Waterpipe Use in Canada: Evidence, Perceptions, and Policy Implications

by

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ABSTRACT

Canadian research on the phenomenon of waterpipe (WP) use has been slow to develop. Significant knowledge gaps have hampered tobacco control efforts in this area. This thesis presents results from three multidisciplinary studies that were designed to provide fundamental knowledge about WP use. Study 1 provided the first Canadian assessment of the chemical contents of commercially available, so-called „herbal" *shisha*. Study 2 described knowledge of Canadian medical students about WP (and other tobacco) use. Study 3 explored young adults" current knowledge and attitudes toward WP use. Collectively, the findings have important implications for designing appropriate education and prevention strategies to address the spread of WP use in Canada, and support an evidence-based approach to developing appropriate policies to address the phenomenon. For years, research interest in smoking WPs in Canada was limited. This created a knowledge gap in tobacco control efforts, which will require further efforts to increase our understanding of the determinants of WP smoking. The present research will help to increase awareness about its health hazards, to design special prevention and treatment interventions, and to incorporate WP use control policy within national and provincial tobacco control policies.

PREFACE

Chapter 2 of this thesis has been published as Hammal F, Chappell A, Wild TC, Kindzierski W, Shihadeh A, Vanderhoek A, Huynh CK, Plateel G, Finegan BA. 'Herbal' but potentially hazardous: an analysis of the constituents and smoke emissions of tobacco-free waterpipe products and the air quality in the cafés where they are served. Tob Control. 2013 Oct 15. doi: 10.1136/tobaccocontrol-2013-051169. I was responsible for the data collection and analysis as well as the manuscript composition.

Chapter 3 of this thesis has been published as Vanderhoek AJ, Hammal F, Chappell A, Wild TC, Raupach T, Finegan BA. Future physicians and tobacco: An online survey of the habits, beliefs and knowledge base of medical students at a Canadian university. Tob Induc Dis. 2013 Apr 4;11(1):9. I contributed to data analysis as well as the manuscript composition, AJ. Vanderhoek was responsible for data collection and contributed to data analysis and to manuscript composition.

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LIST OF ABBREVIATIONS

AAW:	Average Active Waterpipes
ASHRAE:	The American Society of Heating, Refrigerating and Air Conditioning Engineers
AWP:	Active Waterpipe Percentage
Co:	CO2 level outdoor
Cs:	CO2 level in the building
CAN-ADAPTT:	The Canadian Action Network for the Advancement, Dissemination and Adoption of Practice-informed Tobacco Treatment.
Cig:	Cigarette
CIG:	Cigarette smoking venues
CO:	Carbon monoxide
CO2:	Carbon Dioxide
COHb:	Carbonmonoxyhemoglobin
COPD:	Chronic Obstructive Pulmonary Disease
CTUMS:	Canadian Tobacco Use Monitoring Survey
Ds:	Waterpipes Density
DSMIV-TR:	Diagnostic and Statistical Manual of Mental Disorders. Fourth-TR ed
g:	Gram
G:	The generation rate of CO2 for a sedentary person.
GC-MS:	Gas chromatography–mass spectrometry
GYTS:	Global Youth Tobacco Survey
GP	General Practitioner
HPLC:	High-performance liquid chromatography
IARC:	International Agency for Research on Cancer
L:	Liter
m^3:	Cubic meter
ME:	Middle Eastern

MER:	Middle Eastern Region
mg:	Milligram
ND:	Not Detectable
NFDPM:	Nicotine-free dry particulate matter
ng:	Nanogram
NO:	Nitric Oxide
NQ:	Below the limit of quantification
NRT	Nicotine replacement therapy
PAHs:	Poly-aromatic hydrocarbons
PM:	Particulate matter
ppm:	Part Per Million
RCMP:	The Royal Canadian Mounted Police
RMR:	Reduce My Risk
SD:	Standard deviation
TAYES:	The Alberta Youth Experience Survey
TFF:	Tobacco Free Futures
UK:	United Kingdom
UME:	Undergraduate Medical Education
USA:	United States of America
Vo:	Ventilation rate per person
WP:	Waterpipe
WP#:	Waterpipe Café
WHO:	The World Health Organization
WHO-EMRO:	World Health Organization (Eastern Mediterranean Regional Office)
YSS:	Youth Smoking Survey
µg:	Microgram
95% CI:	95% Confidence interval
(G#-F#-C, #-#):	(Group#-Participant Gender & #- Ethnicity, Age group)

CHAPTER 1

INTRODUCTION AND BACKGROUND

The overall purpose of this research was to investigate the emerging phenomenon of WP use in Alberta. Three studies were conducted and presented, including: (1) a chemical analysis of the content of substances used in WPs, marketed to Canadians as “herbal” products; with analyses of main stream and side stream smoke emissions for these herbal products when smoked in lab environment in comparison with tobacco products; and a description of air quality at WP smoking establishments in Edmonton; (2) a quantitative description of the prevalence of WP use among medical students at the University of Alberta, and how they perceive WP use, and (3) a qualitative description of WP use practices and beliefs among immigrants and non-immigrant young Canadians. Results from the research were presented in relation to current policies, along with recommendations for planning future public health interventions.

Waterpipes: A Description

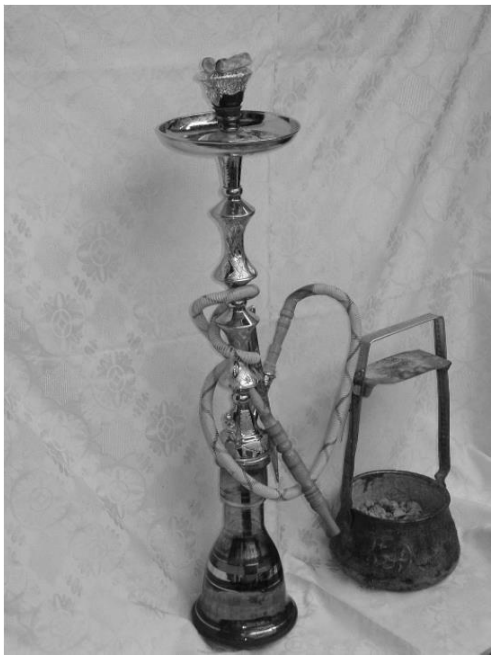

Figure 1.1. The waterpipe (*Hammal et al*.)[1]

A WP is a device used mainly to smoke tobacco; it has numerous names depending on its geographical area of origin (e.g., Narghile, Arghile, Shisha, Hookah, Hubble-Bubble). Despite variations in WP shapes and sizes, all WPs have a similar structure, use the same smoking technique, and share the defining feature of smoke passing through water before inhalation. Contemporary WPs are handcrafted objects with artistic as well as functional properties. A typical WP forms a sinuous hourglass-like figure and is made of several parts (figure 1.1). The base of a WP is a vase-like chamber made of coloured blown glass, often adorned with hand-painted decorations. Atop the

chamber, which is filled partially with water, sits a decorative brass or wooden column with a long brass tube (stem) at its core. The bottom of the stem is submerged in a glass chamber. The rest of the stem rises up through the decorative column and is crowned with a small ceramic bowl and a brass disk for catching ash. Near the middle of the column is a fixture to which a smoking hose (approximately 1 m in length) is attached. Typically, the smoking hose has a wooden grip that forms the mouthpiece and is decorated with fabric and elegant tassels [1].

Preparing a WP usually involves placing rough-cut aromatic tobacco (Muas‟sel, in some countries called "*shisha*") or any other product into the bowl, covering the bowl with perforated aluminum foil, and placing a piece of hot charcoal on the foil to heat the tobacco or Muas‟sel. The smoker holds the smoking hose and inhales through the mouthpiece. The smoker‟s sucking action produces negative pressure inside the chamber, which in turn draws smoke from bowl down through the stem, bubbling through the water in the chamber, and out through the hose into the smoker‟s mouth and lungs (figure 1.2). Smoking sessions can last from 15 min up to several hours. Disposable plastic mouthpieces can be added, ostensibly to limit the spread of disease [1].

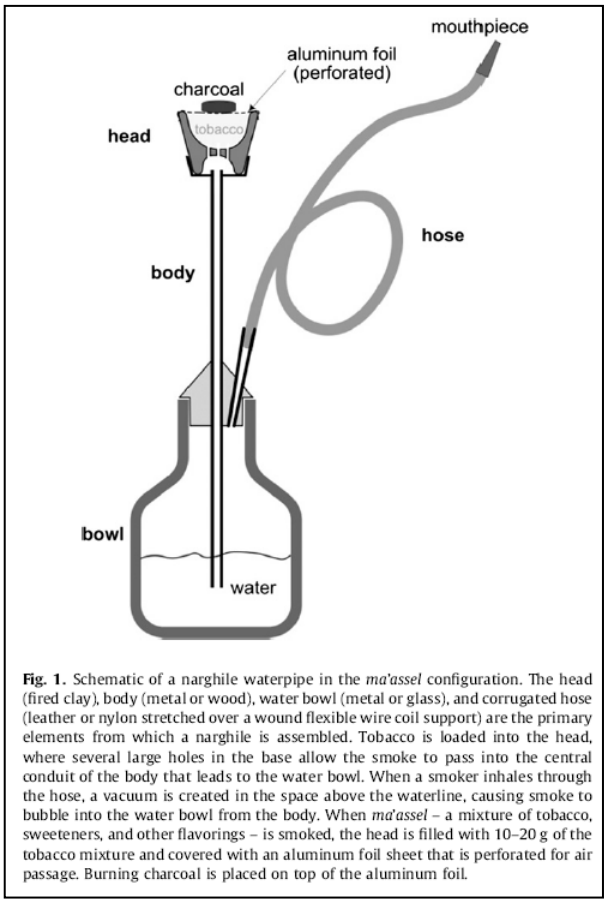

Fig. 1. Schematic of a narghile waterpipe in the *ma'assel* configuration. The head (fired clay), body (metal or wood), water bowl (metal or glass), and corrugated hose (leather or nylon stretched over a wound flexible wire coil support) are the primary elements from which a narghile is assembled. Tobacco is loaded into the head, where several large holes in the base allow the smoke to pass into the central conduit of the body that leads to the water bowl. When a smoker inhales through the hose, a vacuum is created in the space above the waterline, causing smoke to bubble into the water bowl from the body. When *ma'assel* – a mixture of tobacco, sweeteners, and other flavorings – is smoked, the head is filled with 10–20 g of the tobacco mixture and covered with an aluminum foil sheet that is perforated for air passage. Burning charcoal is placed on top of the aluminum foil.

Figure 1.2. The waterpipe parts. (*Monzer et al.)*[5]

Products Used in Waterpipes

Products smoked in WPs are often marketed and labeled as “0.0% tar and 0.5% nicotine”, “0.0% tar and 0.05% nicotine”, or “100% tobacco and nicotine free” (i.e., so-called “herbal” products); however, these marketing and labeling claims are not always accurate [2]. For instance, in California, a laboratory test conducted on WP smoking mixtures marketed as tobacco free found that the products did contain tobacco [3]. Although other tobacco products can be used, such as Tumbak or Ajami, and Jurak, the most popular product available is Muas‟sel (an Arabic word meaning “honeyed”). Muas‟sel is a mixture of tobacco leaves (or other herbs), glycerin and/or honey that is flavoured with apple, mint, strawberry or other fruit flavours. The average amount of Muas‟sel smoked in a smoking session is 10-20 g. Some studies estimate that Muas‟sel tobacco contains 67 mg of nicotine, equivalent to one third of nicotine presented in 20 cigarettes (204 mg/pack) [4].

Charcoal Used

Charcoal is used to sustain the smoke generation process while using WP. Unlike cigarettes, products used in WPs do not burn by themselves, a small piece of burning charcoal is placed directly on top of unflavoured tobacco (Ajami), and indirectly (on top of a perforated aluminum foil) when using Muas'sel. About 5 g of charcoal are consumed in a smoking session [5]. The temperature of tobacco burning in a WP ranges from 450°C closest to the charcoal to 50 °C at the head outlet, which is lower than the maximum temperatures of 900 °C for cigarettes [5, 6]. This lower temperature results in incomplete combustion, which suggests that the smoke production and composition will not be the same as for complete combustion [6, 7]. The charcoal piece is replaced or adjusted regularly during the smoking session in order to maintain the smoke flow. Different types of charcoal are used,

including wood-derived charcoal, self-starting charcoal, and industrial charcoal. All of them lead to exposure to charcoal combustion emissions in addition to the elements resulted from burning the product [6].

The Role of Water and Smoke Exposure

A WP smoker may inhale as much smoke in a one-hour session as someone who inhaled 50 or more cigarettes [8]. There are limited data on potential harmful effects of WP use; however, it is commonly believed by the general public and health professionals that the water contained in WPs filters the smoke and eliminate most of the chemicals resulted from the tobacco burning process [9, 10], and reduces the harmful effects of smoking. This belief is encouraged by the fact that the smoke is significantly cooled as it passes through the water and long delivery pipe, which reduce its subjective harshness when inhaled. However, evidence from empirical studies does not support these beliefs, and indicates instead that WP smokers are at risk of exposure to high volume of smoke[8] that contains potentially high levels of chemicals, toxicants, and carcinogens such as nicotine [4], arsenic, beryllium, nickel, cobalt, chromium, lead, and nicotine-free dry particulate matter (NFDPM) [6], carbon monoxide (CO) [11], particulate matter (PM) [12, 13], carcinogenic poly-aromatic hydrocarbons (PAHs), and volatile aldehydes [14].

Health Hazards

Accumulating data has linked tobacco smoke from WPs with diseases that were also proved to be associated with cigarette use, including: malignancies [15-18], cardiovascular disease [19, 20], lung diseases [21-23], pregnancy complications [24, 25], oral or dental complications [26], hematologic disturbances [27, 28], genetic abnormalities [29, 30], as well as infectious diseases [15].

WP smoking increases heart rate, systolic and diastolic blood pressure, and expired air CO in those who smoke [31]. Compared with cigarettes, WP tobacco is associated with 3.75 times greater carboxyhemoglobin levels in the bloodstream and 56 times more smoke inhaled [32].

Patterns and Context of Use

Intermittent patterns of use are predominant for WP smoking, and there is a wide variability in the frequency of use, ranging from smoking several WPs daily to once monthly; however, most users smoke WPs on a once-daily to once-weekly basis [33, 34]. One of the major characteristics of WP use is its social context, where smokers sit together to smoke WPs, and this social aspect of WP use may become part of rituals of smoking. However, the importance of this social component seems to fade among more dependent smokers, where shifting to more personalized and individualized pattern of use, and increase tendency to refuse to share WP with others or to smoke alone, have been noticed among heavier smokers especially daily smokers. For such smokers, the social context becomes a marginal factor [1, 35]. Smoking locations differ depending on the context of smoking, e.g., restaurants, cafés, homes, at the seaside, and in parks. For many smokers, carrying WP in their cars, or having WP in every location that they frequently visit is a common practice [1, 35].

Evidence of Addictive Effects

WP users, especially daily smokers, show signs and symptoms of nicotine dependence. A substantial proportion of WP smokers increase their smoking frequency and intensity over time [36, 37]. For some users, WPs become a central part of smokers‟ social activities, with efforts made to

ensure availability, carrying a WP with them, or having it available in places that they could visit [36, 37]. It has been shown that WP smokers have expressed an interest in quitting and have attempted to quit in the past [38]. Abstinent WP tobacco smokers report symptoms similar to those reported by abstinent cigarette smokers [34]. Furthermore, evidence suggest that WP use could be a gateway for other forms of tobacco and drug use, and could be the cause of relapse for smokers who quit smoking cigarettes [39].

Using the DSM IV-TR criteria for nicotine dependence [40] to understand the dependence features and characteristics of WP use we can summarize that some WP smokers show signs of tolerance and withdrawal symptoms, use WPs more than intended, want to quit, spend a great deal of time to insure availability, and that WP use can dominate their social and recreational activities [34,36,37].

In contrast, occasional users do not use the WP on a regular basis and are able to abstain from smoking without apparent withdrawal symptoms [34,36,37]. This pattern of use may lead to the common belief that the WP smoking is not addictive. Both WP smoking and cigarette smoking among adolescents are intermittent, mostly social, and influenced by peer pressure, availability and timing considerations. Applying addiction theories that address the development of dependence signs after brief and intermittent cigarette use among beginner smokers, including the loss of autonomy over use [41], may help to understand the development of dependence among WP smokers.

Gender Differences

Many WP users believe that WPs are more appropriate for young smokers and women than cigarettes [1, 42]. Nevertheless, a recently published qualitative study [43] in four countries in the Middle Eastern region

(MER) indicated that there are negative images associated with women smoking WPs, with the practice seen as disrespectful in some conservative societies. Moreover, the sexual allure conveyed through WP smoking as well as WP smoking as a symbol of emancipation was highlighted [43].

Cultural Aspects of Waterpipe Use

Historically, the strongest evidence about the beginning of WP smoking suggest that it began in India in early 17th century [44], it was a sign of nobility and social status at that time [9]. There is also some evidence that it was used in Africa before this date [45]. WPs have been used in China, Persia, Pakistan, Africa, Turkey, the MER, and throughout the Arab world. More recently WP use has expanded from its traditional historical context [36, 46]. A study conducted among New Jersey youth found a significant increase in WP use among African American and Hispanic adolescents [47]. Other studies, conducted among USA university students, found that half of the sample ever smoked tobacco using a WP, and 12.5% were current WP users. Risk factors were having a Middle Eastern (ME) friend, as well as past cigarette or cigar use [48]. Among Arab Americans, predictors of ever use WP were easy access, stress, friends‟ smoking, and mother or sister smoking [49].

The importance of developing culturally appropriate interventions to address the spread of WP smoking in US society was indicated in several studies [48, 50]. A study among Somali refugees in Minnesota found that although Somali youth were less likely to smoke cigarettes compared to state-wide smoking prevalence, they tend to belief that smoking WP is less risky than smoking cigarettes. Positive peer pressure and religion have been argued to be protective factors from smoking cigarettes that could be integrated in future tobacco prevention programs [50].

