FACTORS ASSOCIATED WITH HOOKAH PIPE SMOKING AMONG UNDERGRADUATE STUDENTS AT THE UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

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A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg in partial fulfilment of the requirements for the degree of Master of Medicine in the branch of Paediatrics and Child Health

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DECLARATION

I, Kuban Dhasaradha Naidoo, declare that this research report is my own work. It is being submitted for the degree of Master of Medicine in the branch of Paediatrics and Child Health, to the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other university.

Kuban Dhasaradha Naidoo

On the 27th day of April 2012

DEDICATION

This research project is dedicated to my wife, Shireen and to my parents. Without their belief and encouragement, this project would never have come to fruition.

ABSTRACT

Introduction

Hookah pipe smoking has experienced a prodigious growth in popularity during the past two decades resulting in the adoption of this centuries old practice by scores of new, and often young, smokers. This exposes more young people to the risk of developing tobacco-related diseases. This study aimed to explore hookah pipe smoking in young adults in a South African setting.

Methods

In this cross sectional study conducted at the University of the Witwatersrand, Johannesburg, 824 undergraduate students were enrolled from randomly selected classes. Students completed a 40 item self-administered questionnaire exploring participants' demographics, smoking behaviours, and knowledge, attitudes and practices relating to hookah pipe smoking. Univariate and multivariate analysis of factors associated with hookah pipe smoking behaviour were conducted.

Results

More than half the students (54.2%) had "ever" smoked a hookah pipe, while 14.7% were "current" (each of the past 3 months) smokers. On multivariate analysis, statistically significant factors associated with increased likelihood of "ever" using a hookah pipe were: being "White" (odds ratio [OR] 3.08, 95% confidence interval [95% CI] 1.83-5.18) or "Indian" (OR 2.00, 95% CI 1.07-3.72), previous cigarette use (OR 9.36, 95% CI 6.05-14.50), having a family member (OR 3.22, 95% CI 1.98-5.26) or friends (OR 7.16, 95% CI 3.96-12.92) who had smoked a hookah pipe and holding the following false beliefs regarding the adverse health effects associated with hookah pipe smoking: hookah pipes are not dangerous (OR 3.60, 95% CI 1.18-10.93), hookah pipes are not addictive (OR 7.39, 95% CI 3.84-14.23) and the second hand smoke produced by hookah pipes is not harmful to other people (OR 2.19, 95% CI 1.02-4.72).

"Current" hookah pipe smokers demonstrated poorer knowledge of the adverse health effects of hookah pipe smoking and held more positive attitudes of the practice compared to other students. Usage of hookah pipes tended to be intermittent with only 11.8% of students reporting daily use. The majority of "current" hookah pipe smokers (57.1%) smoked on the university campus.

Adding alcohol and/or marijuana to hookah pipes was reported by just over half of the "current" hookah pipe users.

Conclusion

Hookah pipe smoking was prevalent among undergraduate students at this university. The study identified several factors associated with hookah pipe use, enabling the development of better targeted strategies to arrest this problem.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Hookah pipe smoking is a centuries old habit, believed by some to have originated in India approximately 500 years ago during the time of the Mughal Empire.[1,2] Its spread along the trade routes between south west Asia and the Middle East resulted in the dissemination of this pastime to most of the countries of the Middle Eastern region. Here the smoking of hookah pipes became largely confined to the social domains of older men.[3-5]

However, hookah pipe smoking has steadily increased amongst adolescents and young adults during the past two decades in Europe and North America, with recent reports of usage in Brazil, Korea, Australia and New Zealand.[3,6-10] This form of tobacco use is a significant contributor to the maintenance of high rates of tobacco use among youth and young adults, especially university students, in effect negating the gains achieved by the global decline in overall cigarette smoking in recent years.[11-14] Indeed, the tsunami-like wave of hookah pipe popularity has led to suggestions that hookah pipe smoking represents the second major tobacco epidemic.[15]

Design of hookah pipes

Hookah pipes come in a variety of sizes, designs, colours and materials.[16,17] Some have even been made into works of art by skilled craftsmen in India and the Middle East.[2,18] Globally they have come to be known by many names including hubble bubble, shisha, water pipe, goza, argileh or narghile.[19,20] Despite minor variations that exist between different hookah pipes, the majority consist of the same four basic components:[16,21,22]

- A bowl (head) where the hookah tobacco is placed and heated
- A vase (smoke chamber/body) which is partially filled with water
- A pipe (stem) connecting the bowl to the vase by a tube that carries the smoke down into the water
- A hose with a mouthpiece through which the smoke is drawn from the vase

The hookah tobacco, which is placed in the bowl, is heated indirectly by burning embers or charcoal placed upon the tobacco.[23] The charcoal is often placed on perforated aluminium foil to

prevent direct contact with the tobacco.[24] Hookah smoke is produced at a temperature of approximately 450 degrees Celsius which is about half the temperature at which mainstream cigarette smoke is produced.[3] Inhalation by the smoker draws air over the burning charcoal, thereby heating the tobacco and producing smoke.[24] The smoke is then sucked down the pipe into the vase wherein it passes through the water and bubbles up into the air of the smoke chamber finally reaching the smoker via the hose and mouthpiece.[25] The water cools the smoke and partially filters out some of the tar and particulates contained within the smoke.[2] The filtration process results in progressive brownish discoloration of the water within the vase as the smoking session proceeds, usually necessitating a change of water after each smoking session.[26] Typical hookah pipe smoking sessions last between 30 and 60 minutes but significant variation exists.[21,24,27]

1.3 Factors promoting the increase in hookah pipe popularity

The phenomenal surge in the popularity of hookah pipe smoking has been linked to several factors.[8,16,28] The relatively recent establishment of the 'global community' fuelled by technological advancements such as the Internet and satellite television together with a greater influx of immigrants of Middle Eastern descent into Europe and North America has led to unprecedented exposure to the hookah pipe.[8,29] This 'new dawn' coincided with the introduction of 'maasel' which is a manufactured sweetened or flavoured tobacco.[8,29]

Maasel has proved popular on two levels. Firstly the burning of maasel, imbued with fruit and other flavours, produces a smoke with a remarkably pleasant aroma. Secondly, maasel has resulted in a simplification of the preparation process associated with the hookah pipe.[8,29] Another innovation which has further accelerated the preparation process has been the advent of quick lighting charcoal.[1,28] The reduction in preparation time has found favour particularly among younger smokers in this era of instant gratification.[1]

The beliefs that hookah pipe smoking is less harmful and less addictive than cigarette smoking also seems to play a significant role in increased usage in both the previously tobacco naïve and former cigarette smokers.[16,24,30] The pleasant smell and perceived relative safety has probably underpinned hookah pipe smoking enjoying a significantly better societal acceptance than other forms of smoking.[4,16] Some authors cite the unique degree of parental acceptance as a significant

contributing factor to the increased popularity particularly among younger smokers.[4,16,31] Favourable societal acceptance has also resulted in increased tobacco usage among women in the Middle East, many of whom were previously tobacco naïve in accordance with previously established societal norms.[8,32] Alarmingly, the habit also appears to be finding favour among pregnant women in the Middle East with as many as 25% reporting hookah pipe use during their pregnancies.[33]

Another powerful factor driving the epidemic is the conviviality inherent to the social setting in which the hookah pipe is usually smoked.[23,28,34] Hookah pipe smokers report that the practice fosters a sense of togetherness and in those of Middle Eastern descent, a further reinforcement of cultural identity.[23] The link between the emergence of hookah pipe smoking and clusters of people of Middle Eastern descent appears to have served as a springboard for the subsequent spread of the habit to people of various ethnicities.[9,16]

The final factor promoting the popularity of the habit among youth in particular is the greater accessibility to hookah pipe than other recreational 'drugs' such as cigarettes or alcohol.[31] The costs associated with hookah pipe smoking are considerably less than cigarettes.[16,22] Furthermore young people are able to meet and socialise at hookah bars and cafes while it is illegal for those less than 18 years (sometimes 21 years) to purchase alcohol at bars/pubs.[2,35]

1.4 Risks associated with hookah pipe use

Concerns regarding the significant increase in hookah pipe smoking stems from multiple considerations.[11,27] Firstly, the suggested health risks associated with both tobacco use and the possibility of increased infectious disease transmission from shared mouth-pieces.[20,36] Secondly, the pervasiveness of common misconceptions or "myths" amongst both users of the hookah pipe as well as even health professionals hinder efforts to raise awareness of the health risks.[4,16] Thirdly, hookah pipe smoking has been proven to be an effective mechanism of nicotine delivery thereby placing the user at significant risk of developing nicotine dependence.[5] Fourthly, there is some concern that the growth of hookah pipe smoking may pave the way to increased experimentation and possible abuse of other psychotropic substances such as alcohol or "harder" drugs.[16] This increased experimentation is particularly worrying as it appears that hookah pipes are being used by groups (such as athletes) who have traditionally tended to be tobacco naïve.[12]

Lastly recent evidence suggests that environmental air contamination by hookah pipe smoke may also place non-smokers at risk, despite the deceptively pleasant aromas produced by mint or fruit flavoured tobaccos.[37,38]

1.4.1 Toxic constituents

Analysis of the constituents of hookah pipe smoke has revealed significant overlap with those carcinogens traditionally found in cigarette smoke, namely carbon monoxide, nicotine, nitrosamines and tar, as well as pulmonary disease causing volatile aldehydes and a variety of heavy metals such as arsenic, nickel, cobalt, chromium, cadmium and lead.[4,7,21,30] The smoke also contains combustion products of charcoal including carcinogenic polycyclic aromatic hydrocarbons and carbon monoxide.[39]

Although it has been claimed that participating in a single hookah pipe session yields the equivalent toxicant exposure as smoking up to as many as fifty cigarettes, attempts to definitively quantify the toxicant exposure from a single hookah pipe smoking session has thus far proved difficult due to the significant number of variables involved, such as the highly variable participation of any given individual within the setting of a hookah pipe smoking session, the size of the hookah pipe, the duration of the smoking session, the constituents of the tobacco used and the type of charcoal used.[8,27]

Notwithstanding the difficulties created by the variables listed above, experiments to compare toxicant exposure resulting from smoking a hookah pipe versus a cigarette have been done in South Africa and the United States. The mean pre-smoking carboxyhaemoglobin concentrations determined by these experiments ranged from 0.8 to 1.0% for hookah pipe smokers 1.0 to 2.9% for cigarette smokers. Ultimately, both groups of researchers found that the increase in plasma carboxyhaemoglobin concentration following hookah pipe smoking was substantially greater than that following cigarette smoking.[7,40]

One of the criticisms undermining the results of research comparing the health effects of hookah pipe to cigarette smoking has related to the longer duration of a hookah pipe session compared to the time taken to smoke a single cigarette.[27] In response to this concern, the American researchers also measured the serum carboxyhaemoglobin levels five minutes after the commencement of smoking both hookah pipes and cigarettes (five minutes being the mean time

taken to smoke a single cigarette). At that common point in time, hookah pipe smoking had resulted in a four-fold greater increase in plasma carboxyhaemoglobin concentration than cigarette smoking.[7]

This laboratory evidence has been borne out by two recent (2009) case reports of a nineteen year old student in Singapore and a twenty five year old Turkish man who both suffered carbon monoxide poisoning following hookah pipe smoking sessions.[41,42] Their plasma carboxyhaemoglobin levels on presentation were 27.8% and 28.7% respectively, which was nearly 30 times greater than the baseline levels determined by the studies noted above.

1.4.2 Systemic illnesses

Nevertheless, the significant overlap in known toxicant exposure places hookah pipe smokers at risk for the development of similar diseases to those afflicting cigarette smokers.[5,11,43] Health risks that have been postulated thus far include malignancies (lung, oesophageal and gastric), decreased pulmonary function, cardiovascular diseases and a greater susceptibility to infectious diseases.[15,16,22] The past two years has heralded the emergence of reports confirming the deleterious effects of hookah pipe smoking. A 2010 systematic review determined that hookah pipe smoking was significantly associated with lung cancer, respiratory illness, low birth-weight and periodontal disease.[36] A subsequent meta-analysis of the effects of hookah pipe smoking on lung function provided further evidence of the deleterious effect on lung function associated with hookah pipe smoking and postulated that hookah pipe smoking is likely to be a cause of chronic obstructive airways disease.[44]

1.4.3 Infectious diseases

The common practice of the sharing of the same hookah mouth piece by participants of a hookah pipe smoking session raises the possibility of increased incidence of infectious diseases among hookah pipe smokers secondary to the transmission of various types of pathogens including viruses, bacteria and fungi.[11,16,43] Viruses implicated include herpes simplex, Ebstein-Barr and common respiratory pathogens.[16] Bacteria include Mycobacterium tuberculosis (TB), and transmission of fungi such as Aspergillus species has also been documented.[16,20,36]

1.4.4 Hookah pipe 'myths'

Misconceptions that seem to be universally prevalent include:[16]

- hookah pipe is safer than cigarettes owing to the lower nicotine content,
- the water in the pipe safely filters toxins,
- if the smoke is less irritating, it is safer for the respiratory tract, and
- the addition of fruit makes hookah pipe smoking a healthy habit

It is worth considering the possibility that the tobacco industry, via aggressive advertising campaigns in combination with the associated media hype, may have willingly created the ideal environment to continue the perpetuation of some of these misconceptions.[2]

Investigators examined a sample of 74 hookah tobacco packs from nine countries, including two sold in South Africa, and found that none complied with Article 11 of the World Health Organization's Framework Convention on Tobacco Control.[43] Nearly 80% of the packs listed the content of tar as 0.0%, and nicotine between 0.05 and 0.5%.[43] These descriptors appear to be intentionally misleading (tar is only produced upon heating the tobacco, therefore the packaged tobacco does not technically contain any tar) and serve to conceal the potential risks of smoking hookah pipes.[45] Unfortunately, despite the burgeoning body of scientific evidence to the contrary, addressing these misconceptions continues to provide a considerable challenge to authorities and health professionals wishing to curb this growing epidemic.

1.4.5 Nicotine dependence

In light of the considerable tobacco use by adolescents and young adults, aspects of nicotine dependence have been reported by various research papers during the past 15 years.[46] With respect to hookah pipe smokers, nicotine dependence appears to be a vastly underestimated risk.[21,25,47] This seems to stem from the beliefs that nicotine is effectively filtered by the water in the hookah pipes vase and that the usual intermittent nature of hookah pipe usage is incongruent with dependency.[23,24] Investigators successfully established the effectiveness of the hookah pipe as a nicotine delivery system by demonstrating elevated urinary cotinine levels, a surrogate marker of nicotine absorption, in hookah pipe smokers.[5]

From a biomedical point of view, the essential components of nicotine dependence (or addiction) include: [23]

- tolerance – diminished effects with continued use of the same amount of nicotine or need for increased amounts of nicotine to achieve psychoactive effects,
- greater use of nicotine than intended – in terms of amount used or duration of use,
- interruption of important social, occupational, or recreational activities due to amount of time spent using nicotine containing products,
- continued use despite resultant physical, psychological or social problems,
- unsuccessful attempts to cut down or quit, and
- the occurrence of withdrawal symptoms during prolonged abstinence or use reduction

Although concerns regarding dependence are infrequently reported by hookah pipe smokers, qualitative research has found a range of dependence experiences among hookah pipe smokers.[48]

Furthermore approximately 20% of teen smokers (all types of tobacco) demonstrated significant nicotine dependence lending weight to suggestions that the developing adolescent brain is more susceptible to the addictive effects of nicotine resulting in a shorter duration from time of exposure to development of dependence.[18] This has added another dimension to the complex process which underlies the decision by adolescents to start and then continue smoking. Thus, it would appear that the most effective sustained method of reducing the harm caused by tobacco products is via primary prevention, i.e. preventing people becoming addicted.[49]

1.4.6 Abuse of other psychotropic agents

It is thought that the hookah pipe was originally utilised to smoke opium and hashish until tobacco became more widely available in the 17th century.[2] Interestingly, the modern epidemic of hookah pipe smoking seems to draw inspiration from the past with reports of marijuana being added to hookah pipe tobacco.[25,50] Another psychotropic commonly being used in conjunction with the hookah pipe is alcohol, which is added to, or replacing, the water in the vase.[50] This may serve as an introduction and subsequent stepping stone to the continued use of other psychotropic drugs.[16]

1.4.7 Road traffic crashes

A novel adverse effect of hookah pipe smoking which has been recently reported is the increase in road traffic crashes associated with hookah pipe smoking.[10] Mechanisms postulated to explain this association include: (a) the effects of carbon monoxide, (b) cognitive impairments secondary to chronic nicotine exposure and (c) increased frequency of nocturnal cough producing greater fatigue, all of which could produce errors from drivers, together with the fact that prior injury histories and risky behaviours are reported to be more common in smokers.[10]

1.4.8 Dangers of second hand smoke

Until recently, the potential of environmental tobacco smoke produced by hookah pipes to damage the health of smokers and nearby non-smokers was debatable. However, it has now been shown that indoor air contamination by a variety of harmful substances does occur during hookah pipe smoking.[37] Researchers measured significant amounts of volatile organic compounds, polycyclic aromatic hydrocarbons, metals, carbon monoxide and nitrogen oxides in a room following a hookah pipe smoking session.[37] These data confirm the risks posed to smokers and non-smokers in close proximity to a hookah pipe. The population most at risk of the deleterious effects of the environmental carbon monoxide appear to be infants and young children.[26] Carbon monoxide can, by virtue of damage to the inner ear in young babies, produce irreversible hearing loss.[26] These findings support the notion that children in close proximity to hookah pipes are placed at increased risk of conditions traditionally associated with exposure to second hand cigarette smoke such as lower respiratory tract infections and allergic phenomena including asthma.[18]

1.5 Prevalence of hookah pipe smoking

1.5.1 University students

The consensus that hookah pipe smoking has increased in high income countries has thus far largely been derived from studies conducted on university students.[21,24,25,51] Studies conducted in the United States and England among university students demonstrate prevalence rates of hookah pipe use within the past 30 days ("current" use) ranging from 8–20%, which are, in general, lower than the rates of 28-42% which have been reported from countries within the Middle

Eastern region.[4,30,32] The reasons behind the difference in prevalence rates have yet to be elucidated.

The decision by researchers in high income countries to place university students at the forefront of their respective research projects appears to be vindicated by the fact that the majority of the 300 or so hookah bars that have recently sprung up in the United States are located in college towns and cities.[24,25] Furthermore, given the melting pot of cultures inevitably present on university campuses, it stands to reason that universities would provide the ideal environment to foster the cross-cultural spread of hookah pipe smoking.

1.5.2 School-aged children

More recently however, attention has turned to younger age groups, with studies conducted among American middle and high school students in Arizona and New Jersey demonstrating prevalence rates ranging from 2–17%.[35,52] Once again, these rates are lower than the 30% reported among adolescents from Estonia, Latvia, Lebanon and Slovenia and the 37-41% reported among Israeli school students.[16,43,53] Collectively, these data provide a chilling insight into the pervasiveness of hookah pipe smoking and serves as a strong call for increased attempts by authorities to stem this alarming tide.

