likely to be current or life time users of smokeless tobacco if they participated in intercollegiate sports. The most likely explanation is that athletes might perceive smoking to be detrimental to health as it reduces lung function but might believe that use of smokeless tobacco releases adrenaline that enhances their performance. Even though smoking waterpipe involves smoking it is perceived to be less harmful than smoking cigarettes.

Involvement in Greek organizations and tobacco use- Ample research has examined the prevalence of excessive alcohol and substance use among Greek members compared to non-Greek members (Cashin, Presley, & Meilman, 1998; McCabe et al., 2005). Alcohol, tobacco, marijuana, and other substances play a central role in the socialization process, especially among college students. Membership in Greek organizations provides the opportunity to be accepted by peers and socialize with them. For example, research on cigarette smoking has shown that adolescents are more likely to smoke if their peers smoke (Eisenberg & Forster, 2003; Leatherdale, McDonald, Cameron, & Brown, 2005). Yet, little is known about how affiliation with Greek organizations relates to waterpipe use.

Living arrangements- Students who live in households that they share with friends have greater access to socializing compared to those who live with their parents or those who reside in dorms where they are under supervision (Gfroerer et al., 1997; Jones et al., 1992; Wechsler et al., 2001). As more and more students are purchasing waterpipe paraphernalia from the internet (Smith-Simone et al., 2008), they are more likely to smoke at home more than going to waterpipe bars and cafés. Living conditions could influence waterpipe use among college students.

2.7.3 Psychosocial Correlates

2.7.3.1 Perceived risks

Theoretical background- Health behavior theories help in clarifying how relationships between variables explain and predict human behaviors (Glanz, et al, 1997). A cognitive model that may provide insight into risks of waterpipe smoking among college students is the Health Belief Model (HBM). The HBM was developed by Hochbaum, Rosenstock and colleagues in the 1950s and is based on the value expectancy theory, which means

individuals avoid negative consequences associated with their unhealthy behavior and place value in executing the healthy behavior (Janz & Becker, 1984). The HBM mostly emphasizes on perceptions or beliefs as a basis for decision making process. Major constructs of beliefs as described by the model are perceived susceptibility, perceived severity, perceived benefits, and perceived barriers. Together, perceived susceptibility and perceived severity are labeled as perceived threat. The construct of perceived threat, operationalized as perceived risk in this study, hypothesizes that individuals are motivated to make decisions about health behaviors based on perceived harm of the negative consequence. College students are less likely to smoke if they believe smoking has harmful consequences. Anti-smoking messages directed at young adults such as college students are likely to be more successful if researchers and policy makers had a better understanding of how this age group perceives the risks of smoking waterpipe.

The majority of evidence in regards to harm perception is surrounding cigarette smokers, which has been assessed by several studies. Some studies have highlighted varying degrees of risk awareness among adolescents (Slovic, 2000). Earlier studies have found that college students consider smoking less hazardous than using illicit drugs (Luce & Merrell, 1995; Slovic, 2000). Luce and Merrell (1995) assessed lethality and abuse potential of cocaine, heroin, marijuana, alcohol, and tobacco in a sample of college students. Students overestimated deaths from cocaine, heroin, and marijuana and underestimated deaths from tobacco and alcohol. Slovic (2000) found that a high proportion of adolescent smokers perceived no health risk from smoking the next cigarette or from smoking regularly for the "first few years." Denial of short-term consequences, coupled with underestimation of addictive properties of tobacco, indicated lack of

knowledge of the risks from smoking cigarettes among young adults. The aforementioned studies suggest that smokers are misinformed about the health risks of tobacco products. There is clearly a need to design educational interventions as prevention strategies to combat tobacco use among young adults.

The general perception among waterpipe smokers regarding health hazards is that it is less harmful than smoking cigarettes. A widespread belief among smokers is that since the smoke in a waterpipe passes through water, toxins in the smoke are filtered by water before inhalation rendering it less harmful than cigarette smoke. In addition, the maximum temperature in the head of a waterpipe is approximately 450 °C, which is too low to sustain combustion compared to 900 °C found in cigarettes (Shihadeh, 2003). The smoke is considerably cooled to a lower temperature as it passes through the water and to the smoker through the hose. It is likely that this coolness may reinforce a belief of reduced harm to the smoker.

Smokers all over the world hold an unsubstantiated presumption that waterpipe smoking is safer and less addictive than cigarette smoking (Eissenberg et al., 2008; Shafagoj et al., 2002; Shihadeh, 2003). Data about perceptions of waterpipe use in the U.S. supports this notion. A study conducted as an internet survey among college freshmen to understand their harm perception of nicotine products showed that 37% of the students perceived waterpipe to be less harmful than regular cigarettes (Smith et al., 2007). Another survey conducted to understand the attitudes and perceptions among waterpipe smokers showed similar misconceptions (Maziak, 2008; Smith-Simone et al., 2008). Primack et al. (2008), showed that 33.1% believed that waterpipe smoking was less harmful than smoking cigarettes and more than half (52.1%) of the sample of students perceived waterpipe

smoking to be less addictive than cigarette smoking. One year of waterpipe smoking was more likely to be associated with low perceived harm and low perceived addictiveness compared to cigarette smoking.

Similar perceptions regarding harm reduction was found in studies conducted in Middle-Eastern countries. A study conducted among middle school children (n=388) in Israel showed that 90% believed waterpipe smoking was not healthy for them, however at least 50% of them perceived waterpipe smoking to be safer than smoking cigarettes. The alarming fact was that their perception was similar to their parents' (Varsano et al., 2003). A study conducted in Syria showed that cigarette smokers were more likely to attempt quitting compared to waterpipe smokers, 74% versus 46% respectively, and had made a quit attempt in the previous year, 58.1% versus 22.8% for cigarette and waterpipe smokers respectively (Ward et al., 2006). This could be a reflection of the perceived susceptibility of waterpipe smokers that smoking waterpipe is safer than smoking cigarettes. The same results were seen among waterpipe café patrons in Egypt (Israel, El-Setouhy, & Mohamed, 2003). An alarming result was shown by a study conducted among pregnant women in Lebanon that showed the dearth of knowledge regarding harmful effects of waterpipe smoking. Of the women surveyed, almost one fourth of them had smoked during their pregnancies (Chaaya et al., 2004). The information gathered from these studies may be used to give direction to future research and help design more effective prevention programs.

2.7.3.2 Resistance self-efficacy

Theoretical background- Self-efficacy, an individual's perception of the ability to successfully perform a behavior, is a key component of Bandura's Social Cognitive

Theory. Self-efficacy relates to beliefs about personal capabilities of performing specific behaviors in specific situations (Strecher, DeVellis, Becker, & Rosenstock, 1986). Bandura (1977) posited that perceived self-efficacy beliefs can influence various aspects of behavior including the adoption of new behaviors as well as inhibition of existing behaviors. Self-efficacy is critical to understanding individual behaviors and motivation (Bandura, 1977). It provides the theoretical foundation underlying resistance self efficacy beliefs. Resistance self-efficacy pertains to one's perception of his/her ability to resist involvement in substance use. It also implies resistance against peer pressure to smoke. Resistance self-efficacy has been postulated to be associated with smoking behavior in several studies (Engels, Hale, Noom, & De Vries, 2005; Haukkala, Uutela, Vartiainen, McAlister, & Knekt, 2000; Kear, 2002).

Studies have established a negative relationship between smoking behavior and smoking resistance self efficacy: smokers with high resistance self efficacy are less likely to be involved in smoking and vice-a-versa (Bandura, 1977; Conditte & Lichtenstein, 1981; DiClemente, 1985; Kear, 2002). Kear (2002) examined psychosocial determinants of cigarette smoking among a sample of 224 college students. Smoking resistance self efficacy had the highest impact on smoking behavior among other predictors. In another study, Stacy and colleagues (1992) examined a sample of high school students and found that social influence of friends, which is a strong predictor of adolescent smoking, was moderated by self efficacy to resist smoking (Stacy, Sussman, Dent, Burton, & Flay, 1992). High self efficacy was deemed as a protective factor against social influence to smoke. Other studies have shown similar results (Choi et al., 2001; Sussman, Dent, Flay, Hansen, & Johnson, 1987).

Based on the notion that adolescents are less likely to succumb to pressure to use drugs if they have the confidence and skills to resist, developing resistance self efficacy has been a focus of many approaches to drug prevention (Bell, Ellickson, & Harrison, 1993; Botvin, 2001; Ellickson, McCaffrey, Ghosh-Dastidar, & Longshore, 2003; Ellickson, Tucker, & Klein, 2003; Musher-Eizenman, Holub, & Arnett, 2003). Similar approaches could be taken to prevent waterpipe use if resistance self efficacy is shown to be a prominent predictor.

2.7.3.3 Risk taking/sensation seeking tendency

Sensation seeking is characterized by “varied, novel, complex, and intense experiences, and the willingness to take physical, social, legal, and financial risks for the sake of such experience” (Zuckerman, 1994). Zuckerman and colleagues (1978) categorized sensation seeking into thrill and adventure seeking, experience seeking, disinhibition, and boredom susceptibility (Zuckerman, Eysenck, & Eysenck, 1978). Thrill and adventure seeking measures a person's desire to engage in risky activities involving speed, movement and defiance of gravity; experience seeking is the need to seek experience through the mind and senses that include music, art, travel etc.; disinhibition measures the desire for social stimulation in uninhibited social activities such as parties and social drinking; and finally, boredom susceptibility refers to an aversion to monotony and a preference for unpredictable situations (Zuckerman, 1986). Previous studies have reviewed the area of sensation seeking and drug and alcohol use. Two dimensions of sensation seeking such as thrill and adventure seeking and disinhibition have been identified by several studies to be related to substance abuse (Bardo, Donohew, & Harrington, 1996; Donohew et al., 1999; Donohew et al., 1999; Zuckerman, Ball, & Black, 1990). In addition,

some constructs of sensation seeking have also been associated with alcohol consumption. Earleywine and colleagues (1990) revealed a correlation between personality measures and alcohol consumption in a sample of college students. Quantity and frequency of alcohol consumption were positively related to behavioral inhibition, accounting for 63% of the variance (Earleywine, Finn, & Martin, 1990). Beck et al. (1995) found that social context and sensation seeking preferences were associated with the drinking habits among college students. Both male and female students had high levels of disinhibition (Beck et al., 1995). Several other studies have studied this correlation among college students (Henderson, Goldman, Coovert, & Carnevalla, 1994; Parent, 1999; Stacy, 1997).

A study among 8th and 11th graders found that students with high disinhibition scores were more likely to be heavy smokers compared to those with lower disinhibition scores. The same study showed that high disinhibition scores almost doubled the risk of current marijuana use for 8th graders and one and a half times for 11th graders (Kopstein et al., 2001).

Till date, no published study exists on waterpipe use and its predictors. Since college students experiment with a spectrum of substances during college life, it can be hypothesized that sensation seeking could be a predictor of waterpipe use, based on the influence it has on cigarette smoking, and use of marijuana, alcohol and other drugs. Furthermore, college students could also be influenced by peer sensation seeking preferences. Alcohol and marijuana users tend to socialize and cluster with those who have similar sensation seeking preferences (Donohew et al., 1999; Donohew et al., 1999).

2.7.3.4 Peer influence

Peer influence has long been a consistent predictor of smoking among adolescents (Aloise-Young, Graham, & Hansen, 1994; Flay, Hu, & Richardson, 1998; Urberg, Degirmencioglu, & Pilgrim, 1997). Studies among college students have similarly indicated that peer use is a significant predictor of smoking (Morrell et al., 2005; Rigotti et al., 2000). Morrell and colleagues (2005) examined predictors of smoking in a sample of college students ($N = 21,410$) from 13 universities. Results from the study revealed that students were less likely to have tried smoking if fewer than 75% of their friends smoked. A longitudinal study conducted among adolescents showed that factors motivating initiation of smoking differ from factors motivating continuation (Ary & Biglan, 1988). Social influences (peer smoking) was a better predictor of continued smoking than of onset. The study showed that number of friends who smoked and the number of offers of cigarettes in the previous week were both significantly related to continuation of smoking. This demonstrates that focusing on peer influences could play an important role in cessation programs. There are other studies that suggest that smoking onset may depend on age. In a cross sectional study, Krosnick and Judd (1982) found that peer smoking was more highly related to smoking among high-school students than among middle-school students (Krosnick & Judd, 1982). A study conducted among African American college students showed that those who reported having childhood friends who did not smoke or having some friends who smoked during childhood were less likely to be trial smokers compared to those who reported having most childhood friends who smoked (Hestick et al., 2001). These conclusions have been supported throughout the literature.

Although many studies have examined predictors of cigarette smoking among college students, hardly any study has focused on the role of peer influence on waterpipe

use. There is lack of understanding of whether peer influence predisposes individuals to experiment with waterpipe and facilitate frequent use. It is conceivable that since waterpipe use is considered a social activity, such an influence may encourage conformity among circle of friends if members in the circle are waterpipe users.

Main research questions and specific hypotheses of the present included:

Research question 1: Are demographic characteristics (gender and race/ethnicity) associated with waterpipe use among college students?

Hypothesis 1a: Male college students are more likely to be ever users of waterpipe compared to female students

Hypothesis 1b: Asian students are more likely to be ever users of waterpipe compared to students of other groups

Research question 2: Are background variables such as involvement in Greek organizations, participation in athletics and living arrangements associated with waterpipe use among college students?

Hypotheses 2a: Students who belong to Greek organizations (fraternities/sororities) are more likely to be ever users of waterpipe compared to those not affiliated with Greek organizations

Hypotheses 2b: College athletes are less likely to be ever users of waterpipe compared to non-athletes

Hypotheses 2c: Students who live in the dorms or those who live on their own are more likely to be ever waterpipe smokers compared to those who live with parents

Research question 3: Is perceived risk of smoking associated with waterpipe use among college students?

Hypothesis 3a: Lower level of perceived likelihood of getting sick from waterpipe use is associated with current use of waterpipe among college students

Hypothesis 3b: Lower level of perceived likelihood of getting addicted to waterpipe (or nicotine) is associated with current use of waterpipe among college students

Research question 4: Is peer influence associated with waterpipe use among college students?

Hypothesis 4: Having friends, roommates and girlfriends/boyfriends who smoke waterpipe is associated with of current waterpipe use

Research question 5: Is resistance self efficacy associated with waterpipe use among college students?

Hypothesis 5: Higher level of resistance self-efficacy is associated with lower likelihood of current waterpipe use among college students.

Research question 6: Is sensation seeking characteristic associated with waterpipe use among college students?

Hypothesis 6: Higher level of sensation seeking is associated with higher likelihood of current waterpipe use among college students.

2.8 Theoretical concept of social context

The concept of social context, as it relates to health behavior, mainly stems from an amalgamation of intrapersonal and interpersonal health behavior theories. Influential

intrapersonal health behavior theories that include the Health Belief Model and the Theory of Reasoned Action/ Planned Behavior (Ajzen, 1991; Janz & Becker, 1984) explain health behaviors based on the underlying principle that health behaviors are governed by psychosocial and motivational correlates such as beliefs, attitudes, and expectations at the individual level. However, a comprehensive understanding of behaviors requires integrative analysis of the situational factors and personal factors that influence the behavior. Studying health behavior is incomplete if the broader aspect of social context is ignored (Glass & McAtee, 2006). Therefore, in recent times, health behavior researchers have shifted the paradigm towards a broader perspective by incorporating social ecological models in explaining social contexts in which behaviors take place (Burke, Joseph, Pasick, & Barker, 2009).

The social context model identifies social structures, and socialization processes in a social environment at any given period of time (Earle & Earle, 1999). Thus, the model provides an advantage to addressing health behaviors by explicitly going beyond individual level theories and including situational factors that include a wide array of contextual factors such as social relationships, organizational structures, and societal influences in addition to individual's demographic characteristics (Sorensen et al., 2003). Earle and colleagues (1999) identified two dimensions of social context: social environmental and time. Social environment includes components of external influences such as social norms, peer influence, community and institutional experiences (Beck, Thombs, & Summons, 1993). The time dimension, on the other hand, gives a perspective of immediate situation that exists in social environment at a given place and time (Earle & Earle, 1999).

In the absence of a social context theory, the majority of research on social context is based on derivative models that have been developed for specific health problems (Holahan, Moos, Holahan, & Brennan, 1997; Sorensen et al., 2003). To date, little is known about how these components of social context function for behaviors such as smoking. Studies on drinking behaviors have explained social context as an interaction between motivational, situational, relational, and temporal factors (Beck & Summons, 1987; Beck et al., 1993; Thombs et al., 1993). Considering what is known so far about motivational and situational factors that influence drinking behaviors among college students, it can be hypothesized that similar correlates could influence waterpipe smoking among college students.

2.8 Social context of smoking waterpipes

Binge drinking, smoking and drug use have long been a part of the social scene in colleges (Kidorf, Sherman, Johnson, & Bigelow, 1995; Lewis & O'Neill, 2000; Presley, Meilman, & Leichter, 2002). Situational context and psychosocial correlates of alcohol consumption and drug use among adolescents have been explained by substantial body of empirical research over the last few decades. However, despite high prevalence of waterpipe use among college students and identification of multiple social contexts in separate studies, a clear portrayal of the correlates that influence waterpipe use among college students is limited.

Intrapersonal factors (beliefs, perceptions) as well as environmental variables influence waterpipe use (Aljarrah et al., 2009; Maziak, Ward, Afifi Soweid et al., 2004; Maziak, Ward, & Eissenberg, 2004). Therefore, theoretical concepts of the Social Cognitive Theory (SCT) are appropriate to explain waterpipe use (Bandura, 1986). The

SCT explains behavior in terms of a reciprocal, dynamic and triadic model in which personal factors, environmental factors and behavior interact together to influence behavior. The constructs of the SCT include environment (factors external to an individual, including physical factors such as availability of services and social factors such as family, friends, etc.); reciprocal determinism (dynamic interaction between person, behavior and environment, in which behavior is performed); behavioral capability (knowledge and skill to perform the behavior); outcome expectations (anticipatory outcome of a behavior); outcome expectancy (value that one places on the behavioral outcome); observational learning (behavioral acquisition by observing actions and outcomes of others); reciprocal determinism (responses that increase or decrease the likelihood of reoccurrence of behaviors); self efficacy (confidence in ability to perform a behavior); self regulation (self control of goal directed behavior).

Environment refers to factors in an individuals' surrounding, which can affect their behavior. Social environment might refer to people, norms, and personal relationships such as those between peers and college friends. Physical environment refers to more tangible structures surrounding an individual and may include waterpipe establishments. The situation is a person's perception of the place, time, and activity (Glanz et al., 1997). In the case of waterpipe use among college students, the college environment, waterpipe smoking peers and friends owning waterpipe paraphernalia in dorms serve as part of the social environment. Expectations refers to what an individual believes will be the likely result or outcome of a particular behavior. For instance, students may have expectations of getting nicotine high, or relaxation and counter boredom as a result of smoking. Students may also believe that it is safer to smoke waterpipe than cigarettes and may have expectations of

looking “cool” among peers. Observational learning is the acquisition of a behavior that occurs by watching others perform the behavior and by watching the outcomes/experiences of others who perform the behavior. This is also termed as vicarious experience (Glanz et al, 1997). For waterpipe smoking this is especially relevant in terms of emulating or adopting behaviors based on observing other students. Reciprocal determinism refers to the idea that behavior change results from a dynamic, bidirectional interaction between an individual and the environment. Based on this construct, waterpipe smoking is the result of a dynamic interaction between the actual behavior of smoking, the college environment and the individuals themselves.

By assessing all these factors, a comprehensive understanding of waterpipe smoking among college students can be achieved. This multidimensional approach may be more useful for developing tobacco prevention programs than those that only consider cognitive factors alone. Such an effort has been challenging due to lack of established instruments that capture the dimensions of social context associated with waterpipe smoking.

2.8.1 Social context of drinking alcohol among college students

Binge drinking and heavy consumption of alcohol among young adults, especially college students, has been a public health concern for many years. Recent studies have shown that, among college students registered full-time, 63.9% are current drinkers, 43.5% are binge drinkers, and 16.0% are heavy drinkers (SAMHSA, 2010). Researchers have deemed binge drinking among college students as a very serious concern (Hingson, Heeren, Winter, & Wechsler, 2005; Slutske, 2005; Wechsler et al., 2002).