Religion and Waterpipe Use

The high prevalence of WP use in ME and North African cultures has led to a false assumption that WP use has a religious dimension, especially among Muslim people. The World Health Organization (WHO-EMRO) news analysis on tobacco use argued that WP use is more a general social problem, highlighting the importance of promoting a change in social beliefs and norms for successful control of the problem, and highlighted the potential role of religion in motivating users to stop [51, 52]. A study conducted in rural Egypt assessed the impact of a Fatwa (religious ruling) on smoking that was issued by the grand Mufti of Egypt. This study found that of WP cafés patrons, 83.2% were aware of the Fatwa and 80.8% though that smoking is a sin, i.e., “Haram” [53]. Another study found that cigarette smokers were more likely to believe that smoking is a sin compared to WP smokers [54]. Nevertheless such knowledge and belief was not associated with quit attempts among smokers [53]. This finding is in accordance with several reports which suggested that although religiosity is associated with less use of tobacco, inadequate evidence is available to support religious-based approaches for tobacco control interventions [55].

Waterpipe Promotion Online

An assessment of 144 websites promoting WP smoking establishments in USA found that none of them required age verification and less than 1% included a tobacco-related warning on the first page. The most common promotion topics for WP use were flavourings, pleasure, relaxation, product quality, and cultural and social aspects [56].

A comparison of WP and cigarette related videos on YouTube found that the number of viewers of WP videos was significantly lower, while the

number of comments per 1000 views was significantly higher for WP videos [57]. The analysis indicated that WP related videos were more likely to portray tobacco use in positive light (92% vs. 24%), while they were less likely to mention short term consequences (18% vs. 50%), long term consequences (2% vs. 44%) of tobacco use, and to contain explicit antismoking messages (0% vs. 39%) and to provide specific information on how to quit tobacco use (0% vs. 21%) [57].

These studies concluded that these websites and videos may play a role in misinforming WP users about the consequences of WP use, and that health education and policy measures should be taken to counter these misinformation and correct the common misconceptions [56, 57].

Attitudes Toward Waterpipes

Compared to cigarettes, attitudes toward this type of tobacco use is generally permissive and sometimes positive. Most WP smokers believe that WPs are less harmful and less addictive than cigarettes [39, 58]. Many users are convinced that what is used in the WPs is not a real tobacco, and that they could easily quit anytime without any difficulty, but few are interested in quitting.

Several factors could contribute to these distinctive attitudes, including: (1) the fact that WP smoke does not smell like cigarettes due to the added flavours; (2) users‟ perceptions that WP smoke does not have the same harshness as cigarettes, due to the fact that the burning temperature of WP is less that the cigarettes and to the cooling effect of water; (3) intermittent patterns of use, and the ability of some WP smokers to abstain for a while without experiencing withdrawal symptoms; (4) cultural assumptions related to this type of tobacco smoke, which lead to a more permissive attitude even among women in conservative societies like ME societies and Arab countries;

(5) a social context of use that promotes the impression that WP smoking is merely another mean of socializing; (6) marketing claims and media role; (7) the fact that in western societies, the ability of WP cafés to circumvent smoke free legislation, may send a confusing message that it is safe; and (7) a general lack of interest and knowledge about this method of tobacco use among both scientists and decision makers

Global Trends in Waterpipe Use

Since the early 1990s there has been a resurgence in WP popularity, especially among young adults and youth [59]. Accumulated evidence and expert reports estimated that more than 100 million persons worldwide consume tobacco using WPs [60]. Data also showed that WP has been introduced into new regions in the world away from its traditional historical context [36, 46, 61, 62]. The Global Youth Tobacco Survey (GYTS) showed that non-cigarette tobacco use (mostly via WPs) was reported by 15.6% of males and 9.9% of females, compared to 6.7% of males and 3.2% of females reporting cigarette smoking [63]. Reports about increase its popularity are emerging from different parts of the world including, the USA, England, France, and Germany. For instance, a study among university athletes in Pittsburgh, Pennsylvania showed that while smoking cigarettes is low among them, about 35% of athletes reported smoking WPs comparing to about 28% among their student counterparts [64]. The increase in WP popularity resulted in the WHO issuing an advisory note calling WP tobacco use as the first new tobacco trend of the 21st century [7]. Similarly, the American Lung Association issued an alert calling the WP tobacco use as an emerging deadly trend [65].

Several reasons could be cited as explanations for increased WP popularity, though these reasons could be different in different societies. For

instance, experiencing the exotic ambiance of the ME history could be a motive in western societies, while for youth and women in oriental conservative societies (in general) could be an expression of liberty, independence, and a western liberal lifestyle. Nevertheless, some of the reasons could be summarized as follows: (1) introducing a wide variety of new tobacco flavoured mixtures into the market; (2) increased WP availability; (3) the common belief that WP use is less harmful than other forms of tobacco use; (4) the social aspect of WP and seeking fun and leisure with friends; (5) exemption of WP cafés from clear air legislation; (6) increased awareness and knowledge about the cigarette health effects; (7) marketing claims and media role; and (8) relatively permissive attitudes toward WP smoking, comparing with negative attitudes toward cigarettes smoking.

Waterpipe Use in Canada

In Canada, in 2006, the Canadian Tobacco Use Monitoring Survey (CTUMS) asked for the first time about WP use. WP use was reported by 4% of Canadians aged 15 years and older, 25% of them were young adults aged 20-24, and 13% were youth aged 15-19. Among respondents 29% thought that smoking tobacco in a WP is less harmful than other tobacco use, 34% thought it reduced the level of tar, and 24% thought that smoking tobacco in a WP reduced the risk to health compared to smoking cigarettes [66]. However, in 2008, CTUMS did not report any data about WP use in its summary report. In 2009, a study published in UK concluded that in the absence of public health policy, this tobacco use method is more acceptable in the Canadian students‟ society due to the superficial view that smoking a WP is less harmful than smoking cigarettes [67]. In the absence of a national strategy to curb this public health threat, it was not surprising to witness accumulating reports about increase WP smoking prevalence, for instance, in Alberta, The Alberta Youth Experience Survey (TAYES) 2008, reported that

about 10% of the students (grade 7-12) have tried a WP [68]. In 2010, a study in Montreal found that about 23% of young adults aged 18 to 24 years reported WP use in the previous year [69]. The 2011 (CTUMS) summary result reported that 4% of young adults aged 20 to 24 currently used WPs, and 24% of the same age group had ever tried a WP [70].

In November 2009, the Royal Canadian Mounted Police (RCMP) seized about two tons of Egyptian WP tobacco in Oakville, Ontario [71]. Similarly, in 2010, the RCMP seized over two tons in Montreal, Quebec [72], about seven tons in Mississauga, Ontario, in 2011 [73], and 1.6 tons in Edmonton in May, 2014 [74]. The tobacco products seized were not identified as containing tobacco. Charges from these seizures can result in fines of up to a million dollars and in imprisonment for up to five years. The willingness of the importers to risk such penalties and the amounts of tobacco seized could be good indicators of the size of the WP smoking business in Canada.

The 2006 Canadian Youth Smoking Survey estimated that about 172,000 Canadian students less than 18 years of age reported ever trying smoke WPs. Among those who have tried, 68,000 were current WP smokers. Over 4,700 Canadian children in grade 8 currently use WP, with over 2000 of them currently using both WPs and cigarettes (Youth Smoking Survey, 2006, unpublished data). Unfortunately the Youth Smoking Survey (YSS) did not assess how young people accessed WPs, nor did it measure contextual aspects of WP use. Preliminary analyses of the 2006 Youth Smoking Survey indicated some correlation between smoking WP and other drugs use. For instance, “ever had a drink of alcohol” was reported by about 94% of only WP users compared to 69% for non-tobacco users. Similarly, about 74%, and 25% of only WP users reported “ever used marijuana, or hallucinogens”, compared to 26%, and 5.7% for non-tobacco users, respectively (Youth Smoking Survey, 2006, unpublished data). This cross

use of substances was reported elsewhere suggesting that WP use could be a gateway for other forms of tobacco and drug use [75, 76] and could cause relapse for people who have quit smoking cigarettes [36].

Physicians and Smoking

Physicians play a crucial role in preventing disease and promoting a healthy lifestyle [77]. The willingness of physicians to engage in providing prevention counseling is influenced by many factors, especially, their training [78], their own personal habits and their self-confidence in doing so effectively [79, 80]. This “personal-clinical relationship” has been well validated among Canadian and USA physicians [80, 81] and was especially relevant in the area of tobacco control, as non-smoking physicians were more likely to report encouraging cessation among their patients than those who smoke [80]. A similar trend was found among medical students, where healthy personal practices were found to equate with engagement in preventive counseling and appreciation of importance of this role as part of their professional responsibility [82]. A combination of didactic and interactive training during medical school can improve knowledge, attitude, and counseling skills regarding tobacco cessation and other forms of behavioral change [83, 84]. There is very limited information about the prevalence of smoking among Canadian medical school students and their perceived level of education and preparedness to address tobacco use with their patients [85]. There are limited data on WP use in medical students, a popular emerging method of smoking that is frequently thought of as less harmful than cigarettes [86].

Summary

From a public health prospective, allowing a device that within 45 minutes of a smoking session, can produce about (50 L) of smoke, with poorly characterized chemical constituents may be very problematic and potentially illegal in relation to clean air legislation. The increased interest in and knowledge about WP and its health effects led to a ban on WP smoking in public places in some countries, such as Syria, Lebanon and Turkey [87-89]; however, the public health response in Canada and USA has been almost absent [65]. The fact that WPs have not specifically and explicitly been mentioned in Canadian tobacco acts and regulations creates ambiguity in the enforcement procedures, and allow a space to play around or bypass the regulations in respect of taxation, labelling marketing, and selling WPs [90], and WP smokers enjoy the privilege of smoking WP at WP cafés that still circumvent clean air legislation [56, 91, 92].

Rationale and Overview of Research

Smoking products (called *shisha*) described as “tobacco free”, “0% nicotine and 0% tar” or “herbal” have become widely available. These latter forms of WP products are frequently described as “healthy”. However, there is no substantive information provided on the constituents of the “herbal” *shisha* products offered for sale or on the toxicants present in the mainstream and sidestream smoke produced when they are burned in a WP. Furthermore, there are limited data on the air quality of establishments where the use of “herbal” WP is sanctioned. To address this knowledge gap, the first study of this thesis presents results of the analysis of constituents of a randomly selected sample of herbal products that are available in the Canadian market, and on sidestream and mainstream emissions when these products burned in laboratory conditions. Additionally, a random sample of WP cafés was visited for air quality assessment. Study findings will help evaluate the claim that “herbal” WP is healthy and safe.

Although the importance of developing culturally appropriate interventions to address the spread of WP smoking was indicated in several studies [93,94], developing appropriate intervention to address this issue still in its infancy due to the lack of knowledge and interest among general public, healthcare professionals, and decision makers. Therefore, to increase our understanding on healthcare professionals‟ knowledge and attitude toward WP use and explore how we address this gap in knowledge, the second study reports on the findings of an online survey on tobacco use and education conducted among medical students at the University of Alberta. Furthermore, to increase our understanding of WP users‟ attitudes and knowledge toward WP use, we need to explore what they think, do, and feel about this method of smoking. In the third study, we used qualitative methods as they allow for in-depth examination of people‟s experiences and

their realities, help us understand what they think, do, and say about their experiences [95-97]. Focus groups were conducted with young adults‟ WP smokers from different ethnic backgrounds.

To achieve all these objectives, we conducted secondary analyses of Alberta data that have been collected on WP use as part of a grants awarded by Health Canada and Alberta Health Services to the University of Alberta‟s Addiction and Mental Health Lab and Department of Anesthesia and Pain Medicine to explore the issue of WP use. For years, Department of Anesthesia and Pain Medicine has been involved in programs aiming at providing smoking cessation support for every smoker who is admitted to hospitals, including Reduce My Risk (RMR) and Tobacco Free Futures initiatives (TFF) [98]. Lately, this work has expanded its scope to health promotion activities, including developing innovative approach for promoting cessation services through manned and touchscreen kiosks. Additionally, we increased our effort to address the emerging methods of smoking such as WP and electronic cigarettes.

Thesis format

A paper-based format has been used to prepare this thesis. Analyses of the collected data has been organized into a series of three manuscripts/papers. Paper 1 (Chapter 2) presents WP content analysis, smoke emission analysis, and air quality measurement. Paper 2 (Chapter 3) presents data from online survey among medical students. Paper 3 (Chapters 4) reports on collected qualitative data on knowledge and attitude toward WP use among young adults. Then the final chapter (Chapter 5) is a general discussion and conclusions on policy implications of findings.

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CHAPTER 2

"HERBAL", BUT HAZARDOUS: AN ANALYSIS OF THE CONSTITUENTS AND SMOKE EMISSIONS OF TOBACCO-FREE WATERPIPE PRODUCTS AND THE AIR QUALITY IN THE CAFÉS WHERE THEY ARE SERVED[1]

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Abstract

Background: A wide variety of "herbal" waterpipe products (called „*shisha'*) are available. There are no data on the composition of such products or the emissions produced when they are combusted and limited data on the air quality of establishments where "herbal" WP is smoked.

Methods: Three studies of "herbal" WP: (1) samples of "herbal" *shisha* were subjected to chemical analysis; (2) "herbal" *shisha* and tobacco *shisha* were burned in a WP smoking machine; main and side stream smoke were analyzed; and (3), the air quality of six WP cafés was assessed by measurement of ambient carbon monoxide, microparticle and nicotine vapor content.

Results: We found considerable variation in heavy metal content between the three products tested, one being particularly high in lead, chromium, nickel, and arsenic. A similar pattern emerged for polycyclic aromatic hydrocarbons (PAHs). Smoke emission analyses indicated that toxic by-products produced by the combustion of "herbal" *shisha* were equivalent or greater than those produced by tobacco *shisha*. The results of our air quality assessment demonstrated that mean $PM_{2.5}$ levels and CO content were significantly higher in WP establishments compared to a casino where cigarettes were smoked. Nicotine vapor was detected in one of the WP cafés.

Conclusions: "Herbal" *shisha* products tested contained toxic trace metals and PAH levels equivalent to, or in excess of, those found in cigarettes. Their smoke emissions contained carcinogens equivalent to, or in excess of, those of tobacco products. The content of the air in the WP cafés tested was potentially hazardous. These data suggest that smoking "herbal" *shisha* is potentially dangerous to health.

Background

WP use is increasing among young adults in North-America [1, 2]. While tobacco is the most common form of *shisha* used in WP smoking, products described as “tobacco free”, “0% nicotine and 0% tar” or “herbal” have become widely available. These latter forms of *shisha* are frequently described as “healthy”. Terms such as “relish hookah smoking experience the healthy way” [3], “a healthier alternative to hookah molasses tobacco” [4], and “the same flavourful smoke found in other *shisha* without the harmful effects of tobacco”[5] are prominent on company websites. Despite these statements, there is no substantive information provided on the constituents of the “herbal” *shisha* products offered for sale or on the toxicants present in the main and sidestream smoke produced when they are burned in a WP. Furthermore, there are limited data on the air quality of establishments where the use of “herbal” *shisha* is sanctioned.

In a forty five minute use episode, a WP user inhales between 50-100 L of smoke [6, 7] which has been found to contain large quantities of toxicants and carcinogens [8-14]. However, many WP users believe that smoking the WP is less harmful than smoking cigarettes [15], often deriving this belief from the assumption that passage of the smoke through water eliminates the harmful substances normally associated with tobacco smoking [9, 16]. Directly challenging this belief are studies of urinary biomarkers for carcinogens that have demonstrated that WP use results in systemic exposure to carcinogens at levels similar to those experienced by cigarette smokers [17]. Furthermore, exposure to both tobacco and tobacco-free WP smoke has also been shown to result in acute impairment of cardiac autonomic function in WP users [18].

In the last decade, evidence on the potential harmful effects of WP use has continued to accumulate [19]. As a result the World Health Organization

has advised prohibition of WP use in public spaces consistent with bans on cigarette use [20]. While authorities in North America have varyingly followed this advice, some hospitality venues have sought and won exemptions to tobacco smoking bans by serving ostensibly tobacco-free WP products [21, 22]. One challenge faced by these authorities is the scarcity of data on the toxicant emissions or health effects of second hand smoke from tobacco-free WP products. To date no study has reported second hand smoke emissions from tobacco-free WP products, and only one study has reported toxicant content of mainstream smoke [10].

The aim of this study was to provide an assessment of the chemical constituents of samples of tobacco-free, often referred to as “herbal” products used in WPs in Canada. In addition, we sought to describe the emissions produced when a sample of these herbal products are smoked under controlled conditions. Finally, we wished to determine if individuals not smoking a WP, but present in a WP café, were passively exposed to potentially toxic substances by measuring simple air quality markers ($PM_{2.5}$ and CO) in WP cafés where “herbal” WP products were being smoked.

Methods

"Herbal" *Shisha* Procurement and Sample Preparation

Samples of "herbal" *shisha* labelled as "0.0% tar and 0.0% nicotine" or "100% tobacco free" were obtained from four different local retail outlets in Edmonton, Alberta, Canada. One standard flavour was selected (strawberry). Three brands of "herbal" *shisha* that are widely available in Canada were randomly selected as "herbal" *shisha* test products for the purposes of this study. Nine 50-gram boxes each of Soex (India) and Hydro (United States), and three 250 gram boxes of Zero n Zero (United States) were purchased. For each brand the contents of the boxes were mixed together to form one base sample. In the same retail outlets we purchased a supply of charcoal (Al-Fakher, China) for use in our smoke constituent experiments.

Characterization of Constituents of Unburned "Herbal" *Shisha*

Two 100 gram samples of each brand were appropriately blind coded, packaged and shipped to a commercial analytical laboratory (Labstat International UCL, Kitchener, Ontario, Canada) for analysis. At the laboratory the samples were removed from the wrapping and three replicates of each of the brands supplied were used for extraction and analysis. Standard methods were used to evaluate the levels of nicotine [23], heavy metals [24], and polycyclic aromatic hydrocarbons (PAHs) [25].

