Nicotine & Tobacco Research, Volume 12, Number 6 (June 2010) 606–612

Original Investigation

Water pipe tobacco smoking among university students in Jordan

Mohammed Azab, M.D., Ph.D.,[1] *Omar F. Khabour, Ph.D., M.Sc.,*[2] *Almuthanna K. Alkaraki, M.Sc.,*[2] *Thomas Eissenberg, Ph.D.,*[3,4] *Karem H. Alzoubi, Ph.D.,*[5] *& Brian A. Primack, M.D., Ed.M., M.S.*[6,7]

[1] *Department of Toxicology, Jordan University of Science and Technology, Irbid, Jordan*
[2] *Department of Medical Laboratory Sciences, Jordan University of Science and Technology, Irbid, Jordan*
[3] *Department of Psychology and Institute for Drug and Alcohol Studies, Virginia Commonwealth University, Richmond, VA*
[4] *Syrian Center for Tobacco Studies, Aleppo, Syria*
[5] *Department of Clinical Pharmacy, Jordan University of Science and Technology, Irbid, Jordan*
[6] *Department of Medicine, University of Pittsburgh School of Medicine, Pittsburgh, PA*
[7] *Department of Pediatrics, University of Pittsburgh School of Medicine, Pittsburgh, PA*

Corresponding Author: Brian A. Primack, M.D., Ed.M., M.S., Department of Medicine and Pediatrics, University of Pittsburgh School of Medicine, *230 McKee Place 600, Pittsburgh, PA 15217, USA. Telephone: 412-586-9789; Fax: 412-692-4858. E-mail: bprimack@pitt.edu*

Received January 2, 2010; accepted March 16, 2010

Abstract

Introduction: Although water pipe tobacco smoking is common in Lebanon and Syria, prevalence in neighboring Jordan is uncertain. The purposes of this study were (a) to assess the prevalence of water pipe tobacco smoking among university students in Jordan and (b) to determine associations between sociodemographic variables and water pipe tobacco smoking in this population.

Methods: A trained interviewer administered a questionnaire among randomly selected students at four prominent universities in Jordan. The questionnaire assessed sociodemographic data, personal history of water pipe tobacco use, and attitudes regarding water pipe tobacco smoking. We used logistic regression to determine independent associations between sociodemographic and attitudinal factors and each of two dependent variables: ever use of water pipe and use at least monthly.

Results: Of the 548 participants, 51.8% were male and mean age was 21.7 years. More than half (61.1%) had ever smoked tobacco from a water pipe, and use at least monthly was reported by 42.7%. Multivariable analyses controlling for all relevant factors demonstrated significant associations between ever use and only two sociodemographic factors: (a) gender (for women compared with men, odds ratio [*OR*] = 0.11, 95% *CI* = 0.07–0.17) and (b) income (for those earning 500–999 Jordanian dinar (JD) monthly vs. <250 JD monthly, *OR* = 2.37, 95% *CI* = 1.31–4.31). There were also significant associations between perception of harm and addictiveness and each outcome.

Discussion: Water pipe tobacco smoking is highly prevalent in Jordan. Although use is associated with male gender and upper middle income levels, use is widespread across other sociodemographic variables. Continued surveillance and educational interventions emphasizing the harm and addictiveness of water pipe tobacco smoking may be valuable in Jordan.

Introduction

Tobacco use is a global epidemic that kills 5 million people each year (World Health Organization, 2005). Public health interventions generally focus on cigarette smoking, but tobacco smoking using a water pipe (a.k.a., hookah, narghile, or shisha pipe) is common in many world regions (Knishkowy & Amitai, 2005; Maziak, Ward, Soweid, & Eissenberg, 2004).

Water pipe tobacco smoking may carry substantial health risks. Water pipe tobacco smoke contains tar (including polycyclic aromatic hydrocarbons and heavy metals; Sepetdjian, Shihadeh, & Saliba, 2008; Shihadeh, 2003), volatile aldehydes (Al Rashidi, Shihadeh, & Saliba, 2008), carbon monoxide (CO); (Maziak et al., 2009), and nicotine (Shihadeh & Saleh, 2005; Neergaard, Singh, Job, & Montgomery, 2007). There is growing evidence that water pipe tobacco smokers are exposed to these smoke toxicants. For example, in a recent clinical study, relative to after smoking a single cigarette, using a water pipe to smoke tobacco for 45 min led to 48 times the smoke volume inhaled, blood plasma concentrations of CO that were three times greater, and nicotine concentrations that were 1.7 times greater (Eissenberg & Shihadeh, 2009). While more research is needed, data suggest that water pipe tobacco smoking is associated with cancer, cardiovascular and pulmonary disease, and other disorders (Cobb, Ward, Maziak, Shihadeh, & Eissenberg, 2010; Knishkowy & Amitai, 2005; Maziak, Ward, et al., 2004).