1.6 Hookah pipes in South Africa

To date, very little has been published on this phenomenon in South African settings. Precious little is known regarding the usage of hookah pipes among South African university students despite studies conducted in Europe and North America having suggested that the prevalence appears to be highest amongst university students.[24] A 2008 study conducted among undergraduate students from two South African medical schools reported prevalence rates of 43.5% and 18.6% of "ever" and "current" hookah pipe use respectively.[54] Furthermore, a 2009 study conducted at a secondary school serving a disadvantaged community close to central Johannesburg demonstrated an astonishingly high prevalence rate of 60% of hookah pipe smoking. The study also revealed substantial rates of concurrent marijuana and alcohol use during hookah pipe smoking sessions (15% and 10% respectively).[50]

1.7 Time for a comprehensive tobacco control policy?

Despite the dearth of local data pertaining to the use of hookah pipes, it seems that joining the efforts to curb the global spread of hookah pipe (and other forms of tobacco) use, is of paramount importance. Certainly, components essential to combating the growing epidemic include a comprehensive knowledge base of the extent of the problem and the formulation of effective control strategies. The institution of active surveillance to gauge hookah pipe usage will allow for improved appreciation of the rate and patterns of spread. Investigation of the perceptions and societal views related to hookah pipe smoking will further enhance understanding of local trends. The data produced by these proposed measures will allow for the development of targeted control interventions aimed simultaneously at the prevention and cessation of hookah pipe smoking.

1.8 Does cigarette control equal hookah control?

Although it may appear tempting to view hookah pipe use as a parallel to cigarette use, and therefore utilise the well-established, existing data regarding the control of smoking to develop hookah pipe smoking control strategies, the usage patterns of hookah pipe users documented in the Middle East, in particular, show significant differences between hookah pipe and cigarette use.[23] Additionally, differences between new and established smokers are also emerging, as the hookah pipe revival continues into its third decade.[55] Thus it seems that the development of effective hookah pipe control strategies mandates a novel approach.

1.9 What this study adds

This study adds to the global picture of hookah pipe smoking by aiming to establish the factors associated with hookah pipe smoking among undergraduates drawn from multiple faculties at one of the largest universities in South Africa. The study secondarily intends to both determine the prevalence of, and investigate the knowledge, attitudes and practices of students with respect to hookah pipe smoking.

This study differs considerably from many previously published reports in that the majority of the students of the University of the Witwatersrand, Johannesburg do not have strong links to a

Middle Eastern heritage, thus exploring both the cross cultural appeal of hookah pipe smoking and the effectiveness of its spread to previously naïve populations.

Given the diverse ethnic and socio-economic backgrounds of the student population at the University of the Witwatersrand, Johannesburg, together with the wide range of social behaviours typical of these young adults, the study should provide useful insights into the hookah pipe phenomenon within a South African context, with the hope of aiding in the development of relevant and effective campaigns to arrest this growing problem.

CHAPTER TWO

2.0 METHODOLOGY

2.1 Aim and Objectives

Aim

To determine factors associated with hookah pipe smoking among undergraduate students at the University of the Witwatersrand, Johannesburg.

Objectives

1. To determine the prevalence of hookah pipe smoking among undergraduate students at the University of the Witwatersrand, Johannesburg
2. To establish factors associated with hookah pipe smoking
3. To describe the knowledge, attitudes and practices of "current" hookah pipe smokers

2.2 Study design

A cross-sectional study design was used.

2.3 Study site

Data collection occurred at the University of the Witwatersrand located in Johannesburg, Gauteng. Students were approached at lecture theatres located on the various campuses within the university.

2.4 Study period

Data collection took place between 18 and 22 October 2010. There were no holidays (public or religious) or scheduled examinations during this period.

2.5 Study population

All undergraduate students registered for the 2010 academic year at the University of the Witwatersrand, Johannesburg

2.6 Sampling

2.6.1 Inclusion criteria

- All undergraduate students with a minimum age of 18 years (voluntary participation)

2.6.2 Exclusion criteria

- All students less than 18 years of age at the time of the study
- Any student registered for a postgraduate degree

2.6.3 Sample size

The study attempted to enrol about 800 students which would represent approximately four per cent of the total undergraduate student population (2010 data provided by the Management Information Unit of the University of the Witwatersrand, Johannesburg). Studies conducted in the United States, Canada and England among university students demonstrated prevalence rates of hookah pipe use within the past 30 days ranging from 8–20%.[9,21,25] Based on an estimated local prevalence of 12% for "current" hookah pipe smoking at the University of the Witwatersrand, Johannesburg it was calculated that a sample of 800 would estimate the prevalence of "current" hookah pipe smoking with a four per cent margin of error to a power of 91%, with 95% confidence intervals. Sample size calculation was performed using STATA 11® (StataCorp, Tulsa, USA).

2.6.4 Sample selection

The University of the Witwatersrand, Johannesburg has five faculties to which the undergraduate student population belongs. Each of the faculties offers various undergraduate degree types with years of study ranging from one to six. The year of study is defined as the academic year of study rather than the number of years that a particular student has been enrolled. For the purpose of this study a class was defined as all the students belonging to the same year of study within a particular degree type, e.g. Bachelor of Pharmacy, year of study two.

There were 109 undergraduate classes at the University of the Witwatersrand, Johannesburg in total for the 2010 academic year. A list of these classes was created and classified alphabetically, stratified by faculty and degree type. The years of study within each degree type were listed in

ascending numerical order. A unique number ranging from 1 to 109 was allocated in sequence to each of the classes (Appendix A).

These classes were then randomly re-assorted to create a second list of classes (Appendix B). A computer generated random set of numbers containing all numbers from 1 to 109 was used to determine the order of the classes within Appendix B. The randomly chosen numbers were sequentially matched to the corresponding classes from Appendix A. Appendix B was then used to determine the classes approached to potentially participate in the study.

The respective faculty co-ordinators were then approached to facilitate the sampling process by providing timetables of the classes within their respective faculties. The co-ordinators also provided contact details of the relevant lecturers to allow for pre-authorisation of the researcher's presence within the lecture theatres.

Classes were then approached as per Appendix B and students were invited to participate in the study until the target sample size was achieved. In some instances, the prior conclusion of the 2010 academic programme (i.e. students were no longer attending lectures) resulted in minor deviations from the sequence contained in Appendix B. Data collection ceased following the enrolment of more than 800 students.

2.7 Study definitions

The study utilised the following list of definitions for the purpose of classification of smoking status:

Relating to hookah pipe smokers:

- "Ever" smoker – anyone who has used a hookah pipe at least once in their lifetime
- "Never" smoker – anyone who has never smoked a hookah pipe
- "Current" smoker – anyone who has used a hookah pipe at least once during each of the preceding three months*
- "Previous" smoker – any "ever" smoker that is not a "current" smoker

* The definition of "current" hookah pipe smoker utilised by this study differs from the definition adapted from the 1998 World Health Organisation guidelines. Traditionally, a "current" smoker has been defined as anyone who reports use of a hookah pipe during the past

30 days.[34] To the best of the researcher's knowledge there is no existing definition of an "established" hookah pipe user (one report proposed that "established" smokers were those with longer periods since initiation of hookah pipe smoking but did not qualify this statement).[55] In order to select against the group of individuals who may have smoked hookah pipes for the first time during the previous month, the definition of "current" smoker was broadened to encompass a three month period. This was done with an aim toward improving the quality of the knowledge, attitudes and practices data obtained from the "current" smokers.

Relating to cigarette smokers:

- "Ever" smoker – anyone who has smoked a cigarette at least once in their lifetime
- "Never" smoker – anyone who has never smoked a cigarette
- "Current" smoker – anyone who reports either "daily" or "occasional" frequency of cigarette use
- "Previous" smoker – any "ever" smoker that is not a "current" smoker
- "Established" smoker – anyone who has smoked at least 100 cigarettes in their lifetimes

2.8 Data Instruments

Self-administered questionnaires (Appendix C) were distributed to participants. The questionnaire was developed, having considered instruments used previously to assess hookah pipe tobacco smoking.[25,30,34,53] It was anticipated that the questionnaire would take about 15-20 minutes to complete, depending on the respondents hookah smoking practice.

The questionnaire included items pertaining to demographic characteristics and tobacco use behaviours of participants, as well as the tobacco use behaviours of their family and friends. Also included were questions that measured knowledge, attitudes and hookah pipe practices. Questions pertaining to attitudes and practices were largely reserved for those participants who were classified as "current" smokers (n=120).

Demographic characteristics included the following variables: age, sex, self-reported race, faculty of study and year of study. Tobacco use behaviours encompassed lifetime and current use of various types of tobacco in respect of type, age at initiation, frequency and magnitude of tobacco use. Potential future use of tobacco was also assessed.

Knowledge and perceptions of the adverse health effects associated with hookah pipe use were mostly assessed using three-point Likert-type questions. Questions also canvassed opinions on some commonly held misconceptions relating to hookah pipes including its comparative safety relative to cigarettes. Answers to the knowledge items were categorised and coded as ‘‘agree’’, ‘‘disagree’’ and ‘‘unsure’’.

Attitudes concerning hookah pipe smoking were assessed either by three-point Likert-type or multiple choice questions. Attitude items included questions about the appealing characteristics of hookah pipes, the influence of peer pressure, signs of dependence phenomena, effects of campus based control measures and use of campus quit smoking programmes. An opinion question on the regulation of hookah pipe smoking on campus was the only attitude question addressed to both hookah pipe and non-hookah pipe smokers.

The practice questions addressed patterns of smoking, including frequency, number, duration and venues of hookah pipe smoking. Questions about the sharing of hookah mouth pieces, the addition of alcohol or marijuana to hookah pipes, the average monthly cost of hookah tobacco and the usual purchase point of hookah tobacco were also asked.

2.9 Pilot Study

A pilot study was conducted on the medical school campus among members of the target population. The original questionnaire was issued to seven randomly selected students to assess clarity of the questions, time taken to complete the questionnaire and readability. The questionnaire was subsequently slightly modified based on the inputs of this pilot.

2.10 Data Collection

The questionnaires were distributed to the students of the selected classes within their lecture theatres. Permission was sought from the lecturer, to explain the nature of the study to the selected classes, prior to commencement of the lecture, and students were invited to complete questionnaires at the end of the lecture, thereby minimising the disruption to the lecture. Once the questionnaires were completed they were collected by means of collection boxes placed at the exit of the lecture theatre.

2.11 Data Management

Data was coded and captured using Microsoft Excel 2007® (Microsoft, Seattle, USA). To protect the integrity of the database, the Microsoft Excel database was write-protected and stored, whilst copies of the database were used for analysis. For the purposes of descriptive analysis, data was exported to Statistica 9.1® (Statsoft, Tulsa, USA) and STATA 11® (StataCorp, College Station, USA), which were utilised for all other analysis.

Some variables needed to be defined or calculated before they could be analysed. These were as follows:

- For purposes of data analysis the variable for family member use of cigarettes was categorized into three groups: "yes" if the participant indicated use of cigarettes by either their father or mother or siblings, "no" if response was "none" and "unsure" if response was "unsure".
- For purposes of data analysis the variable for family member use of hookah pipes was categorized into three groups: "yes" if the participant indicated use of hookah pipes by either their father or mother or siblings, "no" if response was "none" and "unsure" if response was "unsure".
- Number of years since initiation of hookah pipe smoking: the difference between the participant's current age and the age at which they started smoking hookah pipes was calculated.
- Calendar year of initiation of hookah pipe smoking: the difference between the year the study was conducted (2010) and the calculated number of years since initiation of hookah pipe smoking was calculated.
- "Current" cigarette smokers: the sum of all participants indicating either "daily" or "occasional" frequency of cigarette use.

2.12 Data Analysis

For descriptive purposes, medians (together with inter-quartile ranges [IQR]) have been reported for all variables related to age, while proportions (percentages) have been reported for all other categorical variables. Chi squared tests, t-tests, or one-way ANOVA have been used to assess

significant differences between proportions, as appropriate. All analyses considered a value of $p<0.05$ as significant with 95% confidence intervals reported for estimates.

Univariate and multivariate logistic regression models were used to determine factors associated with "ever" hookah pipe use. To build each model, the crude associations between potential factors and "ever" hookah pipe use were assessed using univariate logistic regression, reporting the unadjusted odds ratios and 95% confidence intervals. For adjusted analysis, multivariate logistic regression was undertaken, reporting the adjusted odds ratios and 95% confidence intervals. Two methods were used for variable selection to ensure that no potentially important variable was left out of the multivariate model. These included: a) a plausible relationship with the outcome variable and b) significant univariate relationship extended to a value of $p<0.10$ as acceptable.

Variables that were selected from these two selection techniques were used for modelling. Those that were significant ($p<0.05$) in the model as well as those that improved the model fit were retained in the final models.

2.13 Finance

A successful application for financial assistance was made to the University of the Witwatersrand's Faculty Research Committee, which awarded an MMed individual research grant to facilitate the completion of this study.

2.14 Ethical considerations

Ethics approval has been obtained for this study (Ethics clearance number: M10957 [Appendix D]) from the Committee for Research in Human Subjects at the University of the Witwatersrand, Johannesburg (Medical).

Permission for the study was also obtained from the Deputy Registrar-Academic and Research at the University of the Witwatersrand, Johannesburg (Appendix E). Each participant was issued with an information sheet (Appendix F) prior to the completion of the questionnaire.

No identifying data fields (name, student number) were included in the questionnaires thereby preventing the possible linkage of a questionnaire to a particular participant. Students were asked to deposit both completed questionnaires and blank questionnaires in the collection box provided

to prevent any possible discrimination between participants and non-participants. The researcher did not collect any questionnaires from students directly. The collection boxes were subsequently retrieved by the researcher. Completed questionnaires were stored in locked drawers and were accessible solely by the researcher.

Given the strong association between ethnicity and hookah pipe usage demonstrated in previous studies, the researcher deemed the question to determine "race/ethnicity" relevant to the study proposed.

Questions deemed to be of a sensitive nature e.g. "Have you ever added marijuana (dagga/weed/zol/grass/pot/ganja/hash) to your hookah pipe tobacco?" included the response option of "No comment" to reduce any potential concerns of the respective participant.

CHAPTER THREE

3.0 Results

3. 1 Descriptive Analyses

3.1.1 Demographic characteristics

A total of 831 questionnaires were completed. Seven questionnaires, which were completed by students aged 17 years or less, were consequently excluded leaving a final sample size of 824. The sample consisted of 448 females (54.4%) and 375 males (45.6%), with one participant not indicating his/her sex. The median age of the sample was 20 years (IQR: 19-21 years), with ages ranging from 18 to 32 years; 29 participants did not indicate their respective ages. All four major race groups were represented within the sample with 385 participants classifying themselves as "Black" (47.1%), 248 as "White" (30.3%), 128 as "Indian" (15.6%), 35 as "Coloured" (4.3%) while a further 22 participants reported "Other" (2.7%) as their race group (figure 3.1).

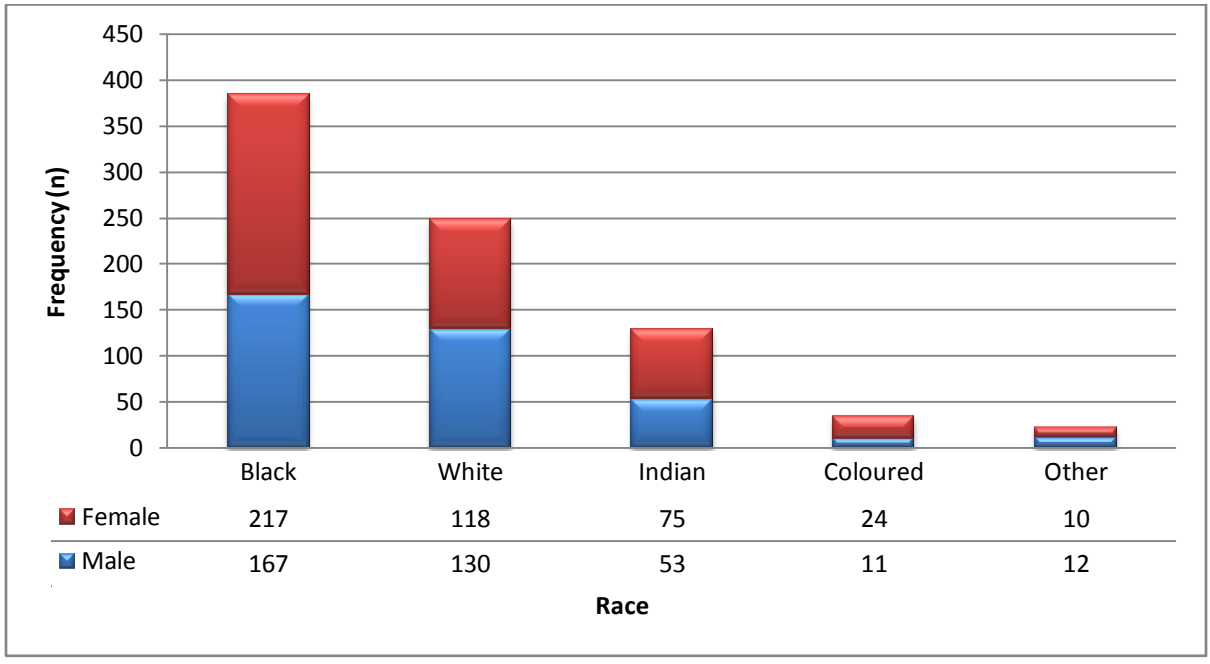

Figure 3.1 Racial distribution of participants (stratified by sex) [N=817]

The sample was drawn from all five faculties at the University of the Witwatersrand, Johannesburg. The Faculty of Engineering and the Built Environment provided the largest

number of participants with 271 (32.9%), followed by the Faculty of Commerce Law and Management with 173 (21.0%). The faculties of Health Sciences and Humanities made similar contributions with 133 (16.1%) and 131 (15.9%) participants respectively. Lastly, the smallest number of participants (116 [14.1%]) emanated from the Faculty of Science. Figure 3.2 illustrates both the relative contributions of each of the five faculties to the final sample, as well as the sample's intra-faculty sex distribution. The Faculty of Engineering and the Built Environment is the only faculty at the University of the Witwatersrand, Johannesburg with a male predominance and this was evident in the study sample. The overall predominance of female undergraduate students on campus (56.3%) is reflected in all of the remaining four faculties.

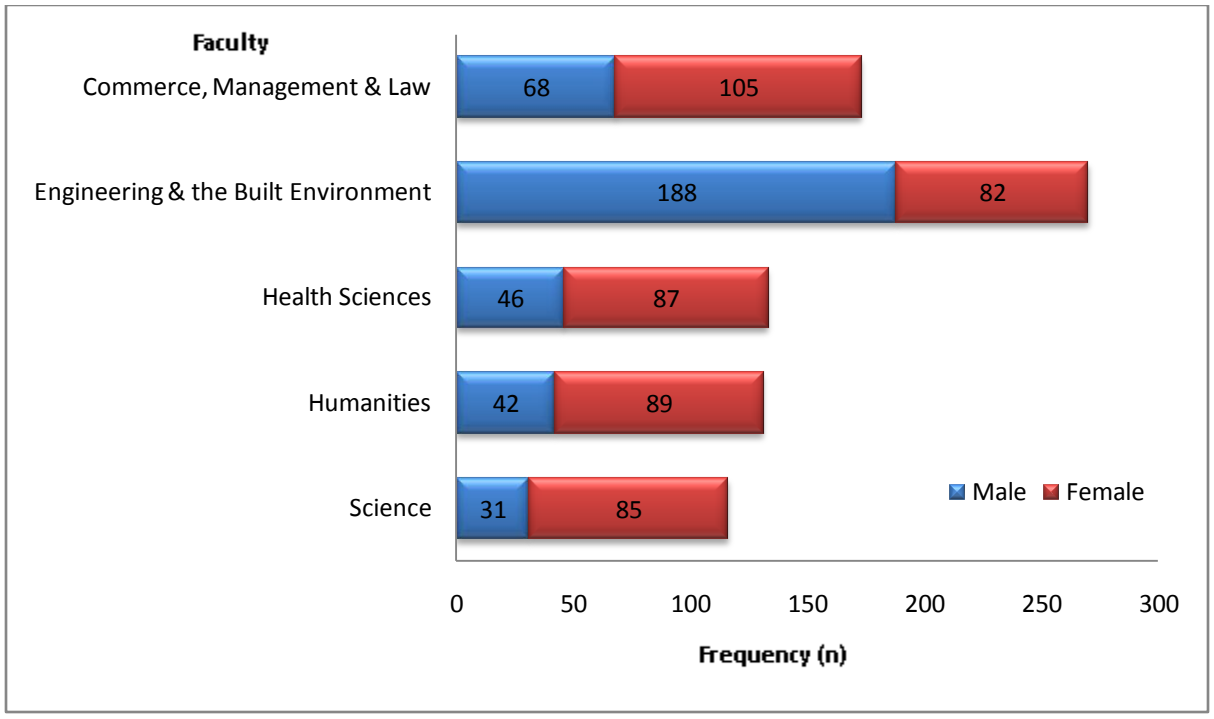

Figure 3.2 Participants' faculty affiliation (stratified by sex) [N=823]

The sample represented five of the six possible undergraduate years of study. The absence of sixth year students was due to the fact that the 2010 sixth year lecture programme had concluded prior to the data collection period. Predictably, given that nearly half of all undergraduate students are in the first year of study, the sample was dominated by first year students totalling

445 (54.0%). There were also significant numbers of second and third year students with contributions of 166 (20.1%) and 118 (14.3%) respectively. The fourth and fifth year students provided relatively modest contributions overall, with 68 fifth year students (8.3%) and 27 fourth year students (3.3%).