For nicotine content a standard additions assay was performed on each replica for verification of the data. The content data from the *shisha* samples were compared with control data and, if the results were acceptable, an outlier test was performed. Outliers were analyzed and if an assignable cause for the deviation was discovered the data point was removed. If no

assignable cause was found, the outliers were included in the data set and all subsequent calculations. The results of the three replicates were averaged in each case.

Smoke Constituent Analysis

Appropriately coded and packaged samples (200 grams) along with a randomly selected sample of Al-Fakher charcoal were sent to the Aerosol Research Laboratory at American University of Beirut (AUB, Beirut, Lebanon) for mainstream and sidestream smoke emissions analysis.

A standard protocol was used to generate mainstream and sidestream smoke from the three test materials and a popular tobacco containing WP product (Two Apples, Nakhla Tobacco, Cairo, Egypt) [7]. The Two Apple product was used for comparative purposes.

Briefly, WP smoke was sampled using a smoking machine that can be digitally programmed. The machine split the smoke from the WP into two streams using a computer-activated diaphragm pump. A standard smoking regimen of 171 puffs, each puff with a volume of 0.53 L, a 2.6 s duration, and a 17 s inter-puff interval was used. The head of the WP was filled with 10g of sample product and a perforated aluminum foil sheet was used to cover the head. A burning quick-light charcoal disk was placed on the head of the WP. For each product, five replicate smoking sessions were held. The amount of nicotine, CO, tar, and PAHs was determined by following standardized procedures and using GC-MS and HPLC [8, 9, 26].

Air Quality Measurements in Waterpipe Cafés

Six randomly selected cafés were covertly visited during evening hours on weekend days in Edmonton, Alberta, Canada. The research team followed a protocol for air quality assessment that has been previously used

in similar setting [27, 28]. A table near the middle of the venue, away from the corners, was selected (when possible) and a bag containing the concealed monitors was left resting on a seat at the table away from the direct stream of smoke emitting from any WP. For comparison, a similar protocol was used in two separate occasions to measure air quality in a casino where cigarette smoking was permitted.

A SidePak™ personal aerosol real time monitor (TSI, Inc., St. Paul, MN) was used to measure $PM_{2.5}$. The $PM_{2.5}$ in WP cafés was derived using a WP-specific calibration factor of 0.37 [29], while in the casino the commonly used calibration factor for tobacco smoke (0.32) was used. CO and carbon dioxide (CO_2) concentrations along with the ambient humidity and temperature were simultaneously measured in these venues using the Q-Trak indoor air quality monitor (TSI, Inc., St. Paul, MN). Monitors were calibrated prior to each visit and set to record real-time measurements every ten seconds during the visit. Air quality data was collected for 10 minutes outdoors before and after the visit for comparison and collected inside each café/casino for one hour.

Nicotine concentration in the ambient air was determined using a passive sampling device Monitor of Nicotine (MoNIC) which was developed and supplied by the Institute of Occupational Health, Lausanne, Switzerland [30]. Nicotine badges were attached to the outside of the sampling monitor bags during the one-hour sampling period. After the visit the badges were placed into air tight containers until shipped for analysis. Badges were analyzed by methods previously described [31].

The room size and ceiling heights were measured using tile size/count along with a Zircon Sonic Measure (DM S50L, Campbell, CA) to determine the room volume. Numbers of occupants and burning WPs were recorded every 10 minutes. Other possible sources of CO, CO2, and $PM_{2.5}$ within the

smoking venue were documented. Ventilation rates were estimated using the ASHRAE equation [28, 32]. Analyses were conducted using the Statistical Program for the Social Sciences (SPSS) version 19.0 (IBM SPSS, Armonk, NY).

Results

Constituents of Unburned "Herbal" *Shisha*

There was high variability in toxicant content among analyzed "herbal" products as shown in Table 2.1. . For example, lead and arsenic levels were below the limit of quantification (NQ) in two brands and in the third they were 438 ng/mg and 281 ng/mg, respectively. Chromium levels among the three products tested ranging from 160 ng/mg to 2190 ng/mg and nickel levels ranging from 150 ng/mg to 626 ng/mg. Similar findings were seen for PAHs concentrations with naphthalene levels ranging from 14.5 ng/mg in one product to 32.2 ng/mg in another; benzo(a)anthracene ranging from 0.4 ng/mg to 5.68 ng/mg; chrysene ranging from 1.0 ng/mg to 11.1ng/mg and benzo(a)pyrene levels ranging from NQ to 6.33 ng/mg. No nicotine was detected in any of the tested products.

Smoke Constituents

Mainstream smoke emissions of "herbal" *shisha* products tested contained substantial quantities of toxicants with considerably varying concentrations between brands and in virtually all cases equalled or exceeded concentrations found when the smoke produced by the tobacco comparator was analysed (Table 2.2.). For example tar levels were 909 mg/session for tobacco vs. 1080, 1260, 2350 mg/session for "herbal" *shisha*; and benzo(a)pyrene levels were 96 ng/session for tobacco vs. 95, 86, and 140 ng/session for "herbal" *shisha*.

Analyses of sidestream smoke emissions showed similar findings (Table 2.3.). For example, ultrafine particulate levels were 4.9×10^{12}/session for tobacco vs. 5.2, 3.7, and 5.3×10^{12}/session for the "herbal" brands; and benzo(a)pyrene levels were 66 ng/session for tobacco vs. 108 ng, 90 ng, and 121 ng for the "herbal" brands.

Air Quality in Cafés

The characteristics of the visited venues, average number of occupants, average number of active WPs, ventilation rates (Vo), WP density (Ds) (# active WPs / venue volume in 100 m^3) and the ventilation adjusted WP density (Ds/Vo: ([# active WPs/venue volume in 100 m^3] / ventilation rate) are summarized in Table 2.4.. No other sources of $PM_{2.5}$ such as an open grill or cooking fire were observed in the smoking areas where the measurements were obtained. Mean $PM_{2.5}$ levels across all WP cafés ranged from 14 to 430 µg/m^3. The overall mean level of $PM_{2.5}$ in the WP smoking establishments was 264 µg/m^3 ($\pm$214) with a range of 1 to 2675 µg/m^3. This was significantly higher than the comparison cigarette smoking venue - mean of 215 µg/m^3 ($\pm$165) with a range of 2 to 726 µg/m^3; $p<0.001$. The overall mean level of CO in WP smoking establishments was 6.7 ppm ($\pm$4.5) with a range of 0 to 18 ppm. This was significantly higher than that in the cigarette smoking venue, where mean CO levels were 0.4 ppm ($\pm$0.4) with a range of 0 to 2 ppm; $p<0.001$ (Table 2.5., Figure 2.1., 2.2.).

Nicotine vapor concentrations were below detectable limits in 5 out of 6 WP smoking venues tested. In one location the nicotine amount absorbed by the nicotine badge was 0.15 mg, indicating the combustion of tobacco on the premises. This amount of nicotine is equivalent to the passive inhalation of 0.75 of a cigarette. No cigarette smoking was observed at any of the WP smoking venues. Nicotine concentrations detected during each of the two visits to the casino were 0.22, and 0.29 mg (equivalent to the passive inhalation of 1 and 1.5 cigarettes, respectively).

Discussion

This is the first comprehensive assessment of the constituents of unburned "herbal" *shisha*. In addition, we have determined the composition of the mainstream and sidestream smoke produced by the combustion of such products in a WP and in a convenience sample, the quality of the air in venues where "herbal" WPs are smoked in Canada. Our results showed high variability in constituents of different "herbal" products analyzed. When smoked under simulated conditions, "herbal" products yield higher levels of toxicants including tar, PAHs, ultrafine particles and aldehydes compared to tobacco products. Our findings indicate that the ambient air quality of WP cafés is potentially unhealthy, containing high concentration of $PM_{2.5}$ and CO. In one of six WP cafés visited we found evidence of nicotine vapor suggesting that nicotine-containing *shisha* was being smoked on the premises.

The International Agency for Research on Cancer (IARC) classifies heavy metals and PAHs as carcinogenic or possibly carcinogenic to humans [33]. Our data reveal that "herbal" *shisha*, depending on the brand, may contain significant concentrations of these substances. If one compares our data for "herbal" *shisha* with those of cigarettes by *Hammond et al.*[34] the findings are instructive: one of the "herbal" products we tested contained more than four times the concentration of chromium, twice that of nickel and greater amounts lead and arsenic than that found in Canadian cigarettes. Similarly, the amount of Benzo(a)pyrene that was found in one "herbal" product was comparable to Canadian cigarettes [34]. The other two products tested were more benign, however, the lack of standardization of content and information about the constituents is a concern. For each tobacco product sold in Canada, Health Canada requires disclosure of 26 chemical constituents including heavy metals and 41 smoke emissions [34, 35].

Unfortunately, thus far these requirements are not imposed on “herbal” products smoked in a WP.

The consumption of “herbal” *shisha* results in the emission of an array of toxicants including CO, NO, tar, volatile aldehydes and PAHs. Empirical data have previously shown emission of high levels of toxicants from WP tobacco use [7, 9, 36]. The current study reports about the constituents of mainstream and sidestream smoke produced when “herbal” *shisha* are burned [10]. Our findings for “herbal” *shisha* mirror, to a degree, data from studies of smoke produced by herbal cigarettes, particularly with respect to PAH production [37].

For all three products we found that the main and sidestream smoke produced significant quantities of CO. Of particular significance was the more than six-fold increase in CO found in sidestream relative to mainstream smoke, suggesting that passive exposure to CO by non-participants could be considerable, a finding confirmed by our air quality analysis (*vide infra*). Although CO symptoms of toxicity can be nonspecific (dizziness, irritability, confusion/memory loss, disorientation, nausea and vomiting, syncope, difficulty coordinating and breathing, and chest pain), prolonged exposure can lead to more serious effects including myocardial infarction, cerebral edema, coma, and death.[38] WP smoking yields high levels of CO in the smoke, and carbonmonoxyhemoglobin (COHb) levels in WP smokers‟ blood have been shown to be higher than in other forms of smoking [39]. A number of case reports have detailed early CO toxicity in WP smokers, some presenting to emergency rooms with arterial COHb levels approaching 30% [40, 41].

We demonstrated a variation in toxicant production in mainstream smoke depending on the product tested. Interestingly, although all three of the “herbal” brands tested were described on the exterior labeling as containing “0% tar”, our analysis showed that levels of tar in mainstream

smoke produced on combustion of these materials was considerable and far in excess of that experienced by cigarette smokers smoking single cigarettes [34].

Volatile aldehydes exposure has been associated with respiratory disorders [11], can cause irritation in the respiratory tract [42], and contributes to the development of lung cancer and chronic obstructive pulmonary disease [43]. According to the IARC, formaldehyde is classified as a human carcinogen implicated in causing nasopharyngeal cancer and leukemia.[44] Acrolein is considered a major cigarette related lung cancer agent and one of the most mutagenic aldehydes in cigarette smoke [45]. Acrolein levels in Canadian cigarette smoke have been reported at 71.7(21.1) µg/cig [34]. Our analysis revealed high production of the aforementioned volatile aldehydes during the smoking of "herbal" *shisha*.

A study of ultrafine particles in cigarette smoke found that the particles yield ranged between 2.6×10^{6} particles per cigarette for cigarettes manufactured by Phillip Morris, and 8.8×10^{9} particles per cigarette by Marlboro Red [46]. In our results the yield was higher and ranged between 3.7×10^{12} and 5.3×10^{12} for "herbal" WP and 4.8×10^{12} in tobacco WP.

In our study there were greater numbers of smokers and less ventilation per unit area in the WP venues than in the casino where cigarettes were smoked. Despite these differences, the level of exposure to $PM_{2.5}$ in the casino location was still considerable. Consistent with previous reports [26], in our analysis of mainstream and sidestream smoke we found greater ultrafine particles and other toxicant emissions from WP smoke compared to reported emissions from a single cigarette. However, because a typical WP use episode is between 45 minutes and one hour in duration, and a cigarette may be smoked over as short an interval five minutes, comparing mainstream and sidestream emissions per unit smoked may lead to confusion. A more

understandable and obvious metric may be toxicant emissions per smoker hour. Using this approach (emissions per one person hour), Daher *et al*.[26] demonstrated that a WP user releases into the environment approximately twice the amount of aldehydes and PAHs and ten times the amount of CO than an average cigarette user (two cigarettes per hour) over the equivalent time period.

One goal of smoke-free legislation is to protect individuals from second-hand smoke exposure and the associated increased risk for coronary artery disease, lung cancer and respiratory infections [47]. Although the ventilation rates for all visited venues, except one, fall within the ASHRAE acceptable standards [32], our snapshot of the air quality in the WP cafés visited indicated high $PM_{2.5}$ levels (mean 264 $\mu g/m^3$; maximum 2675 $\mu g/m^3$). Comparable levels of $PM_{2.5}$ were reported with cigarette and WP tobacco smoking venues in both Syria (464 $\mu g/m^3$) [48] and Lebanon (349 $\mu g/m^3$) [49], and in WP smoking venues in the USA (374 $\mu g/m^3$) [27].

Although our research team did not observe any other possible sources of $PM_{2.5}$ in the areas where measurements were obtained, the existence of such sources could not be ruled out in sites visited, especially from adjacent kitchen spaces. However, data from a recent study comparing $PM_{2.5}$ levels in WP smoking and smoke-free restaurants found that $PM_{2.5}$ levels in the former were significantly higher than in the latter [27]. These data lend support to our findings as in both locations one would expect to find comparable non-WP sources of $PM_{2.5}$.

The potential health effects of repeated long-term exposure to high levels of $PM_{2.5}$ include an increased cardiovascular risk and mortality, inflammatory lung injury and subclinical atherosclerosis [50, 51]. Moreover, uncertainties exist related to the consequences of short-term exposures to $PM_{2.5}$ but there is strong evidence that even brief exposure can trigger an

acute event in patients with angiographically documented coronary artery disease [52]. In asthmatic patients, exposure to approximately 200 μg/m^3 $PM_{2.5}$ for 2 hours increased inflammatory mediators [53]. A cohort study found an association between ambient $PM_{2.5}$ and levels of C-reactive protein, an indicator related to increased risk of coronary events [54]. In another study, *Urch et al.* [55] demonstrated that controlled short-term (2-hr) chamber exposures to 147 (±27) μg/m^3 ambient $PM_{2.5}$ and 239 (±6) μg/m^3 ozone in 23 normal, non-smoking healthy adults significantly increased diastolic blood pressure (DBP) compared to filtered air, with a strong association between the 2-hr change in DBP and the organic carbon fraction of the $PM_{2.5}$.

Canada uses an Air Quality Health Index (AQHI) [56] to help the public understand what ambient air quality means to their health. It measures ambient air quality in relation to health on a scale from 1 to 10; the higher the number, the greater the health risk. A category that describes the level of health risk as “high” is at the upper end of the scale, from 7 to 10. A 1-hour average $PM_{2.5}$ level of 200 μg/m^3 which was easily exceeded in three of the six WP cafés tested in our study (Table 2.5.) corresponds to an AQHI ~10 and indicates that $PM_{2.5}$ in air in these WP cafés represents a potentially hazardous exposure.

We did not find any nicotine in the “herbal” products tested, however, we did detect nicotine vapor in the ambient air at one of the WP cafés visited. WP cafés are exempted from clean air legislation provided that tobacco products are not smoked on site; however, our findings suggest that violations may be occurring.

WP smoking is a practice that carries with it the real risk of changing the social norms regarding its use, normalizing tobacco use, and undermining tobacco control efforts. Our recent survey of medical students at the University of Alberta revealed that current WP smoking among this health

educated group was double the cigarette smoking, with most respondents indicating that they choose to smoke tobacco in their WPs [57]. Furthermore, WP use could be a gateway for other forms of tobacco and drug use, and could be the cause of relapse for smokers who quit smoking cigarettes [58]. Given our findings and the accumulating evidence on the air quality in the WP smoking venues [27, 59], the exemption of WP cafés from smoke-free places legislation is a concern and reinforces the call for changes to current law [21, 22, 60].

Conclusion

High levels of toxicants that are classified as carcinogenic or known to have harmful effects on health are present in "herbal" *shisha* sold in Canada. The mainstream and sidestream smoke produced when these products are burned in a WP contain numerous carcinogens and potentially unhealthy concentrations of CO and tar. The air quality of WP cafés is in consequence less than optimal. These findings do not support the common belief that smoking "herbal" *shisha* is a safe and healthy alternative for smoking tobacco WP. To the contrary, "herbal" *shisha* produce many of the major tobacco disease-related toxicants in equal or greater quantities as their tobacco-based counterparts.

What this paper adds

This paper demonstrates that

- There is great variability in the composition of “herbal” *shisha* which can contain toxic trace metals and other carcinogens in excess of that found in cigarettes.
- The mainstream and sidestream smoke produced when “herbal” *shisha* is burned contains carcinogens equivalent to, or in excess of, those of tobacco products.
- The air quality in commercial venues where “herbal” is smoked is potentially hazardous, as it may contain significant amounts of ultrafine particulate matter.