It is important to note that college students are more likely to be engaged in heavy and binge drinking compared to their non-college-attending counterparts (Slutske, 2005; SAMHSA, 2010). These results raise several questions regarding factors that influence drinking behaviors among young adults. Some studies have highlighted the situational context, such as locations, to be one of the prime factors that influences drinking among college students (Presley et al., 2002). Apart from the environmental influences, intrapersonal factors, such as positive outcome expectations like enhanced arousal, sexual enhancement, improvements in cognitive and motor abilities, improvements in social behavior, and tension reduction have also been reported (Kidorf et al., 1995; Lewis & O'Neill, 2000). Among other factors, researchers have identified situation-specific motivations, also known as social context, that influence drinking alcohol among adolescents (Beck & Summons, 1987). The five distinct patterns of social context of drinking alcohol identified among adolescents are social facilitation, stress control, school defiance, peer acceptance, and parental control (Beck et al., 1993). It is not known if the same patterns are associated with waterpipe use.

2.8.2 Social context of smoking cigarettes among college students

In 2009, an estimated 23.3% of the population aged 12 or older was reported to be current cigarette smokers (SAMHSA, 2010). Despite drastic reduction in smoking prevalence in the past few decades among adults, the rates among young adults, especially college students, have not decreased significantly (Wechsler et al., 1998). However, one of the salient features that has been documented among college students is the lower rates of smoking compared to non-college attending counterparts (Johnston, O'Malley, Bachman, Schulenberg, 2010).

Social context of smoking has been under review in the field of tobacco control to understand the social determinants of health (Lawn, Pols, & Barber, 2002; Parry, Thomson, & Fowkes, 2002; Pickett, Wakschlag, Rathouz, Leventhal, & Abrams, 2002; Stead, MacAskill, MacKintosh, Reece, & Eadie, 2001). Among adolescents, a variety of factors, such as peer influence and parenting practices, have been found to be associated with smoking habits (Simons-Morton, Haynie, Crump, Eitel, & Saylor, 2001). The literature on social context of smoking cigarettes among college students is scarce even though the majority of college students are social smokers, who mostly smoke with others rather than smoking alone (Moran, Wechsler, & Rigotti, 2004).

2.8.3 Social context of using cannabis among college students

High prevalence of cannabis use among college students has been documented by many studies (Caldeira, Arria, O'Grady, Vincent, & Wish, 2008; Compton, Grant, Colliver, Glantz, & Stinson, 2004; Hammersley & Leon, 2006; White, Labouvie, & Papadaratsakis, 2005). According to longitudinal studies, the rise in prevalence of cannabis use among college students has been gradual. It rose from 27% in 1991 to 36% in 1998 and has remained steady with insignificant decline in the past few years (Johnston, O'Malley, Bachman, & Schulenberg, 2007). The rate is much higher among young adults who attend college compared to their non-college attending peers (Johnston, O'Malley, Bachman, & Schulenberg, 2007).

A recent study on cannabis use identified social contexts in which college students use cannabis. Factors such as social facilitation, meaning to enhance feelings of well being, conviviality and social interaction were associated with cannabis use (Beck et al., 2009). These were similar to that which had been previously identified for alcohol use (Beck et al.,

2008). Other distinct factors that were identified were peer acceptance, emotional pain associated with personal or academic problems and depression, and sex-seeking. It is not known if similar motivational factors influence waterpipe use.

2.9 Conclusion

The majority of adolescents live much of their lives in conformity with parental expectations and restrictions until they start college. Often termed as emerging adulthood, this developmental stage (between ages 18-25) is neither adolescence nor young adulthood (Arnett, 2000). It is characterized by freedom from regulations and independence from social norms. College students are a significant “at risk” population for adopting harmful health behaviors.

Although, there is no nationally representative data that depicts prevalence of waterpipe use among adolescents, rapid proliferation of hookah bars around campuses shows that in recent years waterpipe use has entered the realm of experimentation among college students. Based on the literature, it is evident that waterpipe use remains problematic among college students. Despite the upsurge in prevalence, surprisingly, very few studies have examined determinants of waterpipe use. Moreover, no literature exists on the role of social context in influencing waterpipe use among college students. An understanding of factors that motivate initiation and continuation is pertinent for designing effective strategies to prevent and treat tobacco-related mortality and morbidity.

Chapter 3: Study 1: “It is a college thing to do....” Waterpipe smoking among college students: A qualitative exploration

Abstract:

Tobacco use among college students represents a significant public health concern. In recent years, alternative tobacco products such as waterpipes are rapidly gaining popularity, especially among college students. Studies focused on understanding perceptions associated with smoking waterpipe have been scarce. A series of 59 in-depth, in-person, semi-structured qualitative interviews were conducted to gain a better understanding of the psychosocial and environmental influences on waterpipe smoking in a sample of college students who were regular waterpipe smokers. MAXQDA was used to code emergent themes and organize the data.

The majority of waterpipe smokers was male (79.7%), of Asian origin (45.8%), and almost one fourth (42.4%) owned waterpipes. Only 15% were dual users of cigarettes. The findings suggested that waterpipe smoking was a typical way of socializing and solidifying camaraderie among college students. The results indicated naiveté related to waterpipe smoking such as perceptions that smoking waterpipe was safer and less addictive than smoking cigarettes. It was a common belief that water in the waterpipe absorbed all the “impurities” in the tobacco. Some of the main reasons for smoking waterpipe were social acceptance of waterpipes compared to other tobacco products, peer influence, relaxation, socializing with friends, perception of looking “cool”, and physiological effects commonly referred to as “buzz.” Not needing an ID to go to the hookah cafés, unlike going to bars was frequently cited as an advantage, especially among those who were not of legal age to drink. Some of the students used waterpipes to smoke other products such as marijuana on a regular basis. Interventions focusing on changing the perceptions of college students regarding health hazards associated with waterpipe smoking should be developed.

3.1 Introduction

Tobacco use among college students represents a significant public health concern. One of the goals of Healthy People 2020 is to prevent tobacco use to improve quality of life of individuals of all ages (United States Department of Health and Human Services [USDHHS], Healthy People 2020, 2012). In order to achieve this goal, thoughtful consideration has to be given to the plethora of tobacco products college students are using. The range of tobacco products available to young adults is diverse. In recent years, even though cigarette smoking rates among young adults have decreased (CDC, 2004), use of alternative tobacco products is an emerging trend (CDC, 2005). One tobacco product that is rapidly gaining popularity is waterpipe, also known as hookah, narghile, arghile, goza, and shisha (Maziak, Ward, Afifi Soweid et al., 2004). Waterpipe smoking involves heating of tobacco with charcoal, and the passage of smoke through water and a hose. This phenomenon is well established among college students in the Middle East and is rapidly proliferating in the US (Martinasek et al., 2011; Maziak, 2011; Primack et al., 2008; Smith-Simone et al., 2008).

Studies conducted among the Middle Eastern college students show a high prevalence of waterpipe smoking, ranging from 20-43% for life time use and 11-28% for current use (Chaaya et al., 2004; Maziak, Fouad et al., 2004; Najla et al., 2010; Refaat, 2004; Tamim et al., 2003). To date, only a handful studies have focused on college students in the US. Among college students in the US, it ranges from 7.2-20% for current use and 29.5-41% for ever use (Eissenberg et al., 2008; Primack et al., 2010; Primack et al., 2008). It is speculated that ubiquitous waterpipe establishments, aggressive marketing, availability of flavored tobacco, and widespread perception of reduced harm are some reasons behind

the escalating popularity (Grekin & Ayna, 2008; Khalil et al., 2009; Shihadeh, 2003; Smith-Simone et al., 2008).

Because waterpipe smoking is a fairly recent phenomenon in the US, research is still underway to determine predictors and correlates of use among college students. The aim of this study was to gain an understanding of how knowledge, beliefs, peer influence, situational context, culture/tradition, perception of harm, and outcome expectations influence waterpipe use among college students.

3.2 Methods

3.2.1 Sample recruitment and data collection

A qualitative exploration was conducted among college students to gain an understanding of factors that influenced waterpipe smoking. Over a period of 12 months, a series of 59 in-person, in-depth, semi-structured interviews were conducted with a diverse student population. Because understanding waterpipe use among college students is still in infancy, a qualitative approach was appropriate for fulfilling the aims of this study.

Study participants were recruited from a variety of sources. A convenience sample of 36 waterpipe smokers who participated in a study, “standardization of methods to measure waterpipe smoke emissions and exposure” (NIH, NCI, RO108-0430 PI: Pamela I. Clark) was included in the interview. The rest of the participants were recruited through snowball sampling.

Smokers were included in the study if they were 18 years of age, had smoked waterpipe three times in the past six months and once in the past 30 days. Effort was made to include a variety of waterpipe smokers that included social smokers, waterpipe owners, non-daily smokers, and smokers from different ethnicities to understand the range of

factors that influenced waterpipe smoking. Individuals who used other forms of tobacco products (e.g. cigarettes, cigars, smokeless tobacco) were not excluded from the study.

A semi-structured interview guide focusing on knowledge, attitude, social influences and perception of waterpipe use among young adults was developed (Appendix I). Some of the open ended questions in the guide included, “what is the first thing that comes to mind when you think of waterpipe smoking?”, “what roles do external factors such as friends, relatives and availability of waterpipe play in influencing your behavior?”, “what do you know about the health effects of smoking waterpipe?”, “what are some of the reasons why you smoke waterpipe?” Items on the interview guide were pre-tested for appropriateness with two waterpipe smokers, with some minor modifications made in rewording some questions. Once the questions were finalized, participants were scheduled for the interviews.

In-person interviews were conducted in a quiet private room. The same interviewer performed all the interviews to prevent inter-interviewer bias. Prior to the interviews, participants completed demographic questionnaires and a brief tobacco use history questionnaire using a paper-pencil format (Appendix II). The tobacco use history questionnaire included items related to their frequency of waterpipe use, preferences of tobacco flavors, places where they smoked, people they smoked with etc. Participants were also asked about use of other tobacco products such as cigarettes, cigars, and smokeless tobacco.

Each interview was audio taped. Most lasted from 30 to 60 minutes. The one-on-one discussion format enabled participants to express themselves thoughtfully and honestly. The semi-structured design also encouraged respondents to go beyond the

predetermined questions, give personal accounts, and share their experiences. Permission to record the session was obtained prior to beginning each interview. Body language and non-verbal cues were also noted during the sessions. The study was explained and eligible participants were asked to sign the informed consent form that was previously approved by the University of Maryland, Institutional Review Board (Appendix III). A copy of the informed consent form was provided to all participants. Participants were monetarily compensated (\$10) for their participation. Waterpipe smokers were interviewed until no new themes emerged (Lincoln & Guba, 1985).

3.3 Analysis Plan

All interviews were independently transcribed verbatim. The software MAXQDA, a qualitative data management software, was used for coding and organizing the data. Analysis involved repeated reading of the text to generate emergent themes. Two research assistants, who were trained on the software, separately analyzed the data. Through an iterative process, themes were compared and contrasted to assure accuracy and completeness. Any disagreements were resolved by discussing the issues until a consensus was reached.

3.4 Results

3.4.1 Sample characteristics

Table 1 presents the characteristics of the study sample. The majority of the participants were male (78%) with Asians accounting for 47.4%, whites 35.6%, blacks 13.6%, and biracial 3.4%. Most Asian participants were originally from India or Pakistan. Almost 33% of the students smoked waterpipe at least monthly, 35.6% smoked weekly, and 27.1% were daily smokers. Almost 45% of them owned waterpipes and smoked at

home (27.1%), at friends' place (23.7%), in the dorms (18.6%), or in hookah cafés (18.6%). The majority of students (74.6%) had never smoked cigarettes, only 15.3% were daily and 10.2% were non-daily cigarette smokers. None of the students had ever tried smokeless tobacco.

Insert table 1 about here

3.4.2 Emergent themes

3.4.2.1 General practice of hookah use

The following narrative from a young male smoker summarizes the general perception of hookah use among college students:

- *My friends are very accepting of hookah smoking because they think it is a better alternative, those who don't smoke cigarettes will smoke hookah because it is more acceptable. I think you can't tell them that you are cigarette smoker. I feel better telling my parents that I am smoking hookah, it's just steam tobacco, and it is not bad, not addictive. It is easier for me; it makes me comfortable in front of others because a lot of people around me, both friends and family, are against cigarette smoking.*

Overall, hookah users could be classified into regular and occasional smokers.

Occasional users smoked once every few months while regular users smoked at least once a week, if not daily. Occasional smokers perceived waterpipe use as a social activity mostly occurring in hookah cafés. Such an event was more imperative for underage students who were restricted from going to bars to drink. Frequent users either owned a waterpipe (which they either bought online or received as a gift from a relative or friend) or had close friends who owned one. Regular users mostly lived in houses or apartments close to campus that

they shared with friends. Students who owned waterpipes were more knowledgeable about its morphology and ingredients, mostly because they assembled and disassembled the waterpipe to get it ready to smoke. In general, it was perceived that regular waterpipe smoking was more common among male students than female and was perceived as “cool” by many students.

- *It is not something that I would do on a regular basis. It is just for socializing, having fun, when you are bored. The hookah bars do an awesome job of making it exciting. There is music, cool couches, cool setting, and so many people. The setting draws me to the hookah bars (Occasional smoker).*
- *I have a hookah pipe at my place and we always sit around passing the pipe and its pretty popular. I've been smoking every single day 5 times a day for the past few months. We chain smoke for a very long time. The thing is, we are watching TV and playing videogames. ...you are smoking, smoking, smoking..... (Regular smoker).*
- *I spend a lot of time fixing bong and waterpipes for a lot of my friends. I own one myself. I know how to assemble it. The coal is at the top and then the foil and the tobacco and the bowl. I have seen a lot of designs with different heights, different attachments to the hose for different flavors. I know that the water is used as a filter, which bubbles and makes it less harsh and smoother (Waterpipe owner).*
- *I definitely think there is a gender effect. I think smoking in general isn't typically appealing to females and I know some guys don't find it attractive (Female smoker).*

3.4.2.2 Smoking initiation Experience

Students reported a variety of ways that facilitated initiation of waterpipe use. Some students were introduced to waterpipe after they visited hookah bars established in the campus vicinity. Many others tried it for the first time at their friends' houses where peer influence provided the impetus for trial. Some heard about it and experimented with it in high school. There were few students who were exposed to it through social networking sites such as "facebook." Students reported being fascinated by the exotic physical appearance of waterpipes that instigated their desire to try it.

Those who went to hookah cafés reported that it was their way of socializing since they were not of legal age to drink or go to bars. Few also reported seeing and trying a waterpipe for the first time at parties they attended. Overall, it was evident that initiation of waterpipe smoking was influenced by peers and social settings. A unique feature was that smokers of Asian (India, Pakistan) and Middle Eastern origin tried it for the first time with cousins or older siblings instead of friends. Some of them even received waterpipes as gifts from family members and relatives.

- *When I was in college I didn't have a fake ID so the only place I could go to was the hookah bar. The first time I tried it was when I was 16; I went to a local hookah bar with a friend of mine.*
- *A couple of my friends smoked a lot before me and one day I was just over and decided to try it. It was at my friend's house, he has one. I was probably 17.*
- *The first time I saw was on face book. I saw a lot of pictures of people smoking from this pretty looking pipe. It looked really cool. After that I was like, I want to try that.*

- *My first experience was with my older cousin. She is a lot like me amongst our family circle; she actually asked me if I wanted to do it. I had heard about it but I never did it. I said I didn't have a problem with it (Pakistani smoker).*

3.4.2.3 Perceived benefits of smoking waterpipe

College students listed several benefits associated with smoking waterpipe such as stress relief, relaxation, socializing, and bonding with friends. Almost all smokers stated that they would never smoke waterpipe by themselves and that it was a group activity they indulged in, with close friends. Those who owned a waterpipe associated smoking as a way of “hanging out” with friends at home. They reported they would often engage in other activities such as play video games, watch movies, and play cards while sharing the hose. Some smokers who usually went to cafés and bars to smoke waterpipe implied that it was “a fun thing to do” and the only way of “hanging out with friends.” This perception was common among students who were not of legal age to drink alcohol. Also, normally smokers shared one waterpipe and shared the expenses. The low cost made it more attractive.

Some compared the experience of smoking waterpipe with drinking alcohol and stated that unlike drinking alcohol, one did not lose inhibition and “got out of control.” Others who compared waterpipe with cigarettes believed that smoking waterpipe was safer and less addictive than smoking cigarettes. This perception was fairly common among all participants. The majority mistakenly believed that in a waterpipe most carcinogens and toxins were absorbed by water while the smoke passed through it, making it safer to smoke. Participants also implied that waterpipe smoking was socially acceptable and did not have

the social stigma attached to it compared to cigarette smoking. Another noted benefit was the legal aspect of waterpipe unlike marijuana.

- *It definitely helps you relax, helps to escape and be in another world. It is more relaxing than going to a bar to drink where you scream over the music. In a hookah bar you can sit and talk to people.*
- *The water is supposed to take out a lot of the impurities in the tobacco. You get less of the carcinogens in tobacco. It is definitely safer than cigarettes.*
- *Some students are not old enough to drink and with the whole legal issue you won't get into trouble when you smoke hookah.*
- *It is not that expensive. One hookah is like \$20 among few people.*
- *I like it because it is a behavior that you don't get addicted to.*
- *It is accepted more than smoking cigarettes, or pipes or cigars. Non-smokers do not look down upon hookah smokers.*

3.4.2.4 Perceived harm

Other than some short term negative health effects, the majority of smokers were unaware of the health consequences associated with smoking waterpipe. They reported feeling lightheaded and nauseous after smoking on few occasions. Most of them considered themselves invulnerable to the harmful health effects since they did not smoke waterpipe every day. Some who had tried researching the risks of smoking waterpipe on the internet were unable to find conclusive information, which bolstered their beliefs.

An inconvenience that waterpipe owners repeatedly noted was the risk associated with burning the carpet with lit charcoal while smoking waterpipe indoors. Others complained of the lack of portability, hassle associated with setting it up, cleaning up

afterwards, and the cost that accrued after purchasing waterpipe paraphernalia if smoked on a regular basis.

- *You have to get everything ready, set it up; it is not like cigarette where there is immediate gratification. You can't be at work and take a hookah break. It is not convenient because lots of them are really big. You won't be able to carry a hookah walking down the street.*
- *It is pretty expensive once you factor in all the supplies. Tobacco and coals are expensive. I mean it could be costly as a habit especially if you smoke hookah a lot spending a lot of your income on tobacco and coal.*
- *I am sure it has some negative health consequences. I am not sure what they are. I have heard of some people throwing up and getting dizzy after smoking waterpipe. I have heard people say it is unhealthy for you but I don't know the facts.*
- *One disadvantage I would say is burning of the carpet with the coal. If someone pulls the pipe too hard or trips on the pipe it falls over. Once the coal is on the ground it is too late, especially if it breaks into a million pieces.*

3.4.2.5 Reasons to smoke waterpipe

Social contexts emerged as one of the main motives behind smoking waterpipe. Described below are some themes associated with smoking waterpipe among college students that were captured through the interviews.

3.4.2.5.1 Peer influence

Peer influence played a significant role in influencing waterpipe smoking. Most smokers learned about it from friends in high school or in college. They either watched

their friends do it or their friends took them to hookah cafés to smoke. They formed cliques and started smoking waterpipe to conform to the group norms.