3.1.2 Personal history of other types of tobacco use

"Ever" use of cigars or cigarillos was reported by 190 participants (23.1%), 89 participants had "ever" used e-cigarettes (10.8%) and 23 (2.8%) had "ever" tried snuff (figure 3.3). The majority of participants (70.4%) had never used any of the types of tobacco listed above. "Ever" use of cigarettes was reported by 366 participants (44.4%). Nearly sixty percent of "ever" cigarette users had also tried at least one of cigars, cigarillos, snuff or e-cigarettes. However, more than ninety percent of those participants that had tried cigars, cigarillos, snuff or e-cigarettes also reported "ever" use of cigarettes.

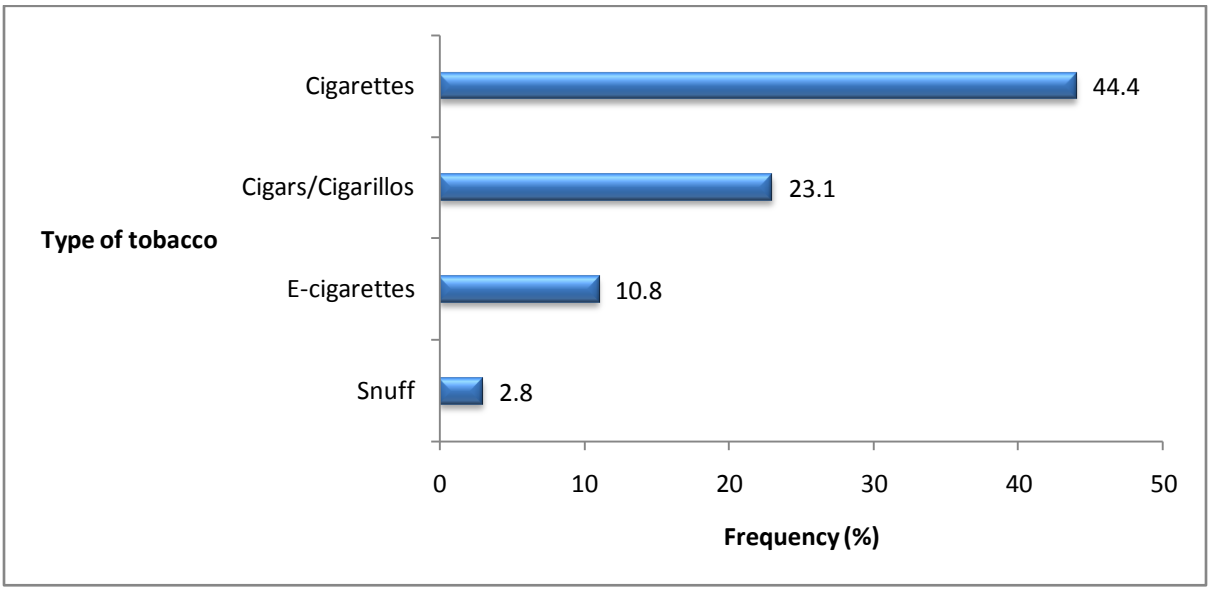

Figure 3.3 Distribution of "ever" use of different types of tobacco by participants (N=824)

Twenty six percent of "ever" cigarette smokers had smoked more than 100 cigarettes in their lifetimes which allowed for their sub-classification as "established" smokers. The number of "current" cigarette smokers was 126 which equated to a prevalence of 15.3%. Among the "current" cigarette smokers the frequency of cigarette use was reported as "daily" by 47 (37.3%)

and “occasional” by 79 students (62.7%). Nearly two-thirds of “ever” cigarette users (65.5%) reported no current use at all.

3.1.3 “Ever” use of hookah pipes and/or cigarettes among family and friends

Among the members of the participants’ immediate families, 36.9% of fathers, 11.1% of mothers and 22.8% of siblings had “ever” smoked cigarettes. About 7.5% of participants were unsure of their family members’ cigarette smoking history. Hookah pipe smoking on the other hand was reported to have been practised by only 6.2% of fathers and 3.0% of mothers. Usage appeared more common among siblings with a reported prevalence of 29.0%. Uncertainty regarding hookah pipe usage among family members was reported by 14.8% of participants, nearly double the reported rate of uncertainty pertaining to cigarette smoking among family members. The comparison between “ever” use of cigarettes and “ever” use of hookah pipes by family members is illustrated in figure 3.4.

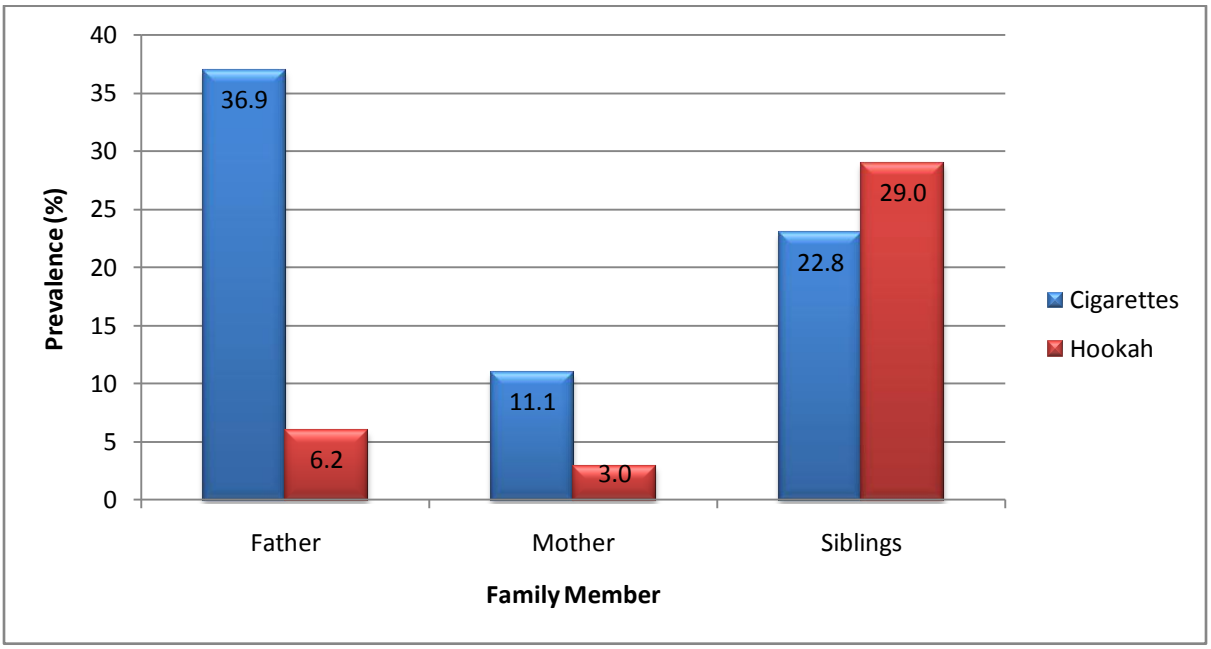

Figure 3.4 “Ever” use of cigarettes and/or hookah pipes by family members (N=824)

Hookah pipe usage by friends of participants was reported by the majority (70.0%) while only 8.5% of participants were unsure if any of their friends smoked a hookah pipe.

3.1.4 Knowledge of health effects associated with hookah pipe smoking

In excess of three-quarters of participants, 626 (76.1%), believed that hookah pipe smoking was harmful to the health of the hookah pipe smoker. A few participants, 54 (6.6%), believed that it made no difference to health, 138 participants (16.8%) were unsure of its health effect while only five participants (0.6%) believed that hookah pipe smoking improved the health of the smoker.

The participants' opinions of various adverse health effects associated with hookah pipe use was sought by means of a three-point Likert-type scale (table 3.1).

Table 3.1 Knowledge of adverse health effects associated with hookah pipe smoking

Adverse Health Effect	N	Agree n (%)	Disagree n (%)	Unsure n (%)
Hookah pipe smoking is dangerous	822	597 (72.6)	57 (6.9)	168 (20.4)
Hookah pipe smoking is addictive	821	474 (57.7)	187 (22.8)	160 (19.5)
Hookah pipe smoking can cause serious medical diseases	820	440 (53.7)	86 (10.5)	294 (35.9)
Hookah pipe smoking can cause sexual dysfunction	820	148 (18.0)	114 (13.9)	558 (68.0)
Sharing a hookah pipe can result in the transmission of diseases	820	425 (51.8)	130 (15.9)	265 (32.3)
Second hand smoke from hookah pipes is harmful to other people	820	418 (51.0)	110 (13.4)	292 (35.6)

Table 3.1 indicates that nearly two-thirds of participants either agreed or disagreed with five of the six statements listed. The only statement which elicited a significant degree of uncertainty (as indicated by 'unsure' responses) was related to sexual dysfunction associated with hookah pipe use. On average, just over half the participants were in agreement that hookah pipes are associated with the listed adverse health effects while approximately one seventh of participants disagreed. It is interesting to note that more than three times as many participants disagreed with the statement that "Hookah pipe smoking is addictive" compared to those who disagreed that "Hookah pipe smoking is dangerous".

The three-point scale was also utilised to assess the participants' opinions regarding statements comparing the risks associated with hookah pipe smoking to that associated with cigarette smoking. Comparisons were drawn in respect of danger, addictiveness and nicotine content. Similar proportions of participants considered hookah pipe smoking to be less dangerous (38.6%) or as dangerous (38.2%) in comparison to cigarette smoking. However, this was not the case with respect to the comparison of perceived addictive potential. The belief that hookah pipe smoking was less addictive than cigarette smoking was held by 41.2% of participants while substantially fewer participants (29.8%) believed hookah pipe smoking to be equally addictive. A third of participants (32.3%) believed that hookah pipe tobacco contained less nicotine than cigarettes while 19.7% disagreed. The combination of all three beliefs favouring a lower risk profile associated with hookah pipe smoking (less dangerous, less addictive, less nicotine) was held by 140 participants (17.1%). At the opposite end of the spectrum, 81 participants (9.9%) disagreed with all three beliefs, considering hookah pipes to be more problematic than cigarettes. Uncertainty with respect to the reduced risks associated with hookah pipe smoking compared to cigarette smoking in terms of danger, addictive potential and nicotine content was expressed by 26.7%, 29.8% and 48.0% of participants respectively.

The perception that the water in hookah pipes safely filters toxins was reported by only 96 participants (11.7%). Even less common (4.0%) was the notion that the addition of fruit to the hookah pipe tobacco makes it a healthy habit. In contrast, the proportion of participants that disagreed with these two 'myths' were 46.5% and 70.1% respectively.

3.2 Prevalence of hookah pipe smoking

A total of 817 students (99.2% of total sample) answered the question "Have you ever smoked a hookah pipe?" producing 443 positive replies, which translated to a prevalence of 54.2% of "ever" hookah pipe use. Among the 443 "ever" hookah smokers 51.7% were female. Almost one quarter (24.3%) of "ever" hookah pipe smokers owned a hookah pipe.

Among the "ever" hookah pipe smokers, 120 participants (27.1%) indicated that they had smoked a hookah pipe at least once during each of the preceding three months which, for the purpose of this study, defined them as "current" hookah pipe smokers. The overall prevalence of "current" hookah pipe smoking was 14.7%. A little over one third of "current" hookah pipe smokers were female (37.5%).

Among non-hookah pipe smokers, 41 participants (11.0%) indicated a willingness to try hookah pipe smoking in the future (figure 3.5). This was twice the proportion of cigarette naïve participants (5.2%) who had indicated a willingness to try cigarette smoking in the future.

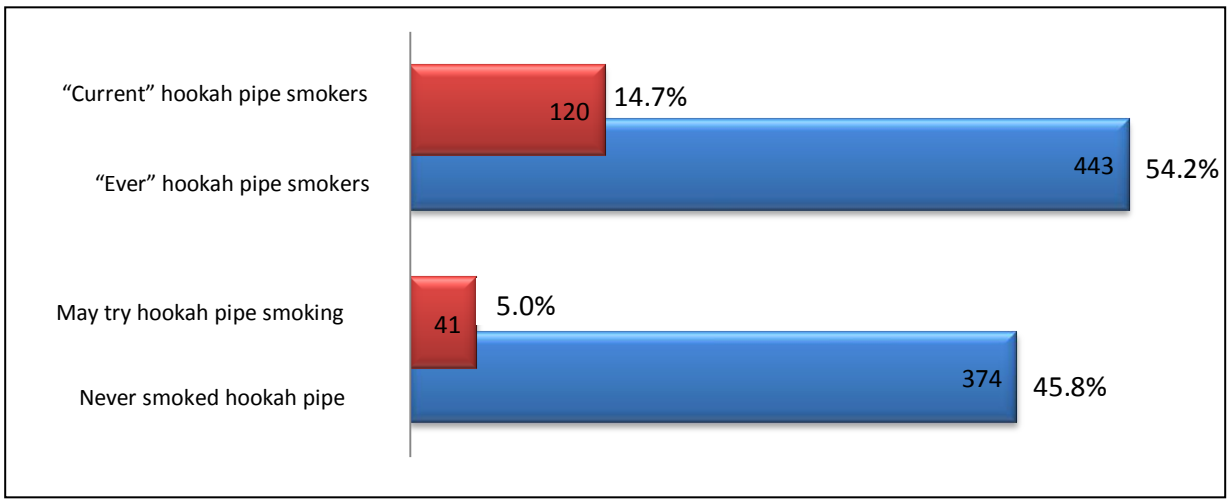

Figure 3.5 Hookah pipe smoking prevalence (N=817)

3.3 Initiation of hookah pipe smoking

The median age of "ever" hookah pipe smokers was 20 years (IQR: 19-21 years), with ages ranging from 18 to 32 years. The median age for the initiation of hookah pipe smoking among "ever" smokers was 17 years (IQR: 16-18 years), with ages ranging from 11 to 24 years.

By subtracting the difference between the current age of "ever" hookah pipe smokers and their age at the time of initiation of hookah pipe smoking, from the current year of the study (2010) it was possible to determine the year during which the participants starting smoking hookah pipes (figure 3.6).

Although no provincial or national data exists regarding the timing of the surge in hookah pipe popularity in South Africa, these data demonstrated a marked increase in annual incidence among participants during the period 2005 to 2009. Collectively, 75% of participants initiated hookah pipe smoking during the past four years and the median duration since the initiation of hookah pipe smoking among participants was 2 years (IQR 1-3 years). Thus it would appear that for the majority of participants the practice of smoking hookah pipes was relatively "young". Unfortunately this study was unable to estimate the potential beginning of the hookah pipe epidemic in this setting due to the skewed distribution of the participants' ages.

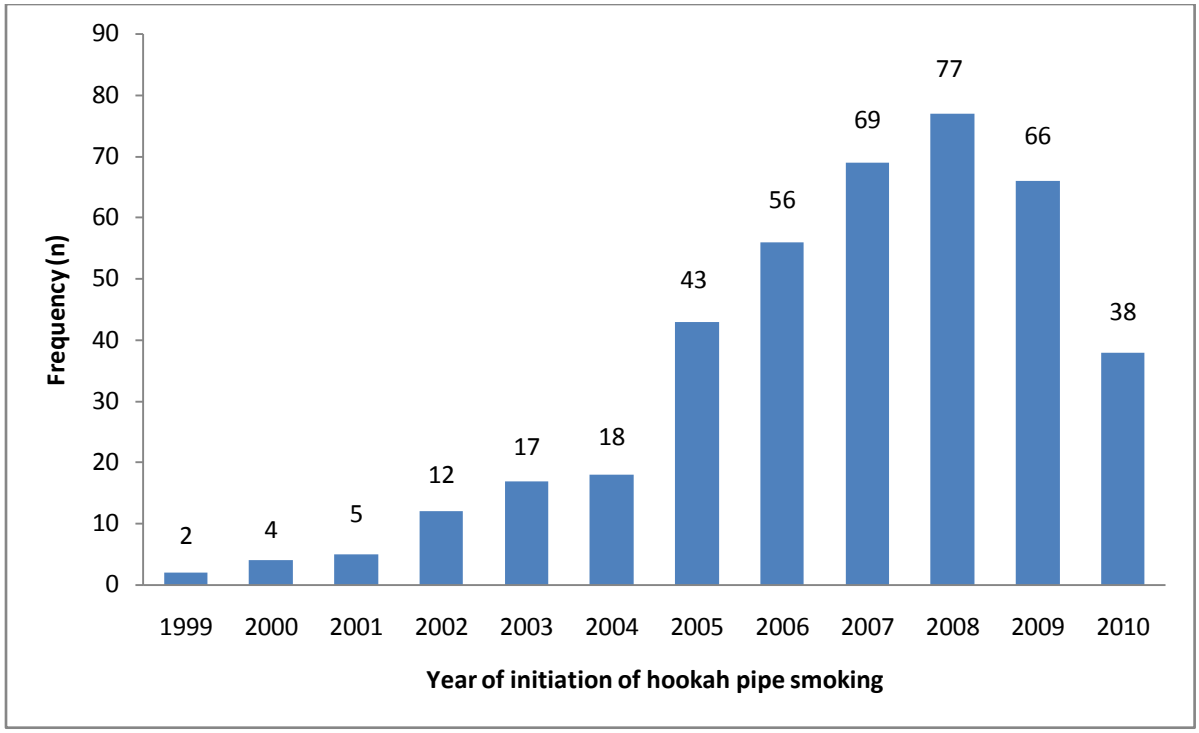

Figure 3.6 Distribution of years of initiation of hookah pipe smoking (N=407)

3.4 Factors associated with "ever" use of hookah pipes

In order to address the primary aim of this study, viz. determination of the factors associated with hookah pipe smoking among undergraduate students at the University of the Witwatersrand, Johannesburg the outcome of "ever" smoked hookah pipes was considered in respect of four groups of possibly associated factors.

3.4.1 Demographic factors

The first group considered demographic factors which included the student's sex, age, race group, faculty and year of study (table 3.2).