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Tables

Table 2.1. “Herbal” products content analysis

	Product A (Zero-zero)		Product B (Soex)		Product C (Hydro)	
Product Constituent	Average(S.D.)	(95% CI)	Average(S.D.)	(95% CI)	Average(S.D.)	(95% CI)
Toxic Trace Metals [ng/g]						
Cadmium	BDL	N/A	BDL	N/A	BDL	N/A
Lead (2B)*	BDL	N/A	NQ	N/A	438(8)	418-458
Chromium (1)*	160 (28)	91.9-229	401 (13)	367-434	2190(517)	906-3475
Nickel(1,2B)*	150 (10)	126-174	158 (9)	136-181	626(33)	544-708
Arsenic (1)*	NQ	N/A	NQ	N/A	281(27)	214-349
Selenium	BDL	N/A	BDL	N/A	BDL	N/A
Mercury	BDL	N/A	BDL	N/A	BDL	N/A
Nicotine [mg/g]						
Nicotine	BDL	N/A	BDL	N/A	BDL	N/A
Polyaromatic Hydrocarbons,PAHs [ng/g]						
Naphthalene (2B)	32.2(10.0)	7.32-57.1	23.9(4.5)	12.7-35.0	14.5(3.9)	4.73-24.2
1-methylnaphthalene	36.9(8.4)	16.0-57.9	27.7(1.9)	22.9-32.5	11.3(3.2)	3.38-19.1
2-methylnaphthalene	16.9 (3.0)	9.54-24.3	19.2(2.7)	12.4-25.9	7.48(2.23)	1.95-13.0
Acenaphthylene	1.21(0.10)	0.95-1.47	0.59(0.22)	0.05-1.13	2.82(0.76)	0.927-4.72
Acenaphthene	0.76(0.22)	0.22-1.29	1.23(0.42)	0.19-2.26	NQ	N/A
Fluorene	3.29(0.26)	2.65-3.93	2.79(1.26)	0.00-5.92	4.95(1.25)	1.85-8.05
Phenanthrene	3.78(0.91)	1.53-6.03	13.7(2.5)	7.40-19.9	20.1(2.8)	13.1-27.0
Anthracene	0.58(0.09)	0.35-0.81	0.34(0.14)	0.00-0.68	1.41(0.19)	0.943-1.87
Fluoranthene	4.87(1.11)	2.11-7.63	3.07(0.45)	1.94-4.20	20.1(1.8)	15.6-24.6
Pyrene	3.88(0.71)	2.11-5.65	4.35(0.27)	3.69-5.00	17.9(0.9)	15.6-20.2
Benzo(a)anthracene(2B)	0.38(0.09)	0.16-0.61	1.28(0.20)	0.79-1.78	5.68(0.43)	4.61-6.75
Chrysene(2B)	1.03(0.18)	0.57-1.49	7.12(0.35)	6.24-8.00	11.1(0.7)	9.25-12.9
Benzo(b)fluoranthene(2B)	NQ	N/A	1.07(0.20)	0.59-1.56	9.85(0.56)	8.45-11.3
Benzo(k)fluoranthene(2B)	NQ	N/A	NQ	N/A	4.41(0.07)	4.22-4.59
Benzo(j)fluoranthene(2B)	NQ	N/A	NQ	N/A	4.54(0.16)	4.15-4.92
Benzo(e)pyrene	0.29(0.15)	0.00-0.65	1.63(0.14)	1.28-1.98	7.25(0.41)	6.24-8.25
Benzo(a)pyrene(1)	NQ	N/A	0.53(0.15)	0.16-0.91	6.33 (0.69)	4.63-8.03
Perylene	BDL	N/A	NQ	N/A	1.53(0.22)	0.995-2.08
Indeno(1,2,3-cd)pyrene(2B)	NQ	N/A	NQ	N/A	6.26(0.38)	5.32-7.19
Dibenz(a,h)anthracene(2A)	BDL	N/A	BDL	N/A	0.71(0.07)	0.54-0.88
Benzo(g,h,i)perylene	NQ	N/A	0.49(0.20)	0.001-0.99	8.23(0.74)	6.38-10.1
pH						
pH	5.96(0.00)	5.95-5.97	3.64(0.00)	3.63-3.65	5.10(0.01)	5.07-5.14
Moisture (%)						
Dry Matter	76.0(0.2)	75.5-76.6	69.3(0.8)	67.4-71.3	80.9(0.1)	80.5-81.2
Moisture	24.0(0.2)	23.4-24.5	30.7(0.8)	28.7-32.6	19.1(0.1)	18.8-19.5

* IARC classified: Group 1, carcinogenic to humans; Group 2A, probably carcinogenic to humans; Group 2B possible carcinogenic to humans. BDL: Below the Limit of Detection. N/A: Not Applicable. NQ: Below the Limit of Quantification.

Table 2.2. Mainstream smoke analysis

	Tobacco†	Product A (Zero-zero)†		Product B (Soex)†		Product C (Hydro)†	
Repeated runs (N)	5	6		5		5	
Toxicant emissions(per WP)	**Mean(SD)**	**Mean(SD)**	**p-value***	**Mean(SD)**	**p-value***	**Mean(SD)**	**p-value***
Carbon monoxide,(mg)	197(13.1)	286(42)	0.001	237(42)	0.08	269(17)	<0.001
Nitric oxide,(mg)	0.28(0.04)	0.35(0.03)	0.006	0.32(0.02)	0.002	0.35(0.06)	0.03
Tar,(mg)	909(195)	1080(238)	0.2	1260(233)	0.03	2350(324)	<0.001
Volatile Aldehydes,(µg)							
Formaldehyde	36.0(6.25)	41(14)	0.5	66.0(9.68)	0.0004	111(29)	<0.001
Acetaldehyde	492(88)	604(159)	0.2	348(70)	0.02	933(239)	0.04
Acrolein	ND	ND		26.7(27)	0.06	203(182)	0.04
Propionaldehyde	92.9(16.7)	105(35)	0.5	59(11.7)	0.006	181(65)	0.02
Methacrolein	19.9(2.63)	20(6)	1	22.92(4.6)	0.4	25(6)	0.1
Polyaromatic Hydrocarbons,(ng)							
Naphtalene	230(64)	266(101)	0.5	176(15)	0.1	269(60)	0.3
Acenaphtylene	74(13)	66(14)	0.8	44(8)	0.002	62(15)	0.2
Acenaphtene	ND	ND		ND		ND	
Phenanthrene	1185(246)	1445(364)	0.2	660(148)	0.004	1275(266)	0.6
Anthracene	234(44)	243(59)	0.8	144(30)	0.005	253(56)	0.6
Fluoranthene	639(118)	796(202)	0.2	496(110)	0.08	891(248)	0.07
Pyrene	564(103)	719(193)	0.1	471(118)	0.2	854(211)	0.02
Benzo[a]anthracene	130(27)	183(56)	0.09	144(27)	0.4	293(84)	0.003
Chrysene	135(24)	210(57)	0.02	161(28)	0.1	279(59)	0.001
Benzo[k+b]fluoranthene	72(10)	92(23)	0.1	71(15)	0.9	145(25)	<0.001
Benzo[a]pyrene	96(21)	95(20)	0.9	86(18)	0.4	140(30)	0.03
Benzo[g,h,i]perylene	57(10)	64(15)	0.4	50(12)	0.3	88(12)	0.002
Indeno[1,2,3-cd]pyrene	69(9)	84(20)	0.2	66(15)	0.7	107(11)	<0.001

* p-value; for “herbal” products compared with tobacco.

† 10 g of the product.

ND: Not Detectable.

Table 2.3. Sidestream smoke analysis

	Tobacco †	Product A (Zero-zero)†		Product B (Soex)†		Product C (Hydro)†	
Repeated runs (N)	5	6		5		5	
Toxicant emissions(per WP)	**Mean (SD)**	**Mean (SD)**	**p-value***	**Mean (SD)**	**p-value***	**Mean (SD)**	**p-value***
Carbon monoxide,(mg)	1880(151)	2912(256)	<0.001	2560(280)	0.001	2825(267)	<0.001
Nitric oxide,(mg)	4.5(0.12)	4.91(0.48)	0.8	5.75(0.48)	<0.001	5.66(0.46)	<0.001
Nanoparticles,(10^12)	4.8(0.43)	5.18(0.56)	0.3	3.73(0.59)	0.009	5.32(0.62)	0.2
Volatile Aldehydes,(µg)							
Formaldehyde	4285(836)	2220(389)	<0.001	2270(372)	0.001	2724(286)	0.004
Acetaldehyde	1690(405)	2427(758)	0.09	1200(264)	0.05	2963(869)	0.02
Acrolein	210(64.9)	257(97)	0.4	245(60)	0.4	838(293)	0.002
Propionaldehyde	142(39)	241(80)	0.03	116(41)	0.3	241(110)	0.09
Methacrolein	45(12)	50(25)	0.7	37.8(6.44)	0.3	60(25)	0.3
Polyaromatic Hydrocarbons,(ng)							
Naphtalene	87(29)	69(29)	0.3	82(21)	0.8	89(14)	0.9
Acenaphtylene	ND	ND		ND		ND	
Acenaphtene	ND	ND		ND		ND	
Phenanthrene	60(10)	156(94)	0.05	61(18)	0.9	191(67)	0.003
Anthracene	27(25)	56(15)	0.04	51(9)	0.08	63(13)	0.02
Fluoranthene	66(12)	188(144)	0.09	59(23)	0.6	235(96)	0.005
Pyrene	77(12)	201(138)	0.08	75(25)	0.9	256(107)	0.006
Benzo[a]anthracene	30(4)	87(39)	0.01	38(20)	0.4	109(45)	0.005
Chrysene	52(7)	136(58)	0.01	63(23)	0.3	161(56)	0.003
Benzo[k+b]fluoranthene	70(11)	126(32)	0.005	100(26)	0.05	130(32)	0.004
Benzo[a]pyrene	66(8)	108(23)	0.004	90(16)	0.02	121(27)	0.002
Benzo[g,h,i]perylene	104(17)	116(19)	0.3	125(31)	0.2	122(27)	0.2
Indeno[1,2,3-cd]pyrene	150(18)	174(31)	0.2	164(33)	0.4	185(34)	0.08

* p-value; for “herbal” products compared with tobacco.

† 10 g of the product.

ND: Not Detectable.

Table 2.4. Waterpipe café parameters and ventilation rates

Venue	Area (m^2); ceiling height (m)	Volume (m^3)	Ave. occupants	Ave. person/100m^2	Ave. # Active waterpipes (AAW)	CO2 indoors - outdoors (ppm)	Vo = G/(Cs-Co) Ventilation rate per person	Est. (AWP) %	Ds WP Density (AAW/100 m^3)	Ds/Vo Ventilation adj. W density
WP1	164;3.8	623	36	22.0	12	860-384 = 476	5000/476=11	33	1.9	0.18
WP2	131;2.7	354	54	41	21	740-358 = 382	5000/382=13	39	5.9	0.45
WP3	110;4.27	471	43	39	24	844-417 = 427	5000/427=12	56	5.1	0.44
WP4	112;3.05	340	38	34	17	840-498 = 342	5000/342=15	45	5	0.34
WP5	70;6.0	422	13	19	7	1563-430=1133	5000/1133=4	56	1.7	0.39
WP6	227;2.9	804	16	5.77	4.2	648-379=269	5000/269=19	26	0.5	0.03
CIG A	5800;4.5	26100	418	7.21	43*	539-349=190	5000/187=26	10*	0.16	0.01
CIG B	5800;4.5	26100	528	9.10	50*	493-325 = 168	5000/168=30	9*	0.19	0.01

* Cigarettes instead of waterpipes.

AAW = Average Active Waterpipes = average number of active waterpipes during the period of visit.

AWP = Active Waterpipe Percentage = (average active waterpipes/occupants) x100 Waterpipe Ds = AAW/100 m^3.

Co: the CO2 level outdoor; Cs: the CO2 level in the building.

Ds = W Density = (AAW/100 m^3).

Vo = Ventilation rate per person; Vo = G/(Cs-Co).

G = 5000ppm-L/s-person, (the generation rate of CO2 for a sedentary person).

WP# = Waterpipe Café; CIG: cigarette smoking venues; WP= Waterpipe.

Table 2.5. Average real-time air quality measures.

Venue	Ave. $PM_{2.5}$ indoor ($\mu g/m^3$)	Ave. $PM_{2.5}$ outdoor ($\mu g/m^3$)	Ave. $PM_{2.5}$ in – out ($\mu g/m^3$)	Ave. CO indoor (ppm)	Ave. CO outdoor (ppm)	Ave. CO in – out (ppm)
WP1	385	10	375	10.2	0.00	10.2
WP2	140	2	138	11.4	0.00	11.4
WP3	430	10	420	6.9	0.18	6.72
WP4	299	11	288	1.8	0.25	1.55
WP5	59	11	48	3.1	0.75	2.35
WP6	14	10	4	1.9	0.04	1.86
CIG A	219	5	214	0.43	0.03	0.4
CIG B	213	3	210	0.37	0.01	0.36

WP# = waterpipe Café; CIG: cigarette smoking venues.

Indoor: average of 60 minutes.

Outdoor: average of 20 minutes.

Figures

Figure 2.1. $PM_{2.5}$ levels (µg/m3) of exposure in waterpipe cafés compared with cigarette smoking venues

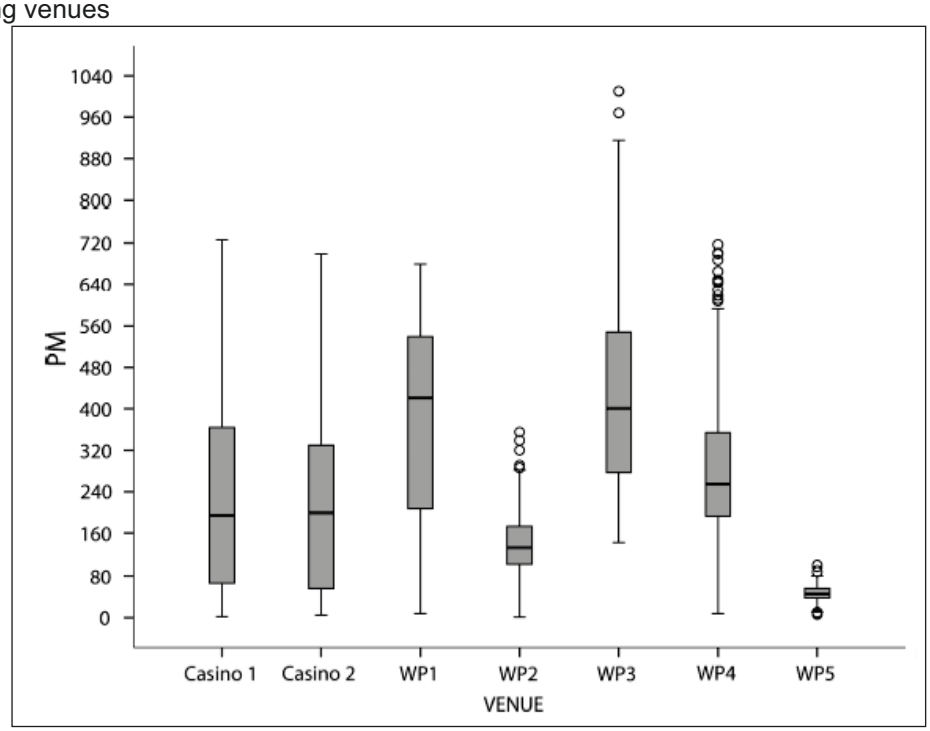
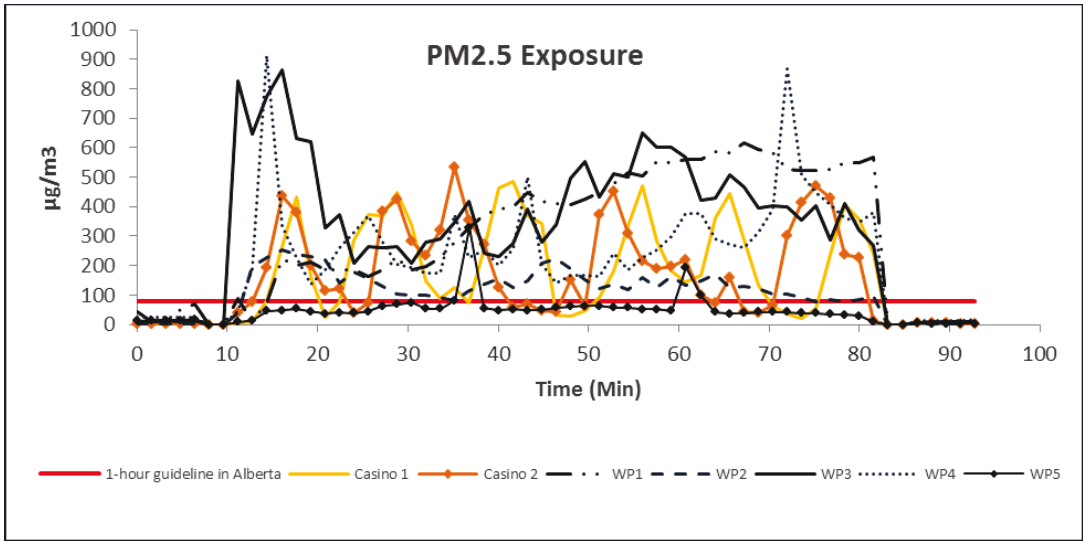


Figure 2.2. Real time $PM_{2.5}$ levels (µg/m3) of exposure in waterpipe cafés compared with cigarette smoking venues



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CHAPTER 3

FUTURE PHYSICIANS AND TOBACCO: AN ONLINE SURVEY OF THE HABITS, BELIEFS AND KNOWLEDGE BASE OF MEDICAL STUDENTS AT A CANADIAN UNIVERSITY[2]

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Abstract

Background: Little is known about the knowledge and attitudes towards tobacco use among medical students in Canada. Our objectives were to estimate the prevalence of tobacco use among medical students, assess their perceived level of education about tobacco addiction management and their preparedness to address tobacco use with their future patients.

Methods: A cross-sectional online survey was administered to University of Alberta undergraduate medical school trainees. The 32-question survey addressed student demographics, tobacco use, knowledge and attitudes around tobacco and waterpipe (WP) smoking, tobacco education received in medical school, as well as knowledge and competency regarding tobacco cessation interventions.

Results: Of 681 polled students, 301 completed the survey. Current (defined as “use within the last 30 days”) cigarette, cigar/cigarillo and WP smoking prevalence was 3.3%, 6% and 6%, respectively. One third of the respondents had ever smoked a cigarette, but 41% had tried cigars/cigarillos and 40% had smoked a WP at some time in the past. Students reported moderate levels of education on a variety of tobacco-related subjects but were well-informed on the role of tobacco in disease causation. The majority of students in their final two years of training felt competent to provide tobacco cessation interventions, but only 10% definitively agreed that they had received enough training in this area.

Conclusions: WP exposure/current use was surprisingly high among this sample of medical students, a population well educated about the role of tobacco in disease causation. The majority of respondents appeared to be adequately prepared to manage tobacco addiction but education could be improved, particularly training in behavioral modification techniques used in tobacco use cessation.