- *Almost none of my friends smoke cigarettes so I feel very little social pressure to smoke cigarettes. But a lot of them smoke hookah so there is a lot of social pressure to smoke hookah. If everybody is smoking hookah and socializing then I would do it too. I would not go to a hookah bar and smoke it all by myself.*
- *Students would smoke hookah just to fit in. There is that pressure in the dorms. When you are younger, it is important to be a part of a group.*

3.4.2.5.2 Socializing

Socialization was cited as the most common reason to smoke waterpipe. When asked if they would smoke alone, almost all of the said they would never do so. Those who owned a waterpipe enjoyed having friends at their place, watching movies, playing video games, and eating while smoking. Most of them agreed that it helped them bond with friends. Others enjoyed going to hookah cafés with friends. They believed that smoking waterpipe facilitated conversation and helped make new friends. Smokers of Asian and Middle Eastern origin also socialized with cousins and siblings in addition to their friends. For them, smoking waterpipe was more acceptable in the family and some of them even smoked at home. Respondents differentiated socializing while smoking waterpipe versus drinking alcohol with friends. Drinking was associated with playing games like “beer pong”, “losing inhibition” and “going wild.” Waterpipe smoking on the other hand, had the connotation of “being laid back”, “chilling with friends” and “conversing in a serene surrounding.” Socializing was important to college students because they did not want to be labeled as “anti social.”

- *I would never smoke alone. I have a hookah that I own. My friends come over and I like the social aspect of it. It is very much a bonding thing. We usually are playing a board game, or videogames, or watching a movie while we smoke.*
- *For me smoking hookah is 99.9% social. It is not something that I would necessarily ever do alone. It would just never occur to me. I enjoy it when everyone sits around even drinking tea or coffee but doing something while smoking hookah.*

3.4.2.5.3 Availability

Easy access to waterpipe was a primary motive to many students for initiation and continuation. Students often went to hookah bars in the campus vicinity. Others had easy availability because their close friends or roommates owned a waterpipe. Many of them said they “smoked it, because their friend/roommate had it.” They enjoyed being surrounded by friends at home and smoking.

- *I smoke because I like going to hookah bars with my friends. There are so many outside the campus, it's like right on your face. We don't have to go too far to hang out with friends.*
- *Most of my friends who live in the dorms have one and I smoke it because it is right there all the time and my friends are always smoking it. Either I go there or they bring theirs to my place.*

3.4.2.5.4 Flavored tobacco

One of the most common reasons to smoke waterpipe was the availability of multiple tobacco flavors. The flavorings attracted smokers and also enticed new smokers. Students were unlikely to smoke waterpipe if the tobacco was not flavored. Flavors that

appealed to smokers of some cultures were also available. For instance, “paan” (betel leaf), which is a popular flavor among South Asians was also available as a tobacco flavor.

- *It tastes good and there are so many different varieties. I don't know if I will smoke hookah if it was not flavored. I tried piped tobacco once, it was harsh.*
- *I love the flavors of hookah. I had “paan” flavor the other day it's like this Indian thing and it was the best flavor ever (Indian smoker).*

3.4.2.5.5 Novelty

The unique physical appeal and exoticism attracted many students to experiment with waterpipe. Innovative designs including diverse sizes, colors, and materials contributed to its novelty and popularity. The most common adjective used to describe the apparatus was “cool.” In addition, students were attracted to the ambience of hookah cafés. They enjoyed the lighting, food, music, and the unique décor of the cafés.

Some students who regarded themselves as sensation seekers associated waterpipe smoking as a symbol of Arabic culture and enjoyed the thrill of experiencing a different culture. It was also common to hear description of “playing tricks with O smoke rings”, which was new to most students. It was also noted that even though waterpipes were novelty products for most students, among students of Asian heritage, it was something they had been familiar with since early childhood.

- *One of my roommates in college had a hookah and I think the attraction to it was more because it was ethnic and different, as people don't see it as often.*
- *A lot of students think it is interesting; it is not a part of American culture. It is one of the reasons that got me into it but as I got older I began to appreciate the cultural nuances. I am someone who tries new things.*

- *I like the fact that I can blow O's and make tricks.*
- *For me because I am into Arabic music. I like sitting on the cushions on the floor. I think that is cool. The ambience is very and very different. It is very different from American bars.*

3.4.2.5.6 Physiological effects

Relaxation: One of the most common physiological reactions associated with waterpipe smoking that was reported was relaxation. Smokers associated smoking waterpipe with the feeling of relaxation that was derived from feeling lightheaded. Dual users found waterpipe smoking more relaxing than smoking cigarettes. Other smokers preferred the relaxing environment of hookah cafés compared to the clamor in bars. Smoking waterpipe was considered as a getaway from the stress of college life.

- *Very calming, very relaxing you get to go out with your friends doing something.*
- *I feel that hookah is a lot more relaxing than smoking cigarettes. I feel like my lungs feel less coarse when I smoke hookah than cigarettes (Dual user).*
- *The lightheadedness feeling is a relaxed feeling*
- *What I envision when I think of hookah are dim lights, music, people having fun, just chill atmosphere, nothing serious, just seems very relaxing. A bar doesn't feel relaxing. The atmosphere is different. The presence of alcohol makes it loud. Going to a hookah bar seems more relaxed.*

Buzz: The terminology most commonly used by smokers to describe the effects of smoking waterpipe was “buzz.” Smokers were asked to explain what “buzz” meant to them and were asked to compare “buzz” from drinking alcohol and smoking cigarettes (only for dual users) to the “buzz” from smoking waterpipe. Smokers used words such as “dizzy”,

“euphoric”, “relaxed”, “couch- locked”, “tingly”, “depressant than a stimulant”, “head rush” to describe the feeling of “buzz.” Some smokers asserted that they smoked waterpipe for the “buzz effect.” Some of them mixed drinking alcohol and smoking waterpipe to enhance the “buzz.” Most of them concurred that the buzz from alcohol was stronger and lasted longer compared to the buzz from waterpipe. Dual smokers of waterpipes and cigarettes had mixed opinions associated with sensory effects of smoking. Some believed buzz from waterpipe was stronger while some disagreed.

- *Buzz to me means feeling lightheaded.*
- *It is hard to interpret buzz. At one extreme, you feel like your head is spinning a little bit, little dizzy, loss of balance. And there is the other kind of buzz which is more low key, subtle you feel like purely relaxing. Subtle buzz is when you are little lightheaded and mostly relaxed and almost euphoric but not extremely physical.*
- *It is different from drinking alcohol because it does not impair your judgment like alcohol does and alcohol effects last for a while unlike hookah buzz. After you go home from a bar you still feel tipsy but after you go home from a hookah café you don't feel the buzz.*
- *I think the hookah gives a better buzz compared to cigarettes. It is more pleasant because of the flavor.*

3.4.2.6 Concomitant cannabis use

Mixing of marijuana with tobacco in a waterpipe was reported by several students. Although it was not very common, some students practiced it regularly while others had friends who used it on occasions. Those who mixed tobacco and marijuana reported experiencing “enhanced buzz.” Others who had tried it said it was a “waste of weed.” Some

students solely used waterpipe just to smoke marijuana out of it. It can be speculated that concomitant cannabis use is associated with the popularity of waterpipe use among young adults.

- *We do a lot of mixing with cannabis and tobacco; we call it the “special hookah.”*
- *It makes hookah a lot more fun when you mix it. In my experience different people use different proportions; I use 80% weed and 20% tobacco. But I wouldn't say a lot of people do that.*
- *It is relaxing and you feel good doing it. We smoke more of cannabis than tobacco from a hookah. The buzz from cannabis is a lot more than the one from tobacco.*

3.4.2.7 Health effects

Although almost all smokers believed waterpipe smoking was not beneficial to their health, they were ambiguous about the health hazards associated with it. Some were not cognizant of the fact that waterpipe was actually a tobacco product. Most participants concurred that they would either cut down or quit if they were aware of the harmful consequences of smoking waterpipe. Some students believed it was not harmful because it did not have the surgeon general labeling indicating its harmful and addictive properties like other tobacco products. Occasional smokers believed they were impregnable to the health risks associated with smoking because they were not heavy smokers. Sharing the hose while smoking in groups led them to believe that they were not exposed to the maximum harm. Some regular smokers considered smoking waterpipe as an activity associated with college life and were planning on discontinuing after college. The majority of students echoed similar sentiments.

- *I don't do it as often; I tend to think I won't develop a disease like lung cancer. I don't think about it while I am smoking hookah. I think other young people also think that they are young and they don't do it as often, so it is not going to affect them. I don't smoke it that often and I don't see it as being a concern to me (Occasional smoker).*
- *Whenever you are smoking hookah you are actually sharing it and so you are kind of splitting up the risk factors among yourselves. I feel like out of all the things you can smoke hookah is probably the safest. I am just a social smoker (Occasional smoker).*
- *It's funny.... when I first started smoking hookah I used to run track. I asked my friend because I was really concerned about my lungs. And he told me not to worry and that the water filters everything out. I am not concerned about health because I haven't been smoking for a very long time; this is just a phase and I will get over it eventually. I don't see myself smoking hookah for 5-10 years (Daily smoker).*

3.4.2.8 Comparison with cigarettes

Throughout the interviews, smokers made several comparisons between waterpipe and cigarettes. When students (who only smoked waterpipe) were asked “if you think smoking is bad for you, why do you smoke waterpipe but not cigarettes?” most smokers stressed social acceptance, reduced harm, and palatable properties associated with waterpipe.

- *The water going through the smoke would be an advantage as passing through water a lot of impurities will be left in the water as opposed to smoking a cigarette through a cotton filter. I think it is healthier compared to smoking cigarettes and*

cigars. You get less of the carcinogens in hookah tobacco. It is definitely safer than cigarettes (Hookah smoker).

- *This is something that I have heard that the a lot of the tobacco that is manufactured for hookah does not have the additives as cigarettes like the ones that make it easier for the body to absorb the nicotine. So you don't get addicted as quickly and therefore you smoke less (Waterpipe smoker).*
- *If you see someone smoking a cigarette you think oh ewww... that's gross... but if you see someone smoking hookah it looks more appealing (Waterpipe smoker).*

In contrast, when dual smokers were asked “do you prefer smoking waterpipe or cigarettes?” they emphasized on the feasibility, portability, and convenience of smoking cigarettes compared to smoking waterpipe. One dual smoker explained,

- *Cigarette is more accessible and you can do it on the go or whatever or in the car or something. Hookah you actually have to sit down and set it up and it's just a lot of work. You can step outside for five minutes and smoke cigarettes; you have to set everything up for a hookah and it takes a long time.*

Others chose to smoke cigarettes to get “nicotine high” and smoked waterpipe socially.

- *When I have a craving for nicotine I would smoke a cigarette. I think cigarette gives more intense of a buzz. Cigarette buzz is higher and more intense. Hookah is more relaxing as it lasts for a longer period of time. I think it is relaxing and it is good for a conversation. I don't really do it alone but I do it with my friends.*

Non daily cigarette smokers preferred smoking waterpipe to cigarettes mostly because of the masking of the harshness of smoke by the fruity flavors. Some asserted that they would smoke cigarettes if they were flavored.

- *I don't like the smell of cigarettes and if that's what hookah smelled or tasted like, I wouldn't have liked it. I feel like shisha doesn't leave a smell on you it doesn't go into your clothes the way a cigarette does.*
- *I think if cigarettes were flavored a lot more people would smoke it but they just banned it because it's so appealing. If I could smoke a strawberry margarita cigarette I would be like, yea sure.....*

3.5 Discussion

Our findings suggested that waterpipe smoking is a typical way of socializing and solidifying camaraderie among college students. However, the results indicated several misconceptions and naiveté related to waterpipe smoking. Some common fallacies that emerged throughout the interviews were (a) smoking waterpipe is safer than smoking cigarettes, (b) waterpipe is less addictive than cigarettes, (c) water in the waterpipe bowl filters impurities; it is more effective than cotton filter in cigarettes.

Perception that waterpipe smoking is safer and less addictive than cigarette smoking is fairly common and has been consistently documented (Primack et al., 2008; Smith et al., 2007; Varsano et al., 2003). Contrary to these unsubstantiated popular beliefs, studies show that waterpipe smoking may be equally if not more harmful than smoking cigarettes (Eissenberg et al., 2008; Shafagoj et al., 2002; Shihadeh, 2003). Shihadeh (2003) analyzed mainstream smoke and found as much tar as 20 low-tar cigarettes from a single waterpipe smoking session, and high levels of heavy metals such as arsenic, chromium, and lead.

Waterpipe smoking produces larger puff volumes and longer duration of exposure (Djordjevic et al., 2000). Inhalation of large puffs and long duration of smoking sessions could expose smokers to more carcinogens compared to smoking cigarettes (Fromme et al., 2009). A waterpipe smoker may inhale as much smoke as a cigarette smoker may inhale from 100 or more cigarettes (WHO, 2005). Moreover, compared to smoking cigarettes, which involves combustion of approximately 1 gm of tobacco, smoking waterpipe consists of heating 10-20 gm of tobacco, delivering higher nicotine levels (Shihadeh & Saleh, 2005). Such a dosage of nicotine can arguably cause chemical addiction among waterpipe users, transforming social smokers into regular users (Maziak, 2008). In addition to long term health consequences, short term effects such as changes in central nervous system symptoms related to high levels of CO after waterpipe smoking have also been documented (Clark, Sharma, Hyoshin, Brinkman, & Gordon, 2012). Smokers reported increase in lightheadedness, headache, heart pounding, confusion, and weakness after smoking waterpipe. These symptoms were positively correlated with levels of exhaled CO. It is possible that waterpipe smokers describe these symptoms as the “buzz” effect commonly reported after smoking (Clark, et al., 2012); however this needs to be further examined by future studies.

Despite these health risks, lack of awareness among students demonstrated the need for interventions that would debunk these myths. Information about potential short term hazards, chronic health risks, and addictive properties of waterpipe need to be disseminated among young adults. Colleges and universities, in the US, enroll more than 12 million students (National Center for Education Statistics, 2011). They provide a unique platform for researchers and policy makers to reach out to this vulnerable population that has legal

access to tobacco products such as waterpipes. Novel approaches that include behavioral change strategies, along with policy changes that discourage waterpipe use and reinforce educational messages to young adults need to be developed.

While most studies on waterpipe indicate escalating numbers of hookah establishments around college campuses, other mechanisms of acquiring waterpipes have not been adequately explored. In our study, 44% of the students owned a waterpipe. A growing number of students have unlimited access to waterpipe paraphernalia that they purchase from the internet, local ethnic stores (that sell *maassel*, quick light charcoal), and tobacco shops. The method of acquiring waterpipes is important because it was found that college students who smoked regularly, almost on a daily basis, owned waterpipe paraphernalia. Some also smoked it more than once a day; “I smoke it because I have it” was a common response. This phenomenon is of concern because if immediate action is not taken, consequences similar to cigarette smoking among young adults are likely to occur. Like cigarette smoking, students who experiment with waterpipe in college will likely transition into dependent users as adults and the prolonged use could result in addiction in adulthood increasing the burden of morbidity related to tobacco use (Escobedo et al., 1993; Taioli & Wynder, 1991). This is one of the first attempts in exploring the consequences of owning a waterpipe as opposed to only going to hookah cafés to smoke. Future studies on waterpipe use should start asking questions related to waterpipe acquisition and researchers should not be limited to the assumption that the only access students have, is going to hookah cafés.

One of the interesting findings of this study was the concomitant use of cannabis while smoking waterpipe. To our knowledge, this is one of the few studies to confirm the

practice among college students. High prevalence of cannabis use among college students has been documented by many studies but the association between using waterpipe as a “bong” to smoke cannabis has not been established (Caldeira et al., 2008; Compton et al., 2004; Hammersley & Leon, 2006; White et al., 2005). Because cannabis is an illicit drug, students might be mixing cannabis and tobacco in a waterpipe in an attempt to circumvent the regulations. The ability to smoke cannabis out of a waterpipe might be one of the main reasons why waterpipe smoking is rapidly gaining popularity among college students. It was noteworthy that this practice was more common among students who owned waterpipes and smoked at home. The social contexts in which college students use cannabis such as social facilitation, conviviality, and social interaction are comparable to the motivational factors that influence waterpipe use (Beck et al., 2009). In the presence of similar social contexts, it is possible that students are more likely to experiment with cannabis in addition to waterpipe, which could have serious repercussions. Waterpipe could be a gateway drug to cannabis use. These findings draw attention to the need for better understanding of the risks of mixing cannabis and tobacco.

There were limitations to this study. The sample was convenient rather than representative. Since college students mostly smoke in groups, attempts were made to recruit waterpipe smokers through snowball sampling. This method could have led to sampling bias in that smokers of a particular subculture were included more than others. For instance, our sample consisted more of Indian and Pakistani smokers than the Middle Eastern students. Even though waterpipe smoking is a tradition in many of these regions, the nuances between South Asian and the Middle Eastern cultures could not be captured. In addition, the study did not sample sufficient tobacco users that used other forms of tobacco

such as cigars and smokeless tobacco. Therefore, the association between waterpipe and other forms of tobacco could not be fully understood. Since the study was qualitative with a relatively small sample size, no definitive conclusion could be reached in determining factors that influenced waterpipe smoking among college students.

These results have significant public health implications. Even though universities have regulations against indoor smoking (Wechsler et al., 2001), these rules are not applied to waterpipe smoking. Most students in the current study reported smoking in dormitories despite smoke-free rules. Universities need to have strict policies against smoking waterpipe in residence halls. In addition, residence advisors need to be more vigilant about the practice of smoking waterpipe in residence halls and should discourage the behavior. Development of effective interventions for students as well as university administrators is likely to help reduce the current practice of smoking waterpipes in college premises.

Furthermore, the number of waterpipe establishments around college campuses as reported by several anecdotal reports have been on the rise (Smith-Simone et al., 2008). They are exempt from clean indoor air ordinances, which make them a suitable place for smoking and socializing. These establishments operate as tobacco retail shops that derive most of their income from the sale of tobacco products, all other sales being “incidental” (Noonan, 2010). However, in some states the directive regarding the proportion of income from tobacco sales is very vague. In the absence of substantial legislation, hookah bars may continue to grow around college campuses targeting more and more students.

Currently, increasing numbers of waterpipe smokers use flavored tobacco rather than traditional tobacco (Aljarrah et al., 2009; Smith-Simone, Maziak, Ward, & Eissenberg, 2008). Studies support the notion of strong preference of flavored tobacco and the belief

that waterpipe is safer due to fruity flavors (Aljarrah et al., 2009; Roskin & Aveyard, 2009). The trend of using flavors to attract smokers seems to be similar to the trend of adding flavored additives to cigarettes. Even though flavors in cigarettes (except menthol) have been banned under the Family Smoking Prevention and Tobacco Control Act, the same does not apply to other tobacco products like waterpipe (111th Congress, 2009). Such a loophole in the legislation might encourage tobacco companies to market flavored alternative products to young adults. Future policies should consider these possibilities and modify current regulations. Thus, using the combination of education, policies, and enforcement, the threat of the hookah epidemic can be prevented.

Table 1: Characteristics of study participants (n=59)

Gender (male)	78%
Race	
Asian	47.4%
White	35.6%
Black	13.6%
Biracial	3.4%
Education level	
Freshmen	18.6%
Sophomores	16.9%
Juniors	33.9%
Seniors	30.5%
Frequency of hookah use	
Once a year but not monthly	5.1%
Once a month but not weekly	32.2%
Once a week but not daily	35.6%
Daily	27.1%
People smoked hookah with, in the past 30 days	
Alone	1.7%
With a friend	5.1%
With friends	93.2%
Place smoked hookah in the past 30 days	
In a café	18.6%

At home	27.1%
At relative's house	3.4%
At a fraternity house	5.1%
At friends' house	23.7%
In dorm room	18.6%
Outdoor	3.4%
Own a hookah (yes)	44.1%
Current use of cigarettes	
Daily	15.3%
Some days	10.2%
Not at all	74.6%
Mean age (SD)	21.68 (3.04)
Mean age of initiation of hookah smoking (SD)	17.58 (2.20)

**Chapter 4: Study 2: Social Context of Smoking Hookah: Scale Development and
Validation**

Abstract

Social context is defined as the immediate situational, temporal, and motivational factors that influence the behavior. The aim of this study was to develop an instrument that measured social context of waterpipe use among college students. A pool of 50 items was developed based on 44 in-depth interviews with regular college waterpipe smokers. These were administered to a purposive sample of college students (n=274), who were regular or occasional waterpipe users. Principle components analysis (with varimax rotation) was used to determine the factor structure of these items.