Table 3.2 Demographic factors affecting "ever" hookah pipe use

Demographic Factor	N	"Ever" Smoked Hookah n (%)	Unadjusted Odds Ratio	95% Confidence Intervals
Sex				
Female	447	229 (51.2)	1.00	
Male	369	214 (58.0)	1.31	1.00 – 1.74
Race				
Black	379	131 (34.6)	1.00	
Other	22	13 (59.1)	**2.73***	1.13 – 6.59
White	248	179 (72.2)	**4.91***	3.46 – 6.97
Indian	127	87 (68.5)	**4.12***	2.68 – 6.34
"Coloured"	35	28 (80.0)	**7.57***	3.21 – 17.85
Faculty				
Commerce, Law & Management	172	83 (48.3)	1.00	
Science	116	60 (51.7)	1.15	0.72 – 1.84
Engineering & the Built Environment	267	144 (54.0)	1.26	0.85 – 1.85
Health Sciences	132	74 (56.1)	1.37	0.87 – 2.16
Humanities	130	82 (63.1)	**1.83***	1.15 – 2.92
Year of Study				
First	441	225 (51.0)	1.00	
Second	164	86 (52.4)	1.06	0.74 – 1.51
Third	117	75 (64.1)	**1.71***	1.12 – 2.62
Fourth	27	17 (63.0)	1.63	0.73 – 3.65
Fifth	68	40 (58.8)	1.37	0.82 – 2.30

*$p<0.05$

When compared to “Black” participants, each of the four other race groups were individually associated with a greater likelihood of “ever” hookah pipe use. “Coloured” participants were seven times more likely to “ever” smoke hookah pipes than their “Black” counterparts ($p<0.001$). “White” and “Indian” participants had at least a four-fold greater probability of “ever” smoking a hookah pipe than “Black” participants ($p<0.001$ in both cases). Chi-square analysis revealed no difference in the likelihood of “ever” smoking hookah pipes between “White” and “Indian” participants ($p=0.458$).

Additionally, belonging to the Faculty of Humanities or being in the third year of study was also likely to increase “ever” hookah pipe use ($p=0.011$ and $p=0.012$ respectively).

3.4.2 Use of other types of tobacco by participants

The possible association between use of other types of tobacco and “ever” use of hookah pipes was explored. The types of tobacco investigated included cigarettes, cigars/cigarillos, e-cigarettes and snuff (table 3.3). With the exception of snuff, use of any of the different types of tobacco was significantly associated with a greater likelihood of “ever” hookah pipe use. The smoking of cigars or cigarillos made the “ever” use of hookah pipes in excess of 11 times more likely ($p<0.001$).

Although the use of cigarettes was the tobacco type with the second highest odds ratio (9.87, $p<0.001$), it is worth pointing out that the prevalence of “ever” cigarette use (44.4%) was nearly twice that of “ever” cigar/cigarillo use (23.1%). The significance of cigarette use was further highlighted by the fact that being an “established” cigarette smoker (odds ratio [OR] 2.25, $p=0.026$) as well as a daily cigarette smoker (OR 4.18, $p=0.020$) were both associated with increased likelihoods of “ever” hookah pipe use.

Table 3.3 Effect of use of other types of tobacco on "ever" hookah pipe use

Other Tobacco Used	N	"Ever" Smoked Hookah n (%)	Unadjusted Odds Ratio	95% Confidence Intervals
Other tobacco use				
None	580	236 (40.7)	1.00	
Snuff	23	17 (73.9)	2.45	0.95 – 6.29
E-Cigarettes	88	75 (85.2)	**5.66***	3.08 – 10.39
Cigars/Cigarillos	189	170 (89.9)	**11.63***	7.05 – 19.19
Cigarettes				
"Never" Use	453	144 (31.8)	1.00	
"Ever" Use	364	299 (82.1)	**9.87***	7.07 – 13.78
Non-established smoker	267	210 (78.7)	1.00	
Established smoker	96	86 (89.6)	**2.25***	1.09 – 4.63
Frequency of cigarette use				
Not at all	239	185 (77.4)	1.00	
Occasional	78	70 (89.7)	**2.55***	1.15 – 5.66
Daily	46	43 (93.5)	**4.18***	1.24 – 14.09

*p<0.05

3.4.3 Effect of "ever" use of cigarettes or hookah pipes by family or friends

The third group of factors explored associations between "ever" hookah pipe use and the use of either hookah pipes or cigarettes by members of the student's immediate family or friends (table 3.4).

The use of either cigarettes or hookah pipes by members of the participants' immediate families was associated with increased hookah pipe usage across all categories. Although use by each of the family members was individually significant with respect to both cigarettes and hookah pipes, there was marked variation in the respective numbers within each category. This tends to diminish the significance of the increased probability of hookah pipe usage associated with maternal smoking of cigarettes (OR 6.03, $p<0.001$) or hookah pipes (OR 9.72, $p=0.002$). Nevertheless, a family member known to smoke cigarettes more than doubles the likelihood of "ever" hookah pipe usage ($p<0.001$) while a known hookah pipe smoker within the family increases the chance of "ever" hookah pipe usage by a factor of nearly seven ($p<0.001$).

Table 3.4 Effect of use of cigarettes or hookah pipes by family or friends on "ever" hookah pipe use

Tobacco History	N	"Ever" Smoked Hookah n (%)	Unadjusted Odds Ratio	95% Confidence Intervals
Use of cigarettes by:				
No family members	323	145 (44.9)	1.00	
Father	303	186 (61.4)	**1.59***	1.19 – 2.12
Mother	92	79 (85.9)	**6.03***	3.29 – 11.04
Siblings	187	122 (65.2)	**1.81***	1.29 – 2.54
1 or more family members	434	275 (63.4)	**2.21***	1.67 – 2.93
Use of Hookah pipe by:				
No family members	431	164 (38.1)	1.00	
Father	48	37 (77.1)	**3.01***	1.51 – 5.99
Mother	24	22 (91.7)	**9.72***	2.26 – 41.76
Siblings	238	199 (83.6)	**7.01***	4.78 – 10.26
1 or more family members	265	218 (82.3)	**6.74***	4.71 – 9.65
Friends				
Non hookah pipe smokers	175	25 (14.3)	1.00	
Hookah pipe smokers	574	407 (70.9)	**14.62***	9.22 – 23.19

*$p<0.05$

However, the factor most strongly associated with an increased likelihood of "ever" hookah pipe use on univariate analysis (OR 14.62, $p<0.001$) proved to be the smoking of hookah pipes by friends.

3.4.4 Effect of knowledge of adverse health effects on "ever" hookah pipe use

The final group of factors examined pertained to the participants' knowledge and perception of health aspects associated with hookah pipe use. Knowledge of the adverse health effects of hookah pipe smoking (table 3.5), as well as a comparison between the risk profiles of hookah pipes and cigarettes were investigated.

Despite the vast majority of participants indicating that hookah pipe smoking was harmful to health, the holding of this knowledge did not significantly influence their decision to "ever" smoke hookah pipes (OR 0.86, 95% confidence interval [CI] 0.64-1.15).

In general, disagreement with the stated adverse health effects associated with hookah pipe smoking was associated with an increased likelihood of "ever" smoking hookah pipes. The only exception was disagreement with the statement 'hookah smoking can result in transmission of disease', which failed to achieve statistical significance with respect to its effect on hookah pipe smoking.

Table 3.5 "Ever" hookah pipe use association with knowledge of adverse health effects

Health Effect	N	"Ever" Smoked Hookah n (%)	Unadjusted Odds Ratio	95% Confidence Intervals
Hookah pipe smoking is dangerous				
Agree	592	303 (51.2)	1.00	
Disagree	56	49 (87.5)	**6.67***	2.97 – 15.01
Unsure	168	91 (54.2)	1.13	0.80 – 1.59
Hookah pipe smoking is addictive				
Agree	471	219 (46.5)	1.00	
Disagree	185	167 (90.3)	**10.68***	6.35 – 17.96
Unsure	160	57 (35.6)	**0.64***	0.44 – 0.92
Hookah pipe smoking can cause serious medical diseases				
Agree	440	230 (52.3)	1.00	
Disagree	84	62 (73.8)	**2.57***	1.53 – 4.34
Unsure	292	151 (51.7)	0.98	0.72 – 1.33
Hookah pipe smoking can cause sexual dysfunction				
Agree	147	73 (49.7)	1.00	
Disagree	112	87 (77.7)	**3.53***	2.03 – 6.13
Unsure	557	283 (50.8)	1.05	0.70 – 1.56
Hookah pipe smoking can result in transmission of disease				
Agree	424	260 (61.3)	1.00	
Disagree	129	84 (65.1)	1.18	0.78 – 1.78
Unsure	263	99 (37.6)	**0.38***	0.28 – 0.52
Second hand smoke from hookah pipes is harmful to other people				
Agree	417	224 (53.7)	1.00	
Disagree	108	84 (77.8)	**3.02***	1.84 – 4.94
Unsure	291	135 (46.4)	0.75	0.55 – 1.01

*$p<0.05$

Nearly one in four participants did not believe that hookah pipes were addictive. Holders of this 'false' belief were at least ten times more likely to smoke hookah pipes than students who

believed that hookah pipes were addictive ($p<0.001$). Although less than ten per cent of participants indicated that hookah pipes were not dangerous, participants holding this view were significantly more likely to indicate "ever" hookah pipe use (OR 6.67 [$p<0.001$]).

Uncertainty surrounding hookah pipes' adverse health effects did not appear to influence "ever" hookah pipe smoking for the most part. There were however, two exceptions. Uncertainty of hookah pipes' addictive potential and whether the sharing of hookah pipes results in disease transmission were both significantly associated with decreased likelihoods of "ever" hookah pipe use (OR 0.64 [$p=0.017$] and 0.38 [$p<0.001$] respectively).

The combined belief that hookah pipes, in comparison to cigarettes, were less dangerous, less addictive and that hookah pipe tobacco contained less nicotine than cigarettes, resulted in an odds ratio of 3.31 (95% CI 1.83–6.02) in favour of the outcome of "ever" smoking hookah pipes.

Lastly, the belief that the water in hookah pipes safely filters toxins was associated with a significantly increased likelihood of "ever" hookah use (OR 2.95, 95% CI 1.80-4.83), while the belief that the addition of fruit to hookah makes it a healthy habit did not significantly influence the decision to "ever" smoke hookah pipes (OR 1.42, 95% CI 0.69-2.95).

3.4.5 Multivariate Analysis

All factors that were significantly associated with the outcome "ever" smoked hookah on univariate analysis ($p<0.05$) were included in a backward regression model. Factors that narrowly failed to achieve statistical significance on univariate analysis ($p \geq 0.5 < 0.10$) were also included in the backward regression model. The factors found to be independent predictors of "ever" hookah pipe use are listed in table 3.6.

The most impressive predictor of "ever" hookah pipe use was previous use of cigarettes by the participants (OR 9.36, 95% CI 6.05-14.50). However, the use of hookah pipes by either family members (OR 3.22, 95% CI 1.98-5.26) or friends (OR 7.16, 95% CI 3.96-12.92) also appears to have had significant influence on the decision to smoke hookah pipes.

Both "White" (OR 3.08, 95% CI 1.83-5.18) and "Indian" (OR 2.00, 95% CI 1.07-3.72) participants were more likely to have used hookah pipes than their "Black" counterparts.

Table 3.6 Independent predictors of "ever" hookah pipe use

Factor	Adjusted Odds Ratio	95% Confidence Intervals	p Value
Race			
Black	1.00		
White	**3.08**	1.83 – 5.18	p<0.001
Indian	**2.00**	1.07 – 3.72	p=0.029
Other tobacco use			
No use of cigarettes	1.00		
"Ever" use of cigarettes	**9.36**	6.05 – 14.50	p<0.001
Use of hookah pipes by others			
No use by family members	1.00		
Use by family members	**3.22**	1.98 – 5.26	p<0.001
No use by friends	1.00		
Use by friends	**7.16**	3.96 - 12.92	p<0.001
Knowledge of adverse health effects			
Hookah pipe smoking is dangerous			
Agree	1.00		
Disagree	**3.60**	1.18 – 10.93	p=0.024
Unsure	1.26	0.72 – 2.20	p=0.417
Hookah pipe smoking is addictive			
Agree	1.00		
Disagree	**7.39**	3.84 – 14.23	p<0.001
Unsure	1.41	0.81 – 2.45	p=0.218
Second hand smoke from hookah pipes is harmful to other people			
Agree	1.00		
Disagree	**2.19**	1.02 – 4.72	p=0.045
Unsure	1.21	0.75 – 1.96	p=0.430
Hookah pipe smoking can result in transmission of disease			
Agree	1.00		
Disagree	0.80	0.41 – 1.57	p=0.513
Unsure	**0.56**	0.35 – 0.90	p=0.017

The holding of inaccurate beliefs regarding the adverse health effects of hookah pipe smoking also increased the likelihood of smoking hookah pipes. Among the misperceptions concerning hookah pipes effects on health, the false belief that hookah pipes are not addictive (OR 7.39, 95% CI 3.84-14.23), most profoundly influenced the decision to smoke hookah pipes.

The only factor on multivariate analysis which was found to significantly decrease the likelihood of "ever" hookah pipe use was uncertainty regarding the ability of hookah pipes to transmit diseases (OR 0.56, 95% CI 0.35-0.90).

3.5 Knowledge, Attitudes and Practises of "current" hookah pipe smokers

The following is a description of the responses of the 120 participants, who reported "current" hookah pipe use (i.e. use during each of the previous three months), to various aspects concerning hookah pipes.

3.5.1 Knowledge

3.5.1.1 Health Effects

With respect to the effect of hookah pipe smoking on the health of the smoker, 76 (63.3%) "current" hookah pipe smokers believed that it was harmful, 17 (14.2%) thought that it made no difference, 2 (1.7%) indicated that it improved health, while 25 (20.8%) were unsure.

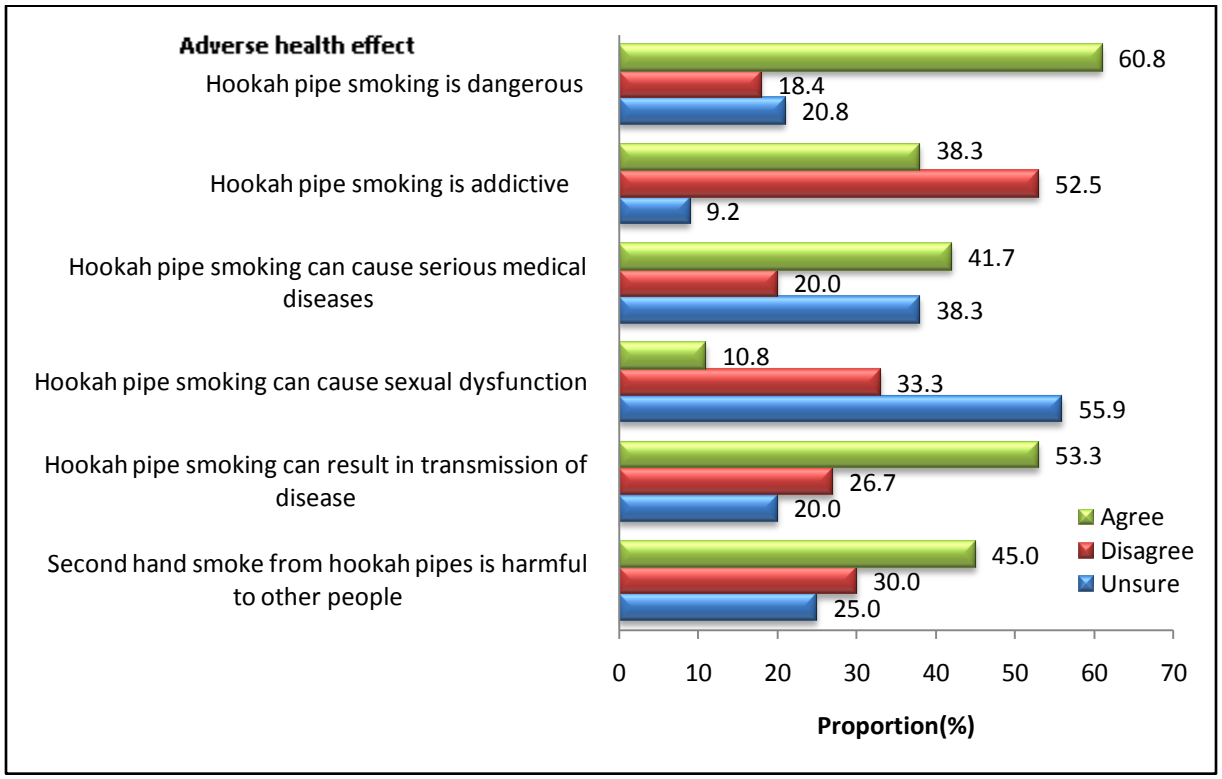

Figure 3.7 Proportions of responses by "current" hookah pipe smokers related to statements about the adverse health effects associated with hookah pipe smoking (N=120)

When compared to either the "never" or "previous" hookah pipe smokers, the "current" hookah pipe smokers reported higher proportions of "disagree" responses for all six of the listed adverse

health effects (figure 3.7). On average, the proportions reported were almost twice as large as compared to the "previous" hookah pipe smokers, and nearly five and a half times larger than those of the "never" hookah pipe smokers.

Of particular importance was the finding that the majority (52.5%) of "current" hookah smokers did not believe that hookah pipe smoking was addictive. On chi-square analysis, this proportion was significantly higher than the 17.6% response rate among the rest of the sample ($p<0.001$).

3.5.1.2 Comparison of risk profiles: hookah pipes vs. cigarettes

Nearly three quarters of "current" hookah pipe smokers believed hookah pipes to be less dangerous (n=87) and less addictive (n=91) than cigarettes. Just over half (n=62) also agreed that hookah pipe tobacco contained less nicotine than cigarettes. The combination of all three beliefs, favouring the health risk profile of hookah pipes over cigarettes, was held by 49 "current" hookah pipe smokers (40.8%). In contrast, only 7 "current" hookah pipe smokers (5.8%) reported uniform disagreement with these three beliefs.

3.5.1.3 Hookah pipe 'myths'

Even among "current" hookah pipe smokers, the notion that "the addition of fruit to hookah pipe tobacco makes it a healthy habit" found paltry support (8.3% positive response). The majority (67.5%) disagreed, with the remaining quarter unsure of the validity of the statement.

Opinion regarding whether the water in hookah pipes safely filters toxins was more closely divided with 32 (26.7%) agreeing with the statement, 47 (39.2%) disagreeing and 41 (34.2%) unsure of the validity of the statement.

3.5.2 Appealing characteristics of hookah pipes

The three most appealing characteristics of hookah pipes, with positive responses exceeding 50%, were their taste, the social atmosphere associated with their use and the smell of hookah tobacco (figure 3.8). On the other hand, the least popular aspect of hookah pipe smoking related to its use as a means of 'fitting in' with friends (3.5%).

The use of hookah pipes for non pleasurable aims, such as coping with stress (12.2%) or as a concentration aid (6.1%), did not appear to contribute much to its appeal.