Background

Physicians play a crucial role in preventing disease and promoting a healthy lifestyle [1]. The willingness of physicians to engage in providing prevention counseling is influenced by many factors, especially, their training [2], their own personal habits and their self-confidence in doing so effectively [3,4]. This “personal-clinical relationship” has been well validated among Canadian and USA physicians [4,5] and is especially relevant in the area of tobacco control, as non-smoking physicians are more likely to report encouraging cessation among their patients than those who smoke [4]. A similar trend is found among medical students, where healthy personal practices are found to equate with engagement in preventive counseling and appreciation of importance of this role as part of their professional responsibility [6]. A combination of didactic and interactive training during medical school can improve knowledge, attitude, and counseling skills regarding tobacco cessation and other forms of behavioral change [7,8]. There is very limited information about the prevalence of smoking among Canadian medical school students and their perceived level of education and preparedness to address tobacco use with their patients [9]. There are no data on WP use in medical students, a popular emerging method of smoking that is frequently thought of as less harmful than cigarettes [10].

In this cross-sectional survey of University of Alberta undergraduate medical students, we sought to report on their smoking status, what their opinions were regarding the risks of WP smoking, the extent of their knowledge about the role of tobacco in disease causation and their understanding of the relative effectiveness of currently used tobacco cessation interventions. Finally, we requested they provide their views on the education they received about tobacco addiction management, their self-perceived capacity/competency to treat patients with tobacco addiction and

the role of physician leadership in advancing tobacco control and management.

Methods

Students in the undergraduate Doctor of Medicine program in the Faculty of Medicine and Dentistry at the University of Alberta, Edmonton, Canada, were invited to participate in a cross-sectional, anonymous on-line survey. The questionnaire was available on-line for a six week period in 2012. During that time, we tracked the completion of questionnaires, noting the date and time of survey completion. Four email reminders were sent out during the course of the survey, each of which contained a summary of the invitation letter and link to the questionnaire.

The undergraduate program spans four years, beginning with two years of preclinical education. In the third year, students begin their clinical education, which consists of two years of clerkship in a variety of medical specialties. During the fourth year of their education, students are given three months of protected time to undergo 10–15 weeks of electives, interview for residency positions and prepare for graduation. The pre-clinical medical curriculum at the University of Alberta is based on system blocks focusing on small group learning. Tobacco related education is integrated into each system block with no special block devoted solely to tobacco. Therefore it was difficult to estimate how many hours of tobacco education medical students receive throughout their undergraduate medical education. There were approximately 170 students enrolled in each year of the program for the 2011/12 school year. All 681 students in the graduating classes of 2012 to 2015 (46.4% female) were eligible to participate in the survey.

Development of the survey instrument

The questions were developed with guidance of previously used questionnaires on tobacco and education among medical students [11,12] and with the support of a consultant experienced in social research methodology who provided assistance in the selection, placement, response sets, content and face validity of the question items. In all questions on knowledge, opinion and attitude, a six-point Likert scale was used where 1 was negative and 6 positive.

The survey instrument consisted of 32 questions with an estimated completion time of five to ten minutes. Six domains of questions were asked of respondents: 1. Student demographics and current tobacco use (defined as “use within the last 30 days”) and “ever tobacco use” (9 questions) 2. Knowledge and attitudes toward tobacco and WP smoking (5 questions) 3. Health implications of smoking (3 questions) 4. Effectiveness and priority of tobacco cessation interventions (1 question) 5. Perceived education and competency (10 questions) 6. Perceived physicians role in tobacco cessation (4 questions).

Procedures

The Health Ethics Review Board at the University of Alberta approved the survey. The Undergraduate Medical Education (UME) office posted a bulletin about the survey on the on-line learning community for the Faculty of Medicine and Dentistry that included a description of the survey, a link to the invitation letter and a link to the survey instrument. The UME office subsequently sent an email to all medical students alerting them to the bulletin. Students who read the bulletin and clicked on the link to the survey were taken to a secure internet site (FluidSurveys, Ottawa, ON, Canada) where they were asked to complete an anonymous informed consent form if

they wished to participate in the survey. Potential participants were informed that for voluntarily completing the questionnaire, they were eligible to receive either a $5.00 unique OneCard certificate (the OneCard is the student identity card that can contain monetary value to purchase certain services and products on the university campus) or a $5.00 Starbucks e-gift card. Only those who wanted to receive the incentive were asked to provide their email address at the end of the questionnaire. The email addresses were separated from the survey data to maintain anonymity.

Statistical analysis

Incomplete questionnaires were not used in the analysis. Demographic and “current use” and “ever use” data were summarized using descriptive statistics. Categorical variables were reported using frequencies, while continuous data were analyzed using means and standard deviations. All group comparisons for categorical variables were conducted using chi-square analyses where two-sided p-values <0.05 were considered statistically significant. Multivariate analysis was used to identify predictors for competency to counsel patients and prescribe medication. The Statistical Package for the Social Sciences (SPSS, Version 19.0, IBM, Armonk, NY, USA) was used for data management and statistical analyses.

Results

Response rate

We received 301 completed surveys and 12 incomplete responses out of 681 potential respondents. The survey response rate was calculated as: (number of completes) / (number of completes + number of incompletes + number of refusals), which in this case was: (301) / (681) = 44.2%. The highest response rate (65%) was from students who had just completed their first year of school and the lowest (25%) from recent graduates.

Sample characteristics

Of the 301 respondents, 51% were females and the mean age was 24.4 years (SD = 2.8). About 37% of respondents had just completed their first year of medical school, while 14% of respondents had just graduated from their fourth year (Table 3.1.).

Smoking prevalence and opinions

More students had ever smoked cigars/cigarillos (40.5%) or WPs (39.9%) than those who had ever smoked a cigarette (29.9%). Similarly, current smoking rates were higher for cigars/cigarillos (6.6%) and WP (6.0%) than for cigarettes (3.3%). Among those who had ever smoked a WP, the majority (53.8%), had done so at a WP café. The most common materials reported to be smoked in a WP were tobacco (59.7%) and herbal products (42.9%). There was no difference in beliefs about the health consequences of WP smoking between those who indicated that they were “ever” smokers and non-smokers. A significant minority of all respondents believed that smoking tobacco in a WP was less harmful than smoking tobacco in the form of a cigarette. Surprisingly, 10% of those who had smoked a WP indicated

that they did not think that smoking tobacco in a WP was addictive, a belief not shared by non-smokers (Table 3.2.).

Perception of exposure to tobacco related education

Respondents reported moderate levels of education on a variety of tobacco-related subjects. The overall tobacco education score was 3.25 (95% CI 3.14-3.36). Limited education was reported on the role of tobacco in addiction pathology, pregnancy and pediatrics and on the pharmacotherapy of nicotine addiction. Respondents reported greater exposure to education about counseling and motivational interviewing techniques and the role of tobacco in public health and the most education about the role of tobacco causing in disease. Less than 10% of respondents reported that they received “a lot of education” about any of the subject areas surveyed (Figure 3.1.).

Perceived competence in tobacco cessation interventions

Fewer than 10% of respondents in any year, strongly agreed with the statements “I have received enough training on tobacco cessation interventions”; “I am comfortable providing medications to assist in tobacco cessation” and “I am familiar with the current guidelines for treating tobacco use”, however, some 30% of final-year students felt knowledgeable (strongly agree and agree somewhat) about guidelines and were satisfied with the education they have received. Fifty per cent felt competent to counsel patients and prescribe medication. A difference in self-reported competence was apparent in the responses as students progressed through the program (Figure 3.2.). Multivariate analysis showed that the year of education was the only significant factor in predicting if students were likely to counsel smokers who are seeking help to give up smoking.

Health consequences of smoking

Most students believed that cigarettes are either mostly or totally responsible for chronic obstructive pulmonary disease (95%), lung cancer (91%), coronary artery disease (54%) and, to a lesser extent, bladder cancer (Figure 3.3.). Most students thought that cigarettes were not at all or not very responsible for the development of gallstones and appendicitis. The majority of students (92%) agreed that non-smokers could expect to live an average of ten years longer than smokers; however, they did not believe that quitting at the age of 30 would extend a smoker"s life expectancy to that of a life-long non-smoker.

Tobacco cessation

Most participants believed that pharmacotherapies alone were at least somewhat effective in tobacco cessation (Figure 3.4.). The intervention most regarded as extremely effective by 17.1% of students was “a group cessation program including several sessions and nicotine replacement therapy”. Most participants thought that both advice from a general practitioner and willpower alone were somewhat ineffective. Respondents generally agreed (85%) that physicians play a leadership role in tobacco management and that it is a priority for physicians. However, nearly one-third of students did not think that physicians are motivated to implement tobacco cessation programs with their patients and 35% of respondents did.

Discussion

This survey was carried out to assess the use of tobacco products and the tobacco-related attitudes, knowledge, and education of University of Alberta medical students. Self-reported cigarette use among our survey population was low, but lifetime exposure to alternative methods of tobacco consumption (WP, cigars) was surprisingly common. While students reported some exposure to all domains of tobacco education surveyed, they expressed only moderate confidence in their own ability to counsel and treat smokers. This was despite correctly identifying the key role of tobacco in the pathogenesis of lung cancer, chronic obstructive pulmonary disease and coronary artery disease.

Self-reported current cigarette use among our study population was low (3.3%). In contrast, recent surveys of medical students in Germany, the USA and the UK reported much higher rates of cigarette use (20%, 11% and 10%, respectively).[11-13] The only other recent survey of cigarette use among Canadian medical students reported similar data to that reported in this study [9]. The latest WHO estimates for adult cigarette smoking prevalence were 29% in Germany, 24% in the UK, 26% in the USA, and 17% in Canada [14].

Although self-reported cigarette use among medical students in Canada is lower than the use of cigarettes among the general population, it is concerning that current cigar/cigarillo use among this health aware group is equivalent to that in the general population and exceeds it in the case of the use of the WP [15]. Although 40% of respondents indicated that they had smoked a WP at some point, they were skeptical of the alleged safety of this practice. Several studies confirm their suspicions, asserting that WP smoking is both harmful and addictive; smokers are exposed to high levels of particulate matters, carbon monoxide, and other chemicals, which affect lung

health [16]. More than half of those who had ever smoked a WP did so in a public café. The proportion of students being introduced to WP in these venues highlights the importance of smoke-free legislation being applied to WP cafés [17]. Almost half of the students who ever smoked the WP did so at home or in other locations, suggesting that we may be witnessing a normalization of WP smoking in Canada among young adults. Most respondents indicated that they chose to smoke tobacco in their WPs, a practice that carries with it the real risk of nicotine addiction [18].

While the causative role of tobacco in the etiology of disease was well known by respondents, they indicated that they received less education about the management of tobacco use in pregnancy and childhood. This may well be a reflection of the relative paucity of research and the difficulty in treating tobacco addiction in both these groups. Tobacco use during pregnancy is a key modifiable risk factor for innumerable perinatal complications but poor implementation and psychosocial barriers frequently compromise the success of cessation efforts [19]. Nevertheless, it is vital that physicians champion smoking cessation interventions as a routine part of prenatal care, as the long term benefits to both child and mother are inestimable. The adverse consequences of second hand smoke on child health have been well described and the imperative for treatment of nicotine addiction compelling [20]. The results of our survey suggest that a focused tobacco management module in both the pediatric and obstetric blocks could well be appropriate with an emphasis on motivational techniques to promote behavior change.

Less than 10% of graduating respondents strongly agreed that they were familiar with the current guidelines for treating tobacco use, in comparison, 99% of general practitioners are familiar with hypertension guidelines and 90% of clinicians are familiar with the guidelines for the treatment of angina [21,22].

These data point to the need to encourage widespread exposure of medical students in Canada to the excellent CAN-ADAPTT resource which includes not only guideline information but also links to a range of educational resources including instruction of motivational interviewing techniques [23].

It was disappointing that although a role for leadership by physicians in tobacco addiction management was acknowledged, one-third of respondents believed that physicians were not motivated to implement tobacco cessation programs and more than half thought that their advice would be ineffective. These data mirrored findings in a Quebec study which demonstrated that while many physicians discussed tobacco addiction with their patients in two years of seeing them [24], a significant minority perceived that these interventions took too much time or were not effective [25]. As knowledge-based learning is cultivated and reinforced through clinical observation, it is important that practicing physicians model the appropriate attitudes and actions towards tobacco use [26].

Although medical students from different countries agreed on the dangers of tobacco use, they differed in their perception of effective cessation methods. While medical students in London and Edmonton rated pharmacotherapy as more effective than physician advice, willpower or alternative therapy, and perceived “group cessation programs including nicotine replacement therapy (NRT)” to be the most effective tobacco cessation intervention, German medical students viewed “willpower alone” to be extremely effective [11]. Though advice from a physician doubles a smoker"s chances of quitting [27], the majority of students from medical schools in Canada, Britain and Germany viewed “GP advice” as ineffective [11]. Despite their confidence in counseling and medicating tobacco users, this view may discourage clinical students at the University of Alberta from offering appropriate advice to current smokers.

Limitations

A self-administered survey is a convenient and effective way to measure knowledge and opinions but has inherent drawbacks. Our survey was only able to measure education and competency subjectively, relying on students to report on these parameters accurately. Objective measures of clinical competency must be sought through other modalities.

Within these constraints, we took steps to ensure that the data we did obtain were of optimal quality by developing clear and concise wording and placement of question items and providing a logical flow to reduce respondent bias, burden and the length of the survey instrument. Heerwegh and Looseveldt[28] found that, when comparing data quality in face-to-face versus on-line survey responses, those who responded on a web survey were more inclined to opt for “don‟t know” responses. To minimize this effect, our survey instrument contained only one item with a “don‟t know” response category. The use of on-line surveys has been found to increase reporting of sensitive issues (like smoking behavior), increase the accuracy of reporting and decrease the likelihood of a question being skipped compared to other methods of data collection, especially among young, well-educated and computer literate populations [29].

A response rate of 44.2% is well within an acceptable range for online surveys of medical students. For example, a one-week survey of New York medical students resulted in a 30% response rate [30]; a 25-week mixed mode survey of Canadian physicians and medical students produced an email response rate of 29.9% [31] and an online survey of fourth-year medical students enrolled in six schools in New York City, which ran for 13.5 weeks, garnered a response rate of 50% [12]. Response rates were not uniform across the University of Alberta medical classes. Conclusions, especially those concerning the class of 2012, must be interpreted with caution. Our

overall data suggest that there may be room for improvement in tobacco cessation intervention training. As the sampling frame was limited to one university, it may not be representative of medical education in all of Canada. Nonetheless, given the limited numbers of medical schools in Canada and the standardization of medical curriculum through licensing exams, we can assume that some of these findings may be relevant to other Canadian institutions.

Conclusions

University of Alberta medical students have lower cigarette smoking rates than students in Europe but seem to use cigars and WPs quite frequently. They are knowledgeable about the health consequences of tobacco addiction but still require education on the practical aspects of the treatment of tobacco addiction.

Practice Implications

Although cigarettes have been the main focus of tobacco education, students and physicians must not overlook other forms of tobacco use such as cigars, cigarillos or WPs. Further analysis of both student and physician awareness of alternative tobacco use will inform continuing education on the subject and updated guidelines for the treatment of tobacco use. Additional training on behavior modification therapy and the effect of physician advice on patient behavior is also needed to address an overemphasis on pharmacotherapy. As medical students learn from a combination of didactic lectures, interactive exercises, and mentor role modeling, regular practice of preventative behavioral change interventions amongst physician preceptors can teach future physicians to employ this method as well. An evaluation of recent graduates in clinical practice will provide further clues into the long

term effectiveness of current tobacco medical education. Medical students and current physicians would benefit from the tools, support and ongoing education to make them effective leaders in tobacco cessation and health promotion.