Four factors emerged with eigenvalues greater than 1 and accounted for a cumulative variance of 48%. One factor did not meet the minimum internal consistency criterion of .70, and therefore was not retained. The final 3 factors explained 47% of the variance and possessed adequate reliability. These factors were labeled “social facilitation” ($\alpha = .86$), “family/cultural influence” ($\alpha = .80$), and “alternatives to cigarettes” ($\alpha = .85$). The summed scores for the three social context subscales were examined across 3 frequency categories of waterpipe use: “at least once a year but not monthly” (occasional), “at least once a month but not weekly” (monthly) and “at least once a week or daily” (weekly). Those who reported smoking waterpipe on at least weekly basis reported significantly higher scores on social facilitation than the other two groups. Similar effects were observed for family/cultural influence; weekly smokers used waterpipe more frequently in a context of family/cultural influence than occasional smokers. Findings of this study confirm the multidimensionality of the social context of waterpipe use among college students. An identification of situation-specific contexts among college students

could facilitate designing interventions targeted towards preventing waterpipe use in this population.

4.1 Introduction

Young adults aged 18-25 years have the highest rate of tobacco use (41.6%) compared to adolescents (11.6%) and adults (27.3%) (SAMHSA, 2010). College students are known to experiment with a broad spectrum of tobacco products including cigarettes, cigars, and smokeless tobacco (Rigotti et al., 2000). One tobacco product that is rapidly gaining popularity among college students is waterpipe, also known as hookah, narghile, arghile, goza, and shisha (Maziak, Ward, Afifi Soweid et al., 2004).

Waterpipe smoking is popular among college students. In the Middle Eastern countries where it is very popular, the prevalence of ever use ranges from 19% to 62.6% (Gadalla et al., 2003; Maziak, Fouad et al., 2004; Tamim et al., 2003). In the US, even though there are not yet national data on prevalence rates, recent university-based studies support the notion of increasing waterpipe popularity (Eissenberg et al., 2008; Grekin & Ayna, 2008; Primack et al., 2008; Smith et al., 2007). In a survey of freshmen students (n=411), current waterpipe use was reported by 15.3% of the students (Smith et al., 2007). Another study among 647 college students showed that 41% reported ever smoking waterpipe, 30.6% smoked in the past year while 9.5% reported smoking in the previous month (Primack et al., 2008). In another college student survey, it was found that 48% had ever smoked a waterpipe, 43% had used it in the past year, and 20% had smoked it in the past month (Eissenberg et al., 2008). Primack and colleagues analyzed data from 8,745 college students at eight institutions as part of the National College Health Assessment

(Primack et al., 2010) and found that 29.5% reported ever smoking waterpipe and 7.2% reported smoking at least once in the past 30 days.

Waterpipe smoking is different from using traditional tobacco products such as cigarettes, cigars, pipes, and smokeless tobacco. Because of the historic and popular trend of smoking in groups, smoking waterpipe is a communal experience, especially among college students (Asfar et al., 2005; Martinasek et al., 2011). Therefore, the unique social contexts that are associated with waterpipe use need to be examined. Social context is defined as the immediate situational, temporal, and motivational factors that influence the behavior (Beck et al., 1995; Thombs et al., 1993). Among college students, the social context of smoking waterpipe encompasses interpersonal factors such as peer influence (e.g., having networks of friends who smoke and/or own waterpipes) and environmental correlates like college settings (e.g., establishments such as hookah cafés in campus vicinity, or “hookah rooms” in fraternity houses, that make waterpipes more accessible and attractive to students). Situational factors such as socialization with friends and intimacy associated with smoking in a group have been shown to reinforce waterpipe use (Maziak, Fouad et al., 2004; Varsano et al., 2003). In addition, elaborate rituals associated with preparing waterpipe to get it ready to smoke, social ambience, eating and having a conversation while smoking have been documented as motivators of smoking waterpipe (Maziak, Ward, Afifi Soweid et al., 2004). Moreover, among college students, these motivators depend on the circumstances. For instance, smoking waterpipe in a café might have different motivators such as the ambience, music, and food, which may be different from those that prompt students to smoke in the dorms, such as socializing with friends, playing video games, and watching movies while smoking.

Very little is known about these social contexts that influence waterpipe use among college students. An understanding of the social context could help explain why, where, when, and with whom students smoke waterpipe. Research in the field has been hindered in part due to a lack of reliable and validated instruments that measure these factors. Additional knowledge regarding social/environmental contexts that reinforce the behavior may help explain and predict waterpipe use and ultimately inform successful interventions. The primary aim of this study was to develop and validate an instrument that measures the social context of waterpipe smoking among college students. Items for the questionnaire were generated to include the social context concepts of situational, motivational, temporal, and environmental factors associated with waterpipe use.

4.2 Methods

4.2.1 Questionnaire development

To generate an initial item pool, a series of 44 in-depth, semi-structured interviews were conducted among college students who were regular waterpipe smokers. Smokers were interviewed if they were at least 18 years of age, had smoked waterpipe three times in the past six months and once in the past 30 days. Interview participants were recruited from a variety of sources. A convenience sample of 36 waterpipe smokers who participated in a study, “standardization of waterpipe smoking methods” (NIH, NCI, RO108-0430 PI: Clark) was included in the interview. Others were recruited through snowball sampling. To understand the factors that influence waterpipe smoking among young adults, a range of smokers that consisted of social smokers, waterpipe owners, non-daily smokers, and smokers belonging to different ethnicities were included.

Qualitative data from the interviews were reviewed to gain fundamental understanding of the circumstances surrounding waterpipe use and engender as many items as possible to capture the construct of social context. Social context scales such as those previously developed for alcohol and cannabis use among college students were used as guiding frameworks (Beck et al., 2009; Beck et al., 1993). Based on the interviews, items that represented why, where, when, and with whom students smoked waterpipe during school attendance were developed. It was ensured that the most pertinent and appropriate items were addressed in the instrument. An initial pool of 49 items was generated. The items were reviewed by two experts, one of whom was a content expert (tobacco control) and the other was an expert on instrument development. They provided feedback on the content validity, clarity, conciseness, and face validity of individual items and assisted in identifying items which were redundant or needed to be reworded. One of the experts suggested adding one more item. A final pool of 50 items preceded by the question, “how often do you smoke hookah?” was used. Each item had response options “never”, “seldom”, “occasionally”, and “frequently” scored as 1, 2, 3, and 4 respectively. Once the preliminary pool was generated, all items were tested for appropriateness by pilot testing the instrument with eight waterpipe smokers using “think aloud” cognitive interviews. An interviewer followed the items one-by-one using probes, when needed, to elicit further information. This helped in refining ideas and finding out how the target population talked and/or thought about the content domain. Poorly worded or misleading items were rewritten and corrected. The final 50 items were retained.

4.2.2 Subjects

A purposive sample of 274 waterpipe smokers was recruited through word of mouth and direct recruitment in local hookah cafés around college campuses. Once regular waterpipe smokers were identified, snowball sampling was used to recruit other users. College students, 18 years or older, who smoked at least once in the past year were included. Users of other forms of tobacco were not excluded.

Hookah cafés in the vicinity of the campus were identified. The majority of the data were collected from waterpipe users who were present in these venues. While recruiting, users, who were usually smoking waterpipe in groups, were approached and were verbally informed about the purpose, procedures, benefits, and confidentiality issues of the study. Once students agreed to participate in the study, they were asked to sign the informed consent form (Appendix IV) and to complete the confidential survey using a paper-and-pencil method. In addition, participants were provided with a list of smoking cessation resources if they are interested in quitting (Appendix V). Among those who were approached, the response rate was approximately 90%. In addition, in-person surveys were also conducted in the dormitories from students who identified themselves as regular waterpipe users. Students were reimbursed with a \$10 gift certificate for participation. The study was approved by the University of Maryland College Park Institutional Review Board.

The sample consisted of 64.2% males, 19% freshmen, 27% sophomores, 28.5% juniors, and 25.5% seniors. More than a third of the smokers (43.4%) were white, almost 40% were Asians, 13% were black, 2.6% were biracial and the rest identified themselves as “other” race. For the purpose of analysis, those who identified themselves racially as white, black, biracial and “other” were combined (60.2%) and compared with self identified

Asians (39.8%). There were 100 students (36.5%) who had ever smoked cigarettes and 171 (62.4%) who had ever tried cigars. Only 12.8% of waterpipe smokers were daily cigarette smokers and 15% were non-daily cigarette smokers. None of the students reported ever using smokeless tobacco.

4.2.3 Materials

The questionnaire consisted of four parts (Appendix VI). The first part asked for demographic variables (age, gender, race, ethnicity, and education level) and was used to characterize the sample. Those who identified themselves as Asians were asked to specify their country of origin. The second part inquired about waterpipe use. Questions regarding frequency of use, age of initiation, ownership of waterpipes, place where they usually smoked, and people with whom they smoked were also collected. Frequency of use had response options such as "used, but not in the past 12 months", "used, but not in the past 30 days", or "used in the past 30 days." These measures were consistent with the ones used to capture tobacco history in the College Alcohol Study (Rigotti et al., 2000). Among students who smoked waterpipe in the past month, number of days smoked in the past 30 days was also collected. Smokers were asked about their concomitant use of cigarettes, cigars and, smokeless tobacco. If participants responded positively to past or current use of other products, age of initiation of use and frequency of use were collected. The third part of the survey consisted of the pool of 50 items intended to measure the social context of waterpipe smoking. Participants were given a choice of variety of situations, that is why, when, where, and with whom they would smoke waterpipe.

The fourth section of the survey included the Marlowe-Crowne Social Desirability scale (Crowne & Marlowe, 1960), measuring smokers' tendency to respond in a socially desirable way. The 33-item true-false scale has been widely used to assess response bias in self-report research. For 18 of the 33 items, selection of "true" response indicated stronger tendency to respond in a socially desirable way than someone with "false" response. The remaining 15 items were considered denial items, which were reverse coded (Beretvas, Meyers, & Leite, 2002). This scale possessed adequate reliability (Cronbach's $\alpha = .88$; test-retest $r = .89$; Crowne & Marlowe, 1960).

4.3 Results

Data were analyzed using Statistical Package for the Social Sciences 18.0 for Windows. The level of significance was fixed at 5%. Sample characteristics were compared across three levels of frequency of waterpipe use "at least once a year but not monthly," "at least once a month but not weekly," and "at least once a week or daily." Table 1 summarizes the demographic characteristics and smoking behaviors of the study sample.

Insert Table 1 about here

Male smokers were more likely to be monthly or weekly smokers compared to female smokers, who were more likely to be occasional smokers. Of those who smoked at least once a week or daily, 46.3% were Asians from countries such as India, Pakistan, Iran, Lebanon, Syria, Saudi Arabia, and Nepal and 53.7% were of Non-Asian descent that included groups such as white, black, and biracial smokers. Occasional waterpipe smokers (annual and monthly) were less likely to also be cigarette smokers. Life time use of cigars was more common among monthly and weekly smokers compared to occasional waterpipe

smokers. Those who smoked waterpipe at least once a month or once a week were significantly more likely to be younger and had an earlier age of initiation of waterpipe smoking (see table 1).

4.3.1 Exploratory data analysis

The minimum amount of data for factor analysis was satisfied, with a final sample size of 268 waterpipe smokers, using listwise deletion. First, the factorability of the items was examined. The Kaiser-Meyer-Olkin measure of sampling adequacy was .91, above the recommended value of .6 (Kaiser, 1970). The communalities were all above .3 confirming that each item shared some common variance with other items. Given these indicators, exploratory factor analysis was conducted with all 50 items.

Analyses were completed in three steps. First, the social context items were subjected to a principle components analysis for extraction, using a varimax rotation (Kachigan, 1991). An eigenvalue of 1 was set as the cut-off value for inclusion of unique factors (Nunnally & Bernstein, 1994; Hair, Anderson, Tatham, & Black, 1998). Because this was an exploratory analysis, based on the recommendation of Stevens (1992), only factor loadings with an absolute value greater than 0.4 were used as criteria for item retention.

Initially, eleven factors emerged with eigenvalues greater than 1 accounting for 65.78% variance. Initial eigen values indicated that the first four factors explained 30.8%, 7.63%, 5.86%, and 3.76% of the variance respectively. The rest of the factors had eigen values of just over one, and each explained only 2% of the variance. A final solution that retained 4 factors explaining 48% of the variance was preferred because of ‘leveling off’ of eigen values on the scree plot. Items that loaded on more than one factor were eliminated.

In the final stage, a principal components factor analysis of the remaining items, using varimax rotation was conducted with four factors that explained 50.8% of the variance. All items in this analysis had primary loadings over .4. The fourth factor, consisting of 5 items, did not meet the minimum internal consistency criterion of .70, and therefore was not retained. The final solution retained 3 factors explaining 47% of the variance. The factor loading matrix for this final solution is presented in Table 2.

Insert Table 2 about here

Eight items loaded on the first factor and was labeled “social facilitation.” Socializing with friends, smoking with friends who owned a waterpipe, ability to smoke waterpipe indoors while engaging in other activities were some items that loaded on this factor. The second factor labeled as “family/cultural influence”, that comprised of five items indicated that smoking in this context, was mostly influenced by culture and smoking at home with family members and relatives. The third factor was labeled “alternative to smoking cigarettes and drinking” and consisted of six items. Items that comprised this factor included smoking waterpipe as an alternative to smoking cigarettes and drinking with friends. The subscales had low correlations with each other suggesting that these scales were tapping distinct dimensions.

4.3.2 Reliability Analysis

Internal consistency for each subscale was examined using Cronbach’s alpha (Cronbach, 1951). An alpha level of at least .70 was deemed acceptable for exploratory research. The alphas of the subscales were excellent: .86 for “social facilitation” (8 items), .80 for “family/cultural influence” (5 items), and .85 for “alternative to smoking cigarettes

and drinking” (6 items). The internal consistency did not vary as a function of gender or race across all social context subscales.

4.3.3. Social desirability bias

Correlation analyses were conducted between each of the three social context subscale scores and the measure of social desirability (Crowne & Marlowe, 1960). The results indicated that “social facilitation” ($r=.19$, $p<.01$), “family/cultural influence” ($r=.05$, $p>.05$) and “alternative to smoking cigarettes and drinking” ($r=.12$, $p<.05$) had small (albeit significant) correlations with social desirability. The low order of correlation coefficients indicated that the self-reported responses were free of social desirability bias.

4.3.4. Group differentiation – Social context scale differences across demographic category

The summed scores for each social context subscale were examined across frequency of waterpipe use categorized as “at least once a year but not monthly” ($n=51$), “at least once a month but not weekly” ($n=126$), and “at least once a week or daily” ($n=94$). The summed scores were examined across demographic groups, frequency of waterpipe use, and life time use of cigarettes using analysis of variance.

Insert Table 3 about here

The results showed that social facilitation was significantly higher among weekly smokers ($M = 24.24$, $SD = 5.49$) compared to monthly ($M=20.34$, $SD=4.87$) and occasional smokers ($M=17.29$, $SD= 5.23$), $F(2,268) = 32.60$, $p<.001$. Similarly, weekly smokers were more likely to smoke in a context of cultural influence ($M=9.53$, $SD= 3.42$) compared to the other two groups (means = 6.58, 6.96), $F(2,268) = 21.82$, $p<.001$.

Female smokers were more likely to smoke waterpipe ($M=12.28$, $SD= 4.74$) as an alternative to smoking cigarettes and drinking compared to male smokers ($M=11.05$, $SD= 5.70$), $t(271) = 2.06$, $p < .05$ and smokers of Asian origin were significantly more likely to smoke in a context of family/cultural influence ($M = 8.43$, $SD =3.76$) compared to Non-Asians ($M = 7.35$, $SD = 3.12$), $t(269) = 2.56$, $p<.05$). Those who ever smoked cigarettes were more likely to smoke waterpipe in a context of social facilitation ($M=22.24$, $SD= 5.64$) than those who never smoked cigarettes ($M=20.48$, $SD= 5.70$), $t(269) = 2.45$, $p < .05$.

4.4 Discussion

The situational contexts of alcohol consumption and drug use among adolescents have been explained by a substantial body of empirical research (Kidorf et al., 1995; Lewis & O'Neill, 2000; Presley et al., 2002). However, despite the relatively high prevalence and identification of multiple social contexts in separate studies, a clear portrayal of correlates that influence waterpipe use among college students is limited. The aims of this study were to develop a scale that measured the social contexts of smoking waterpipe among college students and to examine the dimensionality, reliability, and validity of the scale in a sample of regular waterpipe smokers. An exploratory factor analysis showed that there were at least three dimensions to the social context of waterpipe use. Construct validity of the scale was established by differentiating between groups, where scores of social context subscales were compared as a function of frequency of waterpipe smoking, demographic variables, and lifetime use of cigarettes.

The first factor that emerged was smoking waterpipe for social facilitation. Similar to previous findings for alcohol and cannabis use among college students (Beck et al., 2009; Beck et al., 1993), social facilitation was consistent with waterpipe smoking. Social

facilitation was associated with enhancing conviviality with friends, smoking waterpipe indoors while engaging in other activities and having easy access to waterpipe paraphernalia through friends who owned them. Compared to established waterpipe smokers who smoke on their own, the social facilitation is more pronounced among college students who are intermittent users and mostly smoke in groups (Asfar et al., 2005). For instance, during the in-depth interviews students commented “it is not something that I would ever do alone. It would just never occur to me. I enjoy it when everyone sits around doing something while smoking hookah”, “it is a social activity; I would never do it alone.” It appeared that situational factors such as socialization with friends and intimacy associated with smoking in a group are important factors associated with waterpipe use (Maziak, Fouad et al., 2004; Varsano et al., 2003). Peer influence has long been a consistent predictor of smoking among adolescents (Aloise-Young et al., 1994; Flay et al., 1998; Urberg et al., 1997). Studies among college students have similarly indicated peer use as a significant predictor of smoking (Morrell et al., 2005; Rigotti et al., 2000). It is conceivable that because waterpipe use is considered a social activity, peer influence is likely to encourage waterpipe use.

One unique factor that emerged as a social context subscale was family/cultural influence. Waterpipe smoking has been a part of traditional culture in many Middle Eastern and some Asian countries for centuries. In some cultures, it is common to share waterpipe with family members, so that it is socially acceptable for a father to offer his teenage children a puff of waterpipe (El-Roueiheb et al., 2008). For some, initiation of waterpipe smoking takes place at home with an immediate family member, signifying the role of cultural influence (Zoughaib et al., 2004). Also, religion plays an important role in

determining smoking behavior (Islam & Johnson, 2003). Historically, in Islam, smoking tobacco is regarded as an acceptable social activity that is discouraged (mukrooh) but not prohibited (haram) (Ghouri et al., 2006). It may be one of the reasons why waterpipe smoking is so popular in the Middle Eastern countries (Ghouri et al., 2006). Our study sample comprised students representing multiple ethnic backgrounds including significant proportions of Asian students originally from countries such as India, Pakistan, Syria, Lebanon, and Iran, where waterpipe smoking is fairly common. As expected, smoking in a cultural context was found to be greater among Asian participants. While the role of race/ethnicity in smoking waterpipe is yet to be examined in the US, it can be speculated that when families emigrate from the Middle Eastern and Asian countries to the US, they still practice smoking waterpipe with family members, which is an inherent part of their culture. A study among Arab-Americans showed that 52% of the youth had family members who smoked waterpipe at home compared to 14% among non-Arab-Americans (Weglicki, Templin, Rice, Jamil, & Hammad, 2008). Considering the changing demographics of the United States, it is important to understand the predictors of waterpipe use among ethnic groups.

The third factor involved smoking waterpipe as an alternative to smoking cigarettes and drinking. Waterpipe smokers hold an unsubstantiated presumption that waterpipe smoking is safer and less addictive than cigarette smoking (Eissenberg et al., 2008; Shafagoj et al., 2002; Shihadeh, 2003). A widespread belief among smokers is that since the smoke in a waterpipe passes through water, toxins in the smoke are filtered by water before inhalation, rendering it less harmful than cigarette smoke (Griffiths, Harmon, & Gilly, 2011). It is likely that the cooling of the smoke as it passes through the water and the

hose reinforces the belief of reduced harm. Anti-waterpipe smoking messages directed at young adults such as college students are likely to be more successful if researchers had a better understanding of how this age group perceived the risks of smoking waterpipe.