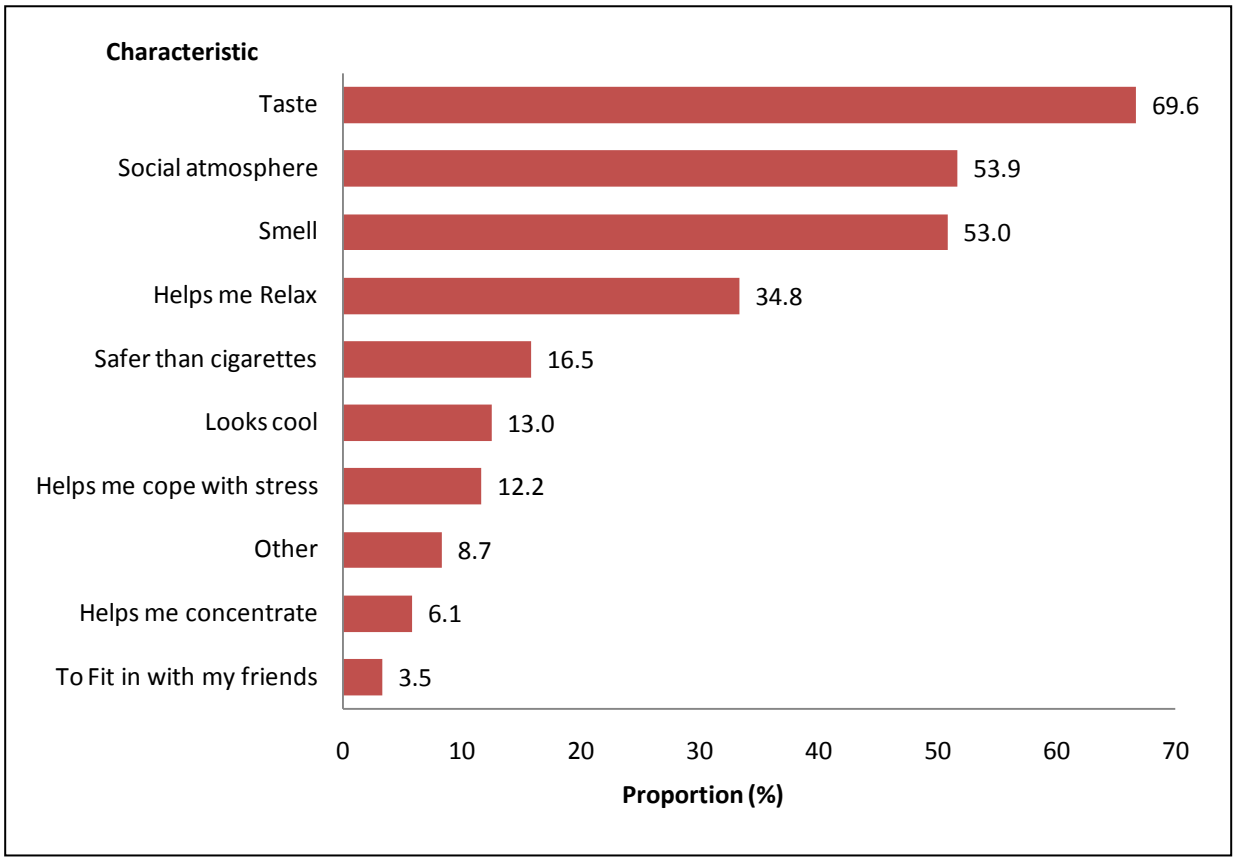

Figure 3.8 Appealing characteristics of hookah pipes (N=115)

3.5.3 Attitudes

3.5.3.1 Introduction to hookah pipe smoking and peer pressure

Overall, the majority (78.3%) of "current" hookah pipe smokers indicated that they were initially introduced to hookah pipe smoking by friends (figure 3.9). Family members (siblings and other relatives) were responsible for 16.5% of introductions to hookah pipe smoking. Family members were responsible for a higher proportion of introductions among female "current" smokers (26.2%) than males (11.0%). Friend introductions were more common among males (82.2%) than females (71.4%). Self discovery of hookah pipe smoking was generally low (5.2%) particularly among females (2.4%).

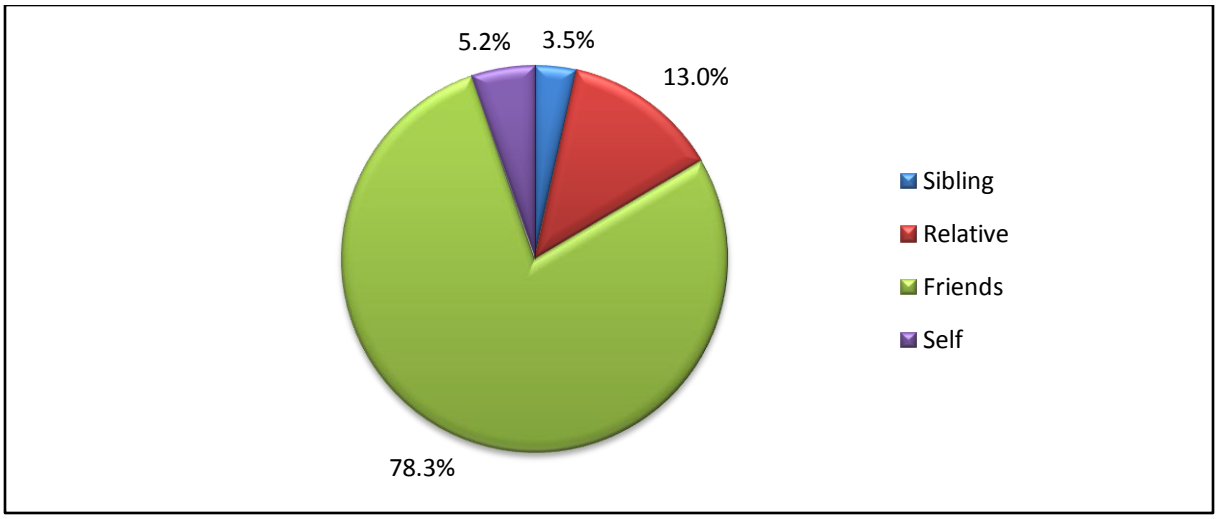

Figure 3.9 Persons responsible for introduction of participants to hookah pipe smoking (N=115)

Only 16.5% of "current" hookah pipe smokers (n=19) felt that peer pressure was an important factor in their decision to start smoking the hookah pipe.

3.5.3.2 Dependence and quitting

Less than ten percent reported an uncontrollable urge to smoke the hookah pipe following abstinence from hookah pipe smoking for a few days.

The idea of quitting hookah pipe smoking did not appear to be a priority as most "current" hookah pipe smokers appeared happy to continue smoking. Seventy percent (n=75) showed no inclination toward quitting, while less than a third collectively were either thinking about quitting (n=17), or ready to quit (n=15) at the time of questioning. The possible role of a campus quit programme was marginalised, as the majority of "current" hookah pipe smokers (85.0%) would not even consider using one. Less than five percent of "current" smokers would consider using a campus quit programme while 11.5% were unsure.

3.5.3.3 Regulation of hookah pipe smoking on campus

Support for the regulation of hookah pipe smoking on the university campus was elicited from nearly one third (n=36) of "current" hookah pipe smokers. Nearly half (n=55) opposed any regulation while the remainder (n=22) were unsure. The interventions that appeared to hold the greatest potential to effect changes in the patterns of hookah pipe smoking were the banning of

the sale of hookah pipe tobacco on campus, as well as the complete banning of hookah pipe smoking on campus (table 3.7). Less than a quarter of "current" hookah pipe smokers indicated that graphic posters on campus or designated smoking areas would result in a reduction in their hookah pipe usage.

Table 3.7 Predicted effect of campus interventions on hookah pipe smoking

Intervention	N	Smoke More n (%)	No Change n (%)	Smoke Less n (%)
Placement of graphic posters warning of the risks of smoking hookah	112	10 (8.9)	81 (72.3)	21 (18.8)
Restriction of hookah smoking to designated areas	112	13 (11.6)	82 (73.2)	17 (15.2)
Ban of the sale of hookah pipe tobacco	112	13 (11.6)	61 (54.5)	38 (33.9)
Complete ban on the smoking of hookah pipes	112	12 (10.7)	55 (49.1)	45 (40.2)

3.5.4 Practices

3.5.4.1 Frequency and duration of hookah pipe use

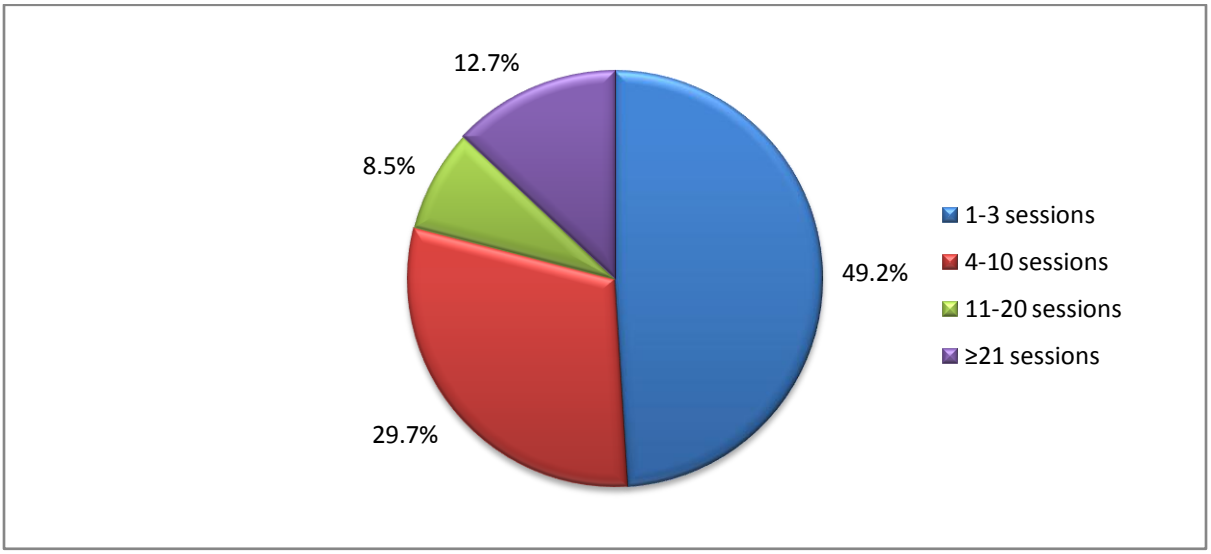

Figure 3.10 Participant hookah pipe smoking sessions during the previous month (N=119)

The majority of "current" hookah smokers (n=58) reported less than four hookah pipe smoking sessions during the past month (figure 3.10). Almost a third (n=35) smoked the hookah pipe up to ten times during the month, while 15 (12.7%) reported use exceeding 20 sessions during the previous month.

The majority of "current" hookah pipe smokers reported smoking frequencies of either less than once a week (n=56) or once weekly use (n=49). Among those that used the hookah pipe once a week, there was no significant difference between weekday (n=25) and weekend (n=24) use. Finally, daily use was reported by 14 (11.8%) "current" hookah smokers.

The majority (56.3%) of hookah pipe smoking sessions lasted less than half an hour. Session lengths of between 16 to 30 minutes were most commonly reported, followed by those of less than 15 minutes duration (figure 3.11).

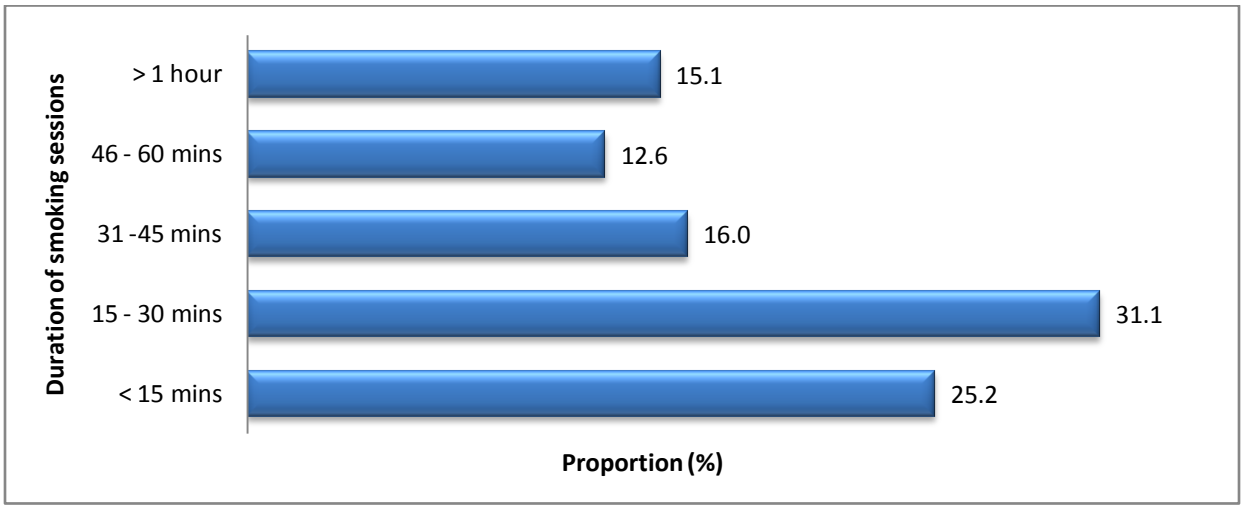

Figure 3.11 Hookah pipe smoking sessions by duration (N=119)

The hookah smoking sessions tended to be in group settings with the sharing of the hookah pipe's mouth piece proving to be an extremely common practice, as reported by the bulk of the "current" hookah pipe smokers (n=108, 93.9%).

3.5.4.2 Venues of hookah pipe use

The most popular venues for hookah pipe smoking were at home (n=45), on campus (n=26) and at parties (n=24). Other venues, including public places such as bars, cafes and parks, proved far less popular representing 20.2% of responses (n=24) cumulatively. More than half (n=68) of the "current" hookah pipe smokers practised the habit on the university campus and 46 "current" hookah pipe smokers (41.8%) indicated that they usually purchased their hookah pipe tobacco on campus.

3.5.4.3 Cost of hookah pipe use

Nearly sixty percent of "current" hookah pipe smokers (n=67) spend less than 25 rands on hookah pipe tobacco per month (figure 3.12). A further 24 spent between 25 and 50 rands per month. Only seven reported expenditure in excess of one hundred rands per month.

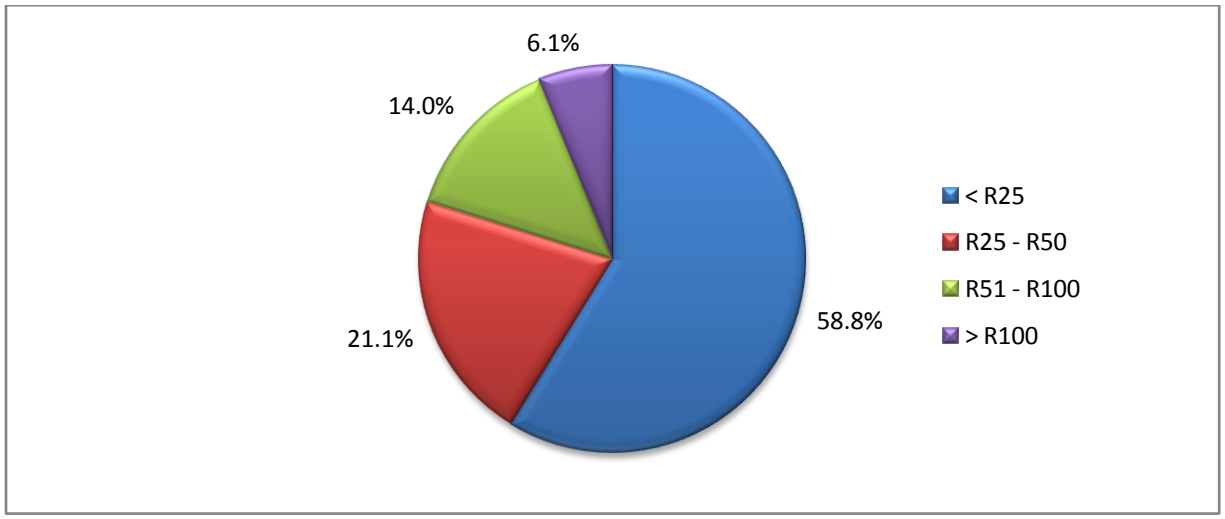

Figure 3.12 Average amount (in rands) spent on hookah pipe tobacco per month (N=114)

3.5.4.4 Addition of other psychotropic substances

The addition of other psychoactive substances also proved to be commonplace among "current" hookah pipe smokers with 62 (53.9%) and 61 (53.0%) adding alcohol and marijuana to their hookah pipes, respectively. Overall response rates to both questions were good (95.8%) with

only 3 (2.6%) and 9 (7.8%) participants choosing not to comment on alcohol and marijuana use respectively.

CHAPTER FOUR

4.0 DISCUSSION

4.1 Main Findings

The prevalence of "ever" and "current" use of hookah pipes were 54.2 and 14.7% respectively. Males and females were equally likely to have "ever" smoked a hookah pipe while a greater proportion of males (62.5%) were "current" hookah pipe smokers. "Black" students were the least likely to smoke hookah pipes. On multivariate analysis, statistically significant factors associated with increased likelihood of "ever" using a hookah pipe were: being "White" (OR 3.08, 95% CI 1.83-5.18) or "Indian" (OR 2.00, 95% CI 1.07-3.72), previous cigarette use (OR 9.36, 95% CI 6.05-14.50), having a family member (OR 3.22, 95% CI 1.98-5.26) or friends (OR 7.16, 95% CI 3.96-12.92) who had smoked a hookah pipe and holding the following false beliefs regarding the adverse health effects associated with hookah pipe smoking: hookah pipes are not dangerous (OR 3.60, 95% CI 1.18-10.93), hookah pipes are not addictive (OR 7.39, 95% CI 3.84-14.23) and the second hand smoke produced by hookah pipes is not harmful to other people (OR 2.19, 95% CI 1.02-4.72).

4.2 Prevalence of hookah pipe smoking

The prevalence of "ever" hookah pipe smoking among undergraduate students at the University of the Witwatersrand, Johannesburg was 54.2% which, at first glance, appears more comparable to the prevalence rates recently reported among Middle Eastern university students rather than those reported among North American students.[15,24,30,56] On the other hand, the prevalence of "current" hookah pipe smoking of 14.7% bears favourable comparison to rates reported among North American students as opposed to the higher rates found among their Middle Eastern counterparts.[15,24]

Admittedly, the definition of "current" hookah pipe smoker utilised by the study might have resulted in a slightly lower prevalence rate than that which might have resulted from use of the definition adapted from World Health Organisation guidelines, present in the majority of hookah pipe literature.[34] However, the timeline of the reported prevalence rates among students warrants further consideration.

There has been a significant increase in worldwide prevalence rates of hookah pipe smoking reported with the passage of time. At a Lebanese (Beirut) university the prevalence rate of hookah pipe smoking among students rose from 30% in 1998 to 43% in 2002.[4] Although reported at various sites within the Middle East, point prevalence rates of "ever" hookah pipe smoking have steadily increased during the past decade. Reported prevalence rates include 32% (Lebanon, 2001), 45% (Syria, 2003), 54% (Pakistan, 2008) and 61% (Jordan, 2008). These high rates bear testimony to the ever increasing popularity of hookah pipe smoking, even in countries with long histories of hookah pipe usage.[15,30,34,57]

A similar trend has been demonstrated in North America. Initial prevalence rates of "ever" hookah pipe smoking prior to 2007 ranged from 15-20%, but two studies in 2007 and 2008 found prevalence rates of 41% and 30% respectively.[12,21,25] Although the rate of the 2008 study was not the highest reported, it was of considerable importance in that it represented both a very large (8745 students), as well as, randomly selected sample.