Water pipe tobacco smoking is often associated with countries of the Eastern Mediterranean Region (EMR), including Egypt, Kuwait, Lebanon, and Syria. In these countries, self-reported ever use of water pipe tobacco ranges from 22% to 69% (Maziak, Fouad, et al., 2004; Memon et al., 2000; Mohamed et al., 2003; Tamim et al., 2003). Use is particularly high among university students. In Syria, for example, 45% of university students report having ever used water pipe (Maziak, Eissenberg,

doi: 10.1093/ntr/ntq055
Advance Access published on April 23, 2010

et al., 2004), and in Lebanon, 23%–30% report weekly water pipe use (Tamim et al.; Chaaya et al., 2004). Data regarding tobacco consumption in these countries have been used to support public health policy changes, such as Syria's presidential decree in October 2009 banning cigarette and water pipe smoking inside cafes, restaurants, and other public spaces (Oweis, 2009).

While data describing the prevalence of water pipe tobacco smoking are available to support public health policy in some EMR countries, those data are lacking for others. For example, Jordan is an EMR country where 48% of men and 10% of women smoke tobacco cigarettes (Shafey, Dolwick, & Guindon, 2003); however, water pipe tobacco smoking prevalence is uncertain. Clearly, public health interventions addressing smoking are appropriate, and the extent to which these interventions include water pipe tobacco smoking may depend upon the availability of reliable data demonstrating its prevalence as well as factors that may contribute to this behavior. Because water pipe tobacco smoking is common in university students in Syria, Lebanon, and the United States (Cobb et al., 2010), our first look at the prevalence of this behavior in Jordan focused on this population.

The primary purpose of this study was to assess the prevalence of water pipe tobacco smoking among university students in Jordan. In order to determine the most appropriate populations for targeting of interventions, we also aimed to determine the association between water pipe tobacco smoking and major sociodemographic factors, such as age, gender, income, and marital status. Also in order to assist with development of future interventions, our third and final aim in this study was to assess the association between perception of harm and addiction of water pipe tobacco use and water pipe tobacco smoking among the studied population.

Methods

Design, participants, and setting

This cross-sectional study involved administration of a questionnaire by a trained interviewer from March to July 2008. The study was conducted at four large prominent universities in Jordan—Jordan University of Science and Technology (JUST), Yarmouk University, Irbid National University, and Jerash Private University. Of the 25 universities in Jordan, 10 are public and 15 are private. Thus, we selected similar proportions for our study sites: JUST and Yarmouk are public, while Irbid and Jerash are private.

Procedures

The study protocol was approved by the Institutional Review Board of JUST. Informed consent was obtained from all participants before all interviews. In order to select participants randomly, we used a two-stage cluster sampling strategy. In the first stage, main campus regions (a.k.a., "yards") were randomly selected from a list of all such yards at each participating university. Roughly one third (19 of 59 total yards) were selected. In the second stage, we utilized a systematic random sampling procedure that involved selecting every seventh student to enter the selected yard. Using this sampling strategy, 735 undergraduate students were invited to participate in the study. Of those, 552 students (75.1%) completed the anonymous questionnaire. Response rates were similar across universities (range: 74%–78%). Our final sample consisted of the 548 students (99.3% of collected questionnaires) for whom we had complete data for our primary outcome, ever smoking of water pipe tobacco.