During the in-depth interviews conducted in the initial phases of this developmental process, students often compared the outcome expectations of drinking and smoking waterpipe. While college students drink in a social context to get drunk (Beck et al., 1993), they experience “head rush” or “high” commonly referred to as “buzz” with waterpipe smoking (Griffiths et al., 2011). Students tended to smoke waterpipe because unlike drinking, smoking waterpipe did not affect their sobriety, allowed them to relax, and be in control of their senses (Primack et al., 2012). As indicated, students tended to substitute drinking with smoking waterpipe to enhance social interaction. The social components of waterpipe smoking that included conviviality and peer interaction coupled with the unsubstantiated belief that waterpipe smoking is healthier than other substance use, might be associated with the increasing prevalence of waterpipe use among young adults.

These findings have several public health implications. Despite the potential health risks and the recent upsurge in popularity, currently, there are no prevention or cessation strategies in place for waterpipe smoking. Lack of interventions to assist with cessation of waterpipe smoking based on the Cochrane review reveals the gravity of the problem (Maziak, Ward, & Eissenberg, 2007). Any intervention effort with this population must provide a non-traditional approach to address the unique needs of college smokers (Escoffery, McCormick, & Bateman, 2004). Smoking cessation studies have found that college students may not engage in formal programs or interventions provided by professionals (Obermayer, Riley, Asif, & Jean-Mary, 2004). Innovative delivery tools such

as computer based resources (Escoffery et al., 2004) and cell phone technologies (Obermayer et al., 2004) may be more effective in this population. In addition, based on the social context factors, a multidimensional approach may be more useful for developing prevention programs than those that consider cognitive factors alone. Interventions may be more effective if the programs are culturally appropriate and involve family members.

There were a number of limitations associated with this study. First, the sample was not randomly selected suggesting that there may be a generalizability bias. The results of this study may not be generalized to other college student populations, high school students, non-college attending young adults and older adults. Second, since the data was self-reported and biochemical verification was not performed to ensure smoking status, reliability of the information depended on the students' honesty of their responses. To minimize this self-report bias, all data were checked for social desirability bias. Also, the cross-sectional study design hindered determination of any causal effects. Additionally, combining all races (white, black, biracial and others) into non-Asian may have posed some biases. Therefore, caution should be taken while interpreting the ethnic/racial differences between Asians and non-Asian before reaching conclusive decisions.

Although, there is no nationally representative data that depict prevalence of waterpipe use among young adults, rapid proliferation of hookah bars around campuses shows that in recent years, waterpipe use has entered the realm of experimentation among college students. It is evident that waterpipe use is a problem among college students. An understanding of factors that motivate initiation and continuation of waterpipe use is pertinent for designing effective interventions.

Table 1: Sample characteristics (n=274)

	Frequency of waterpipe smoking		
	At least once a year but not monthly n=51	At least once a month but not weekly n=128	At least once a week or daily n=95
Gender (%)			
Male	49 ^a	63.3 ^a	73.7 ^a
Female	51 ^a	36.7 ^b	26.3 ^b
Race (%)			
Asian	39.2 ^a	35.2 ^a	46.3 ^a
Non-Asian	60.8 ^a	64.8 ^b	53.7 ^a
Education level (%)			
Freshmen	9.8 ^a	24.2 ^a	16.8 ^a
Sophomore	19.6 ^{a,c}	28.1 ^a	29.5 ^a
Junior	37.3 ^{b,c}	25.0 ^a	28.4 ^a
Senior	33.3 ^{b,c}	22.7 ^a	25.3 ^a
Ever smoked cigarettes (%)			
Yes	23.5 ^a	35.2 ^a	45.3 ^a
No	76.5 ^b	64.8 ^b	54.7 ^a
Ever smoked cigars (%)			
Yes	47.1 ^a	67.2 ^a	64.2 ^a
No	52.9 ^a	32.8 ^b	34.7 ^b
Mean Age (SD)	21.5(3.38) ^a	20.3(1.88) ^b	20.8(1.69) ^b
Mean age of initiation of waterpipe smoking (SD)	18.1(4.06) ^a	16.7(1.88) ^b	16.4(2.06) ^b

Note: Across any column, frequencies in each group and means with different superscripts differ significantly ($p < .05$).

Table 2: Rotated factor loadings for the principal components analysis of the Social Context Scale

Items	Factor Loadings		
	Factor1	Factor 2	Factor 3
<i>Social facilitation</i>			
Because my friends smoke hookah	.611		
To socialize with friends	.753		
Because it is easily accessible	.691		
Because my friend owns a hookah	.691		
For bonding with friends	.732		
With more than one friend	.701		
Because I can smoke it indoors	.675		
Because I can do other activities while smoking	.639		
<i>(Cronbach's alpha=.86; males=.85, females=.86)</i>			
<i>Family/cultural influence</i>			
At home		.663	
At relative's house		.792	
Because it is part of my culture/tradition		.705	
Smoke alone		.688	
Smoke with a relative		.807	
<i>(Cronbach's alpha=.80; males=.81, females=.78)</i>			
<i>Alternative to smoking cigarettes and drinking</i>			
Because it is socially more accepted than cigarettes			.742
Because it is legal			.753
Because it is less addictive than cigarettes			.851
Because it is less harmful than smoking cigarettes			.765
Because it is an alternative to drinking with friends			.531
Because the buzz does not affect my sobriety like alcohol			.629
<i>(Cronbach's alpha=.85; males=.85, females=.84)</i>			

Note: Values <.4 are left blank

Table 3: Mean social context scores for demographic and tobacco use (cigarettes and waterpipe) variables

	<i>Social facilitation</i>	<i>Family/cultural influence</i>	<i>Alternative to smoking cigarettes and drinking</i>
Frequency of waterpipe use			
Occasional (n=51)	17.29 ^a	6.58 ^a	10.56
Monthly (n=128)	20.34 ^b	6.96 ^a	11.20
Weekly (n=95)	24.24 ^c	9.53 ^b	12.37
Gender			
Male (n=176)	20.66	7.86	11.05 ^a
Female (n=97)	21.94	7.63	12.28 ^b
Race			
Asian (n=108)	21.55	8.43 ^b	12.15
Non-Asian (n=164)	20.83	7.35 ^a	11.05
Education level			
Freshmen (n=51)	20.47	7.52	11.71
Sophomore (n=74)	22.21	7.45	12.37
Junior (n=78)	20.01	8.08	10.83
Senior (n=68)	20.54	7.98	11.13
Ever smoked cigarettes			
Yes (n=100)	22.24 ^a	8.28	11.29
No (n=174)	20.48 ^b	7.49	11.61

Note: Within each social context factor score (column), means with different superscripts differ significantly for each variable ($p < .05$)

**Chapter 5: Study 3: Demographic and psychosocial correlates of waterpipe use
among college students**

Abstract

Waterpipe smoking has become increasingly popular among college students over the past few years. While much is known about factors that influence other tobacco products such as cigarettes, very little is known about the determinants of waterpipe use. The aim of this study was to explore whether demographic and psychosocial variables are related to waterpipe smoking among college students. A cross sectional study was carried out among college students in order to assess the correlates of waterpipe smoking. A confidential web-based survey was used. The study was voluntary and students, 18 years or older regardless of smoking status, were eligible.

The sample consisted of 378 respondents, of which there were 68% females and 32% males, with mean age of 20 years. Racial distribution of the sample was largely white (69%), the rest being Asian (14%), black (14.3%), and American Indian (2%). Waterpipe smoking was reported by 59% (34.5% among males and 64.5% among females). The risk of smoking waterpipe was higher among cigarette (AOR=7.28, CI: 3.59-14.76) or cigars smokers (AOR= 2.54, CI: 1.28-5.04). Having a smoker friend increased the risk of waterpipe smoking (OR=2.85, CI: 1.36-5.97). Participants with high levels of self efficacy to resist waterpipe (AOR=.97, CI: .96-.99) were less likely to ever smoke waterpipe. The results highlight the popularity of waterpipe smoking among college students and underscore the need for more research of this growing trend. Understanding patterns of predictors of waterpipe use among college students is critical in developing effective prevention and treatment interventions.

5.1 Introduction

According to the National Survey on Drug Use and Health, in 2009 an estimated 69.7 million Americans, 12 years or older, reported use of tobacco, of which 58.7 million smoked cigarettes, 13.3 million smoked cigars, and 8.6 million used smokeless tobacco, confirming that tobacco is one of the most widely abused substances in the US (SAMHSA, 2010). Tobacco use is a problem behavior among college students, who experiment with a variety of products (Wechsler et al., 2001; Wechsler et al., 1998). Recently, waterpipe, a novel tobacco product, also known as hookah, shisha, narghile, goza, has become increasingly popular among college students (Cobb et al., 2010; Grekin & Ayna, 2008; Primack et al., 2008).

Waterpipe smoking involves heating of tobacco with charcoal, and the passage of smoke through water and a hose before it is inhaled by a user. Even though a perception that waterpipe smoking is safer than smoking cigarettes is fairly common, studies have shown that waterpipe smoking produces tar, heavy metals, high levels of nicotine, and carbon monoxide levels (Al Mutairi et al., 2006; Eissenberg & Shihadeh, 2009; Monzer et al., 2008; Shafagoj et al., 2002; Shihadeh, 2003). Waterpipe smoking is associated with cancer, respiratory problems, and cardiovascular disorders, suggesting potential health risks similar to cigarette smoking (Gupta et al., 2001; Hoffmann et al., 1997; Lubin et al., 1990; Shafagoj & Mohammed, 2002). Contrary to popular beliefs, waterpipe smoking may be equally, if not more, harmful than smoking cigarettes (Eissenberg et al., 2008; Shafagoj et al., 2002; Shihadeh, 2003).

Despite the potential harm, research on the correlates of waterpipe use among college students is very limited. While much is known about factors that influence the use

of other tobacco products like cigarettes, very little is known about the determinants of waterpipe use (Byrne et al., 1995; Steptoe et al., 1996; Von Ah et al., 2005). For instance, sociodemographic factors (gender, race) and environmental correlates (involvement in fraternities/sororities and sports) have been associated with cigarette smoking among college students (Emmons et al., 1998; Gray & Donatelle, 1990; Hestick et al., 2001; Moskal et al., 1999; Rigotti et al., 2000). College students who are white, members of fraternities or sororities, and do not participate in athletics are more likely to be cigarette smokers (Emmons et al., 1998). Similarly, living arrangements that include living with parents, living in residence halls or restricted housing where smoking is not permitted, reduce the likelihood of smoking among college students (Gfroerer et al., 1997; Jones et al., 1992; Wechsler et al., 2001).

Psychosocial determinants such as beliefs, peer/familial influence, resistance self efficacy, and sensation seeking tendencies have been strong predictors of cigarette smoking (Choi et al., 2001; Donohew et al., 1999; Hines et al., 1998; Hu et al., 2006; Kopstein et al., 2001). Young adults are more likely to initiate smoking if their peers and family members smoked, and more likely to quit if they had fewer friends who smoked (Chassin, Presson, Sherman, & Edwards, 1991; Morrell et al., 2005; Rose, Chassin, Presson, & Sherman, 1996). Compared to nonsmokers, smokers are more likely to have low levels of self efficacy (Martinelli, 1999). Sensation seekers are more likely to be cigarette smokers (Kopstein et al., 2001). The extent to which these perceptions influence waterpipe use among college students is not known. It is also not clear if use of cigarettes and cigars affect the level of waterpipe use in this population.

The purpose of the present study was to explore whether demographic characteristics (gender, race/ethnicity, and education level), university contexts (involvement in fraternity/sorority, participation in athletics, living situation during school year), and psychosocial variables (sensation seeking, self efficacy, peer and family influence, perception of risks) are related to waterpipe smoking among college students. While data collection is still underway, this study presents the preliminary results of the study, focusing primarily on waterpipe use. Findings from this study may help develop effective prevention programs for young waterpipe smokers.

5.2 Methods

5.2.1 Participants

Participants consisted of undergraduate students enrolled in psychology courses at the University of Maryland. Students who were interested in earning research credits were asked to create an account in the department research website, SONA system at <http://psychology.umd.edu/research/sona.html> and sign up for the study. The study was administered as a web-based survey using surveymonkey.com®, a secure online survey tool, during spring 2012. The system asked the students for name and university ID, which restricted students to complete the survey more than once. The study was voluntary and students, 18 years or older regardless of smoking status, were eligible. To be retained for analyses, respondents needed to complete the section on demographic information. Individuals who participated received one research credit.

The sample consisted of 378 respondents, of which there were 68% females and 32% males. Racial distribution of the sample was largely white (69%), the rest being black (14.3%), Asian (14%), and American Indian (2%). Only 7.7% of the students were of

Hispanic ethnicity. The average age of the sample was 20 years and students were evenly distributed across education level; 29% freshmen, 21% sophomores, 30% juniors, and 20% seniors. A total of 223 students (59%) had ever smoked a waterpipe, 147(40%) had ever tried smoking cigarettes, and 124 (33%) had ever smoked cigars. Only 6% of the students had smoked waterpipe in the past 30 days.

5.2.2 Development of the survey

The survey instrument (Appendix VII) was developed based on the findings of the in-depth interviews conducted during study 1. In addition, research questions were generated by reviewing the literature to identify variables previously associated with cigarette smoking among college students. The survey was pilot tested among college students (n=8) who did not participate in the final survey. Cognitive “think aloud” interviews were carried out to detect problems respondents might have in understanding questions or terms used, correct use of skip patterns, and improve comprehension of the response scales and survey format. The time taken to complete the survey was between 10-25 minutes. The survey was approved by the University of Maryland Institutional Review Board. Before starting the survey, the students were asked to sign the consent form. The text of the consent that was posted on the website is presented in Appendix VIII.

5.2.3 Measures

Primary outcome variable: The outcome variable was measured as frequency of waterpipe use. Response options included "never used", "used, but not in the past 12 months", "used, but not in the past 30 days", or "used in the past 30 days." Among students who smoked waterpipe in the past month, number of days smoked in the past 30 days was collected. If students responded affirmatively to ever smoking waterpipe, age of initiation, frequency of

use, and a question regarding ownership of waterpipe were also collected. For analysis, categories such as “used, but not in the past 12 months”, “used, but not in the past 30 days”, or “used in the past 30 days” were collapsed into “ever use.”

Demographics and background variables: Demographic variables included age, gender, self-reported race (Asian, White, Black, American Indian, Native Hawaiian or Pacific Islander, Biracial), ethnicity (Non Hispanic, Hispanic), and education level (freshmen, sophomores, juniors, and seniors). Background variables included lifetime and current participation in Greek organizations and athletic teams. All four questions had “yes” and “no” responses. Information on current living arrangements included “lived in campus dorm”, “lived off campus with friends and housemates”, “lived with parents or relatives”, or “other.”

Use of other tobacco products: Participants were asked about their concomitant smoking status of cigarettes and cigars. Response options "never used", "used, but not in the past 12 months", "used, but not in the past 30 days", or "used in the past 30 days" were used (Rigotti et al., 2000). Similar to waterpipe use, past and current use were classified into “ever use” category. If participants responded positively to past or current use, age of initiation and frequency of use were collected.

Peer smoking: Although the role of peer influence on use of tobacco products has been repeatedly examined (Maxwell, 2002; Morrell et al., 2005; Sussman et al., 1990), it is not clear how it affects waterpipe use among college students. Peer smoking was measured using three items: (a) “Does your best friend smoke waterpipe?” (b) “If you are currently involved in an intimate relationship (spouse, boyfriend, girlfriend), does your partner

smoke waterpipe?”(c) “If you have roommates, do they smoke waterpipe?” (Wetter et al., 2004).

Risk taking/sensation seeking: Risk taking tendency operationalized as sensation seeking was measured using the Arnett Inventory of Sensation Seeking (Arnett, 1994). Sensation seeking as proposed by Arnett is conceived as being influenced by a biological predisposition which interacts with the social environment (Roth & Herzberg, 2004). The scale has 20 items featuring two dimensions, novelty and intensity (10 items each). The *Intensity Scale* assessed the intensity of stimulation of the senses (e.g., “When I listen to music, I like it to be very loud,” “It would be interesting to see a car accident happen,” “I like a movie where there are a lot of explosions and car chases”), whereas the items of the *Novelty scale* referred to the openness to experience (e.g., “I can see how it would be interesting to marry someone from a foreign country,” “I would like to travel to places that are strange and far away,” “I think it's fun and exciting to perform or to speak before a group”). Each item was rated on a 4 point Likert scale (4 = “describes me very well”, 3= “describes me somewhat”, 2= “does not describe me very well”, 1 = “does not describe me at all”). Items 2, 3, 6, 10, 13, and 17 were reverse coded (Arnett, 1994). Higher scores indicated higher levels of sensation seeking. The scale has acceptable internal consistency and good criterion-related validity for predicting risk taking behaviors (Arnett, 1994); strong face validity (Zarevski, 1998), and good concurrent validity with measures of alcohol/drug use (Comeau, Stewart, & Loba, 2001).

Resistance self-efficacy: The Lawrance Self-Efficacy Scale was used to measure smoking resistance self-efficacy (Lawrance, 1989). The revised version of the scale was used (Condiotte & Lichtenstein, 1981; Lawrance & Rubinson, 1989). It contained 36 items that

used a 6-point Likert scale (1= “I am very sure I would smoke” to 6 = “I am very sure I would not smoke”) to rate responses in each situation. A higher score indicated a greater likelihood of resisting smoking. The scale has shown high internal consistency (Social Opportunities Scale: .94; Emotions Scale: .96; Friends' Influence Scale: .94), and good concurrent and predictive validity (Lawrance, 1989).

Perceived susceptibility: Risk perception was measured using scales for sickness and addiction, each containing two items as previously used by Smith-Simone and colleagues (Smith-Simone et al., 2008). The items are reported to have high internal consistency with Cronbach’s alpha of .88, and .83 for sickness and addiction respectively (Smith-Simone et al., 2008). Examples to measure sickness included “What is the likelihood of getting *sick* (e.g., dizziness, nausea, vomiting, abdominal pain, diarrhea, sweating, blurred vision, or headache) when using waterpipe alone?”, “What is the likelihood of getting *sick* (e.g., dizziness, nausea, vomiting, abdominal pain, diarrhea, sweating, blurred vision, or headache) when using *waterpipe* socially?” Similarly, addiction was measured using items such as “what is the likelihood of getting *addicted* when using *waterpipe* alone?”, “what is the likelihood of getting *addicted* when using *waterpipe* socially?” Each item was rated as “Low” and “High.” Similar questions were asked for cigarette and cigar use.

5.3 Data analyses

Data were analyzed using PASW 18.0 for Windows. The level of significance was fixed at 5%. Descriptive statistics were used to compare distributions of responses for each variable between participants who had ever or never smoked a waterpipe. Binomial logistic regression was used to evaluate correlates of waterpipe use. First, each variable included in Table 1 was tested in a bivariate logistic model. The unadjusted odds ratios (ORs) and the

95% confidence intervals (CIs) were examined (Table 2). Next, all significant variables related to frequency of use ($p < .05$) were included in a multivariate logistic regression using full entry method. Adjusted OR and 95% CI were examined to assess the significance of the relationships in predicting the likelihood of waterpipe use (Table 3). The statistical procedures used to determine predictors of waterpipe use were repeated for cigarette smoking. Less than 5% of the data were missing.

5.4 Results

5.4.1 Waterpipe use by students' characteristics

Of the participants who completed the survey, the life-time prevalence of waterpipe use was reported to be 59%. As illustrated in Table 1, the life time use of waterpipe differed as a function of several characteristics including gender, race/ethnicity, education level, living arrangements, fraternity/sorority membership, peer influence, perceptions of risks, and concomitant tobacco use, resistance self efficacy, and sensation seeking compared to those who had never smoked a waterpipe. Among waterpipe users, 65.5% were female and 76% were white. The majority of the students (87%) who had ever smoked waterpipe were members of an athletic team and only one third (33%) were members of a fraternity or sorority. Close to half (45%) of the waterpipe users lived in campus housings, another 45% lived off-campus with friends or roommates, and only 10% lived with parents or relatives. Of those who had ever tried waterpipe, 49% had a best friend who smoked, 35% had roommates who smoked, and 17% had partners (girlfriend, boyfriend or spouse) who smoked. Compared to students who had never tried waterpipe, those who had ever smoked perceived waterpipe smoking to be associated with low risks of getting sick while smoking alone (72.6%) and in groups (69%), and low risks of getting

addicted while smoking alone (74%) and in groups (67.3%). Ever use of cigarettes and cigars was reported by 59.6% and 46.6% of the waterpipe users respectively. The average age of initiation of waterpipe smoking was 17 years. Self efficacy to resist smoking waterpipe was significantly higher among those who had never tried waterpipe (M=198.11, sd=20.48) compared to those who had ever tried (M=166.73, sd=36.47). Similarly, sensation seeking was significantly higher among those who had never smoked (M=48.93 (sd=6.97) versus those who had ever smoked (M=46, sd=7.23).