These trends of increasing prevalence rates seem to suggest that usage patterns have yet to stabilise in any of the geographical regions studied thus far. Indeed, the finding that 11.0% of non-hookah pipe smoking participants in this study indicated a willingness to try hookah pipe smoking in the future is evidence to the potential for further growth of the habit at the University of the Witwatersrand, Johannesburg.

Epidemiological studies suggest that the beginning of the hookah epidemic in countries such as Syria predate countries such as the United States by five to ten years.[24,29] This might explain why the prevalence rates at any given point in time have thus far been higher in the Middle East. However, simply comparing the rate among American students in 2008 to that among Syrian students in 2003 would represent an oversimplification of the myriad of factors, discussed earlier, promoting the spread of hookah pipe smoking. These factors serve to temper the value of the comparisons drawn between the prevalence rate among the students at the University of the Witwatersrand, Johannesburg and the rates among students of other regions.

4.3 Demographics of hookah pipe smokers

4.3.1 Sex

Within this study sex was ultimately shown to have no association with "ever" hookah pipe use and the male to female prevalence rate ratio of "ever" hookah pipe use was 1.1:1 while the "current" use ratio (male:female) was 2:1.

The sex of hookah pipe smokers has been the subject of much discussion, particularly within the Middle East.[23,32-34] The smoking of cigarettes by Middle Eastern women has historically been considered taboo.[32,34] Hookah pipe smoking however, does not seem to be viewed in a similar light and has resulted in many Arabian women taking up this habit, often in the company of family members.[33] However, despite the increased popularity among women, the male to female prevalence rate ratios in Middle Eastern countries continue to strongly favour males by factors of as much as five, for both "ever" and "current" use.[30]

In contrast, American studies have not reported an overwhelming male predominance, with male to female hookah pipe smoking prevalence ratios of less than two to one.[12,53] A 2008 study in Pittsburgh (USA) showed almost equal prevalence rates of "ever" hookah pipe use among male and female students.[21]

This current study indicates a greater similarity between local students and American students in terms of the proportion of females willing to experiment with hookah pipe smoking. Nevertheless, the decision to continue smoking hookah pipes seems to remain universally more popular among male students.

4.3.2 Race/ Ethnicity

With regards to racial distribution, the student population at the University of the Witwatersrand, Johannesburg is quite unlike the majority of student populations thus far described in the hookah literature. It is one of the first to feature both a "Black" majority, as well as, significant diversity with respect to racial categorisation.

There was a clear difference between the likelihoods of hookah pipe use between "Black" participants and all other race groups. The race group at greatest risk of hookah pipe use was "Coloureds", with a seven-fold increased risk compared to "Blacks" on univariate analysis.

However, this result failed to achieve statistical significance on multivariate analysis, possibly due to the small number of "Coloured" participants within the sample. Nevertheless, both "White" and "Indian" participants were significantly more likely to use hookah pipes than "Black" participants. There was no demonstrable difference between "White" and "Indian" participants in terms of likelihood of hookah pipe use.

The majority of studies from the Middle Eastern region did not explore the effect of race/ethnicity on hookah pipe smoking as they were generally performed among students of a singular ethnicity.[30,32,34,57,58]

Across the Atlantic, race/ethnicity assumes greater significance.[25,53] Significant racial/ethnic differences had already been documented in the United States in terms of the initiation and subsequent progression to daily cigarette smoking.[59,60] In both instances, "Whites" were more likely to be "ever" or daily cigarette smokers than "Blacks". Thus, the publication of studies demonstrating race to be a significant predictor of hookah pipe smoking status, seemed almost inevitable. American studies have shown that hookah pipe smokers, similar to cigarette smokers, tend to be "White" rather than "African-American".[12,21,53]

The impact of ethnicity was also highlighted by a British study which found that 80% of Arab students, at a single university, had tried hookah pipe smoking and that being Arab was associated with increased hookah pipe use.[51]

To date, there is limited understanding of the factors influencing these racial differences. Some possibilities that have been suggested include: (a) greater effect of peer influences on "White" adolescents, (b) stronger anti-smoking messages from "Black" parents, (c) perception of greater negative consequences of smoking among "Black" girls, and (d) differences in cultural expectations which places "White" girls at higher risk of smoking.[59] The relevance of these factors in a South African setting needs further investigation.

Traditionally the hookah pipe literature has adopted a "White" vs. "Black" approach when considering race/ethnicity as a factor influencing hookah pipe smoking. This study demonstrates that in an environment where there is considerable diversity with respect to race affiliation, simply considering two race groups is inadequate. Thus further research, both quantitative and qualitative, is warranted to explore hookah pipe smoking among various race/ethnic groups.

It was conceivable that "Indian" students might have been more likely to smoke hookah pipes than other race groups, given that they may possibly identify most closely with the Middle East or Asia. The fact that the majority of "Indian" South Africans, descended from people who first arrived in South Africa nearly 150 years ago, are fourth or fifth generation South Africans, has probably diluted any potential effect this relationship may have had. In this respect, South African "Indians" differ considerably from the largely more recent "Indian" diasporas of the United States and the United Kingdom.[61] The study did not examine the influence of religious affiliation. Muslim students may be more likely to adopt Middle Eastern cultural practises. These data suggest that the local propagation of hookah pipe smoking is being fuelled by factors seemingly independent of associations with the Middle East or Asia.

4.3.3 Faculty of Study

The association between a student's academic faculty and their likelihood of smoking the hookah pipe has not been extensively investigated. A 2001 study among Lebanese students found no association between faculty of study and the likelihood of "ever" hookah pipe use.[57] A Syrian study described the prevalence of "current" hookah pipe use among three groups of students stratified by fields of study.[34] The rates among the groups were: 10.2% (health-related), 13% (arts, law and humanities) and 17.7% (science-related). However these differences were not statistically significant.

The first suggestion of an association between faculty of study and hookah pipe use emanated from a 2003 study also undertaken among Lebanese students.[4] Researchers calculated both attitude and knowledge indices among participants and found that greater knowledge (of the adverse effects associated with hookah pipe smoking) and a negative attitude towards hookah pipe use, were both associated with lesser likelihoods of "current" hookah pipe use. Furthermore, when the knowledge and attitude indices were stratified according to faculty, significant associations were found. The combination of these two findings led the researchers to conclude that students from the faculty of health sciences and nursing were the least likely to be "current" hookah pipe smokers.

Results from the University of the Witwatersrand, Johannesburg do not echo the Lebanese findings as students from the faculty of Health Sciences were not significantly less likely to

smoke hookah pipes. Even the faculty of Humanities, positively associated with hookah pipe use on univariate analysis, ultimately failed to achieve significance in the multivariate model. In conclusion, there was no association between affiliation to any of the five faculties and hookah pipe smoking.

4.3.4 Year of Study

The association between a student's academic year of study and hookah pipe smoking is another factor which remains poorly understood. A single British study found that the prevalence of hookah pipe smoking increased with each year of study (up to a maximum of three years of study).[51]

Univariate analysis determined that students in their third year of study were significantly more likely to smoke hookah pipes. Given that less than 10% of undergraduate students belong to the fourth, fifth and sixth years of study collectively, the third year of study actually represents the final year of study for more than 90% of the undergraduate student population. Thus it appeared that the current study provided some support to the premise that hookah pipe smoking increases with time spent at university. However, following adjustment, no significant association was found between year of study and hookah pipe smoking.

4.4 The use of other types of tobacco

The association between cigarette use and an increased likelihood of hookah use has been unequivocally demonstrated on both sides of the Atlantic.[14,21,30,34,51,53] This was also emphatically demonstrated by this study. The use of cigarettes increased the likelihood of hookah use nine-fold. Additionally, being a "current" cigarette smoker as well as the progression to an "established" cigarette smoker were both associated with an increased likelihood of "ever" smoking hookah pipes.

What remains less clear is whether hookah pipe smoking, by virtue of establishing nicotine dependency, may ultimately introduce cigarette smoking to an otherwise nicotine naïve population (the "gateway" theory). Studies have shown that hookah pipe smoking has placed substantial numbers of non-cigarette smokers at risk.[21,30] Among the 443 participants that have "ever" smoked a hookah pipe, nearly one third (32.5%) have never smoked a cigarette. This

mirrors the findings of researchers in Jordan and the United States, who found that 31.2% and 35.4% respectively, of "ever" hookah pipe smokers, had never tried cigarette smoking.[21,30]

One of the trends that has reinforced this concern has been the decreasing age of initiation of hookah pipe smoking, both absolutely and relative to cigarette smoking. A study among Syrian first and fifth year medical students, at a single medical school, found that the first year students had started smoking hookah pipes earlier than the fifth year students.[8] A survey among 1671 Arab American adolescents showed that by the age of 14 years, a greater proportion (23%) had tried hookah pipes than cigarettes (15%).[8]

It is difficult to definitively comment on the situation within the study sample with regards to evidence of the "gateway" effect of hookah pipe usage on cigarette usage. "Ever" use of both hookah pipes and cigarettes was reported by 299 participants. Of the 216 that reported their respective ages at the initiation of both cigarette and hookah pipe smoking, 99 (45.8%) smoked cigarettes first, 59 (27.3%) started with hookah pipes and 58 (26.9%) started smoking cigarettes and hookah pipes at approximately the same time. Furthermore, the median age for the initiation of cigarette smoking (16 years [IQR: 14-17.5 years]) was less than that of hookah pipe smoking (17 years [IQR: 15-18 years]). Although these data seem to refute the "gateway" effect of hookah pipe smoking, the relative "youth" of the hookah pipe smoking habit among most participants raises the possibility that these relationships may yet change with time, as seen in the Middle East.

The use of either cigars/cigarillos or e-cigarettes individually increased the likelihood of "ever" hookah pipe use on univariate analysis. The prevalence of "ever" use of: hookah pipes (54.2%), cigars/cigarillos (23.1%) and e-cigarettes (10.8%) highlights the variety of nicotine delivery models that students are exposed to in addition to cigarettes. Clearly, the design and implementation of effective tobacco control policies for students must now surely extend beyond just cigarettes.

4.5 Influence of family and friends

The multi-faceted contribution of family and friends to the rapid growth in hookah pipe smoking has been well documented. Firstly, the use of tobacco products including cigarettes and hookah pipes by parents and siblings has been shown to independently promote the use of hookah

pipes.[13,34,62] Secondly, the permissive effect of the tacit parental acceptance of hookah pipe smoking has already been discussed. Lastly, and perhaps most importantly, family and friends are responsible for introducing hookah pipes to new smokers in over 90% of cases.[25,32,33]

This study found that having a family member who smokes hookah pipes results in a three-fold increase in the likelihood of "ever" hookah pipe use. The low prevalence of hookah pipe use among the parents of participants (6.2% fathers, 3.0% mothers) coupled with the much higher prevalence among siblings (29.0%) suggests a relatively recent surge in hookah pipe popularity locally.

Interestingly, among family members, maternal tobacco use (cigarettes or hookah pipes) is associated with the highest increase in the likelihood of "ever" hookah pipe use. The dramatic impact of maternal tobacco use demonstrated on univariate analysis begs further investigation, as there were small numbers of mothers reported to have smoked hookah pipes or cigarettes, within this study.

Among "current" hookah pipe smokers within this study, the proportion of females that were introduced to the habit by family members was double that of males. This aspect has not been widely reported by American or British authors, who have noted that friends were responsible for approximately 80% of hookah pipe introductions.[25,51] In contrast, a discrepancy between sexes with respect to their introduction to hookah pipe smoking has been reported by Middle Eastern students. Nearly half of female smokers reported their first hookah pipe experience in the presence of family members as opposed to males who report an overwhelming majority (>85%) of friend introductions.[34]

Having friends who smoke hookah pipe was independently associated with a seven-fold increased likelihood of "ever" hookah pipe use. Indeed, having friends who smoke hookah pipes was second only to "ever" use of cigarettes in terms of the magnitude of its association with "ever" hookah pipe smoking. This association is testament to the importance of the social aspects inherent to the practice of smoking of hookah pipes.

An apparent contradiction is that despite nearly 80% of respondents reporting that they were introduced to hookah pipes by a friend, less than 20% felt that peer pressure was an important

factor in their decision to start smoking hookah pipes. Qualitative assessment of the student's perception of peer pressure might be valuable towards understanding this observation.

4.6 Knowledge and perceptions of the health effects associated with hookah pipe smoking

4.6.1 All participants

4.6.1.1 Absolute health risks

The knowledge and perceptions of students pertaining to the adverse health effects associated with hookah pipe smoking has been thought to influence the decision to smoke hookah pipes.[4,25] The absolute risks associated with hookah pipe smoking have been acknowledged by the majority of students studied previously, regardless of whether or not they smoked hookah pipes.[4,21,30,51] Local knowledge of the harmful effects of hookah pipe smoking appears consistent with international trends.

The majority of participants agreed that hookah pipe smoking was associated with each of the six stated adverse effects bar one - less than 20% of participants agreed that hookah pipe smoking can cause sexual dysfunction. This was also the only health effect that elicited a majority (68.0%) of "unsure" responses. The relatively small proportions of "unsure" responses to the majority of the stated adverse health effects suggest that students perceive themselves to be receiving sufficient information about hookah pipes to enable them to form opinions on the risks of smoking hookah pipes. Alternatively, students could simply be extrapolating knowledge of cigarette effects to hookah pipes. It would be interesting to investigate these sources of information in order to gain further insights into the mindsets of these students, as well as attempt to identify the motives of the respective sources.

Despite three quarter of participants (76.1%) believing that hookah pipe was harmful on the health of the smoker, that knowledge was not accompanied by a significant reduction in the likelihood of smoking hookah pipes. These data seems contrary to other studies that suggest that accurate knowledge of adverse health effects associated with hookah pipe smoking mitigates against the decision to smoke hookah pipes. However, examination of the relationship between false perceptions and the likelihood of hookah pipe smoking proves to be much more revealing.

In general, on univariate analysis, students who disagreed with any of the adverse health effects associated with hookah pipe use were more likely to be hookah pipe smokers. Following adjustment, three beliefs were independently associated with "ever" hookah pipe use. The incorrect beliefs that hookah pipes were neither dangerous, nor addictive, nor harmful to other people, were each associated with increased likelihoods of "ever" hookah pipe use. The most notable being the seven-fold increased risk associated with the belief that hookah pipe smoking is not addictive.

The finding that uncertainty with regards to the possibility of disease transmission through hookah pipe smoking is associated with a decreased likelihood of "ever" smoking hookah pipes is difficult to explain. To the best of the researcher's knowledge, this is a novel finding. Perhaps this is an indication of the heightened concern of the participants to the possibility of contracting infectious diseases such as HIV, herpes or tuberculosis in South African settings.

Some of the "myths" associated with hookah pipe lore were not widely held by the students at the University of the Witwatersrand, Johannesburg. Despite reports suggesting that the belief in the ability of the water in hookah pipes to safely filter toxins, serves as a factor promoting hookah pipe use, this belief was held by only 16.3% of "ever" hookah pipe smokers (11.7% among all participants). Half of the "ever" hookah pipe smokers actually disagreed with the statement (46.5% overall). Even more emphatic was the response pattern to the statement concerning the addition of fruit to hookah pipes. Agreement that the addition of fruit to hookah tobacco makes it a healthy habit was reported by less than five percent of "ever" hookah pipe smokers (4.0% overall) while disagreement was reported by 76.5% of "ever" smokers which was once again higher than the overall response rate of 70.1%.

4.6.1.2 Health risks of hookah pipes versus cigarettes

Among participants, the comparison between the risks of smoking hookah pipes versus cigarettes revealed considerable bias in favour of hookah pipes. Nearly 40% of participants agreed that hookah pipe smoking was either less dangerous or less addictive than cigarette smoking. Fewer than 5% believed that cigarettes were either less dangerous or less addictive than hookah pipes. Participants were also more inclined to believe that hookah pipes contained less nicotine than

cigarettes. The combination of these beliefs tripled the likelihood of "ever" hookah pipe smoking.

Comparison of the perceptions of the health risks associated with hookah pipe smoking with those associated with cigarette smoking reveals one of the most distinct divides between students of the Middle East and those of Europe and North America.

American and British students have almost unanimously endorsed the notions that hookah pipes are less harmful and less addictive than cigarettes.[45] Unsurprisingly, the proportion of hookah pipe smokers subscribing to these beliefs is nearly twice that of non-hookah pipe smokers.[21] This perception of reduced risk has been found to be significantly associated with up to a four-fold greater likelihood of smoking hookah pipes.[21,53]

On the other hand, the majority of students surveyed in two studies conducted in Syria and Jordan reported that they believed hookah pipes to be more harmful than cigarettes.[30,33] Counter intuitively, that belief did not appear to dissuade students from smoking hookah pipes. One possible explanation lies in the fact that, like their American and British counterparts, the surveyed students overwhelmingly agreed that hookah pipes are less addictive than cigarettes. It would appear that the perceived favourable profile of hookah pipes with respect to addiction outweighs any concerns regarding its adverse effect on health.

The findings of this study suggest that local students display a risk perception profile much more similar to American or British students rather than Middle Eastern students.

4.6.2 Knowledge of "current" hookah pipe smokers

The responses of the "current" hookah pipe smokers to the various statements concerning the adverse health effects associated with hookah pipe smoking revealed some consistent patterns when compared to the other participants.

With respect to all six of the stated adverse health effects "current" hookah pipe smokers reported higher proportions of "disagree" responses than either the "previous" or the "never" hookah pipe smokers. On average, the "current" hookah pipe smokers reported "disagree" responses twice as often as the "previous" hookah pipe smokers and more than five times more often than "never" hookah pipe smokers.

With regards to the hookah pipe "myths", the "current" hookah pipe smokers reported "agree" responses at least twice as often as either of the other two groups.

With the exception of the statement concerning hookah pipes and sexual dysfunction, the average "unsure" response rate among "current" hookah pipe smokers was 22.7%. This suggests that the majority of "current" hookah pipe smokers perceived themselves to be sufficiently aware of the health risks of hookah pipe smoking. This is cause for concern as the uniformity of their responses when compared to either "never" or "previous" hookah pipe smokers suggests that the knowledge held by this group is substantially poorer than other students. It seems fair to posit that hookah pipe smoking is enjoying the benefit of 'blissful ignorance'.

This presents a key area which can be targeted by campaigns aimed at decreasing the prevalence of hookah pipe smoking. These data highlight the potential value of educational programmes aimed at reducing the incorrect perceptions of the effects of hookah pipe smoking on health. It would appear prudent to emphasize that smoking hookah pipes is indeed a dangerous habit associated with multiple health risks. Given the significance associated with the false belief that hookah pipes are not addictive, and the fact that more than 50% of "current" hookah pipe smokers share this belief, redressing this particular belief appears to be of paramount importance.

4.7 Attitudes of "current" hookah pipe smokers

4.7.1 Appealing characteristics of hookah pipes

Taste and smell were listed by "current" hookah pipe smokers as two of the three most appealing characteristics of hookah pipe smoking. This suggests that the actual act of smoking the hookah pipe is in itself quite desirable, rather than merely serving as a vehicle to deliver the effects of smoking tobacco (such as relaxation, stress relief, concentration aid). There was additionally, considerable indication (53.9%) that "current" hookah pipe smokers enjoyed the social nature of hookah pipe use. These findings closely resemble the most appealing characteristics reported by both American and Middle Eastern students. [25,33,56]

It was also interesting to note the discrepancy between the perceptions surrounding the use of hookah pipes for relaxation as opposed to its use as a stress reliever. The use for relaxation was reported nearly three times as much as the use for the management of stress. This represents a

stark contrast when compared to cigarette usage, as stress reduction has been reported as a major positive effect of cigarette smoking.[33]

Generally, the participants tended to report characteristics that emphasized the use of hookah pipes as a means to derive pleasure. In contrast, the characteristics which suggested that hookah pipes were used as a tool, either to possibly enhance popularity ("look cool", "fit in") or to manage stress or to aid concentration, were marginal with positive responses of less than 15%. It would appear that "current" hookah pipe smokers have a very positive attitude toward hookah pipes.