Questionnaire and measures

The questionnaire was developed from standard instruments used previously to assess water pipe tobacco smoking (Eissenberg, Ward, Smith-Simone, & Maziak, 2008; Maziak, Ward, Afifi Soweid, & Eissenberg, 2005). The survey was divided into three sections: (a) sociodemographic data, (b) personal history of water pipe and other tobacco use, and (c) attitudes and intentions regarding water pipe tobacco smoking. Sociodemographic variables included age, gender, nationality (Jordanian vs. other), ancestry, religion, university level, marital status, housing status, and personal income. We divided age into categories based on distribution so that representation within each category was roughly equal. Personal history of tobacco use included current and past patterns of use for both water pipe tobacco and cigarettes. For the outcome of "ever use," we asked an item that translated from Arabic as "Have you ever smoked tobacco from a water pipe?" with responses of only "yes" or "no." For our outcome of "use at least monthly," we asked only those who endorsed ever use to indicate whether their usual pattern of water pipe was (1) yearly, (2) monthly, (3) weekly, or (4) daily. We assigned anyone who stated a response of 2, 3, or 4 as using water pipe tobacco at least monthly. Our primary attitudinal measures assessed perception of harm and addictiveness. We framed these items comparing water pipe tobacco smoking harm/addictiveness against that of cigarette smoking. This type of structure is commonly used in the literature in order to obtain data that is not highly skewed (Primack et al., 2008; Smith-Simone, Maziak, Ward, & Eissenberg, 2008; Tamim et al., 2003). A complete questionnaire is available upon request from the authors.

Analysis

We first computed prevalence for both our primary and secondary outcomes, ever use of water pipe tobacco and use at least monthly. We then computed prevalence of each outcome for each sociodemographic variable. We used chi-square statistics to determine statistical significance of differences in prevalence across sociodemographic variables. We then used logistic regression to determine the association between independent and dependent variables. For these analyses, we included in our models only independent variables (i.e., sociodemographic variables) with a univariate relationship with outcomes of $p < .20$. We conducted sensitivity analyses using stepwise backward regression in order to determine the robustness of our results. Finally, we used chi-squared analyses in order to assess the association between water pipe tobacco smoking behavior and beliefs regarding harm and addictiveness. For all analyses, we defined statistical significance a priori with $\alpha = .05$. Statistical analyses were conducted using the Statistical Package for Social Sciences (SPSS) Version 15.0 (SPSS, 2007) and Stata version 9.2 (StataCorp, 2005).

Results

Participants

Demographic characteristics of participants are shown in detail in Table 1. Of the 548 participants, 51.8% ($n = 282$) were male,

Table 1. Demographic characteristics by water pipe tobacco smoking

	Whole sample, $n = 548$	Ever use, $n = 345$		Use at least monthly, $n = 227$	
	n (Col %)	Row %	p^a value	Row %	p^a value
Age (years)			.44		.85
16–19	96 (17.8)	65.6		43.5	
20	112 (20.7)	56.3		38.3	
21	97 (18.0)	60.8		44.1	
22	91 (16.9)	67.0		46.1	
23–25	101 (18.7)	62.4		45.5	
26+	43 (8.0)	72.1		38.1	
Gender			<.001		<.001
Male	282 (51.8)	86.5		64.4	
Female	262 (48.2)	37.4		19.4	
Nationality			.12		.02
Jordanian	504 (92.8)	61.9		41.3	
Other	39 (7.2)	74.4		60.5	
University			.48		.45
JUST	150 (27.4)	59.3		39.3	
Yarmouk	108 (19.7)	70.4		40.7	
Irbid	154 (28.2)	62.3		41.9	
Jerash	135 (24.7)	61.5		48.5	
University type					
Public	258 (47.2)	64.0	.62	39.9	.24
Private	289 (52.8)	61.9		45.0	
University level			.67		.86
First year	105 (20.6)	62.9		44.6	
Second year	124 (24.4)	59.7		40.8	
Third year	103 (20.2)	68.0		46.1	
Fourth year	144 (28.3)	65.3		43.2	
Other	33 (6.5)	57.6		36.4	
Marital status			.78		.66
Single	494 (92.0)	63.0		43.0	
Married	43 (8.0)	65.1		39.5	
Housing status			.10		.15
With family	460 (85.7)	62.0		41.3	
Alone	41 (7.6)	78.1		53.9	
With friends	36 (6.7)	58.3		52.8	
Income[b]			.04		.008
0–249	73 (17.1)	53.4		28.2	
250–499	145 (33.9)	64.8		42.1	
500–999	134 (31.3)	73.1		53.0	
1000+	76 (17.8)	63.2		43.8	
Ever smoked cigarettes					
Yes	309 (56.6)	87.1	<.001	60.2	<.001
No	237 (43.4)	31.2		19.5	

Note. JUST = Jordan University of Science and Technology.
[a]Chi-squared analyses.
[b]Income figures are in Jordanian dinar.