Tables

Table 3.1. Demographic characteristics of University of Alberta medical student respondents

	n/N	%
Gender		
Female	155/301	51.5
Male	146/301	48.5
Class		
2015	111/301	36.9
2014	77/301	25.6
2013	70/301	23.3
2012	43/301	14.3
Smoking status		
Cigarettes (ever)	90/301	29.9
Cigarettes (current)	10/301	3.3
Cigars/Cigarillos (ever)	122/301	40.5
Cigars/Cigarillos (current)	20/301	6.6
Waterpipe (ever)	120/301	39.9
Waterpipe (current)	18/301	6.0
	Mean (SD)	
Age [years]	24.4 (2.8)	21- 47

Table 3.2. Waterpipe smoking practices and beliefs among University of Alberta medical respondents

	Waterpipe						Trend	
	Smokers		Non-smokers		χ^2	*p-value*	χ^2	*p-value*
Smoking location	**n/N**	**%**	**n/N**	**%**				
Waterpipe Café	64/119	53.8	NA					
Home	16/119	13.4	NA					
Some other location	39/119	32.8	NA					
Smoking material								
Tobacco	71/119	59.7	NA					
Herbal products	51/119	42.9	NA					
Cannabis	18/119	15.1	NA					
Don't know	23/119	19.3	NA					
Smoking tobacco in a waterpipe is less dangerous than smoking a cigarette					3.97	0.55	1.75	0.18
Strongly disagree	27/119	22.7	48/181	26.5				
Disagree	37/119	31.1	56/181	30.9				
Disagree somewhat	19/119	16.0	32/181	17.7				
Agree somewhat	23/119	19.3	35/181	19.3				
Agree	10/119	8.4	9/181	5.0				
Completely Agree	3/119	2.5	1/181	0.6				
Smoking tobacco in a waterpipe is not addictive.					21.48	< 0.001	12.4	<0.001
Strongly disagree	45/119	37.8	77/180	42.8				
Disagree	34/119	28.6	69/180	38.3				
Disagree somewhat	17/119	14.3	26/180	14.4				
Agree somewhat	10/119	8.4	7/180	3.9				
Agree	11/119	9.2	1/180	0.6				
Completely Agree	2/119	1.7	0/180	0.0				
Smoking herbal products in a waterpipe has no significant consequences to your health.					2.69	0.75	0.44	0.5
Strongly disagree	40/120	33.3	60/180	33.3				
Disagree	44/120	36.7	76180	42.2				
Disagree somewhat	26/120	21.7	32/180	17.8				
Agree somewhat	6/120	5.0	8/180	4.4				
Agree	4/120	3.3	3/180	1.7				
Completely Agree	0/120	0.0	1/180	0.6				

Figures

Figure 3.1. Perceived amount of tobacco education received in each year of medical school regarding six special areas

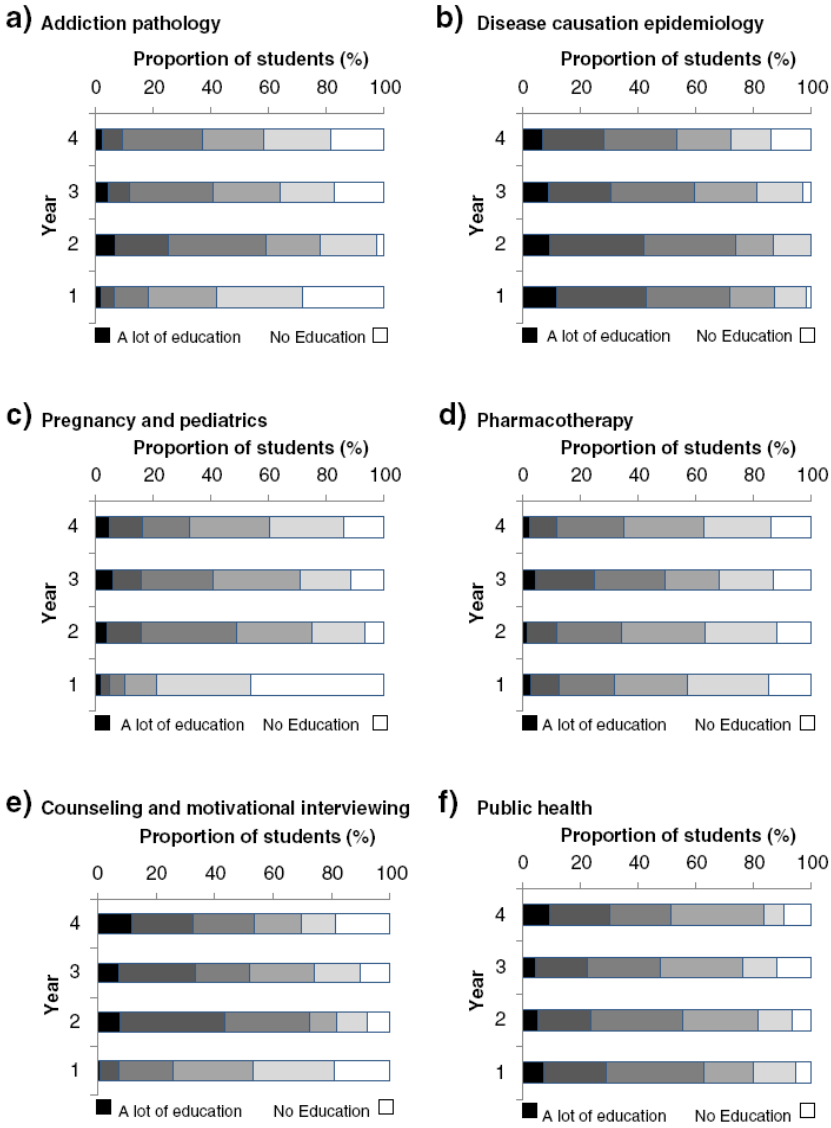

Figure 1 Perceived amount of tobacco education received in each year of medical school regarding six special areas. Students from each year were asked to rate the amount of tobacco education they received in the past year on a scale of 1 to 6 with "1" being "no education" and "6" being "a lot of education" for each of the six special areas (panels **a** to **f**). Student responses were stratified according to their year of medical education from 1-4.

Figure 3.2. Self-reported competencies of medical students regarding tobacco cessation interventions

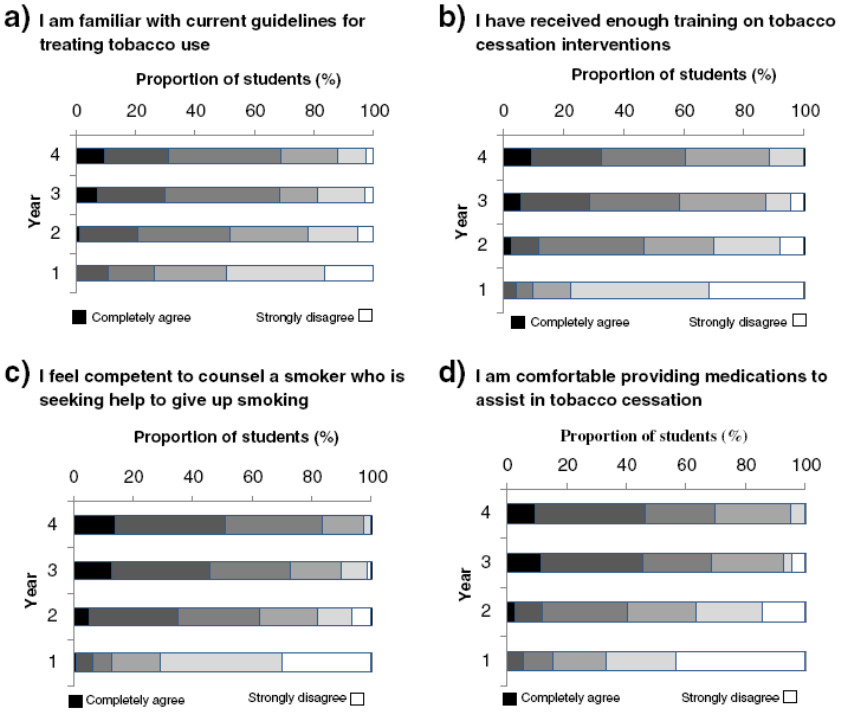

Figure 2 Self-reported competencies of medical students regarding tobacco cessation interventions. Students were asked to rate their level of agreement with the above statements. The rating was on a scale of 1 to 6 with "1" being "strongly disagree" and "6" being "completely agree" for each of the four tobacco cessation interventions (panels **a** to **d**). Student responses were stratified according to their year of medical education from 1-4.

Figure 3.3. The responsibility of cigarettes for six diseases

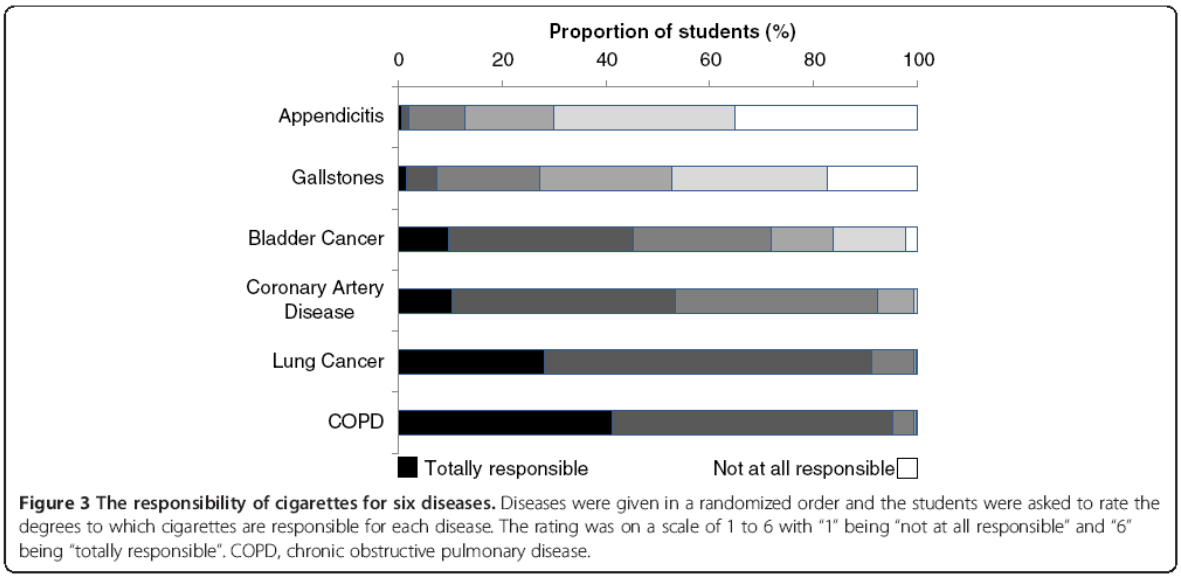

Figure 3 The responsibility of cigarettes for six diseases. Diseases were given in a randomized order and the students were asked to rate the degrees to which cigarettes are responsible for each disease. The rating was on a scale of 1 to 6 with "1" being "not at all responsible" and "6" being "totally responsible". COPD, chronic obstructive pulmonary disease.

Figure 3.4. Perceived effectiveness of smoking cessation methods

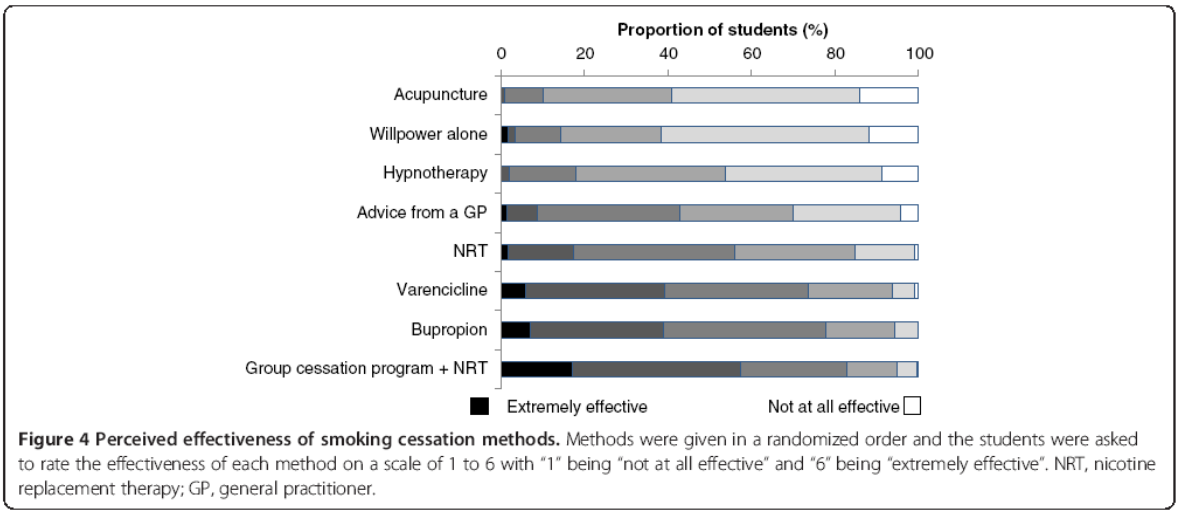

Figure 4 Perceived effectiveness of smoking cessation methods. Methods were given in a randomized order and the students were asked to rate the effectiveness of each method on a scale of 1 to 6 with "1" being "not at all effective" and "6" being "extremely effective". NRT, nicotine replacement therapy; GP, general practitioner.

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CHAPTER 4

MORE SIMILARITIES THAN DIFFERENCES, EXPLORING THE SOCIAL AND CULTURAL ASPECTS OF WATERPIPE SMOKING[3]

[3] Manuscript in preparation

Abstract

Introduction: When asserting the right of individuals to be free to smoke a hookah (waterpipe – WP) in public places (including restaurants and cafés) the *cultural* importance of the practice is often cited. The purpose of this study was to explore the social and cultural significance of WP smoking and to probe what motivates young adults from different cultural backgrounds to initiate this behaviour.

Methods: Qualitative methods were used to elicit the views of groups of WP smokers from different cultural backgrounds. Transcripts were independently coded by two of the study investigators using thematic analysis.

Results: Sixteen focus group discussion sessions with a total of 75 WP smokers aged between 18 and 30 were conducted. Perceptions about WP did not differ between the groups studied. Most started smoking before the age of 18 calling it a „high school thing" and admitted that they had easy access to WP cafés despite being under the legal age to enter such establishments. Factors that influenced this behaviour included "the desire to try something new", "influence of friends", WPs being perceived as "healthier" than cigarettes, and the availability of flavoured shisha. Few participants saw culture (as related to ethnicity) as a factor supporting this behaviours. Many indicated that they did not know if they were smoking tobacco or a "herbal" substance, while some knowingly smoked both. Other materials were added to the water reservoir or to the smoked materials to alter the taste or speed the subjective effects of smoking. Frequency of use was very variable and was influenced by age (reduced as age increased), time available, cost, availability of friends, and the occurrence of withdrawal symptoms.

Conclusion: Peer influence, availability of flavoured products and facile access to WP cafés are major factors in WP initiation. Ethno-cultural issues play only a minor role.

Introduction

Waterpipe (WP) use is rapidly increasing in popularity in Europe, the US and Canada, areas distant from the Middle East, the locale traditionally associated with WP smoking [1,2]. As a relatively new entrant into the tobacco market, WP use is not well regulated [3,4], appropriate control measures being hindered by limited knowledge about the composition of tobacco and "herbal" shisha, lack of long term data on the adverse health effects WP smoking and limited data on the air quality in the WP smoking establishments. WP cafés are still frequently exempt from clean air legislation designed to protect the public from the second hand smoke [3,4]. WP tobacco products and accessories are frequently not compliant with the World Health Organization Framework Convention on Tobacco Control (WHO FCTC)[5] guidelines and requirements for packaging and labeling of tobacco products [6,7].

Efforts to control the smoking of WPs in public spaces in Canada are frequently met with calls to *"respect a traditional cultural practice"* in an attempt to brand tobacco control advocates as culturally insensitive to Middle Eastern traditional practices [8,9].

In this study, we sought to explore the social and ethno-cultural significance of WP smoking for young adults of different cultural backgrounds now resident in Alberta, Canada. We also wished to investigate the key motivating factors for them to initiate WP smoking.

Methods

Focus groups with young WP users in Calgary, Alberta, Canada were employed to explore their knowledge and attitudes about WP use as well as their perceptions of the cultural and social significance of WP use. A combination of convenience and stratified quota sampling strategies with snowball sampling techniques were used to ensure balanced representation of two groups of participants, those who are second generation or more Canadians and those who are immigrants or children of an immigrant. Participants were eligible for the study if they claimed that they had used a WP in the past year and were between 18-30 years old.

Recruitment posters and pamphlets describing the study were distributed in different immigrants‟ organizations and communities, in WP cafés, and at the University of Calgary campus. Additionally, word of mouth was used as a recruitment strategy; participants with whom contact had already been made used their social networks to link the research team to others who could potentially participate. Facilitators were research assistants with social science training. Open-ended questions and probes were developed based on literature review and on consultations with different stakeholders to help guide the discussions and to ensure consistency across groups. To facilitate group discussion, questions were broadly based initially and then gradually became more specific to encourage group discussion [10] in order to ensure coverage of the following topics: knowledge about WPs, WP use behaviours and patterns, feelings including likes or dislikes about the WP, family attitude toward WPs, opinions on the cultural significance of WP use and WP smoking policies. Participants were reimbursed with $25 dollar gift cards for their time and to cover their transportation costs. Data collection started in May 2013 and continued until October 2013. The study was approved by the University of Alberta Health Research Ethics Board

Data analysis

All discussions were audio-recorded and transcribed verbatim. Data were stored and managed electronically on password protected computers. Analysis occurred concurrently with data collection to ensure sufficient exploration of the new themes [11]. Data collection continued until a saturation threshold was reached, where no new themes emerged [12].

We started this study with „„explorer"s eyes"" – without being driven by an *a priori* hypothesis [13]. Thematic analysis techniques were used to analyse the transcripts [14]. Two investigators independently reviewed a sample of transcripts to generate "memos" and to investigate „what is happening here?". Then team members worked together to inductively create an initial list of codes that was modified to a final coding scheme of relevant themes through review and discussion. Two investigators independently used the final coding scheme to code all the transcripts. Categories and theme patterns were identified and a description from each perspective was developed. This iterative approach allowed us to identify themes that were new, repeated, and questions that we needed to modify or include to enhance our understanding [13]. Data were summarized and presented using QSR Nvivo10©.

Results

Participants

A total of 16 focus groups with 75 WP smokers aged between 18 and 30 were conducted. Among our participants, 31 were second generation or more Canadians [C] and 44 who were immigrants or children of an immigrant. The latter were subsequently divided into 5 groups (Asian [A], Eastern Mediterranean [M], African [AF], European [E], and other [O]). Characteristics of participants are summarized in Table 4.1. and themes that emerged through the data analyses are summarized in Table 4.2..

Smoking initiation

The majority of participants reported starting smoking WP during their high school years, calling it a „high school thing" when access to bars was unavailable.

> *"Mostly it was like a huge thing in high school, it's just I feel like extremely younger people like 16 and stuff like that, that's when we started and that's when it was a huge thing." (G14-f2-C, 18-24)*[4]

Several factors were cited as motivation for initiation including the desire to try something new, the belief that the WP smoking was harmless or at least healthier than other forms of tobacco, and flavours which make the smoking experience more pleasant.

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[4] *(**GROUP #** - Gender: **m**: male; **f**: Female & **#** - Ethnicity; **A**: Asian; **M**: middle eastern; **AF**: African; **E**: European; **O**: Other; **C**: Second generation or more Canadian; **Age group**: 18-24; 25-30)*

> *"It was kind of little mischievous and it felt like you were doing something cool. Definitely one of those things we heard about in high school and decided to try it out because people were saying it was kind of cool and you should give it a try." (G2-m2-C, 18-24)*

> *"I think it had to do with the flavour that got me to smoke it. It has a lot of variety." (G3-m5-M, 18-24)*

It was evident that social aspects and peer influence were important factors: all participants claimed that they initiated smoking under the influence of their peers – especially by Middle Eastern friends or more experienced smokers, either in social parties or at WP cafés.