That hookah pipes are safer than cigarettes was reported by only one out of every six "current" hookah pipe smokers as an appealing feature. This was somewhat surprising given that many reports in the literature have suggested this perception to be a significant factor promoting the use of hookah pipes.[8,16,24,26,45,63]

This finding may however, be explained by the high proportion of "current" hookah pipe smokers who reported "ever" cigarette use (80.0%, of which half are "current" cigarette smokers). This is in contrast to some study samples that reported less than 50% "ever" cigarette use among hookah pipe smokers.[25,51] One possibility is that as hookah pipe smoking becomes more entrenched, together with a simultaneous decrease in cigarette smoking, there might be a reduction in the overlap between hookah pipe and cigarette use. This possibility, however, is contrary to the popular "gateway" theory of hookah pipe use actually promoting cigarette use.

4.7.2 Peer pressure

Peer pressure was not felt to be an important factor in the decision to start smoking hookah pipes for the majority of "current" hookah pipe smokers. Furthermore, only three percent of hookah pipe smokers indicated that they use hookah pipes as a means to fit in with friends. It appeared that despite the fact that having friends who smoke hookah pipes increased the chances of "ever" smoking a hookah pipe seven-fold, the "current" hookah pipe smokers were not happy to attribute their decision to smoke hookah pipes to external factors. Nevertheless, peer group influence on smoking, especially among adolescents, tends to result in peer group homogeneity with respect to smoking practices.[64] The study findings most likely reflect the insidious nature of the processes that influence smoking behaviour.

4.7.3 Dependence and quitting

To screen for the possibility of the development of dependence, "current" hookah pipe smokers were asked to indicate if abstinence from hookah pipe smoking for a few days led to an uncontrollable urge to smoke the hookah pipe. The positive response rate of less than ten percent is probably indicative of low levels of dependence. This is not unexpected in view of the relatively short periods of hookah pipe use. The rate of dependence increases with the passage of time.[55] It is also associated with certain characteristic changes in smoking behaviours such as a transition from usually smoking within a group setting to usually smoking alone.[55] This is an area for future investigation among this particular population.

The majority of "current" hookah smokers did not want to quit hookah pipe smoking. Approximately one sixth of "current" hookah pipe smokers were ready to quit and a similar number were thinking about quitting. This attitude possibly stems from the "current" hookah pipe smokers' ill informed opinions of the risks associated with hookah pipe use.

The overwhelming lack of enthusiasm toward a campus quit smoking programme may reflect the perceived low level of dependence among hookah pipe smokers or may be an indication of a strong negative perception of the campus health service held by the "current" hookah pipe smokers. Qualitative assessment would be of value to explore these possibilities. The knowledge obtained from such research may prove to be invaluable in attempting to design tobacco control programmes relevant to these students.

4.7.4 Regulation of hookah pipe smoking on campus

Opposition to the regulation of hookah pipe smoking on campus was indicated by nearly half of the "current" hookah pipe smokers. Although 48.7% still represented the majority, a higher resistance was expected given their status as "current" hookah pipe smokers. Equally surprising was that among "never" hookah pipe smokers, the number in favour of regulation on campus was exactly the same as those in opposition, with about 20% undecided either way. Again, it may have seemed reasonable to expect the majority of non-smokers to support the regulation of hookah pipe smoking on campus. Was this a manifestation of a generalised attitude of opposition to regulation by young people or a sign of the lack of importance or concern afforded to controlling the habit?

The responses of the "current" hookah pipe smokers to the proposed interventions on campus largely indicated defiance towards external attempts to modify their hookah pipe use. However, a third of "current" hookah pipe smokers acknowledged that the combination of banning both the sale of hookah pipe tobacco, as well as, the smoking of hookah pipes on campus, would probably result in a reduction in their hookah pipe smoking.

4.8 Practices of "current" hookah pipe smokers

4.8.1 Frequency and duration of hookah pipe use

For the vast majority of "current" hookah pipe smokers (88.2%) hookah pipe smoking tends to be at most, a weekly rather than a daily habit. There was no apparent preference between weekday and weekend smoking. This intermittent or occasional pattern of use is consistent with the patterns reported by both Middle Eastern and American studies.[24,48]

The duration of hookah pipe smoking sessions rarely exceeded 60 minutes with many typically lasting between 15 and 30 minutes. This finding once again echoed those of an American study.[25]

4.8.2 Venue of hookah pipe use

The most popular venue to smoke hookah pipes was at the participants' homes. Nevertheless, more than half of the "current" smokers reported use on campus. Also noteworthy was the finding that more than 40% of "current" smokers usually purchased their hookah pipe tobacco on campus. This provides a clear indication of the important role played by the campus in the propagation of this habit and underlines the potential impact that regulation of smoking within the campus environment may have.

One finding, contrary to other studies, was the relatively small contribution made by bars and cafes as the primary venue for hookah pipe smoking.[25,58] This unique characteristic must also be considered when planning local tobacco control programmes.

4.8.3 Cost of hookah pipe usage

Nearly sixty percent of "current" hookah pipe smokers spend less than 25 rands per month on hookah pipe tobacco. Given that this amounted to less than the average price of lunch at a chain

restaurant at the time, it appeared that supporting one's hookah pipe habit was not a very expensive pursuit. This is in keeping with other studies that stated that hookah pipe smoking was a relatively inexpensive habit.[45]

4.8.4 Addition of other psychotropic substances

Similar to findings among American hookah pipe smokers, the high concurrent use of both alcohol (53.9%) and marijuana (53.0%) by "current" hookah pipe smokers may be indicative of a non-risk aversive sub-group.[25] These individuals may be more likely to engage in a variety of risky or even illicit behaviours. This mindset may be a crucial component underpinning the "gateway" theory associated with hookah pipe use. Early behavioural intervention among these individuals could potentially ameliorate or even prevent the deleterious effects of these behaviours.

4.9 Differences between univariate and multivariate analysis

On univariate analysis, 30 factors were significantly associated with "ever" hookah pipe use. The majority (28) increased the likelihood of hookah pipe use. Following adjustment only nine remained statistically significant. The multivariate model saw many factors eliminated by backward regression probably due to the relatively small numbers relating to those factors eg. previous use of e-cigarettes (n=88). Other factors were intentionally grouped into one variable for the purpose of modelling such as combining previous tobacco use by each member of the family into previous family use of tobacco.

4.10 Limitations

The findings must be interpreted with due consideration of the limitations placed upon the study.

The cross sectional design of the study precludes assessment of the temporal relationships between factors influencing hookah use and thus prevents causal inferences to be made. Additionally, the factors identified in the literature review were investigated in this study as independent variables only. The possibility exists that some of these factors may in fact be confounders.

The sampling strategy employed randomly selected classes, rather than individual students to participate in the study. The fact that not all members of a particular class may have chosen to participate in the study introduces an element of selection bias. Nevertheless, the final sample proved reasonably representative of the undergraduate population as a whole as illustrated in Appendix G. The fact that the sample consisted only of undergraduate university students belonging to a single university limits the generalisabilty of the study findings to other demographic groups, as well as, to undergraduate students from other universities.

The use of self administered questionnaires introduces the possibility that the data may have been subject to recall bias. To minimise these effects, the questionnaire contained only a few questions requiring detailed recall. Questions of a sensitive nature may introduce an element of social desirability bias. However, research demonstrates self-reported measures of substance use are valid when participants understand the scientific purpose of the study and are assured of anonymity or confidentiality.[65]

CHAPTER FIVE

5.0 CONCLUSION

This study is the first to explore hookah pipe smoking among a general student population at a South African university. The University of the Witwatersrand, Johannesburg has the biggest undergraduate population among full time South African universities which contributed to this study enrolling one of the largest samples to date, thereby allowing for reasonable extrapolation of the findings to other similar environments. The random nature of the participating classes together with the extensive nature of the questionnaire also ensured that this study provides a unique and well rounded picture of hookah pipe smoking in young adults.

Hookah pipe smoking was highly prevalent among undergraduate students at the University of the Witwatersrand, Johannesburg. Factors independently associated with an increased likelihood of "ever" hookah pipe use included; being "White" or "Indian", "ever" use of cigarettes, having a family member who had smoked hookah pipes, having friends who had smoked hookah pipes and holding false beliefs regarding the adverse health effects associated with hookah pipe smoking. The specific beliefs associated with increased likelihoods of "ever" smoking hookah pipes were; that hookah pipes are not dangerous, that hookah pipes are not addictive and that the second hand smoke from hookah pipes is not harmful to other people.

Hookah pipe smokers at the University of the Witwatersrand, Johannesburg bore more similarities to their counterparts in America and Europe, than those of the Middle East. This may have been influenced by the relatively recent onset of hookah pipe smoking among most participants.

Many students perceived hookah pipes to be less problematic than cigarettes. On the whole, the knowledge base of "current" hookah pipe smokers appeared to be poorer than either "never" or "previous" hookah pipe smokers. "Current" hookah pipe smokers generally had very positive attitudes toward hookah pipe smoking and demonstrated little inclination toward quitting hookah pipe smoking at the time of the study.

The usual usage pattern of hookah pipes tended to be intermittent, within a social context, with smoking sessions lasting less than an hour. The university campus provided a popular venue for hookah pipe smoking as well as the source of many students' hookah pipe tobacco. The sensory

qualities of hookah pipes and the social situations within which they are enjoyed were the primary motivations driving the habit among the students.

Of grave concern was the substantial concurrent use of other psychotropic agents including alcohol and marijuana. These findings clearly signal the need for urgent action to arrest these hazardous behaviours.

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CHAPTER SIX

6.0 RECOMMENDATIONS

The findings of the study should sound a clarion call for urgent interventions at multiple levels to arrest the so-called second tobacco epidemic which has clearly reached South Africa.

Proposed components of a tobacco control programme should include:

- The inclusion of hookah pipes in comprehensive tobacco control efforts advocating the simultaneous initiation of prevention and cessation strategies
- Subjecting hookah pipes to the same regulations as cigarettes including the banning of hookah pipe smoking in public places, restriction of sale to minors and the imposition of excise taxes relating to hookah pipes and their accessories including the tobacco
- The placement of strong health warnings, both descriptive and graphic, on hookah product packaging together with the removal of misleading descriptors such as "light" or "contains 0% tar"
- Regulation of the advertising of hookah pipe products
- Development of educational programmes aimed at adolescents, young adults (particularly university students), their parents, pregnant women, people who are exposed to second hand smoke, health professionals, administrators and staff of schools and universities, public health officials and policy makers.

The development of an effective tobacco control policy aimed at altering the behaviours of these students must take cognisance of the following issues:

- Educational programmes must make concerted efforts to debunk the false perception of reduced harm associated with hookah pipes by effectively disseminating the burgeoning body of scientific evidence to the contrary. The notion that hookah pipes are either not addictive at all, or less addictive than cigarettes should be a priority as this seems to be a potent promoter of hookah pipes' popularity
- The restriction of the smoking of hookah pipes on campus, together with the enforcement of the ban on the sale of hookah pipe tobacco on campus should result in a reduction in usage among students

- Assessment of the negative feelings toward campus based quit smoking programmes should allow the university to institute changes in an attempt to create a student friendly programme aimed at promoting student utilisation
- The institution of higher taxation on hookah pipe tobacco and strict regulation of the sale of hookah pipe tobacco to minors should make the habit less accessible to young people

Despite the possible contribution made by this study, there remain many questions to be answered about hookah pipe smoking particularly in South African settings. Surveillance programmes together with both quantitative and qualitative research are essential to provide data which will inform anti-tobacco campaigns. Specific research questions include:

- What are the trends with respect to the overall prevalence of hookah pipe smoking?
- Will hookah pipe smoking become more popular among "Black" youths and adults?
- Will more women go on to become "current" or "established" hookah pipe smokers?
- What is the effect of maternal tobacco use on their children and is it more significant than paternal tobacco use?
- What is the influence on religious affiliation on hookah pipe smoking?
- What are the characteristics that define an "established" hookah pipe smoker?
- Where do the youth obtain their information regarding hookah pipes?
- What informs the quit attitudes of hookah pipe smokers?
- Why do concerns about addiction seem to outweigh those regarding danger among students?
- Will the current trend of declining cigarette usage continue or will it also undergo a resurgence in popularity following on from the popularity of hookah pipe smoking thereby resulting in further increases in nicotine exposure and dependence?
- Similarly, will there be increased usage of other psychotropic agents?

It is vital to realise that the answering of these questions must not delay the institution of programmes aimed at dealing with this epidemic. The quest for additional information must serve as but one element of a multi-pronged attack on this deleterious habit.

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APPENDIX A – Undergraduate class list by alpha-numeric order

Faculty	Degree Type	Year of Study	Allocated number
CLM	Bachelor of Accounting Science	YOS1	1
CLM	Bachelor of Accounting Science	YOS2	2
CLM	Bachelor of Accounting Science	YOS3	3
CLM	Bachelor of Commerce	YOS1	4
CLM	Bachelor of Commerce	YOS2	5
CLM	Bachelor of Commerce	YOS3	6
CLM	Bachelor of Economic Science	YOS1	7
CLM	Bachelor of Economic Science	YOS2	8
CLM	Bachelor of Economic Science	YOS3	9
CLM	Bachelor of Laws	YOS1	10
CLM	Bachelor of Laws	YOS2	11
CLM	Bachelor of Laws	YOS3	12
CLM	Bachelor of Laws	YOS4	13
EBE	Bachelor of Architectural Studies	YOS1	14
EBE	Bachelor of Architectural Studies	YOS2	15
EBE	Bachelor of Architectural Studies	YOS3	16
EBE	Bachelor of Engineering Science in Biomedical Engineering	YOS1	17
EBE	Bachelor of Engineering Science in Biomedical Engineering	YOS2	18
EBE	Bachelor of Engineering Science in Biomedical Engineering	YOS3	19
EBE	Bachelor of Science in Construction Management	YOS2	20
EBE	Bachelor of Science in Construction Management	YOS3	21
EBE	Bachelor of Science in Construction Management	YOS4	22
EBE	Bachelor of Science in Construction Management Studies	YOS1	23
EBE	Bachelor of Science in Construction Management Studies	YOS2	24
EBE	Bachelor of Science in Engineering	YOS1	25
EBE	Bachelor of Science in Engineering	YOS2	26
EBE	Bachelor of Science in Engineering	YOS3	27
EBE	Bachelor of Science in Engineering	YOS4	28
EBE	Bachelor of Science in Property Studies	YOS1	29
EBE	Bachelor of Science in Property Studies	YOS2	30
EBE	Bachelor of Science in Property Studies	YOS3	31
EBE	Bachelor of Science in Property Studies	YOS4	32
EBE	Bachelor of Science in Quantity Surveying	YOS2	33
EBE	Bachelor of Science in Quantity Surveying	YOS3	34
EBE	Bachelor of Science in Quantity Surveying	YOS4	35
EBE	Bachelor of Science in Quantity Surveying Studies	YOS1	36

EBE	Bachelor of Science in Quantity Surveying Studies	YOS2	37
EBE	Bachelor of Science in Town and Regional Planning	YOS4	38
EBE	Bachelor of Science in Urban and Regional Planning	YOS1	39
EBE	Bachelor of Science in Urban and Regional Planning	YOS2	40
EBE	Bachelor of Science in Urban and Regional Planning	YOS3	41
HSc	Bachelor of Clinical Medical Practice	YOS1	42
HSc	Bachelor of Dental Science	YOS1	43
HSc	Bachelor of Dental Science	YOS2	44
HSc	Bachelor of Dental Science	YOS3	45
HSc	Bachelor of Dental Science	YOS4	46
HSc	Bachelor of Dental Science	YOS5	47
HSc	Bachelor of Health Sciences	YOS1	48
HSc	Bachelor of Health Sciences	YOS2	49
HSc	Bachelor of Health Sciences	YOS3	50
HSc	Bachelor of Nursing	YOS1	51
HSc	Bachelor of Nursing	YOS2	52
HSc	Bachelor of Nursing	YOS3	53
HSc	Bachelor of Nursing	YOS4	54
HSc	Bachelor of Pharmacy	YOS1	55
HSc	Bachelor of Pharmacy	YOS2	56
HSc	Bachelor of Pharmacy	YOS3	57
HSc	Bachelor of Pharmacy	YOS4	58
HSc	Bachelor of Science in Occupational Therapy	YOS1	59
HSc	Bachelor of Science in Occupational Therapy	YOS2	60
HSc	Bachelor of Science in Occupational Therapy	YOS3	61
HSc	Bachelor of Science in Occupational Therapy	YOS4	62
HSc	Bachelor of Science in Physiotherapy	YOS1	63
HSc	Bachelor of Science in Physiotherapy	YOS2	64
HSc	Bachelor of Science in Physiotherapy	YOS3	65
HSc	Bachelor of Science in Physiotherapy	YOS4	66
HSc	Diploma in Oral Hygiene	YOS1	67
HSc	Diploma in Oral Hygiene	YOS2	68
HSc	Bachelor of Medicine and Bachelor of Surgery	YOS1	69
HSc	Bachelor of Medicine and Bachelor of Surgery	YOS2	70
HSc	Bachelor of Medicine and Bachelor of Surgery	YOS3	71
HSc	Bachelor of Medicine and Bachelor of Surgery	YOS4	72
HSc	Bachelor of Medicine and Bachelor of Surgery	YOS5	73
HSc	Bachelor of Medicine and Bachelor of Surgery	YOS6	74
Hum	Advanced Certificate in Education	YOS1	75

Hum	Advanced Certificate in Education	YOS2	76
Hum	Bachelor of Music	YOS1	77
Hum	Bachelor of Music	YOS2	78
Hum	Bachelor of Music	YOS3	79
Hum	Bachelor of Music	YOS4	80
Hum	Bachelor of Arts	YOS1	81
Hum	Bachelor of Arts	YOS2	82
Hum	Bachelor of Arts	YOS3	83
Hum	Bachelor of Arts in Dramatic Art	YOS1	84
Hum	Bachelor of Arts in Dramatic Art	YOS2	85
Hum	Bachelor of Arts in Dramatic Art	YOS3	86
Hum	Bachelor of Arts in Dramatic Art	YOS4	87
Hum	Bachelor of Arts in Fine Arts	YOS1	88
Hum	Bachelor of Arts in Fine Arts	YOS2	89
Hum	Bachelor of Arts in Fine Arts	YOS3	90
Hum	Bachelor of Arts in Fine Arts	YOS4	91
Hum	Bachelor of Arts in Social Work	YOS3	92
Hum	Bachelor of Arts in Speech and Hearing Therapy	YOS1	93
Hum	Bachelor of Arts in Speech and Hearing Therapy	YOS2	94
Hum	Bachelor of Arts in Speech and Hearing Therapy	YOS3	95
Hum	Bachelor of Arts in Speech and Hearing Therapy	YOS4	96
Hum	Bachelor of Education	YOS1	97
Hum	Bachelor of Education	YOS2	98
Hum	Bachelor of Education	YOS3	99
Hum	Bachelor of Education	YOS4	100
Hum	Bachelor of Social Work	YOS1	101
Hum	Bachelor of Social Work	YOS2	102
Hum	Bachelor of Social Work	YOS3	103
Hum	Bachelor of Social Work	YOS4	104
Hum	Higher Diploma in Education	YOS3	105
Hum	Higher Diploma in Education	YOS4	106
Sci	Bachelor of Science	YOS1	107
Sci	Bachelor of Science	YOS2	108
Sci	Bachelor of Science	YOS3	109