Insert Table 1 about here

5.4.2 Bivariate relationships between waterpipe use and predictors (demographics and psychosocial variables)

Table 2 shows the unadjusted ORs for the bivariate analyses, which identified significant associations among sociodemographic variables, peer influence, family influence, perception of risks, self efficacy, and waterpipe use. White smokers were more likely (OR=2.11, 95% CI: 1.35-3.30) than non whites to smoke waterpipe. Students who lived off campus with friends were more likely (OR= 3.00, 95% CI: 1.55-5.78) to smoke waterpipe than those who lived with parents or guardians. Being a member of a fraternity or sorority was significantly associated with waterpipe use (OR= 1.87, 95% CI: 1.16-3.03) but not with cigarette smoking.

Insert Table 2 about here

Compared to students who had never smoked waterpipe, students whose best friends smoked waterpipe were almost five times as likely to ever smoke waterpipe (OR= 4.67, 95% CI: 2.84-7.67). Similarly students whose partners smoked were almost six times as likely to smoke compared to those whose partners did not smoke (OR= 5.88, 95% CI:

2.25-15.35). In addition, students whose roommates smoked waterpipe were 4.03 times as likely to smoke compared to those whose roommates did not smoke waterpipe. When comparing students who had ever smoked a waterpipe with those who had not, having siblings who smoked was associated with waterpipe use (OR= 2.34, 95% CI: 1.40-3.91). However, having siblings who smoked cigarettes was not a significant predictor of ever use of cigarettes.

Using high likelihood as the reference, low likelihood of getting sick (OR= 2.79, 95% CI: 1.81-4.31) or addicted (OR= 2.77, 95% CI: 1.79-4.28) when smoking waterpipe alone was associated with waterpipe use. Similarly, low likelihood of getting sick (OR= 2.41, 95% CI: 1.57-3.70) or addicted (OR= 3.06, 95% CI: 1.79-4.70) when smoking waterpipe socially were associated with ever use of waterpipe.

It also appeared that those who had ever smoked cigarettes (OR= 14.56, 95% CI: 7.9-26.84) or cigars (OR= 5.76, 95% CI: 3.36-9.88) were more likely to have ever smoked waterpipe. High levels of resistance to smoke waterpipe decreased the odds of students reporting waterpipe use (OR= .95, 95% CI: .94-.96). In addition, high sensation seeking levels decreased the odds of waterpipe smoking (OR=.94, 95% CI: .91-.97).

5.4.3 Multivariate relationships between waterpipe use and predictors (demographics and psychosocial variables)

The multivariate model included all statistically significant variables from the bivariate model (table 2). The overall fit of a logistic regression model using the Hosmer and Lemeshow test, showed that the model adequately fit the data

($\chi^2(8) = 11.28, p = .186$). A total of 56.2% of the variance in waterpipe use was explained by the predictors (Nagelkerke R square =.562).

Insert Table 3 about here

College students whose best friend smoked waterpipe had greater odds (OR=2.85, CI: 1.36-5.97) of ever smoking a waterpipe. Unlike waterpipe smoking, students whose partner smoked cigarettes were more likely to ever try cigarettes (AOR=8.04, CI: 1.95-33.06) compared to those whose partner never smoked. Similarly, the odds of ever smoking waterpipe were higher among those who had ever smoked cigarettes (AOR=7.28, CI: 3.59-14.76) or cigars (AOR= 2.54, CI: 1.28-5.04). Students with high levels of self efficacy were less likely to ever smoke waterpipe (AOR=.97, CI: .96-.99) or cigarettes (AOR=.92, CI: .89-.94).

5.5 Discussion

The purpose of this study was to examine the role of demographic and psychosocial variables in predicting waterpipe use. The results of this investigation replicated previous findings that waterpipe use is a popular practice among college students (Cobb et al., 2010; Grekin & Ayna, 2008; Primack et al., 2008). In this sample, life time use of waterpipe was independently associated with white race, involvement in Greek organizations, living arrangements, peer influence, low perceived risk of harm (sickness and addiction), life time use of cigarettes or cigars, sensation seeking personality, and low self efficacy to resist waterpipe smoking. However, after adjusting for all other variables the significance was no longer observed for race, involvement in Greek organizations, living arrangements, low perceived risk of harm, and sensation seeking. In the final model, ever use of cigarettes, psychosocial variables such as self efficacy, peer influence, and risk perceptions clearly emerged as the predictors of waterpipe use. These findings are relevant to an increased understanding of the current surge in waterpipe popularity and the future trends.

Compared to previous studies, the prevalence of ever use of waterpipe in this study was high. Surveys have reported life time waterpipe use as high as 41% and 48% among college students (Eissenberg et al., 2008; Primack et al., 2008; Smith-Simone et al., 2008; Smith et al., 2007). This recent rise could be the consequence of increase in waterpipe smoking among high school students, particularly among 12th grade students in recent years (Barnett, Curbow, Weitz, Johnson, & Smith-Simone, 2009; Primack, Walsh, Bryce, & Eissenberg, 2009). However, even though the life time use of waterpipe was high, compared to other studies the prevalence of current use (smoked in the past 30 days) was relatively low (Eissenberg et al., 2008; Primack et al., 2008; Smith et al., 2007). One explanation is that this study was conducted in a convenience sample that was not randomly selected. It is possible that the sample was more inclined to experiment with waterpipe but less likely to use it on a regular basis. Another explanation is that, the sample predominantly consisted of female students who are less likely to smoke waterpipe regularly compared to male students (Baker & Rice, 2008; Maziak, Eissenberg et al., 2004).

In the unadjusted model, whites were more likely to ever smoke waterpipe compared to non-whites. This result is consistent with findings from other studies (Eissenberg et al., 2008; Primack et al., 2008). Affiliations with Greek organizations was associated with ever use of waterpipes but not with cigarette smoking. Those who were fraternity or sorority members were more likely to ever smoke waterpipes, which is similar to previous findings that showed higher prevalence of cigarette, alcohol, and substance use among Greek members compared to non-members (Cashin et al., 1998; McCabe et al., 2005; Morrell et al., 2005). Membership in Greek organizations provides the opportunity to

socialize with peers and smoking waterpipes in groups plays a central role in the socializing process, which might further encourage smoking (Sidani, Shensa, & Primack, 2012). Having “hookah rooms” in fraternity and sorority houses, which allow students to smoke waterpipe indoors unlike cigarettes, may also be one of the reasons why memberships in Greek organizations were associated with waterpipe use but not cigarette smoking. Interventions that target these group members and college policies that are vigilant toward smoking within Greek housing need to be developed to curtail the waterpipe smoking rates.

Smokers hold an unsubstantiated belief that waterpipe smoking is safer and less addictive than cigarette smoking. Studies among college students have shown the extent of these misconceptions (Eissenberg et al., 2008; Primack et al., 2008; Smith-Simone et al., 2008; Smith et al., 2007). Our results reflected similar beliefs among college students. Those who had ever smoked were more likely to associate smoking waterpipe with low risks of getting sick and getting addicted compared to those who had never smoked. These results suggest that educational interventions need to debunk these fallacies.

The results also suggested that waterpipe smoking is popular and is more common than cigarette and cigar smoking among college students. The life time prevalence of waterpipe use was reported by almost 59% of the students, while only 40% had ever tried cigarettes and 33% had ever smoked cigars. In this sample, students who had ever tried cigarettes or cigars were more likely to experiment with waterpipe compared to non-smokers. Similarly, the odds of ever smoking cigarettes were high among those who had experimented with waterpipes and cigars compared to those who had never smoked cigarettes. These findings are consistent with previous surveys suggesting that concurrent use of tobacco products is a common practice among college students (Eissenberg et al.,

2008; Sutfin et al., 2011). An unfortunate possibility is that the concomitant use of tobacco products may increase the risk of nicotine dependence leading to tobacco related diseases. In addition, waterpipe could be a gateway drug to cigarette and cigars or vice-versa. Future studies need to determine the direction of relationship between smoking cigarettes, cigars, and waterpipes.

Students who reported lower levels of self-efficacy were more likely to have ever smoked waterpipes or cigarettes compared to non-smokers. This is one of the first studies to report self-efficacy among waterpipe smokers. These findings were consistent with studies that explored relationships between self-efficacy and cigarette smoking. Previous studies have established a negative relationship between smoking cigarettes and self-efficacy indicating that adults with high resistance self-efficacy are less likely to be involved in smoking (Bandura, 1977; Condiotte & Lichtenstein, 1981; DiClemente, 1985; Kear, 2002). Studies conducted among high school and college students have validated these findings (Choi et al., 2001; Kear, 2002; Stacy et al., 1992). These results suggest that interventions that focus on enhancing refusal skills should be effective in reducing smoking among college students. Although these findings are consistent with previous studies, the mediating role of self-efficacy was not explained in this study and needs to be further explored.

Although sensation seeking has been previously positively linked to smoking (Stephenson, Hoyle, Palmgreen, & Slater, 2003; Urbán, 2010), this study showed that those with high sensation seeking are less likely to smoke waterpipes or cigarettes. Future studies need to confirm these findings. The results were consistent with studies among college students showing that involvement with waterpipe smoking was related to peer smoking

(Smith-Simone, Maziak, Ward, & Eissenberg, 2008; Primack et al., 2008). It is conceivable that since waterpipe use is considered a social activity, such an influence may encourage conformity among circle of friends if members in the group are waterpipe smokers. These results are also consistent with studies that established peer influence as a significant predictor of cigarette smoking and also the Surgeon General's report that indicated significant role of peers during initiation of smoking rather than regular smoking (Morrell et al., 2005; Rigotti et al., 2000; USDHHS, 1994). However, the role of peers in influencing regular use was not determined by the present study.

Some limitations of the study should be noted. The study lacked generalizability given that the sample was predominantly female, White, and drawn from a single department. The respondents may have differed from non-respondents because the survey was only available to Psychology students. The sample was also not representative of the college students, who attended the University of Maryland. This study warrants replication with a larger sample of waterpipe smokers to validate the findings. The cross-sectional design of the study limited determination of the causality of waterpipe use. In addition, all measures were self reported which may have introduced biases such as social desirability and under-reporting. The frequency of use measures were collapsed into dichotomous outcome (ever versus never) to increase the sample size for logistic regression. This limited the ability capture regular waterpipe use (e.g. in the past 30 days, in the past six months) among college students. Future studies should determine the frequency of waterpipe smoking and examine the predictors of regular use.

Despite these limitations, this study is one of the first to examine psychosocial determinants of waterpipe use, such as self efficacy and sensation seeking, in a college

population. There is no single path to being a smoker. An intricate mix of individual and contextual factors contributes to the problem. Due to a multitude of behavioral and environmental factors, college students are at risk of adopting novel and often harmful behaviors. The findings of this study could help health educators and policy makers in designing more informed prevention and treatment interventions targeted to college students. Colleges and universities provide a unique platform for researchers and policy makers to reach out to this vulnerable population that has legal access to tobacco products such as waterpipes. Novel approaches that include behavioral change strategies and reinforce educational messages along with policy changes that discourage waterpipe use need to be developed. In the absence of effective programs, students who experiment with waterpipe in college could transition into dependent users as adults, increasing the burden of tobacco related morbidity and mortality.

Table 1: Characteristics of the study sample (n=378)

	<i>Lifetime use of waterpipe</i>	
	Ever (n=223)	Never (n=153)
Gender		
Male	34.5%	28.8%
Female	65.5%	71.2%
Race		
White	76.1%	60.1%
Non white	23.9%	39.9%
Education level		
Freshmen	26%	32.7%
Sophomore	23.8%	17%
Juniors	29.6%	30.7%
Seniors	20.6%	19.6%
Ever been a member of an athletic team		
Yes	87%	82.4%
No	13%	17.6%
Ever been a member of a fraternity/sorority		
Yes	33.2%	20.9%
No	66.8%	79.1%
Living situation during school year		
Campus dorm	44.8%	53.6%
Off campus	44.8%	27.5%
With parents/relatives	10.3%	19%
Peer smoking		
Best friend smoke	48.9%	17%
Partner smokes	16.6%	3.3%
Roommate smokes	35%	11.8%
Family smoking		
Parents smoke	1.8%	.7%
Siblings smoke	31.4%	16.3%
Perceived risks of smoking		
Low likelihood of getting sick smoking alone	72.6%	48.7%
Low likelihood of getting sick smoking socially	69.1%	48.0%
Low likelihood of getting addicted smoking alone	74.0%	50.7%
Low likelihood of getting addicted smoking socially	67.3%	40.1%
Ever smoked cigarettes	59.6%	9.2%
Ever smoked cigars	46.6%	13.2%
Mean sensation seeking score (SD)	46.0 (7.23) ^a	48.9 (6.97) ^b
Mean waterpipe resistance score (SD)	166.7 (36.47) ^a	198.1(20.48) ^b

Note: Across measures (rows), means with different superscripts differ significantly ($p < .05$)

Table 2: Unadjusted odds ratios for relationship between waterpipe use and cigarette smoking and psychosocial factors among college students

	Waterpipe use (Ever vs. Never)	Cigarette smoking (Ever vs. Never)
	ORs (95% CI)	ORs (95% CI)
Gender		
Male	1.30 (.83-2.04)	1.35 (.87-2.1)
Female	1	1
Race		
White	2.11 (1.35-3.30)**	2.25 (1.39-3.65)**
Non white	1	1
Education level		
Freshmen	.75 (.41-1.37)	.65 (.35-1.19)
Sophomore	1.32 (.68-2.56)	.79 (.42-1.51)
Juniors	.91 (.50-1.65)	.97 (.54-1.76)
Seniors	1	1
Ever been a member of an athletic team		
Yes	1.43 (.81-2.53)	.99 (.55-1.78)
No	1	1
Ever been a member of a fraternity/sorority		
Yes	1.87 (1.16-3.03)*	1.37 (.87-2.17)
No	1	1
Living situation in college		
Campus dorm	1.53 (.82-2.85)	.94 (.48-1.85)
Off campus	3.00 (1.55-5.78)**	2.70 (1.37-5.32)**
With parents/relatives	1	1
Peer smoking		
Best friend smokes		
Yes	4.67 (2.84-7.67)***	4.54 (2.52-8.19)***
No	1	1
Partner smokes		
Yes	5.88 (2.25-15.35)***	9.85 (3.32-29.24)***
No	1	1
Roommate smokes		
Yes	4.03 (2.29-7.08)***	3.59 (1.91-6.73)***
No	1	1
Family smoking		
Parents smoke		
Yes	2.77 (.30-7.25)	1.03 (.55-1.96)
No	1	1
Siblings smoke		
Yes	2.34 (1.40-3.91)**	1.15 (.70-1.91)
No	1	1

Perceived risks of smoking		
Likelihood of getting sick while smoking alone		
Low	2.79 (1.81-4.31)***	3.27 (2.11-5.09)***
High	1	1
Likelihood of getting sick while smoking socially		
Low	2.41 (1.57-3.70)***	3.05 (1.96-4.73)***
High	1	1
Likelihood of getting addicted while smoking alone		
Low	2.77 (1.79-4.28)***	1.29 (.82-2.03)
High	1	1
Likelihood of getting addicted while smoking socially		
Low	3.06 (1.99-4.70)***	1.82 (1.16-2.87)**
High	1	1
Ever smoked cigars		
Yes	5.76 (3.36-9.88)***	3.8 (2.42-5.98)***
No	1	1
Sensation seeking	.94 (.91-.97)***	.95 (.92-.98)**
Resistance to use waterpipe	.95 (.94-.96)***	.91 (.89-.94)***

*[The last category was used as the reference] CI: Confidence intervals; Bold type indicates significant results in each factor; * p<.05; ** p<.01; *** p<.001*

Table 3: Adjusted odds ratios for relationship between waterpipe and cigarette smoking and psychosocial factors among college students

	Waterpipe use (Ever vs. Never)	Cigarette smoking (Ever vs. Never)
	AORs (95% CI)	AORs (95% CI)
Race		
White	1.20 (.63-2.30)	1.22 (.55-2.51)
Non white	1	1
Ever been a member of a fraternity/sorority		
Yes	1.04 (.52-2.07)	-
No	1	
Living situation in college		
Campus dorm	1.31 (.52-3.28)	.93 (.32-2.66)
Off campus	2.11 (.77-5.76)	1.84 (.61-5.50)
With parents/relatives	1	1
Peer smoking		
Best friend smokes		
Yes	2.85 (1.36-5.97)**	2.14 (.81-5.61)
No	1	1
Partner smokes		
Yes	2.81(.74-10.60)	8.04 (1.95-33.06)**
No	1	1
Roommate smokes		
Yes	1.18 (.54-2.59)	1.12 (.46-2.75)
No	1	1
Family smoking		
Siblings smoke		
Yes	.83 (.37-1.88)	-
No	1	
Perceived risks of smoking		
Likelihood of getting sick while smoking alone		
Low	2.02 (.76-5.39)	2.05 (.76-5.49)
High	1	1
Likelihood of getting sick while smoking socially		
Low	.99 (.38-2.59)	1.11 (.41-3.02)
High	1	1
Likelihood of getting addicted while smoking alone		
Low	1.53 (.77-3.02)	-

High	1	
Likelihood of getting addicted while smoking socially		
Low	1.87 (.93-3.74)	1.32 (.66-2.65)
High	1	1
Ever smoked cigarettes/waterpipe		
Yes	7.28 (3.59-14.76)***	12.24 (5.16-28.99)***
No	1	1
Ever smoked cigars		
Yes	2.54 (1.28-5.04)**	1.15 (.58-2.27)
No	1	1
Sensation seeking	.97 (.93-1.01)	.97 (.93-1.02)
Resistance to use waterpipe	.97 (.96-.99)**	.92 (.89-.94)***

*[The last category was used as the reference] CI: Confidence intervals; Bold type indicates significant results in each factor; * $p < .05$; ** $p < .01$; *** $p < .001$*

Chapter 6: Summary and conclusion

The purpose of this study was to understand the association of demographic and psychosocial factors with waterpipe use, using qualitative and quantitative methods. Assessment of the predictors of waterpipe use among college students is important for several reasons. Even though waterpipe smoking may not seem as rampant in the US, the growth of waterpipe market in the form of ubiquitous waterpipe establishments, increasing waterpipe related youtube videos, and blogs defy this perception. An upsurge in google search using the keyword “hookah” or “shisha” is an example of the growing popularity of waterpipe. Until recently, cigarette smoking was one of the most commonly documented problems among college students. Increasing studies report high prevalence of waterpipe use among college students and show lack of interventions to address the problem. Results from this study could help in developing early prevention and cessation interventions that may help in curbing the epidemic.

The findings from the three studies can be summarized as follows:

- Occasional waterpipe use was more common than smoking cigarettes or cigars among college students.
- College students perceived waterpipe smoking to be safer and less addictive than smoking cigarettes or cigars. It was a common belief that water in the waterpipe filtered most of the impurities (toxins and carcinogens) like filters in cigarettes.
- Students smoked waterpipe in the context of social facilitation, family/cultural context, and as an alternative to drinking.
- Social facilitation was a strong correlate of smoking waterpipe. Almost none of the students ever smoked waterpipe alone. The shared experience of smoking waterpipe in groups made it different from smoking other tobacco products like cigarettes and

cigars, which are individualistic experiences. Because conforming to social norms are important to young adults, most college students smoked waterpipe because their friends smoked.