92.8% ($n = 504$) were Jordanian, 92.0% ($n = 494$) were single, and 85.7% ($n = 460$) lived with family. Because nearly 100% were Arab (99.1%) and Muslim (98.7%), these variables were not included in subsequent analyses. Mean age was 21.7 years ($SD = 2.9$), and mean monthly income was 652 JD (ca. 925 US dollars). Students roughly equally represented each of the four study sites (Table 1). Most participants indicated that they were majoring in arts (36.3%), general sciences (30.4%), or medicine (24.8%).

Prevalence of water pipe tobacco smoking

Of the 548 participants, 61.1% ($n = 335$) had ever smoked tobacco from a water pipe. This was slightly higher than the 56.6% of participants ($n = 309$) who had ever smoked a cigarette. Use of water pipe at least monthly was reported by 42.7% ($n = 227$). Of those who had smoked tobacco from a water pipe, pattern of use was approximately equal across categories: yearly (25.6%),

monthly (24.3%), weekly (30.5%), and daily (19.7%). Of ever water pipe tobacco smokers, mean age of initiation was 18.1 years (*SD* = 3.6). First use was most commonly with friends (60.7%) or family (30.9%) but less commonly alone (8.4%). Place of first use was most commonly at home (37.3%) or a café (32.6%).

Associations between water pipe tobacco smoking and sociodemographic variables

As indicated in Table 1, ever use was significantly associated only with gender and income. With regard to gender, men were substantially more likely to have ever used a water pipe to smoke tobacco (86.5% vs. 37.4%, $p < .001$). Use increased for the first three levels of income, peaking at 73.1% of those earning 500–999 per year, but use dropped to 63.2% among the most wealthy. Use at least monthly was also significantly associated with gender and income (Table 1). Additionally, non-Jordanians were somewhat more likely to be smokers at least monthly (60.5% vs. 41.3%, $p = .02$). Table 2 displays unadjusted and adjusted multivariable logistic regression models that controlled for all covariates with a univariable relationship with the outcome of at least $p < .20$. These analyses demonstrated significant associations between ever use and gender (for women compared with men, odds ratio [*OR*] = 0.11, 95% *CI* = 0.07–0.17) and income (for those earning 500–999 vs. those earning <250, *OR* = 2.37, 95% *CI* = 1.31–4.31). A similar pattern was noted for the outcome of at least monthly use (see Table 2). When models were conducted using stepwise backward regression, results were similar in terms of levels of significance.

Associations between water pipe and cigarette smoking

As noted above, ever use of tobacco using water pipes and cigarettes were approximately equal (61.1% vs. 56.6%). Among ever users of water pipe, more had smoked cigarettes than had not (87.1% vs. 31.2%, $p < .001$). Similarly, among water pipe users in the past month, more had smoked cigarettes than had not (60.2% vs. 19.5%, $p < .001$). Although the behaviors were significantly associated, however, the behaviors were not precisely correlated (Pearson's $r = .57$). For example, nearly one third (31.2%) of ever water pipe tobacco smokers had never smoked cigarettes.

Associations between water pipe tobacco smoking and beliefs regarding harm and addictiveness

The majority of the sample (62.2%) believed that water pipe tobacco smoking is more harmful than cigarette smoking, whereas only 9.8% believed that cigarettes are more harmful. The remaining 28.0% felt that harm was about the same. With regard to addiction, the majority felt that cigarettes are more addictive than water pipe (54.6%), with only 13.2% sensing that water pipe was more addictive and 32.2% believing that addictive potential is about the same. Figures 1 and 2 demonstrate associations between water pipe tobacco smoking behavior and beliefs regarding harm (Figure 1) and addictiveness (Figure 2). Although those believing that cigarettes were more harmful than water pipe were more commonly water pipe tobacco smokers (Figure 1), this relationship was only statistically significant for the outcome variable of water pipe use at least monthly ($p < .001$) and not for the outcome of ever use ($p = .09$). Those believing that cigarettes were more addictive than water pipe were more commonly water pipe tobacco smokers ($p < .001$ for both outcomes—use at least monthly and ever use; Figure 2).