APPENDIX B – Undergraduate class list by random order

Faculty	Degree Type	Year of Study	Original allocation	Random allocation
HSc	Bachelor of Clinical Medical Practice	YOS1	42	1
Hum	Bachelor of Arts in Dramatic Art	YOS4	87	2
EBE	Bachelor of Science in Construction Management	YOS2	20	3
HSc	Bachelor of Medicine and Bachelor of Surgery	YOS5	73	4
CLM	Bachelor of Economic Science	YOS2	8	5
CLM	Bachelor of Economic Science	YOS1	7	6
Hum	Bachelor of Music	YOS3	79	7
EBE	Bachelor of Science in Property Studies	YOS3	31	8
HSc	Bachelor of Science in Physiotherapy	YOS2	64	9
EBE	Bachelor of Science in Quantity Surveying	YOS3	34	10
CLM	Bachelor of Laws	YOS2	11	11
CLM	Bachelor of Accounting Science	YOS3	3	12
Hum	Bachelor of Arts in Speech and Hearing Therapy	YOS4	96	13
EBE	Bachelor of Science in Quantity Surveying Studies	YOS2	37	14
Hum	Bachelor of Arts	YOS3	83	15
HSc	Bachelor of Pharmacy	YOS2	56	16
EBE	Bachelor of Architectural Studies	YOS3	16	17
HSc	Bachelor of Health Sciences	YOS2	49	18
HSc	Bachelor of Medicine and Bachelor of Surgery	YOS1	69	19
EBE	Bachelor of Engineering Science in Biomedical Engineering	YOS1	17	20
EBE	Bachelor of Science in Property Studies	YOS1	29	21
HSc	Bachelor of Health Sciences	YOS1	48	22
HSc	Diploma in Oral Hygiene	YOS1	67	23
Hum	Bachelor of Music	YOS2	78	24
EBE	Bachelor of Engineering Science in Biomedical Engineering	YOS3	19	25
EBE	Bachelor of Science in Urban and Regional Planning	YOS3	41	26
EBE	Bachelor of Science in Engineering	YOS2	26	27
CLM	Bachelor of Commerce	YOS1	4	28
Hum	Bachelor of Social Work	YOS3	103	29
HSc	Bachelor of Science in Physiotherapy	YOS4	66	30
EBE	Bachelor of Science in Engineering	YOS4	28	31
CLM	Bachelor of Laws	YOS3	12	32
Sci	Bachelor of Science	YOS2	108	33
Hum	Bachelor of Arts in Speech and Hearing Therapy	YOS1	93	34
Hum	Bachelor of Arts	YOS2	82	35

EBE	Bachelor of Engineering Science in Biomedical Engineering	YOS2	18	36
EBE	Bachelor of Science in Engineering	YOS3	27	37
EBE	Bachelor of Science in Quantity Surveying	YOS2	33	38
HSc	Diploma in Oral Hygiene	YOS2	68	39
HSc	Bachelor of Dental Science	YOS2	44	40
Hum	Advanced Certificate in Education	YOS2	76	41
CLM	Bachelor of Accounting Science	YOS2	2	42
EBE	Bachelor of Science in Quantity Surveying Studies	YOS1	36	43
HSc	Bachelor of Science in Occupational Therapy	YOS1	59	44
HSc	Bachelor of Pharmacy	YOS4	58	45
EBE	Bachelor of Science in Property Studies	YOS2	30	46
Hum	Advanced Certificate in Education	YOS1	75	47
HSc	Bachelor of Science in Physiotherapy	YOS3	65	48
Sci	Bachelor of Science	YOS1	107	49
Hum	Bachelor of Music	YOS1	77	50
CLM	Bachelor of Commerce	YOS2	5	51
Hum	Bachelor of Arts in Dramatic Art	YOS2	85	52
EBE	Bachelor of Science in Town and Regional Planning	YOS4	38	53
CLM	Bachelor of Accounting Science	YOS1	1	54
Hum	Bachelor of Social Work	YOS1	101	55
Hum	Bachelor of Education	YOS2	98	56
EBE	Bachelor of Science in Quantity Surveying	YOS4	35	57
Hum	Bachelor of Education	YOS1	97	58
EBE	Bachelor of Science in Construction Management Studies	YOS1	23	59
EBE	Bachelor of Science in Construction Management	YOS4	22	60
HSc	Bachelor of Medicine and Bachelor of Surgery	YOS6	74	61
EBE	Bachelor of Science in Urban and Regional Planning	YOS1	39	62
Hum	Bachelor of Arts	YOS1	81	63
HSc	Bachelor of Nursing	YOS2	52	64
HSc	Bachelor of Science in Occupational Therapy	YOS4	62	65
EBE	Bachelor of Science in Property Studies	YOS4	32	66
EBE	Bachelor of Science in Engineering	YOS1	25	67
CLM	Bachelor of Economic Science	YOS3	9	68
CLM	Bachelor of Laws	YOS1	10	69
HSc	Bachelor of Science in Occupational Therapy	YOS3	61	70
Hum	Bachelor of Music	YOS4	80	71
Hum	Bachelor of Arts in Social Work	YOS3	92	72
HSc	Bachelor of Nursing	YOS1	51	73

HSc	Bachelor of Medicine and Bachelor of Surgery	YOS3	71	74
HSc	Bachelor of Nursing	YOS3	53	75
Hum	Bachelor of Arts in Fine Arts	YOS3	90	76
Hum	Bachelor of Arts in Speech and Hearing Therapy	YOS2	94	77
HSc	Bachelor of Dental Science	YOS1	43	78
Hum	Bachelor of Arts in Fine Arts	YOS2	89	79
HSc	Bachelor of Medicine and Bachelor of Surgery	YOS4	72	80
HSc	Bachelor of Dental Science	YOS4	46	81
HSc	Bachelor of Dental Science	YOS3	45	82
EBE	Bachelor of Science in Urban and Regional Planning	YOS2	40	83
Hum	Bachelor of Education	YOS3	99	84
CLM	Bachelor of Laws	YOS4	13	85
Hum	Bachelor of Education	YOS4	100	86
Hum	Bachelor of Social Work	YOS4	104	87
Hum	Bachelor of Arts in Speech and Hearing Therapy	YOS3	95	88
EBE	Bachelor of Architectural Studies	YOS1	14	89
HSc	Bachelor of Health Sciences	YOS3	50	90
HSc	Bachelor of Pharmacy	YOS3	57	91
HSc	Bachelor of Science in Occupational Therapy	YOS2	60	92
EBE	Bachelor of Architectural Studies	YOS2	15	93
EBE	Bachelor of Science in Construction Management Studies	YOS2	24	94
HSc	Bachelor of Nursing	YOS4	54	95
HSc	Bachelor of Science in Physiotherapy	YOS1	63	96
HSc	Bachelor of Pharmacy	YOS1	55	97
EBE	Bachelor of Science in Construction Management	YOS3	21	98
HSc	Bachelor of Medicine and Bachelor of Surgery	YOS2	70	99
Hum	Higher Diploma in Education	YOS4	106	100
CLM	Bachelor of Commerce	YOS3	6	101
HSc	Bachelor of Dental Science	YOS5	47	102
Hum	Bachelor of Arts in Fine Arts	YOS1	88	103
Hum	Bachelor of Arts in Dramatic Art	YOS3	86	104
Hum	Bachelor of Arts in Fine Arts	YOS4	91	105
Hum	Higher Diploma in Education	YOS3	105	106
Hum	Bachelor of Arts in Dramatic Art	YOS1	84	107
Hum	Bachelor of Social Work	YOS2	102	108
Sci	Bachelor of Science	YOS3	109	109

APPENDIX C – Study Questionnaire

HOOKAH PIPE SMOKING IN UNDERGRADUATE STUDENTS AT WITS

Please mark the appropriate box with a cross (X) or a tick (√)

1. Please indicate your sex	☐ Male ☐ Female
2. How old are you?	..... years
3. To which faculty do you belong?	☐ Commerce, Law & Management ☐ Engineering and the Built Environment ☐ Health Sciences ☐ Humanities ☐ Science
4. What is your current year of study?	☐ 1st ☐ 2nd ☐ 3rd ☐ 4th ☐ 5th ☐ 6th
5. Which race or ethnic group best describes yourself?	☐ Black ☐ White ☐ Indian ☐ Coloured ☐ Other
6. Have you ever used any of the following types of tobacco?	☐ Cigars/cigarillos ☐ E-cigarettes ☐ Snuff
7. Have you ever smoked a cigarette?	☐ Yes ☐ No *(If no, please skip to question 11)*
8. Have you smoked more than 100 cigarettes in your lifetime?	☐ Yes ☐ No
9. Currently, how often do you smoke cigarettes?	☐ Daily ☐ Occasionally ☐ Not at all
10. At what age did you start smoking cigarettes?	..... years *(please skip to question 12)*
11. Do you think you may try cigarette smoking?	☐ Yes, I may try it at some time ☐ No, I definitely will not smoke cigarettes
12. Do any of your family members smoke or have previously smoked *cigarettes?* (Please mark all appropriate)	☐ None ☐ Father ☐ Mother ☐ Siblings (brother, sister) ☐ Unsure
13. Do any of your family members smoke or have previously smoked *a hookah pipe?* (Please mark all appropriate)	☐ None ☐ Father ☐ Mother ☐ Siblings (brother, sister) ☐ Unsure
14. Do any of your friends smoke a hookah pipe?	☐ Yes ☐ No ☐ Unsure
15. What do you think is the effect of hookah pipe smoking on the hookah pipe smoker's health?	☐ Improves health ☐ Makes no difference to health ☐ Harmful to health ☐ Unsure

Questionnaire Number ____

Page 1

16. Please indicate your response to the following statements by marking a cross (X) or a tick (√)	Agree	Disagree	Unsure
(a) The water in hookah pipes safely filters toxins			
(b) Adding fruit to hookah tobacco makes it a healthy habit			
(c) Hookah smoking is dangerous			
(d) Hookah smoking is less dangerous than cigarette smoking			
(e) Hookah smoking is as dangerous as cigarette smoking			
(f) Hookah smoking is addictive			
(g) Hookah smoking is less addictive than cigarette smoking			
(h) Hookah smoking is as addictive as cigarette smoking			
(i) Hookah tobacco has less nicotine than cigarettes			
(j) Hookah smoking can cause serious medical diseases			
(k) Hookah smoking can cause sexual dysfunction			
(l) Sharing a Hookah pipe can result in the transmission of diseases			
(m) Second hand smoke from hookah pipes is harmful to other people			

17. Have you ever smoked a hookah pipe?	☐ Yes *(If yes, please skip to question 20)* ☐ No
18. Do you think you may try hookah pipe smoking?	☐ Yes, I may try it at some time ☐ No, I definitely will not smoke a hookah pipe
19. Do you think that hookah pipe smoking should be regulated on campus?	☐ Yes ☐ No ☐ Unsure

If you answered 'Yes' to question 17 (ever smoked hookah) then please proceed to question 20, otherwise . . .

Thank you very much for taking the time to complete the questionnaire

Please complete the following questions ONLY if you have ever smoked a hookah pipe

20. At what age did you start smoking the hookah pipe?	..... years
21. Do you own a hookah pipe?	☐ Yes ☐ No
22. During the past 3 months how often have you smoked a hookah pipe?	☐ At least once a month *(please proceed to question 23)* ☐ Less than once a month

If you answered 'At least once a month' to question 22 (how often have you smoked) then please proceed to question 23, otherwise . . .

Thank you very much for taking the time to complete the questionnaire

23. During the past month how frequently did you smoke a hookah pipe?	☐ Less than once a week ☐ At least once a week – mainly on weekends ☐ At least once a week – mainly on weekdays ☐ Daily
24. How many times did you smoke a hookah pipe during the past month?	☐ 1 – 3 times ☐ 4 – 10 times ☐ 11 – 20 times ☐ ≥ 21 times
25. How long do you smoke the hookah pipe (on average) per session?	☐ ≤ 15 minutes ☐ 16 – 30 minutes ☐ 31 – 45 minutes ☐ 46 – 60 minutes ☐ > 1 hour
26. Where do you *mainly* smoke the hookah pipe?	☐ Public places such as bars and cafes ☐ Outdoor areas such as parks ☐ On campus ☐ At home or other peoples' homes ☐ At parties ☐ Other (specify) ....
27. Do you smoke the hookah pipe on campus?	☐ Yes ☐ No
28. On average how much do you spend on hookah pipe tobacco per month?	☐ < R25 ☐ R25 – R50 ☐ R51-R100 ☐ > R100
29. Where do you usually buy your hookah pipe tobacco?	☐ On campus ☐ Other (specify) ....

30. Please indicate what appeals to you about hookah pipe smoking (You can select more than 1 option)	☐ Taste ☐ Smell ☐ Looks cool ☐ Social atmosphere ☐ Safer than cigarettes ☐ To fit in with my friends	☐ Helps me relax ☐ Helps me cope with stress ☐ Helps me concentrate ☐ Other (specify) .....
31. Who first introduced you to hookah pipe smoking?	☐ Parent(s) ☐ Sibling (brother, sister) ☐ Friend(s) ☐ I discovered it myself ☐ Other (specify)	
32. Did you feel that peer pressure was an important factor in your decision to start smoking the hookah pipe?	☐ Yes ☐ No	
33. Do you feel an uncontrollable urge to smoke the hookah pipe after going a few days without smoking the hookah pipe?	☐ Yes ☐ No	
34. Do you ever share the mouth piece of the hookah pipe with others?	☐ Yes ☐ No	
35. Have you ever added alcohol to the hookah pipe?	☐ Yes ☐ No ☐ No comment	
36. Have you ever added marijuana (dagga/weed/zol/grass/pot/ganja/hash) to your hookah pipe tobacco?	☐ Yes ☐ No ☐ No comment	

37. Please indicate how the introduction of the following measures on CAMPUS might affect your hookah pipe smoking	Smoke more	No change	Smoke less
(a) Restriction of hookah pipe smoking to designated areas			
(b) Placement of graphic posters warning of the risks of smoking hookah pipes			
(c) Ban on the sale of hookah pipe tobacco			
(d) Complete ban on smoking hookah pipes			

38. Would you support hookah pipe smoking being regulated on campus?	☐ Yes ☐ No ☐ Unsure
39. Which of the following best describes how you feel about your hookah pipe smoking?	☐ I don't want to quit ☐ I'm thinking about quitting ☐ I'm ready to quit now
40. Would you consider using a campus quit smoking programme?	☐ Yes ☐ No ☐ Unsure

Thank you very much for taking the time to complete the questionnaire

APPENDIX D – Ethics Clearance Certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Dr Kuban D Naidoo

CLEARANCE CERTIFICATE **M10957**

PROJECT Factors associated with hookah pipe smoking among undergraduate students at the University of the witwatersrand, Johannesburg.

INVESTIGATORS	Dr Kuban D Naidoo.
DEPARTMENT	Department of Paediatrics & Child health
DATE CONSIDERED	01/10/2010
DECISION OF THE COMMITTEE*	Approved unconditionally

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 01/10/2010 **CHAIRPERSON** .....
(Professor PE Cleaton-Jones)

*Guidelines for written 'informed consent' attached where applicable
cc: Supervisor : Prof Haroon Salooje

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**
PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES...

APPENDIX E – University Permission Letter

Deputy Registrar: Academic

Private Bag 3, Wits 2050, South Africa • Tel: +27 (0) 11 717-1204 • Fax: +27 (0) 86 553 3695 • E-mail: nita.lawton-misra@wits.ac.za

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Tel +27 (0)11 717-1204

18 October 2010

TO WHOM IT MAY CONCERN

"Factors associated with hookah pipe smoking among undergraduate students at the University of the Witwatersrand, Johannesburg"

It is hereby confirmed that the enclosed research material has been distributed in accordance with the University's approval procedures for such a project. Please be advised that it is your right to withdraw from participating in the process if you find the contents intrusive, too time-consuming, or inappropriate. The necessary ethical clearance has been obtained.

Should the University's internal mailing system be the mechanism whereby this questionnaire has been distributed, this notice serves as proof that permission to use it has been granted.

Students conducting surveys must seek permission in advance from Heads of Schools or individual academics concerned should surveys be conducted during teaching time.

Nita Lawton-Misra
Deputy Registrar: Academic

APPENDIX F – Information Sheet

Dear Student

Factors associated with hookah pipe smoking in undergraduate students at the University of the Witwatersrand, Johannesburg

Hello.

My name is Kuban Naidoo. I am a doctor and a MMed student in the Department of Paediatrics at Wits. As part of the fulfillment of my degree, I am required to complete a research study related to my field.

I would like to invite you to participate in a study looking at various factors associated with hookah pipe smoking. I am trying to find out how many students are smoking the hookah pipe and what students think about this habit. You may know the hookah pipe as a hubbly bubbly, shisha, water pipe or pipe.

Your class was chosen to be invited through a computer generated selection process including all undergraduate classes at the university. Participation in this study will entail the completion of a single anonymous questionnaire. The questionnaire should take 15 - 20 minutes to complete depending on your responses.

Confidentiality will be maintained at all times. The questionnaire does not require your name, student number or any other information which could identify you. The study will not require a signature on a consent form as your consent will be implied by your decision to complete and return the questionnaire. To further ensure your anonymity please place the questionnaire in the collection box located at the exit of the lecture theatre, even if you have chosen not to participate. The research report will also not contain any identifying information.

Participation in this study is completely voluntary and you may withdraw at any stage without notification, and without negative consequences. In addition, you may choose not to respond to certain questions without negative consequences. You need to be 18 years or older to participate in the study, since this is the legal age of consent.

For any questions, concerns or further information regarding this study, please feel free to contact me on 0834676298.

This study was approved by the Committee for Research in Human Subjects at the University of the Witwatersrand (Medical). On any queries or complaints regarding your rights as a participant in this research study, please do not hesitate to contact the Committee for Research in Human Subjects at the University of the Witwatersrand (Medical) at (011)7171234.

There will not be any direct feedback to you of the findings of this study. However, the intention is to publish the results in a scientific journal.

Thank you for taking the time to read this.

Yours sincerely

Kuban Naidoo (Researcher)

APPENDIX G – Demographics of sample vs. total undergraduate population

Table G1 Comparison of demographic characteristics of study sample to that of the total undergraduate population at the University of the Witwatersrand, Johannesburg (2010)

Demographic Factor	Sample N = 824 (%)	All Undergraduates N = 20397 (%)
Sex		
Female	448 (54.4)	11482 (56.3)
Male	375 (45.5)	8915 (43.7)
Race		
Black	385 (46.7)	12230 (60.0)
White	248 (30.1)	4546 (22.3)
Indian	128 (15.5)	2861 (14.0)
Coloured	35 (4.2)	729 (3.6)
Other	22 (2.7)	31 (0.2)
Faculty		
Commerce	173 (21.0)	4672 (22.9)
Engineering	271 (32.9)	3813 (18.7)
Health Sciences	133 (16.1)	2719 (13.3)
Humanities	131 (15.9)	6983 (34.2)
Science	116 (14.1)	2211 (10.8)
Year of Study		
First	445 (54.0)	9001 (44.1)
Second	166 (20.1)	5497 (27.0)
Third	118 (14.3)	3878 (19.0)
Fourth	27 (3.3)	1530 (7.5)
Fifth	68 (8.3)	261 (1.3)
Sixth	0 (0.0)	230 (1.1)