- Students who smoked waterpipe in familial contexts were more likely to smoke regularly compared to others. Students who smoked in this context were mostly of Asian origins from countries such as India and Pakistan, where waterpipe smoking has been practiced for centuries. For these smokers, smoking waterpipe was more accepted by families compared to others.
- Hookah bars provided a social setting for those who were not of legal age to drink. Visiting hookah cafés was more common among students who were not 21 years of age.
- The trend of purchasing waterpipe paraphernalia and smoking inside dormitories or houses was a popular trend. Waterpipe accessories such as charcoal and flavored tobacco were easily accessible for online purchase, which made waterpipe smoking more accessible to students.
- Use of other tobacco products such as cigarettes and cigars were strong predictors of waterpipe use. However, it was not clear if waterpipe was a gateway product to cigarettes and cigars or vice-versa. Future studies need to investigate the direction of this relationship.
- Students are likely to smoke waterpipe if their close friends smoke.
- Smokers with low self efficacy to resist smoking waterpipe were more likely to ever smoke waterpipe.

These findings could be used to inform researchers and policy makers in designing interventions and campaigns to prevent tobacco use among young adults. The study also acquired information regarding the predictors of waterpipe use that could help researchers understand why some young adults smoke waterpipe, some have never tried, while others smoke it regularly. These evidences could be used as variables that may be targeted in designing interventions.

To meet the overall goal of preventing waterpipe use among college students, policy implications at several levels need to be addressed. First, at the college level, interventions that are aimed at educating students from the dangers of tobacco consumption, waterpipe in particular, need to be designed and implemented. Such interventions should focus on demystifying misleading notion that water in the waterpipe absorbs all the toxins and carcinogens and educate students about the health risks. For smokers, who use waterpipe almost on a daily basis, cessation programs need to be developed. Existing treatment interventions for cigarette smoking may not be suitable to treat waterpipe dependence. Programs that are tailored to waterpipe users need to be developed. In addition, college administrators need to be more vigilant about growing waterpipe establishments in the vicinity and make necessary policies to prevent the growth of such establishments. College administrators should also be stringent about smoke free policies and ensure execution of smoking regulations in dormitories that are not only limited to cigarette smoking but also take into account waterpipe smoking.

Second, at the state level, strict policies that are free of loopholes need to be formulated. For instance, under the current policy, hookah cafés are exempt from clean indoor air ordinances if they fall under retail tobacco shops, private clubs, self-employed

and family operated businesses. In the state of Maryland, hookah cafés and bars are exempted as tobacco shops, provided they primarily sell tobacco containing products. Regulations like these are ambiguous as to whether hookah bars and lounges operate as tobacco shops. It is under these gaps in policies, hookah establishments thrive. Moreover, states should increase taxes on tobacco used in waterpipes.

Third, at the federal level, waterpipes and waterpipe tobacco should be subjected to the same regulation as cigarettes under the Food and Drug Administration, according to the Family Smoking Prevention and Tobacco Control Act. Waterpipe should be marketed under similar scrutiny as cigarettes and include health warnings and disclosure of ingredients. Waterpipe smoking in public places should be consistent with cigarette bans due to potential risks of second hand smoking. Lastly, there should be policies regulating online transaction of waterpipe paraphernalia to discourage the unreserved sales of such items.

The health risks associated with waterpipe use coupled with misconceptions that smoking waterpipe is healthier than using other tobacco products need immediate attention. Findings from this study will inform policy makers about how college students are being exposed to waterpipe and how it is rapidly proliferating among young adults. This study will also impart knowledge about the role of psychosocial variables in predicting waterpipe use and identifying intrinsic differences among young adults who choose not to smoke waterpipe versus those who smoke it regularly.

Appendices

Appendix I: Interview guide to Understand Psychosocial Aspects of Hookah Smoking among College Students

A. Introduction (5 minutes)

Script:

Hello, my name is _____, and I'll be asking you questions regarding your hookah use behavior. Thank you for agreeing to participate today.

Today we will be talking about social behaviors of young adults related to hookah use. I'm here to listen to your ideas and thoughts on these issues. There are no right or wrong answers, only opinions, and I'd like to hear your thoughts. Your answers are going to help us to develop

instrument to measure psychosocial impact on hookah smoking among young adults.

We're audio-taping our discussion. Everything you say is important to us, and we want to make sure we don't miss any comments. Later, we'll go through all of your comments and use them to prepare a report on our discussion. I want to assure you, however, that all of your comments are confidential and will be used only for research purposes. Nothing you say will be connected with your name. Also if there are any questions you would prefer not to answer, please feel free not to respond to them.

As I mentioned, we will be taping this discussion. I will start the tape recorder now. After I turn it on, I will ask you for your verbal permission to tape the discussion so that it is on tape. Please respond with a "yes" to confirm that you are aware that we are taping this discussion and that we have your permission to do so.

Tape recorder started: "Now that the tape recorder is on, please respond with a verbal "yes" to confirm that you are aware that we are taping this discussion and have your permission to do so."

B. Warm up/ice (5 minutes)

[Interviewer will show pictures of a person/people smoking Hookah]

1. I'd like to begin by having you telling me what these images mean to you. What comes to mind when you look at them?

C. Perceptions and Beliefs About Hookah Smoking (20 minutes)

2. Now I'd like to talk specifically about the hookah smoking behaviors of either yourself or your friends you know. How would you describe hookah to me? What is it? What do you do with it? Who does it? and Why?

Probe: Do you own your own hookah? Do you know how to set it up? How did you learn how to use it when you first started?

3. Now that you've described it, think back to the last time you or you and your friends were smoking hookah. What was the specific reason you decided you were going to smoke hookah on that particular occasion?

Probe: Are there particular times when you would smoke a hookah? E.g. on Fridays, being stressed etc.

4. In your opinion, what are some of the advantages of smoking a hookah? Disadvantages?

Probe: In other words does hookah smoking help you with anything else going on in your life?

5. If there are associated advantages and disadvantages according to you, how important are they for you?

For example, if you smoke hookah for fun, how important is "having fun" for you? If you don't smoke hookah regularly for health reasons, how important is your health to you?

6. Think about the time when you did not want to smoke a hookah but were influenced by your friends or family to do so. Also think about the time when you wanted to smoke a hookah but were discouraged by your peers or family. Tell me about these experiences. What role does external influence play in smoking hookah?

7. Can you come up with one thing that you think of if you were to refer to something you think is really "cool" or "hip" or "trendy". I'd like you to tell me one thing you consider is "cool" to you.

Probe: On a scale of 1-10, one being the least, how "cool" is the other item that was mentioned?

On a scale of 1-10, one being the least, how “cool” do you think hookah smoking is?

D. Hookah and health consequences (15 minutes)

8. Do you have any thoughts about Hookah and how it may or may not relate to your health in any way?

Probe: Is it good? Bad? No difference, to your health?

9. Are you familiar with what goes into hookah? Are you familiar with what goes into cigarettes, or traditional tobacco smoke? In what ways do you think the two compare?

Probe: do you think the two are different, or the same? how?

10. Are there any other health factors that you think are associated with hookah?

Probe: what are your thoughts when it comes to practical things like sharing the pipe?

Probe: do you have any thoughts about some of the short term effects of smoking hookah, these can be either positive or negative effects?

Probe: How about long term effects?

11. Is there anything at all that would make you smoke hookah less, or more? Is there something that might make you stop altogether?

E. Wrap up and final thoughts, questions: (5 minutes)

We've come to the end of our discussion that was extremely helpful. Are there any additional comments that you want to add or something you would like to say that I did not ask in regards to hookah?

We want to thank you for your participation. Your opinions today will be very valuable as we continue to do our research. We know that your time is valuable and really appreciate your participation.

Appendix II: Demographic information and smoking history of interview participants

- 1. Birthdate: ___/___/___ (mm/dd/yyyy)

- 2. Gender: _____ Male _____ Female

- 3. Marital Status:
_____ Legally Married _____ Separated
_____ Living with Partner/Cohabiting _____ Divorced
_____ Widowed _____ Never Married
_____ Unknown

- 4. Ethnicity: _____ Hispanic or Latino
_____ Not Hispanic or Latino

- 5. Race: (mark all that apply)
__ American Indian, or Alaska Native
__ Asian
__ White
__ Black, or African-American
__ Native Hawaiian or Pacific Islander

- 6. Years of Formal Education (GED= 12 years): ___ years

Smoking History Questionnaire

SECTION A: USE OF HOOKAH

A1. Have you ever used a Waterpipe to smoke tobacco (even one or two puffs)?

- YES.....1
- NO.....2
- RF.....8
- DK.....9

A2. How old were you when you first used a waterpipe to smoke tobacco?

Age..... _____

A3. Who were you with when you first used a Waterpipe to smoke tobacco (check all that apply)

- No one, I was alone.....1
- With one friend.....2
- With more than one friend.....3
- With a family member.....4
- With more than one family member.....5

Other.....6 (Specify: _____)

A4. Where were you when you first used a waterpipe to smoke tobacco?

In a café or restaurant.....1

In my own home.....2

At a family member's house.....3

At a fraternity house.....4

At a friend's home.....5

Dorm room.....6

Other.....7 (Specify: _____)

A5. Is there a particular time of year that is more common for you to smoke tobacco using a waterpipe?

(Circle all that apply)

No, I use it about the same all year-round.....1

Yes, more in the fall.....2

Yes, more in the winter.....3

Yes, more in the spring.....4

Yes, more in the summer.....5

Other.....6

A6. Which of the following choices best describes how often you smoke tobacco using a Waterpipe?

At least once a year, but not monthly.....1

At least once a month, but not weekly.....2

At least once a week, but not daily.....3

At least once a day, or most days each month.....4

(CURRENT HOOKAH USE)

A7. Approximately how many times did you use a Waterpipe to smoke tobacco in the past 30 days?

No. of days.....

A8. On the day(s) when you smoked a Waterpipe, on average how many times a day did you use a Waterpipe to smoke tobacco?

About one time each day.....1

About two times each day.....2

About three times each day.....3

More than three times each day.....4

A9. When you used a Waterpipe to smoke tobacco in the past 30 days, how long did a typical "Waterpipe session" last?

Minutes.....

A10. During the past 30 days, with whom did you most often use a Waterpipe to smoke tobacco? (check all that apply)

- No one, I was alone.....1
- With one friend.....2
- With more than one friend3
- With a family member4
- With more than one family member...5
- Other.....6 (Specify)

A11. During the past 30 days, where did you typically smoke tobacco using a Waterpipe?

- In a café or restaurant.....1
- In my own home.....2
- At a family member's house.....3
- At a fraternity house.....4
- At a friend's home.....5
- Dorm room.....6
- Other.....7 (Specify: _____)

A12. Do you own a Waterpipe?

- Yes.....1
- No.....(skip to A14)2

A13. How many Waterpipe/s do you own? No of Waterpipe/s..... _____

A14. Where did you buy your Waterpipe(S)? (check all that apply)

- Internet.....1
- Convenience store.....2
- Tobacco shop.....3
- It was a gift4
- Street vendor.....5
- Hookah café6
- Other.....7

A15. When you use a Waterpipe to smoke tobacco, do you usually share it with others?

- Yes.....1
- No.....2

A22. When you use a Waterpipe to smoke tobacco, is the tobacco flavored?

- Yes.....1
- No.....2

If yes, what is your favorite flavor _____

A23. Why do you use a Waterpipe to smoke tobacco? (check all that apply)

- Boredom.....1
- It helps me not smoke other tobacco2
- I enjoy the taste.....3

I think about it a lot.....4
 It helps me not smoke cigarettes.....5
 It helps control my weight.....6
 I enjoy the smell.....7
 If I don't smoke a waterpipe, I experience
 unpleasant feelings such as irritability and/or
 have trouble concentrating and/or feel sad.....8
 It is less harsh than smoking cigarette.....9
 I have urges or cravings for it.....10
 I like trying things that are new, different or 'hip'.....11
 It helps me feel less stressed.....12
 It helps control my appetite.....13
 It's consistent with my religious traditions or beliefs..14
 It helps me to feel relaxed.....15
 It's a good way to socialize with friends.....16

SECTION B: PAST CIGARETTE SMOKING

B1. Have you smoked at least 100 cigarettes, approximately 5 packs of cigarettes, in your lifetime?

- YES.....1
 NO2
 NEVER SMOKED.....(Skip to Section C).....8

B2. About how old were you when you first tried cigarettes, even one or two puffs?

Age....._____

B3. How old were you when you started smoking regularly?

Age....._____

CURRENT CIGARETTE SMOKING

Do you now smoke cigarettes every day, some days, or not at all?

- EVERY DAY.....1 # CIGS PER DAY
 SOME DAYS2
 NOT AT ALL...(Skip to Section C)3

Have you ever smoked everyday for at least 6 months?

- YES.....1
 NO2
 DK9

How long have you been smoking cigarettes regularly?

- # YEARS
 DK.....99

SECTION C: PAST USE OF SMOKELESS TOBACCO

C1. Have you used smokeless tobacco, in your lifetime?

YES.....1
NO2
NEVER SMOKED.....(End of interview).....8

CURRENT USE OF SMOKELESS TOBACCO

Do you now use smokeless tobacco every day, some days, or not at all?

EVERY DAY.....1 # TIMES PER DAY
SOME DAYS2
NOT AT ALL ... (Skip to Section C)3

Appendix III: Informed consent form (Qualitative interviews)

CONSENT FORM

Project Title	Standardization of methods to measure waterpipe emissions and exposure
Why is this research being done?	You are being asked to participate in this study at the Center for Health Behavior Research, University of Maryland, because you are a waterpipe (hookah) user, 18 years or older. The purpose of this research project is to understand the perceptions and attitudes regarding hookah use among young adults. This information will help researchers in developing assessment tools to measure psychosocial aspects of hookah smoking.
What will I be asked to do?	You will be asked to fill out your demographic information, complete a hookah and tobacco use questionnaire, the hookah buzz scale and complete a brief interview with a study staff to share your thoughts about hookah use among young adults. The interview will last for approximately 30 minutes. The conversation will be audiotaped. The questions asked during the interview will be very general and open ended. You will be compensated with \$10 for your time.
What about confidentiality ?	<p>We will do our best to keep your personal information confidential. We will ask your demographic information, but your name will not be associated with this information. We will not ask your name other than to sign this consent form. Your responses will be recorded using an audio digital recorder and traditional paper/pen note taking procedures. No one will hear what is on the audio-tape except the researchers. Audio digital recordings will be stored in a locked computer audio file in which the correct username and pass code will be necessary to access the file. Paper notes will be stored in a conventional locked file cabinet. Only the primary investigator and student investigator will have access to the stored files. The audio digital files will be deleted from the computer hard drive and the paper files will be shredded after 10 years per the University of Maryland policy on records retention and disposal. If we write a report or article about this research project, your identity will be protected to the maximum extent possible.</p> <p><input type="checkbox"/> I agree to be audio taped during my participation in this study.</p> <p><input type="checkbox"/> I do not agree to be audio taped during my participation in this study.</p>
What are the risks of this	There are no known medical risks associated with participating in this research project. Some persons may be uncomfortable

research?	talking about their hookah use with the interviewer. This will be rare and the interviewer has been trained to deal with such instances.	
What are the benefits of this research?	This research is not designed to help you personally, but the results may help the investigators learn more about hookah use among young adults. In addition, the information collected during these interviews will also help researchers in developing instruments/scales regarding psycho social aspects of hookah use.	
Do I have to be in this research? May I stop participating at any time?	Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify.	
Is any medical treatment available if I am injured?	NA	
What if I have questions?	<p>This research is being conducted by Dr. Pamela Clark at the University of Maryland, College Park. If you have any questions about the research study itself, please contact Dr. Pamela Clark at 2387 SPH Building, Dept. of Public and Community Health, College Park 20742 Ph no: 301-405 8624 email:clarkp@umd.edu.</p> <p><i>If you have questions about your rights as a research subject or wish to report a research-related injury, please contact:</i> Institutional Review Board Office, University of Maryland, College Park, Maryland, 20742; (e-mail) irb@umd.edu; (telephone) 301-405-0678</p> <p><i>This research has been reviewed according to the University of Maryland, College Park IRB procedures for research involving human subjects.</i></p>	
Statement of Age of Subject and Consent	Your signature indicates that you are at least 18 years of age, the research has been explained to you, your questions have been fully answered, and you freely and voluntarily choose to participate in this research project.	
Signature and Date	NAME OF SUBJECT	
	SIGNATURE OF SUBJECT	
	DATE	

Appendix IV: Informed consent form (Waterpipe use questionnaire)

Project Title	Development of an instrument to measure social context of smoking hookah among college students
Purpose of the Study	This is a research is being conducted by Dr. Pamela Clark at the University of Maryland, College Park. We are inviting you to participate in this survey because you are a college student, 18 years of age or older and have identified yourself as a hookah user. The purpose of this research study is to understand the social context associated with hookah use among college students. Hookah use is on the rise across the country and it is important to better understand factors associated with its use.
Procedures	You are being asked to complete a survey, which will take approximately 10 minutes. You will be compensated with a \$10 gift card for your time.
Potential Risks and Discomforts	There are no known risks from participating in this research study.
Potential Benefits	This research is not designed to help you personally, but the results may help the investigators learn more about hookah use among college students. We hope that, in the future, other people might benefit from this study through improved understanding of factors that influence hookah use among college students.
Confidentiality	The survey is anonymous and will not contain information that may personally identify you. We will not collect any other identifying data such as social security numbers, student identification number, addresses, or phone numbers. We will take several steps to help protect your confidentiality. The completed survey responses will be stored in locked file cabinets, in a locked room. Only the primary investigator and the co-investigator will have access to the file drawer keys.
Medical Treatment	<i>The University of Maryland does not provide any medical, hospitalization or other insurance for participants in this research study, nor will the University of Maryland provide any medical treatment or compensation for any injury sustained as a result of participation in this research study, except as required by law.</i>
Right to Withdraw	<i>Your participation in this research is completely</i>

<p>and Questions</p>	<p><i>voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify.</i></p> <p><i>If you decide to stop taking part in the study, if you have questions, concerns, or complaints, or if you need to report an injury related to the research, please contact the investigator, Dr. Pamela Clark at: 2387 SPH Bldg, Dept. of Public and Community Health, College Park 20742 Ph no: 301-405 2486 email:clarkp@umd.edu</i></p>	
<p>Participant Rights</p>	<p><i>If you have questions about your rights as a research participant or wish to report a research-related injury, please contact:</i></p> <p style="text-align: center;">University of Maryland College Park Institutional Review Board Office 1204 Marie Mount College Park, Maryland, 20742 E-mail: irb@umd.edu Telephone: 301-405-0678</p> <p><i>This research has been reviewed according to the University of Maryland, College Park IRB procedures for research involving human subjects.</i></p>	
<p>Statement of Consent</p>	<p><i>Your signature indicates that you are at least 18 years of age; you have read this consent form or have had it read to you; your questions have been answered to your satisfaction and you voluntarily agree to participate in this research study. You will receive a copy of this signed consent form.</i></p> <p><i>If you agree to participate, please sign your name below.</i></p>	
<p>Signature and Date</p>	<p>PARTICIPANT NAME [Please Print]</p>	
	<p>PARTICIPANT SIGNATURE</p>	
	<p>DATE</p>	

Appendix V: Smoking Cessation Resources

American Lung Association MD (free)

Executive Plaza I, Ste. 600
11350 McCormick Rd
Hunt Valley MD 21031
Helpline: 800-548-8252

Montgomery County Health Dept. (free)

1335 Piccard Dr, Lower Level
Rockville, MD 20850
240-777-1222

Dimension Healthcare Systems (free)

PG Hospital Center
3001 Hospital Center Dr.
Cheverly, MD 20785
301-618-6363

Northwood Presbyterian Church (free)

1200 W. University Blvd
Silver Spring, MD 20902
410-964-2180

Sibley Memorial Hospital (free)

5255 Loughboro Rd
Washington, DC 20016
202-537-4500

Shady Grove Adventist Hospital (free)

9901 Medical Center Dr
Rockville, MD 20850
800-542-5096

Kaiser Permanente (members free)

Various locations in MD
800-444-6696
301-877-7370

Freedom from Smoking (free)

Southern Maryland Hospital
7503 Surratts Rd
Clinton, MD 20735

Holy Cross Hospital (free)

Professional and Community Education Center
1500 Forest Glen Rd
Silver Spring, MD 20910
301-754-7149

Appendix VI: Hookah Use Questionnaire

ID #:
Initials:
Date:
Location:

Thank you for helping us with this survey. The information you give will be used to develop an instrument that will measure social context of smoking hookah among college students. Please **DO NOT** put your name on the survey. You do not have to answer any questions you do not want to answer and can stop participating at any time. Make sure to read every question. If you have questions about any of the items, you may ask the research staff who administering this survey. The questions that ask about your demographics will be used only to describe the types of students completing this survey. The information will not be used to identify you. Once you have completed the questionnaire, you can hand it back to the study staff.