Discussion

In our study of a random sample of students at four large Jordanian universities, we found that water pipe tobacco

Table 2. Multivariable models of water pipe tobacco smoking in Jordan

	Ever use		Use at least monthly	
	OR (95% *CI*) unadjusted	*OR* (95% *CI*) adjusted[a]	*OR* (95% *CI*) unadjusted	*OR* (95% *CI*) adjusted[a]
Gender				
Male	1.00[b]	1.00[b]	1.00[b]	1.00[b]
Female	0.09 (0.06–0.14)[c]	0.11 (0.07–0.17)[c]	0.13 (0.09–0.20)[c]	0.17 (0.11–0.27)[c]
Nationality				
Jordanian	1.00[b]	1.00[b]	1.00[b]	1.00[b]
Other	1.78 (0.85–3.74)	2.78 (0.67–11.51)	2.18 (1.11–4.28)[c]	2.27 (0.66–7.78)
Housing status				
With family	1.00[b]	1.00[b]	1.00[b]	1.00[b]
Alone	2.18 (1.02–4.68)[c]	1.32 (0.43–4.05)	1.66 (0.86–3.21)	0.94 (0.39–2.23)
With friends	0.86 (0.43–1.71)	0.45 (0.13–1.55)	1.59 (0.81–3.14)	0.83 (0.26–2.67)
Income[d]				
0–249	1.00[b]	1.00[b]	1.00[b]	1.00[b]
250–499	1.60 (0.91–2.85)	1.66 (0.85–3.26)	1.86 (1.003–3.44)[c]	1.96 (0.995–3.87)
500–999	2.37 (1.31–4.31)[c]	2.21 (1.10–4.45)[c]	2.88 (1.55–5.35)[c]	2.82 (1.41–5.63)[c]
1000+	1.49 (0.78–2.88)	1.18 (0.54–2.55)	1.99 (0.99–3.98)	1.79 (0.83–3.85)

Note. *OR* = odds ratio.

[a]Adjusted for all variables in the table.

[b]Reference.

[c]$p < .05$.

[d]Income figures are in Jordanian dinar, for which 1 US dollar = 0.70 JD.

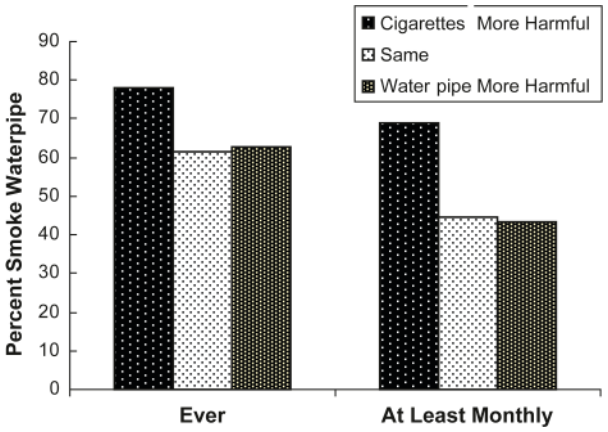

Figure 1. Association between use of water pipe to smoke tobacco and beliefs regarding harm. Bars indicate the percentage of individuals in each harm belief category who have smoked tobacco from a water pipe ever (left side) and at least monthly (right side). Chi-squared tests demonstrate $p = .09$ for ever use and $p < .001$ for use at least monthly.

smoking is highly prevalent: 61.1% of respondents reported ever use and 42.7% reported using at least monthly. These data support public health intervention to reduce tobacco use in this country as well as the need for improved infrastructure for evaluating intervention effects, including surveillance and related research. Second, we found that although water pipe tobacco smoking was associated with male gender and upper middle income, it remains relatively constant across most sociodemographic variables, including age, nationality, university site, university level, marital status, and housing status. Finally, we find that those who believe water pipe tobacco smoking to be less harmful and/or addictive are generally more likely to use a water pipe to smoke tobacco.

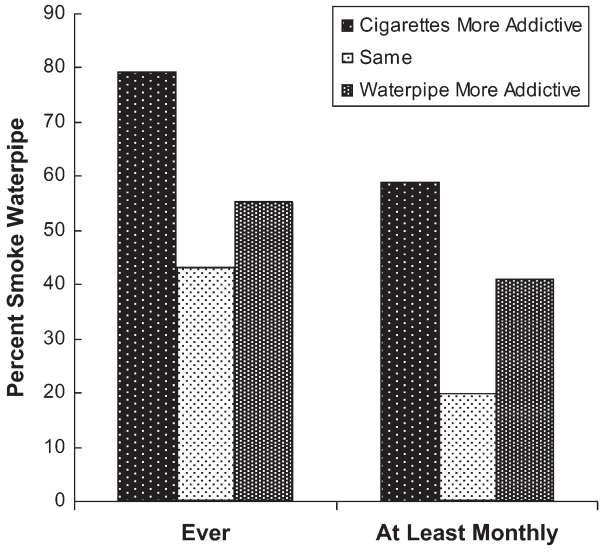

Figure 2. Association between use of water pipe to smoke tobacco and beliefs regarding addictiveness. Bars indicate the percentage of individuals in each addiction belief category who have smoked tobacco from a water pipe ever (left side) and at least monthly (right side). Chi-squared tests demonstrate $p < .001$ for both outcomes (ever use and use at least monthly).