> *"It was a house party; I was sort of pressed into it a little. I was skeptical to try it because I'm asthmatic and I was younger, high school, grade 10 I think. It was so bad, I liked it, it was flavoured and it was fun after a while." (G2-f1-C, 18-24)*

> *"At a social event and I just tagged along and ended up smoking it there but ONLY after a friend assured me that it wasn't something with massive health repercussions." (G3-m3-C, 18-2)*

Interestingly, smokers highlighted the importance of having access to the WP as an encouraging factor in smoking initiation, with many admitted having access to WP cafés under the legal age of 18.

> *"It was a friend's 18th birthday and I was 16 at the time and they told me it was pretty easy to like get in because they really don't ID at the shisha (WP) café, so I thought it was my first like experience to be part of the exclusive over 18 club older cool people that sitting around smoking and I thought it was so awesome and they never ID me, so I guess I just kept on going and it's followed me to this day." (G16-f2-C, 25-30)*

No evident differences were noticed among smokers from different cultural backgrounds regarding smoking initiation although few participants from Middle Eastern Region [MER] origin admitted initiating smoking at ages 11 to 13 at home or with one of their family members or one of their friends.

> *"I smoked with my father, in my culture you can't smoke in front of your father with cigarettes or WP but he told me you can come and I was only 12." (G1-m1-M, 25-30)*

Products used

Many smokers showed ignorance about the products that they were smoking – either at WP cafés or at their friends‟ houses – revealing little to no concern about what they were actually smoking in the WP.

> *"To be honest I don't know much, like I said I go into the cafés and pick out the flavour. I've heard that cafés aren't allowed to put tobacco into their products but my friend says they do anyways." (G2-f3-A, 18-24)*

For smokers who were able to identify the products categorizing them as tobacco and "herbal", some had no preference, smoking both tobacco and "herbal" depending on what was available and offered to them. Others said that they smoke only tobacco for its effect, such as inducing a head rush and/or buzz, emphasizing that they would prefer not to smoke at all rather than smoke "herbal"; others indicated smoking only "herbal" since smoking tobacco did not appeal to them based on the same effects.

> *"I've never smoked the herbal stuff, I actually smoked it once because someone else had it, I smoke the tobacco stuff for the buzz." (G1-m1-M, 25-30)*

The majority of WP smokers from MER reported that they smoke mainly tobacco products, while good numbers of A, E, or C participants were

unaware of the products that they were smoking or indicated that herbal products are what they usually smoke.

Not surprisingly, many smokers mixed tobacco or “herbal” products with marijuana – explaining why and how they do that.

> *“I almost always pair it up with pot I never really smoke it without. Yeah you can smoke WP with pot in it for hours and not really get very high.” (G1-m4-E, 18-24)*

For many smokers, experiencing different flavours was viewed as a motivation to initiate and maintain smoking WPs. Furthermore, in an effort to experience new tastes, many smokers tried to be „super inventive“ in adding materials to the WP such as ice, juice, milk, or peppermint tea; however, for other smokers the purpose of adding „stuff“ to the WP was mainly to enhance or speed up the process of getting high, such as adding tobacco from cigarettes, red bull, alcohol, or marijuana.

> *“We've done peppermint tea bags and that's delicious. Super inventive” (G1-m2-C,18-24)*

> *“I don’t know, it’s pretty you know… its uh, some speed up the process a bit like red bull I guess or some just make it smoother like milk, just changes up the taste really I guess So… Just to experiment right!” (G4-m1-E, 18-24)*

Social context

Most smokers talked about the social context that dominates their smoking, describing WP use as a “social thing to do”. Smokers reported smoking the WP with their friends at social parties, noting that the WP has become a focal point for friends gathering; while for others, smoking the WP is considered an adjuvant activity while engaging in other activities such as watching TV, playing cards or video games, eating, and drinking alcohol.

> *"I think that's part of the reason that people like having them for a party, it kind of makes it like a show piece, like a central place for everyone to gather around, and like, I don't know, like a focal point, kind of like sitting around a fire or something. Smoking WP is sort of like the same idea." (G4-f1-C, 18-24)*

> *"For me, it's usually like you go watch a football game or a hockey game or whatever like at my friend's house. They'll usually, like if there's a get together they'll just spark it up." (G6-m5-M, 18-24)*

As confirmation of the social context of WP smoking, most smokers reported that they usually spend hours smoking while sharing the same WP with their friends – without showing any concern for the potential health consequences associated with this practice.

> *"Usually I share with one other person but sometimes three I guess but it's usually two though. Usually there for a few hours, I wouldn't feel it's not my money's worth if I was there for less than two hours to be honest, usually all night. If I go out that's what I'm doing for the night." (G3-m2-AF, 18-24)*

Smokers perceived smoking WP as a relaxing late night activity after a night out at the bar dancing and drinking, or as a secondary event where people are quieter and less rowdy. It was seen as a fun thing to do with friends that was different from the usual evening or night activities, where they can sit and talk to friends. It was also something that was perceived to be relatively safe and free from potential predicaments associated with other activities such as drinking alcohol.

> *"It's a late night, we don't want to go home... let's go smoke some WP. Usually only lasts about an hour or two cause it closes around four or five in the morning. Um usually go with only around 4 or 5 people, not a*

big group and um yea, sometimes leave early cause we just get nauseous and dizzy." (G6-m2-A, 18-24)

This social aspect of WP use seems to be universal among smokers from different cultural backgrounds, and reinforces the influence of having a friend who used to smoke WP in smoking initiation.

"My friend actually smoked WP a lot, she has for a really long time, and she invited me, she said was that we were going to a WP café, no expectations no idea, I walked in and I was just blown away because first of all I wondered is this legal, I had no idea what was going on or anything and just smoked and there were a bunch of people and it was more a social thing, it was like the most taboo thing I had ever walked into to the 1st time because I never have seen it and had no preconceived idea I did not know what WP was". (G16-f3-C, 25-30)

Cultural context

Although some C participants argued that the cultural dimension is not unique to the WP as all tobacco use is culturally influenced, the cultural impression of WP was cited by some participants as motivation to smoke the WP. Many E, A, and C participants stated that they really do not know about the cultural aspect of WP smoking. Some participants ambiguously linked this practice to family values, while others use the high prevalence of smoking WP in some cultures as a proof of the cultural significance of this practice.

"OH absolutely, I think all tobacco is culturally influenced. I don't think there is any reason if you knew all the health effects going in and everything you're going to gain from it and lose from it. Would you take it?" (G5-m2-C, 18-24)

"No clue, I'm guessing it was religious or like a cultural thing, I would say Middle East but I really don't know." (G2-f2-C, 18-24)

> *"Without a doubt there is a cultural connection, all the Arabs I know there is way higher prevalence with them smoking it, especially frequent WP smokers are Arabs or Muslims I should say." (G6-m7-C,18-24)*

The perception that some Muslims desire to comply with their religion prohibition of alcohol consumption make smoking WP an acceptable alternative social activity was cited by both C and M participants.

> *"Middle Eastern cultures are more Islamic so it has to do with the religious aspect because people don't really drink so they smoke the WP and that's their fun instead of drinking alcohol so we tend to sit there and have coffee, tea and fruits vegetables and sweets and family and giggling and making fun of people." (G5-f1-M, 18-24)*

Some AF and M participants saw that in order to be a „cool guy" and fit in you need to smoke WP:

> *"For me if you want to be a social guy a cool guy in my culture and when you are young it's a hundred percent that you have to do it and after I liked it." (G1-m1-M, 25-30)*

However, the relatively permissible attitude toward WP smoking seems to be gender oriented as what was acceptable for male was not so for female where females smoking WP at a café was considered risking their families" reputation and was seen as a cultural taboo.

> *"Your reputation as a family so if your kids smoke it like 'ahh your kids smoke!' and that's the reputation thing and that's a big deal for Middle Eastern people. Even here when my mom calls back home and she say my daughter went out for WP they are like 'what do you mean your daughter went out for WP ' that's a big deal for them." (G5-f1-M, 18-24)*

One participant did not relate this taboo to the family values but makes it a general statement:

> *"In my culture, guys are ok to smoke WP but girls are not allowed to." (G5-m1-M, 18-24)*

Other participants from the same cultural background acknowledged that their cultures do not really support smoking WP, giving other reasons that could make people more amenable to the WP, such as the fact that it is not an illegal drug.

> *"Honestly, for me in our culture smoking is seen as something that's not very permissible, it didn't actually factor into my decision because I'm not too bounded by my cultural restrictions but basically they wanted to go smoke and I was like yea sure, I know it's not an illicit drug something that's going to ruin my life or something so I gave it a try. I was maybe 19" (G6-m3-M, 18-24)*

Family attitude

The attitude toward WP smoking widely differs among families of WP smokers. Some participants said that their families do not mind them smoking WP emphasising that they prefer it over cigarettes; this was especially true for parents who do not know much about the WP or for parents who are WP smokers, admitting that the latter showed little care about this.

> *"Even though my dad is not a smoker and it's a big no no to him but if we're sitting there with friends and stuff and there isn't a WP going my mom will say this night is very boring even though we could be having the most fun. There is still a big aspect of it, passing around the WP." (G5-f1-M, 18-24)*

Ironically, a female participant, from a cultural background that supposedly supports WP smoking, talked about how her family actually opposes smoking WP – especially for girls.

> *"But for me as a girl when I smoke WP he says' you're a girl you shouldn't be smoking WP and that's the cultural aspect, you're a girl, I don't want to see that in your hand' because people view, reputation stuff family wise people talk even my mom when she does it with me she will say ------, that's enough' even if it's the second puff." (G5-f1-M, 18-24)*

Parents from different cultural backgrounds who knew about the WP were more skeptical and thought that it was a type of drug. Some parents showed a negative attitude toward the WP considering it as bad as cigarettes, and for some especially M participants said that their parents objected they been smoking WP too much. This negative attitude led some smokers to hide their WP smoking admitting that their parents do not know that they are smokers.

> *"My parents are really religious, Catholic and they don't know what's going on so they definitely would not approve especially not at the age that I was." (G2-m1-O, 25-30)*

> *"My parents don't really know, I've asked them if I can buy a WP and my dad didn't really say anything so I think he was ok with it but my mom she was like no you're not really getting one. I think it's because more like different families have different things, my parents are goodies so they want to be like nothing bad, don't drink don't do other stuff but if I don't tell them they're not going to know right so." (G5-m3-A, 18-24)*

Smoking experience

For most smokers, their first experience with the WP took place at a WP cafés, at home with one of their family members, or with friends. The smoking experience and atmosphere surrounding WP use was described generally in positive terms such as enjoyable, fun, quiet, relaxing and a stress reliever.

> *“So I guess I like the more relaxed atmosphere of it and just the fact that you can actually sit there for hours you know relax and smoke a pipe build clouds in your mouth it seemed to be calming and relaxing at the time but I hated the light-headedness and I hated the fact that it would give me shortness of breath.” (G10-f4-C, 25-30)*

Reasons for maintaining WP smoking included the social context and peer influence, enjoyment of making smoke rings, mimicking dragons' fire or playing other tricks with the smoke was one such repeatedly cited reason; this was also a factor as to why many smokers prefer to experience smoking indoors over outdoors. They explained that smoking indoors has advantages such as the ability to play with the smoke, not needing to worry about weather conditions, and some reported that they just simply enjoyed seeing the venue full of smoke.

> *“I actually prefer indoor to be honest. I like to see the place full of smoke to be honest.” (G3-m2-AF, 18-24)*

> *“I think smoking WP outdoors feels a lot better than indoors because the smoke is gone as opposed to indoors where it's like you really can't see anything and smoke is everywhere yea so overall I think it's better, it feels better smoking outdoors.” (G3-m1-M, 18-24)*

Most smokers considered themselves „occasional smokers‟, though some exceptional cases were reported where some smokers among M and AF participants admitted smoking WP every day once or more.

> *“Actually I smoke WP every day twice.”(G5-m4-M, 25-30)*

> *“Every day for 3 years straight I'm pretty sure I smoked every single day with the exception of holidays.” (G10-m1-AF, 25-30)*

The frequency of „occasional‟ smoking – which ranged from 3-4 times a week to 3-4 times a year – was affected by several factors related to age, the

availability of free time, the consideration of cost, friends that WP smokers spent time with, and feeling the need to smoke the WP. For many smokers, smoking frequency has not changed since they began smoking; while for others, smoking frequency has decreased when less free time was available, and when the social circle of friends changed. For them, smoking the WP became a „nostalgic activity", a reminder of the good times that they spent socializing with their friends when they were younger.

> *"We met on the train the other day and we were saying we haven't done it in so long we should go soon. It's a nice memory too it's nostalgic now because you had so much fun with it when you were young." (G2-f1-C, 18-24)*

Knowledge and attitude of health effects

Knowledge about the health effects of WP smoking seems to be limited and mostly stated in comparison to cigarettes. Some smokers admitted that they do not have any knowledge about the health effects of WP smoking, while others had heard about some effects but expressed doubt, and few smokers also clearly stated that they do not care. The assumed filtering role of the water, the assumption that smoking non-tobacco "herbal" products makes the WP less harmful, and the occasional pattern of smoking were factors fuelled the perception that WP is less harmful,

> *"Honestly, I didn't think it was that bad. But I heard once that yea one WP session was like smoking a pack of cigarettes but I really didn't buy into that cause I don't know, it just didn't make sense to me really and because of like the water filter my friends are like "yah it can't be that bad" it gets filtered in the water but that seems like no science too so." (G6-m5-M, 18-24)*

On the other hand, smokers who saw smoking WP as harmful as cigarettes or even worse, talked about the large amount of smoke produced by the WP,

the duration of smoking sessions – which could last for hours – and inhaling burning charcoal fumes. Furthermore, some smokers showed concern about exposure to second hand smoke, and about the fact that smoking "herbal" products should not be seen as a healthy practice.

> *"Obviously you're inhaling a lot of the charcoal and that's going through your lungs as well and I don't know the effect of charcoal on your body per say but in terms of it being compared to smoking 30 single cigarettes I find hard to believe." (G6-m1-C, 18-24)*

Most perceived WP use as less frequent and less addictive than smoking cigarettes. However, some smokers reported getting the head rush and feeling high when using the WP. For others, WP smoking frequency increased with time and smoking became a habit that was hard to break and admitted becoming dependent.

> *"When you smoke WP you feel dizzy and weak if you are a new smoker, your head is spinning and then if you smoke regularly you become dependent on WP. I have friends first time it was social and now every day they are dependent on WP smoke in the morning one in the afternoon one. It is very cultural and having fun but then the real reason after is because you are addicted to it and you can't stop." (G1-m1-M, 25-30)*

> *"Believe it or not every time I do it I say it's the last time then I do it again. I have a friend that has to do it every morning before breakfast. She takes picture and sends it to me and I tell her, you are pregnant this is not fun." (G5-f1-M, 18-24)*

Education and Awareness

Most participants agreed that general awareness about WP among both adults and youth was very limited, emphasizing the importance of using different methods of education to increase awareness. Most participants

highlighted the value of social media (mostly Facebook, Twitter and YouTube ads) as a tool for delivering messages related to WP content and health effects. Others were convinced that school programs are important, giving examples of how school-based prevention programs educated them about cigarettes. Some smokers believed that having warning labels on the products and in cafés would be an effective tool in raising awareness about the health effects of WP smoking and its content.

> *"I think on social media, twitter, Facebook, people talking and commenting on it, you know it's also risky for your health it's that, it's this, they get the negative sides, because it seems that they are always talking about the positive way you know? Yeah it would be good to spread the word of mouth that it's also not very good for you." (G9-f1-M, 18-24)*

> *"Unless the government like enforces it, I don't think the WP bar owners would actually put a sign because it would discourage their own business. It would be nice to have a little poster at least on the door or anywhere before you actually start smoking just to tell you that you are doing it at your own risk. Yeah, it would be easy to target people who actually are smoking WP first." (G11-f3-A, 25-30)*

On the other hand, some participants were more skeptical about the educational programs, suggesting that the problem was not in the availability of information but rather in the attitudes of individuals and in how to motivate people to access existing information. Nevertheless, some smokers were completely negative about the benefits of the educational programs referring to cigarette smoking as an example of a substance that everybody knows is harmful but is continually smoked – despite warning.

> *"No one is going to take it seriously, you know? Like no offense, but I don't think anyone would take that seriously. It's like cigarettes smoking,*

no one listens, well, some people listen, but… Still, it's WP, everyone thinks it's so…" (G14-f1-C, 18-24)

Regulations

Participants from different cultural backgrounds said that the current regulations regarding the WP are confusing. Participants suggested that the exemption of WP cafés from clean air legislation is creating the wrong perception about the safety of the WP, and that the practice of age verification at these facilities is questionable at best.

"It just gives the perception that it's ok, maybe it is just the perception, maybe it is detrimental to our health but no one is closing WP cafés so far so must be ok. I remember once seeing a no smoking sign so if you were to smoke a cigarette you would have to go outside but if you were smoking a WP inside it was fine, it was always really weird to me and there was never anyone checking age like ID cards and sometimes you would see kids that were 12 or 13, it was very perplexing to see that there was no ID'ing or anything, kids can come in if they knew where the place was and had $10 and smoke for 5 hours." (G10-f1-AF, 25-30)

Participants believed that the current display of fruits and bright colors on the product packaging to be deceiving – giving off the impression that they are safe and therefore, suggesting that packaging requirement should be in alignment with that of cigarettes.

"Right now the packages are all bright colors and they attract your eyes because when you see them there is strawberry and kiwi and all the nice flavours so I believe putting pictures on it is a good way, it does veer off some people." (G7-m3-M, 18-24)

Other participants talked about the location of some WP cafés, and how their close proximity to schools created a chance for them to go and smoke during

their lunch breaks or after school. Participants also pointed to unregulated sales and the existence of illegal imports from other countries.

> *"Yea, my progression cause there was a WP cafés right beside my school and they (though usually do so). After my first time my friends wanted to keep going so I just come with them. So you just come there and they don't ID you usually so." (G6-m2-A, 18-24)*

Many participants rely on the government for protection in regards to harmful substances, assuming that the government had already taken some actions and suggesting that additional measures to be put in place to regulate WPs. Participants also noted the increased presence of the WP in the media, giving an example of a character that appeared to be smoking the WP in a Disney movie, and pointed to the fact that smoking the WP was banned in public places in other countries.