A. DEMOGRAPHIC INFORMATION

1. Birthdate: ___/___/___ (mm/dd/yyyy)
2. Gender: _____ Male _____ Female
3. Marital Status:
_____ Legally Married
_____ Living with Partner/Cohabiting
_____ Widowed
_____ Separated
_____ Divorced
_____ Never Married
_____ Unknown
4. Ethnicity: _____ Hispanic or Latino
_____ Not Hispanic or Latino
5. Race: (mark all that apply)
__ American Indian, or Alaska Native
__ Asian (*Country of Origin:* _____)
__ White
__ Black, or African-American
__ Native Hawaiian or Pacific Islander
6. Years of Formal Education (GED= 12 years): ___ years

B. USE OF HOOKAH

B1. Have you ever used a Hookah to smoke tobacco? _____ Yes _____ No
If No, end survey

B2. How old were you when you first used a Hookah to smoke tobacco?
..... years

B3. Who were you with when you first used hookah to smoke tobacco?
..... Alone
..... With a friend
..... With more than one friend
..... With a family member
..... With more than one family member
..... Other (Specify: _____)

B4. Where were you when you first used a hookah to smoke tobacco?
..... In a café or restaurant
..... In my own home
..... At a family member's house
..... At a fraternity house
..... At a friend's home
..... Dorm room
..... Other (Specify: _____)

B5. Which of the following choices best describes how often you smoke a hookah?

..... At least once a year, but not monthly
..... At least once a month, but not weekly
..... At least once a week, but not daily
..... At least once a day, or most days each month

B6. Approximately how many times did you smoke a hookah in the past 30 days?
.....days

C. CIGARETTE SMOKING

C1. Have you smoked at least 100 cigarettes, approximately 5 packs of cigarettes, in your lifetime?

YES..... 1

NO.....2 (***If NO, skip to section D***)

C2. About how old were you when you first tried cigarettes, even one or two puffs?
..... years

C3. How old were you when you started smoking regularly? years

C4. Do you now smoke cigarettes every day, some days, or not at all?

..... EVERY DAY

..... SOME DAYS (***Skip to section D***)

..... NOT AT ALL (***Skip to section D***)

C5. On an average how many cigarettes do you smoke in a normal day?

.....

D. CIGAR USE

- D1. Have you used or tried smoking a cigar?
 YES..... 1
 NO.....2 (*If NO, skip to section E*)
- D2. About how old were you when you first tried smoking cigars? years
- D3. Do you now smoke cigars every day, some days, or not at all?
 EVERY DAY
 SOME DAYS (*Skip to section E*)
 NOT AT ALL(*Skip to section E*)
- D4. During the past 30 days, on how many days did you smoke cigars?
 days

E. CHEWING TOBACCO USE

- E1. Have you used or tried chewing tobacco?
 YES..... 1
 NO.....2 (*If NO, skip section G*)
- E2. About how old were you when you first tried chewing tobacco?..... years
- E3. Do you now chew tobacco every day, some days, or not at all?
 EVERY DAY
 SOME DAYS (*If NO, skip to section G*)
 NOT AT ALL (*If NO, skip to section G*)
- E4. During the past 30 days, on how many days did you chew tobacco?days

G. Social Context of Smoking Hookah

How often do you use hookah?	Never	Seldom	Occasionally	Frequently
1. At a party				
2. In the dorms/off campus housing				
3. At friend's place				
4. At home				
5. At relative's house				
6. In hookah bars and cafés				
7. To get rid of boredom				
8. Because I like the smell				
9. Because I like the taste				
10. Because my friends smoke hookah				
11. Because it relaxes me				
12. To socialize with friends				
13. To smoke marijuana or other substances using hookah				
14. Because it is part of my culture/tradition				
15. Because it is something to do when I have free time				
16. Because it is easily accessible				
17. Because it is cool/trendy/hip/exotic				
18. Because I am not old enough to go to bars (to drink alcohol) but I can go to hookah cafés				
19. Because it is something to do during weekends				
20. Because I like going to the hookah bars				
21. Because it is socially more accepted than smoking cigarettes				
22. Because it is legal				
23. Because it is less addictive than cigarettes				
24. Because it is less harmful than cigarettes				
25. Because my friend owns a hookah				
26. Because I own a hookah				
27. Because it is an alternative to drinking with friends				
28. To blend with others who smoke				
29. Because I like the buzz from smoking hookah				
30. Because the buzz does not affect my sobriety like alcohol				
31. It is just another thing to smoke				
32. Because I can do other activities while smoking hookah like reading, talking, eating etc.				
33. Because I like the flavors of				

tobacco				
34. Because it enhances the effect of alcohol				
35. Because I enjoy doing tricks with the smoke				
36. Because It is a habit				
37. Because I can smoke it indoors				
38. Because it is cheap				
39. For bonding with friends				
40. To come down after drinking alcohol				
41. Before or after a party				
42. During school year				
43. In the morning				
44. In the evening				
45. While studying during exams				
46. With a friend				
47. With more than one friend				
48. Alone				
49. With a relative				
50. With more than one relative				

H. Listed below are a number of statements concerning personal attitudes and traits. Read each item and decide whether the statement is true or false as it pertains to your personally.

1. Before voting I thoroughly investigate the qualifications of all the candidates.
 - a. True
 - b. False
2. I never hesitate to go out of my way to help someone in trouble.
 - a. True
 - b. False
3. It is sometimes hard for me to go on with my work if I am not encouraged.
 - a. True
 - b. False
4. I have never intensely disliked anyone.
 - a. True
 - b. False
5. On occasions I have had doubts about my ability to succeed in life.
 - a. True

b. False

6. I sometimes feel resentful when I don't get my way.

a. True

b. False

7. I am always careful about my manner of dress.

a. True

b. False

8. My table manners at home are as good as when I eat out in a restaurant.

a. True

b. False

9. If I could get into a movie without paying and be sure I was not seen I would probably do it.

a. True

b. False

10. On a few occasions, I have given up something because I thought too little of my ability.

a. True

b. False

11. I like to gossip at times.

a. True

b. False

12. There have been times when I felt like rebelling against people in authority even though I knew they were right.

a. True

b. False

13. No matter who I'm talking to, I'm always a good listener.

a. True

b. False

14. I can remember "playing sick" to get out of something.

a. True

b. False

15. There have been occasions when I have taken advantage of someone.

a. True

b. False

16. I'm always willing to admit it when I make a mistake.
- a. True
 - b. False
17. I always try to practice what I preach.
- a. True
 - b. False
18. I don't find it particularly difficult to get along with loudmouthed, obnoxious people.
- a. True
 - b. False
19. I sometimes try to get even rather than forgive and forget.
- a. True
 - b. False
20. When I don't know something I don't mind at all admitting it.
- a. True
 - b. False
21. I am always courteous, even to people who are disagreeable.
- a. True
 - b. False
22. At times I have really insisted on having things my own way.
- a. True
 - b. False
23. There have been occasions when I felt like smashing things.
- a. True
 - b. False
24. I would never think of letting someone else be punished for my wrong-doings.
- a. True
 - b. False
25. I never resent being asked to return a favor.
- a. True
 - b. False
26. I have never been irked when people expressed ideas very different from my own.
- a. True
 - b. False

27. I never make a long trip without checking the safety of my car.
- a. True
 - b. False
28. There have been times when I was quite jealous of the good fortune of others.
- a. True
 - b. False
29. I have almost never felt the urge to tell someone off.
- a. True
 - b. False
30. I am sometimes irritated by people who ask favors of me.
- a. True
 - b. False
31. I have never felt that I was punished without cause.
- a. True
 - b. False
32. I sometimes think when people have a misfortune they only got what they deserved.
- a. True
 - b. False
33. I have never deliberately said something that hurt someone's feelings.
- a. True
 - b. False

Appendix VII: College Tobacco Survey

Please read every question. Try to answer all the questions.

A. Demographic Information

7. Age: _____ years
8. Gender: _____ Male _____ Female
9. Marital Status:
- | | |
|--------------------------------------|---------------------|
| _____ Legally Married | _____ Separated |
| _____ Living with Partner/Cohabiting | _____ Divorced |
| _____ Widowed | _____ Never Married |
| _____ Unknown | |
10. Ethnicity: _____ Hispanic or Latino
_____ Not Hispanic or Latino
11. Race: (mark all that apply)
- ___ American Indian, or Alaska Native
 - ___ Asian (*Country of Origin:* _____)
 - ___ White
 - ___ Black, or African-American
 - ___ Native Hawaiian or Pacific Islander
 - ___ Other (Specify: _____)
12. Father's country of origin:
13. Mother's country of origin:
14. Paternal grandfather's country of origin:
15. Paternal grandmother's country of origin:
16. Maternal grandfather's country of origin:
17. Maternal grandmother's country of origin:
18. Religion: _____ Christian _____ Muslim _____ Hindu
_____ Jewish _____ Other (specify _____)
19. Year in college: Freshmen _____ Sophomore _____ Junior _____ Senior _____

B. Background Information

- B1. Have you ever been a member of an athletic team? Yes No
- B2. Are you a currently a member of an athletic team? Yes No

- B3. Have you ever been a member of a fraternity or sorority? Yes No
 B4. Are you currently a member of a fraternity or sorority? Yes No
 B5. What is your current living situation (during school year)?
 _____ Living in campus dorm
 _____ Living off-campus with housemates
 _____ Living off-campus alone
 _____ Living with parents/relatives
 _____ Other (specify _____)

The next section of the survey will ask questions about your tobacco use

C. WATERPIPE/HOOKAH SMOKING

- C.1 How often have you used a Hookah to smoke tobacco?
 _____ Never used (skip to C.4)
 _____ Used, but not in the past 12 months
 _____ Used, but not in the past 30 days
 _____ Used in the past 30 days
(If used in the past 30 days, approximately on how many days in the past 30 days did you smoke hookah? _____)

C.2 If you have ever smoked hookah, how old were you when you first used a Hookah?
 years

C.3 Do you own your own hookah **Yes** **No**

C.4 Peer smoking

- C.4.1 Does your best friend smoke hookah? **Yes** **No**
 C.4.1 If you are currently involved in a relationship (i.e., spouse, boyfriend, girlfriend),
 does your partner smoke hookah? **Yes** **No**
 C.4.3 If you have roommates, do they smoke hookah? **Yes** **No**

C. 5 Resistance self efficacy

- 1- I am very sure I would smoke
- 2- I most likely would smoke
- 3- I probably would smoke
- 4- I probably would NOT smoke
- 5- I most likely would NOT smoke
- 6- I am very sure I would NOT smoke

HOW SURE ARE YOU THAT YOU COULD RESIST SMOKING Hookah:	1	2	3	4	5	6
When you are at a friend's house, no adults are home						
When you are playing video games						
When you are at the mall with friends						
When you are roller skating						

When you are watching TV						
When you see others smoking						
When you are doing homework						
When you are uptight						
When you are riding your bike						
When you are angry						
When you are at a party						
When someone offers you a hookah to smoke						
When you want to look cool						
When you are at school during break or after classes						
When you want to feel more grown up						
When you are bored						
When you want to look better						
When you want to take a break from studying						
When you feel ashamed						
When you are waiting to go into the movies						
When you are waiting for someone						
When you feel restless						
When you are playing in your neighborhood						
When you feel frustrated						
When you want to feel more accepted by friends						
When you are worried						
When you feel upset						
When you feel down						
When you feel nervous						
When you feel sad						
When your best friend is smoking						
When you are listening to rock music						
When your friends are smoking						
When you are by yourself						
When your brother or sister is smoking						

D. CIGARETTE SMOKING

D.1 How often have you smoked a cigarette?

- _____ Never (If yes, skip to D.4)
- _____ Smoked, but not in the past 12 months
- _____ Smoked, but not in the past 30 days
- _____ Smoked in the past 30 days

(If used in the past 30 days, approximately on how many days in the past 30 days did you smoke cigarettes? _____)

D. 2. About how old were you when you first tried cigarettes, even one or two puffs?
 years

D. 3 Do you smoke cigarettes every day? **Yes** **No (Skip to D4)**

D.3.1 On an average, how many cigarettes do you smoke per day?

D. 3.2 About how old were you when you started smoking cigarettes daily
 years

D.4 Peer smoking

D.4.1 Does your best friend smoke cigarettes? **Yes** **No**

D.4.2 If you are currently involved in a relationship (i.e., spouse, boyfriend, girlfriend),
 does your partner smoke cigarettes? **Yes** **No**

D.4.3 If you have roommates, do they smoke cigarettes? **Yes** **No**

D.5 . Resistance self efficacy

- 1- I am very sure I would smoke
- 2- I most likely would smoke
- 3- I probably would smoke
- 4- I probably would NOT smoke
- 5- I most likely would NOT smoke
- 6- I am very sure I would NOT smoke

HOW SURE ARE YOU THAT YOU COULD RESIST SMOKING cigarettes:	1	2	3	4	5	6
When you are at a friend's house, no adults are home						
When you are playing video games						
When you are at the mall with friends						
When you are roller skating						
When you are watching TV						
When you see others smoking						
When you are doing homework						
When you are uptight						
When you are riding your bike						
When you are angry						
When you are at a party						
When someone offers you a cigarette						
When you want to look cool						
When you are at school during break or after classes						
When you want to feel more grown up						
When you are bored						

When you want to look better						
When you want to take a break from studying						
When you feel ashamed						
When you are waiting to go into the movies						
When you are waiting for someone						
When you feel restless						
When you are playing in your neighborhood						
When you feel frustrated						
When you want to feel more accepted by friends						
When you are worried						
When you feel upset						
When you feel down						
When you feel nervous						
When you feel sad						
When your best friend is smoking						
When you are listening to rock music						
When your friends are smoking						
When you are by yourself						
When your brother or sister is smoking						

E. CIGAR USE

E.1. How often have you smoked a cigar?

- _____ Never (Skip to E.4)
- _____ Smoked, but not in the past 12 months
- _____ Smoked, but not in the past 30 days
- _____ Smoked in the past 30 days

(If used in the past 30 days, approximately on how many days in the past 30 days did you smoke cigars? _____)

E. 2. About how old were you when you first tried cigars, even one or two puffs?

..... years

E. 3 Do you smoke cigars every day? Yes No (Skip to E. 4)

E.3.1 On an average, how many cigars do you smoke per day?

E. 3.2 About how old were you when you started smoking cigars daily years

E.4. Peer smoking

E.4.1 Does your best friend smoke cigars? Yes No

E.4.2 If you are currently involved in a relationship (i.e., spouse, boyfriend, girlfriend), does your partner smoke cigars? Yes No

E.4.3 If you have roommates, do they smoke cigars? Yes No

E.5. Resistance self efficacy

- 1- I am very sure I would smoke
- 2- I most likely would smoke
- 3- I probably would smoke
- 4- I probably would NOT smoke
- 5- I most likely would NOT smoke
- 6- I am very sure I would NOT smoke

HOW SURE ARE YOU THAT YOU COULD RESIST SMOKING Cigars:	1	2	3	4	5	6
When you are at a friend's house, no adults are home						
When you are playing video games						
When you are at the mall with friends						
When you are roller skating						
When you are watching TV						
When you see others smoking						
When you are doing homework						
When you are uptight						
When you are riding your bike						
When you are angry						
When you are at a party						
When someone offers you a cigar						
When you want to look cool						
When you are at school during break or after classes						
When you want to feel more grown up						
When you are bored						
When you want to look better						
When you want to take a break from studying						
When you feel ashamed						
When you are waiting to go into the movies						
When you are waiting for someone						
When you feel restless						
When you are playing in your neighborhood						
When you feel frustrated						
When you want to feel more accepted by friends						
When you are worried						
When you feel upset						
When you feel down						
When you feel nervous						

When you feel sad						
When your best friend is smoking						
When you are listening to rock music						
When your friends are smoking						
When you are by yourself						
When your brother or sister is smoking						

F. Perceived susceptibility

1. Describe the likelihood of getting **sick** (e.g., dizziness, nausea, vomiting, abdominal pain, diarrhea, sweating, blurred vision, or headache) when using the tobacco products socially or by yourself.

	Likelihood of getting <i>sick</i> when used alone		Likelihood of getting <i>sick</i> when used socially	
Hookah	None	Low	None	Low
	Medium	High	Medium	High
Cigarettes	None	Low	None	Low
	Medium	High	Medium	High
Cigars	None	Low	None	Low
	Medium	High	Medium	High

2. Describe the likelihood of getting **addicted** when using the tobacco products socially or by yourself.

	Likelihood of getting <i>addicted</i> when used alone		Likelihood of getting <i>addicted</i> when used socially	
Hookah	None	Low	None	Low
	Medium	High	Medium	High
Cigarettes	None	Low	None	Low
	Medium	High	Medium	High
Cigars	None	Low	None	Low
	Medium	High	Medium	High

G. Risk taking/sensation seeking

For each item, indicate which response best applies to you:

	Describes me very well	Describes me somewhat	Does not describe me very well	Does not describe me at all
1. I can see how it would be interesting to marry someone from a foreign country.				
2. When the water is very cold, I prefer not to swim even if it is a hot day. (-)				
3. If I have to wait in a long line, I'm usually patient about it. (-)				
4. When I listen to music, I like it to be loud.				
5. When taking a trip, I think it is best to make as few plans as possible and just take it as it comes.				
6. I stay away from movies that are said to be frightening or highly suspenseful. (-)				
7. I think it's fun and exciting to perform or speak before a group.				
8. If I were to go to an amusement park, I would prefer to ride the rollercoaster or other fast rides.				
9. I would like to travel to places that are strange and far away.				
10. I would never like to gamble with money, even if I could afford it.(-)				
11. I would have enjoyed being one of the first explorers of an unknown land.				
12. I like a movie where there are a lot of explosions and car chases.				

13. I don't like extremely hot and spicy foods. (-)				
14. In general, I work better when I'm under pressure.				
15. I often like to have the radio or TV on while I'm doing something else, such as reading or cleaning up.				
16. It would be interesting to see a car accident happen.				
17. I think it's best to order something familiar when eating in a restaurant. (-)				
18. I like the feeling of standing next to the edge on a high place and looking down.				
19. If it were possible to visit another planet or the moon for free, I would be among the first in line to sign up.				
20. I can see how it must be exciting to be in a battle during a war.				

Appendix VIII: Informed consent form (College Tobacco Survey)

Dear Students,

You are invited to take an online survey being conducted by Dr. Pamela Clark at the University of Maryland, College Park. The purpose of this study is to understand predictors that influence tobacco use among college students, hookah in particular.

We are inviting you to participate in this survey because you are a college student, 18 years of age or older. Completion of this survey will take approximately 45 minutes. You will earn one research credit for your participation. The survey will be collected using surveymonkey.com, which is a secure online survey tool.

By typing your name below you agree that you read this informed consent and you are willing to participate in this survey. This survey is voluntary; your decision to participate or not participate will not affect your grade. You can exit the survey at any time. There are no known risks from participating in this research study. Although the data collected is identifiable, it will be protected by law. The survey software (surveymonkey®) will also collect and store the Internet Protocol (IP) of the computer you use to take the survey. The downloaded data will be kept on a password protected computer.

If you have any questions about the survey, please contact Dr. Pamela Clark at 2387 SPH Bldg, Dept. of Behavioral and Community Health, College Park 20742, Ph no: 301-405-8624, email:clarkp@umd.edu

You may print a copy of this consent form for your records.

To take the survey, please click the following link:

<https://www.surveymonkey.com/s/GFQT5N6>

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