> *"I guess when you go to the bar you assume that they are giving you something of a decent quality, legal, some kind of standard in place, not really hurt you. I'm not sure but it might be like if the government comes with a thing that says WP is bad that's definitely going to throw a wrench in the gears of a lot of … especially in such a multicultural city you don't want to step on any toes." (G16-f2-C, 18-24)*

Few participants opposed the notion of banning the WP, arguing that prohibition will not solve the problem and will in turn facilitate the emergence of a black market. Nevertheless, some smokers thought that banning will solve only part of the problem of the WP, due to the fact that many smokers are currently smoking at home.

> *"I don't think banning indoor smoking is a good idea. For example when I was in the UK, in the UK indoor smoking is completely banned indoor WP smoking is completely banned so it's only allowed to be outdoors but there is still so many indoor places except that they just have a*

camera and they look at who you are and if you're from the area they will let you in so it just creates an underground when you ban it." (G3-m2-AF, 18-24)

Discussion

Our findings show that most smokers started smoking under eighteen years of age. Their desire to try something new and their perception of WP use as “healthier” than cigarettes, along with the availability of multiple flavours, were all cited as important factors related to WP initiation. Participants reported that WP use was a social behaviour that involved peer influence. Many smokers did not know if they were smoking tobacco or a “herbal” substance, while some knowingly smoked tobacco. Other materials were added to the water reservoir or to the smoked materials to alter the taste or speed the subjective effects of smoking. Frequency of use was variable and was influenced by age, free time availability, cost considerations, availability of friend to smoke with, and occurrence of withdrawal symptoms. Few participants saw culture as a factor supporting this behaviour.

Smokers from different cultural background gave similar explanations for their motivations for initiation of WP use. Themes emerged in this study were similar to the findings of other studies assessing motives for WP smoking initiation in both MER [15,16] and in western countries [15]. Our participants talked about WP smoking as a „high school thing“ and about smoking in order to be cool and to join the exclusive club of older peers. This may indicate that smoking WP is gradually becoming a „normalized“ behaviour within mainstream „youth culture“ - defined as the body of norms, values, and practices recognized and shared by youth as guide to actions and behaviors [17], rather than being an uninformed behaviour in response to a pressure put on individuals to fit in a specific youth subculture. „Normalization“ as described by *Parker et al.*[18] has five dimensions; availability/access, drug trying rates, usage rates, accommodating attitude by nonusers, and degree of cultural accommodation of use. Those dimensions seem to be applicable on the case of WP. The noticeable rise in WP availability and accessibility, the increased rates of trying and usage

especially among youth and young adults, and the relatively positive attitude toward WP use among general public which made the introduction of WP into western societies and its exemption from currently enforced legislations an acceptable and a „liveable with" reality by the wider society [18]. This behavior normalization within „Youth culture" and the negative attitude toward cigarette smoking could be the reason why WP use has begun to surpass cigarette use as a visible marker of youth culture [19,20].

Our findings pointed to an important attribute of smoking initiation that, although illegal in Canada, many smokers admitted having access to WP in cafés at age less than 18. This youth access to flavoured products combined with notable ignorance or indifference regarding the products used by many participants and the accumulating evidence that products served were not always tobacco free [21–23] creates an added burden on the resources required to enforce the existing regulations [4], Additionally, WP use represents a challenge to tobacco control efforts by normalizing smoking behaviour and being a gateway for other forms of tobacco use [24], and the cause of relapse for smokers who quit smoking cigarettes [25].

The common assumption that cultural aspect is dominant in WP smoking as pictured by media and marketing need to be examined in the light of the definition of what is cultural - "the system of shared beliefs, values, customs, behaviors, and artifacts that the members of society use to cope with their world and with one another, and that are transmitted from generation to generation through learning" [26].

Despite the fact that WP has been used for centuries, its use was very limited to certain locations and age groups and was not considered as part of the society customs and behavioral inheritance especially among youth and women. The relatively recent introduction of the flavoured products into the WP market (late1980"s - [27] and the increase of its marketing and

accessibility lead to the new phenomenon of an increase in WP use among youth and women [28]. Although WP smoking was generally assumed to be more acceptable than smoking cigarettes in MER [16,29], recent evidence suggest that this behaviour could be linked with vulgarity and indignity especially among women, and described as a shameful and disrespectful to the society [30,31]. Those terms were voiced by one of our participants that had cultural ties to that region indicating that her parents were embarrassed when her relativities in the country of origin knew about her smoking the WP. Furthermore, religion which is named as a factor that plays an important role in the cultural identity, particularly in MER, does not seem to support the use of the WP. Participants in a qualitative study from MER saw the increase in the WP prevalence as a consequence of decreasing religious beliefs,[30] and a study in rural Egypt found that of WP cafés patrons 80.8% though that smoking the WP was a sin [32]. This attitude motivated World Health Organization (WHO-EMRO) to emphasize the role of religion in encouraging tobacco users to stop [33,34]. Nevertheless, a recent study among collage Muslim students in US found that religious beliefs on tobacco, religiosity, ethnicity, and nativity did not significantly impact WP smoking, and that only 4% of participants described WP smoking as an important part of their culture [35].

The undeniable highest levels of WP smoking among some ethnic groups in North America, does not necessarily reflect any cultural significance of this practice in their system of shared beliefs, values, and customs that is transmitted from generation to generation. Instead, it could be a result of „cultural predisposition" due to normalization of this behavior subsequent to the endemic increase in the prevalence of this practice in their countries of origin, and expression of WP users" commitment to their perceived hallmarks (or identifiers?) of ethnicity or their ethnic pride,[36] or a mechanism of

retention of ethnic identity to cope with impact of the process of acculturation in the new environment [37,38].

The increase in the WP use and the common belief that it is less harmful than cigarettes [39] is probably more than a merely spontaneous phenomenon. It could be a result of focused marketing strategies that take advantage of the lack of awareness of the dangers of WP smoking, the absence/or lack of enforcement of regulations that govern WP products, and the exemption of WP smoking premises from clean air legislation [3,4]. A comparison of WP and cigarettes related videos on YouTube found that WP related videos were more likely to portray tobacco use in positive light (92% vs. 24%), while they were less likely to mention long term consequences of tobacco use (2% vs. 44%), to contain explicit antismoking messages (0% vs. 39%), and to provide specific information on how to quit tobacco use (0% vs. 21%) [40]. An assessment of 144 websites promoting WP smoking establishments in USA reported that the most common promotion topics were flavourings, pleasure, relaxation, product quality, and cultural and social aspects, with ignorance of any potential harm that could associated with WP use [41]. These studies concluded that these websites and videos may play a role in misinforming WP users about the consequences of WP use, and that health education and policy measures should be taken to counter these misinformation and correct the common [40,41].

Our participants realized the need to increase awareness about WP highlighting the valuable role of social media and school programs as tools for delivering messages related to WP content and health effects to the general public – specifically youth. Additionally, participants emphasized the role that governments could play in protection in regards to exposure to harmful substances, assuming that the government had already taken some actions and suggesting that additional measures to be in place to regulate the WP

issue including labelling and packaging, flavouring, accessibility and age verification, and exemption for clean air legislation.

Conclusion

This study showed no substantial difference between participants from different cultural backgrounds in the way they perceived the WP. Most WP smokers initiate their smoking before the age of eighteen under peer pressure. They were motivated by curiosity, their understanding that it was healthier than cigarettes and the variety of attractive flavours available to smoke. Easy access to WP cafés fostered WP use and fostered the agreeable social nature WP smoking.

The cultural significance of the WP was raised by many participants; however, the actual relation between culture and the WP was poorly identified – it seems that the participants had heard about this relation but none were able to describe it. Participants who have ties to countries where WP smoking is prevalent were divided over the impact of their culture on their own smoking behaviour. While some saw it as encouraging factor, most felt no link between their WP smoking and cultural background.

Limitations

The number of individuals in this study is relatively small and limited to one geographic area. Therefore, while the volume of interviews data was sufficient to provide insights into the range of themes within these two groups, we cannot make broad generalisations about Canadians population as a whole recognizing that thorough ethnographic assessment is required to provide better understanding of a multidimensional phenomenon such as WP smoking and its cultural dimensions.

What this paper adds

This study indicates that there is a need for additional measures to increase awareness about WP and to regulate its use including labelling and packaging, flavouring, accessibility and age verification, and exemption from clean air legislation. Moreover, any future education efforts associated with policy change must emphasise that cultural claims of WP use are not supported by evidence and target the social context and culture of WP use. Future research on the impact of acculturation on ethnic identity and ethnic pride and its relation with WP smoking among different ethnic subgroups, as well as understanding how youth from different ethnic groups perceive health and cultural effects on decision making regarding health-related behaviour is still needed.

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Tables

Table 4.1. Focus Groups Participants

FG participants	N=75	
Age		
18-24	51	68%
25-30	24	32%
Gender		
Male (M)	48	64.0%
Female (F)	27	36.0%
Cultural background		
2ed generation or more Canadian	31	41.3%
Immigrant or children of immigrant	44	58.7%
Ethnicity		
Asian (A)	13	17.3%
Eastern Mediterranean (M)	10	13.3%
African (AF)	12	16.0%
European (E)	7	9.3%
Other (O)	2	2.7%
2ed generation or more Canadian (C)	31	41.3%

Table 4.2. Themes that emerged from data analysis

1.	Smoking initiation
2.	Products used
3.	Social context of smoking
4.	Cultural context of smoking
5.	Family attitude toward smoking
6.	Smoking experience
7.	Knowledge and attitude toward health effects
8.	Education and awareness
9.	Regulations

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CHAPTER 5

CONCLUSION

In this thesis, multiple methods were used to answer different research questions about the phenomenon of WP use. The benefits of using multiple methods were to improve the ability to answer broader and more complete range of research questions, to use the strengths of each method to overcome the weaknesses in another method (complementarity), and to provide stronger evidence for a conclusion through convergence and corroboration of findings (triangulation). This added insights that might be missed when only a single method is used and resulted in a deeper understanding of WP use and permitted drawing a fuller picture of the issues related to WP use in Canada.

For years, interest by researchers and policy makers in the phenomenon of WP smoking in Canada was limited. Therefore, curbing the problem of its increased use especially among young adults has been more difficult because of the lack of knowledge and understanding of the determinants of WP smoking and the attitudes of the general public toward this type of tobacco use.

Study presented in the second chapter of this thesis constitutes the first assessment at the national level of the chemical content of what is called “herbal” *shisha*. This is the first test of the smoke emission of smoking herbal products available in Canada. In this study we found that “Herbal” *shisha* products tested contained toxic trace metals and PAH levels equivalent to, or in excess of, those found in cigarettes. Their smoke emissions contained carcinogens equivalent to, or in excess of, those of tobacco products. The results of our air quality assessment demonstrated that mean $PM_{2.5}$ levels and CO content were significantly higher in WP establishments compared to a casino where cigarettes were smoked. Nicotine vapor was detected in one of the WP cafés. These data suggest that smoking “herbal” *shisha* products is potentially dangerous to health.

Findings from the online survey among medical students at the University of Alberta as an example of the Canadian medical school provided information about the prevalence of smoking in general and on WP use among Canadian medical school students and their perceived level of education and preparedness to address tobacco use with their patients. Results showed that WP exposure/current use was surprisingly high among this sample of medical students. Although participants were knowledgeable about the health consequences of tobacco addiction, this study underscores the fact that education still required on the practical aspects of the treatment of tobacco addiction, and that students and physicians must not overlook other forms of tobacco use such as cigars, cigarillos or WPs.

The qualitative study among young adult WP users explored their current knowledge and attitude toward WP use, and investigated what WP users think, feel, and say about their WP use. Specifically, we were interested in cultural and social significance of WP for users from different ethnics and social backgrounds. Findings showed no substantial difference between participants from different cultural backgrounds in the way they perceived the WP. They were motivated by curiosity, their understanding that it is healthier, and the flavour. Youth were clearly having access to WP cafés under the legal age. The actual relation between culture and the WP was poorly identified, and immigrants were divided over the impact of their culture on WP smoking practice. This study indicated that there is a need for additional measures to increase awareness about WP and to regulate its use including labelling and packaging, flavouring, accessibility and age verification, and exemption for clean air legislation.

Findings of those studies significantly contributed in the initiative to change the current legislation that exempt WP venues form clean air legislation in Alberta and provided valuable information to help designing an appropriate education and prevention interventions to address the spread of

WP use among young adults in Canada and estimating the required effort and resource allocations to translate this knowledge into actions within our communities to increase awareness, to design special treatment interventions, and to ensure that WP tobacco is sold in accordance with Canadian laws.

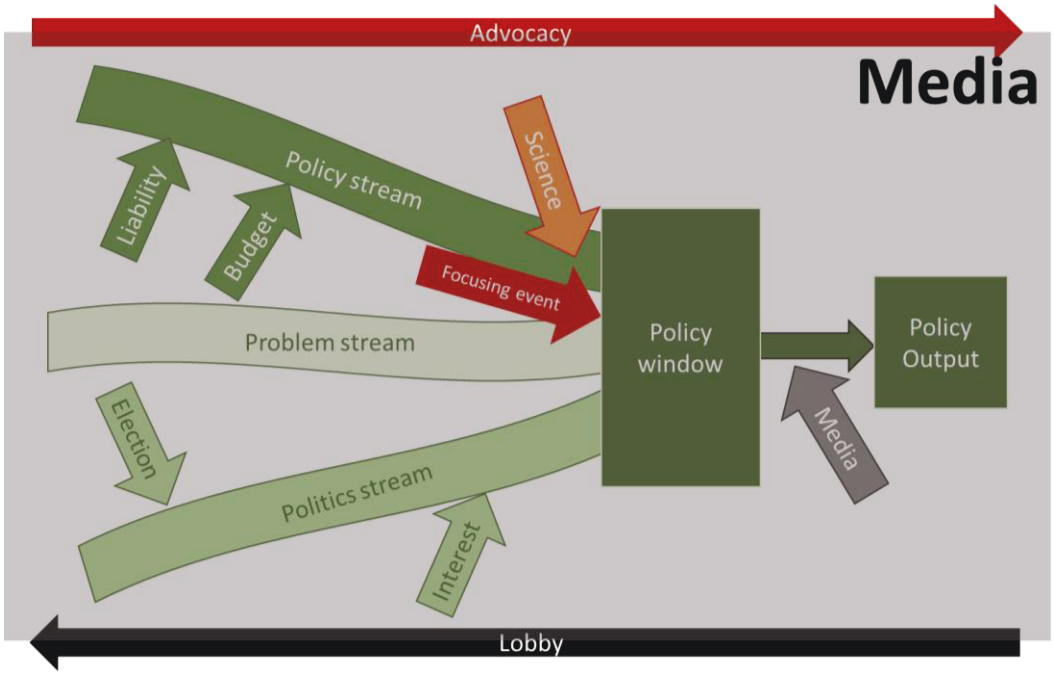
With the global trend of increased WP use prevalence and popularity, especially among youth and young adults, and the accumulated evidence about its harmful effects, there is a need for more comprehensive description of the characteristics of this method of tobacco use. In particular, additional research is needed on prevalence, trends, pattern of use, initiation prevention, marketing, and accessibility. Moreover, studies on long term health effects of WP use are still required, nevertheless, available evidence from smoke constituents and users exposure are strong enough to predict the long term consequences of WP use and to support taking actions toward alerting users, protecting nonusers and informing policy makers.

Canada signed the World Health Organization Framework Convention on Tobacco Control (WHO FCTC) in 2003 and the treaty entered into force in February, 2005. Article 11 in the (WHO FCTC) regulates packing and labelling of all tobacco products, nevertheless, to date WP tobacco products and accessories show very low compliance with the Article 11 requirements [1,2,3]. Furthermore, the (WHO FCTC) guidelines stress the importance of clean indoor air laws and the protection of the second hand smoke [4], however, WP cafés are still exempted from these requirements both in Canada, USA, UK and in other countries [5,6].

From a health policy perspective, papers presented in this thesis represent an example of the contribution of research and the role that evidence-based approach could play in supporting policy change. According to the multiple stream framework introduced by John Kingdon (Figure 5.1),

policy change depends on three streams, the problem stream, politics stream, and policy stream where combining these streams together results in opening of the policy window and leads to policy change [7].

Figure 5.1. Policy streams and policy window, created based on John Kingdom framework



In Alberta, the problem of WP use regulation as the *problem stream* (defined as the environmental conditions that public and policy makers currently defined as public problem) was in discussion at least in tobacco control communities and provincial government officials and policy makers for some time. Several health advocacy organizations were lobbying to push this issue on the provincial government agenda. However, other than the discussion of the Bill 206 which was introduced by a private member of the Assembly [8], there was no clear focusing event behind the shift in the *politics stream* (factors that affect the addition of the problem on the decision agenda) to couple with problem stream to open *"the policy window"* and to trigger the provincial government decision to move forward and introduce the Bill 33 to

address the issue of tobacco like products such as WPs [9]. Our findings were published at a critical point at the time of discussion that was taking place at the government level to address the issue of WP. The peer reviewed published findings provided the evidence-based support that was required for advancing of the *policy stream* (Ideas about the problem and its solution are presented and debated in specialized policy communities) [10]. The first study that we were able to identify to investigate the possible impact of WP smoking on health was published 50 years ago [11], since then the literature have provided sufficient evidence to support a move toward implementing stringent regulations to control tobacco and herbal products use in WP regarding packaging and labelling, import and taxation, and smoking in public places in a way similar to other tobacco products.

Future research on the impact of acculturation on ethnic identity and ethnic pride and its relation with WP smoking among different ethnic subgroups, as well as understanding how youth from different ethnic groups perceive health and cultural effects on decision making regarding health-related behaviour is still needed. However, lesson learned from tobacco control experience with cigarettes suggests that comprehensive approach that includes in addition to policy measurements general public awareness efforts and both initiation prevention and cessation measures is required. Moreover, any future education efforts associated with policy change must be sensitive to social context and culture of WP use indicating that in addition to the mainstream normative interventions that target the general population and healthcare professionals and decision makers, we need to a create a cultural-sensitive intervention that match the target population from different ethnic subgroups.

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