The fact that water pipe tobacco smoking is strongly associated with male gender is consistent with other studies in the EMR (Maziak, Fouad, et al., 2004), although studies outside the EMR often show less difference between the genders (Eissenberg et al., 2008; Primack, Fertman, Rice, Adachi-Mejia, & Fine, 2010; Primack, Walsh, Bryce, & Eissenberg, 2009; Smith, Curbow, & Stillman, 2007). Still, water pipe tobacco smoking is surprisingly frequent among young women in Jordan, with over one third of women in our study reporting that they ever smoked tobacco in a water pipe and nearly 20% reporting monthly use. Thus, targeted interventions should not neglect this population. Water pipe tobacco smoking seems to be highest among the upper middle income bracket. For the lower income levels, the cost of a smoking session in a café (ca. 2–5 Jordanian dinar = 3–7 US dollars) may be prohibitive. However, the very wealthiest students may use water pipes to smoke tobacco less frequently because they receive more exposure to antitobacco programming and education. Interestingly, water pipe tobacco smoking is relatively constant across the remainder of sociodemographic variables, including age, nationality, university site, university level, marital status, and housing status. The lack of an observed difference across these variables suggests that water pipe tobacco smoking is deeply ingrained in Jordanian society and that effective public health efforts to reduce it will need to be robust and widespread.

Although water pipe and cigarette smoking were significantly associated in this sample, it is interesting that there was also disjunction between the two populations—for example, nearly one third (31.2%) of those who had smoked water pipe had never smoked cigarettes. This is consistent with studies in the United States suggesting that many who smoke water pipes would have otherwise been nicotine naïve (Eissenberg et al., 2008; Primack et al., 2009, 2010; Smith et al., 2007). This finding suggests that interventions aimed at reducing water pipe use will need to reach individuals who may not have been traditionally considered at risk for tobacco use.

The sense that water pipe is less harmful than cigarettes was associated with a higher prevalence of using a water pipe to smoke tobacco. Thus, highlighting the smoke toxicant content and user toxicant exposure associated with water pipe tobacco smoking (Cobb et al., 2010; Eissenberg & Shihadeh, 2009) may be one valuable method for intervention. Those perceiving low addictiveness of water pipe were also more likely than others to smoke tobacco using a water pipe, so this perception similarly may present a valuable opportunity for education. Adding to the growing body of evidence that water pipe tobacco smoking supports nicotine/tobacco dependence will be important (Hammal, Mock, Ward, Eissenberg, & Maziak, 2008; Salameh, Waked, & Aoun, 2008).

One potentially counterintuitive observation was that—compared with those who believe the addictive potential to be similar between cigarettes and water pipe—those believing water pipe to be more addictive than cigarettes were more likely to be water pipe smokers (Figure 2). This observation may reflect the personal experience of water pipe tobacco smokers who have indeed found it to be addictive. Qualitative investigations may be valuable to investigate this issue.

Although the demographics of our sample approximate those of our target population in terms of key variables, such as age, gender, and income, we did not collect demographic data on

nonparticipants. Thus, our sampling strategy limits the external generalizability of this study. Future studies should assess populations representative of the nation as a whole in order to include the nonuniversity population. Additionally, because of the cross-sectional nature of our data, we cannot infer causality. For example, although those who believe water pipe tobacco smoking to be nonharmful may subsequently begin using a water pipe, the nature of our data could also support alternative interpretations, such as the idea that once people begin to smoke tobacco using a water pipe they hear from friends with whom they smoke that the water pipe is not harmful.

Despite these limitations, this study offers a first look at national data related to water pipe smoking in Jordanian university students and suggests that ever use and use at least monthly are very high (~60% and 40%, respectively)—and even higher than cigarettes. It further suggests that use is widespread across a spectrum of sociodemographic variables but does seem to be concentrated among men and the upper middle income bracket. Surveillance, further research, and educational interventions emphasizing the harm and addictiveness of water pipe tobacco smoking may be highly valuable in Jordan.

Funding

This work was supported by the National Institutes of Health (R03-TW008371 to OK and MA; R03-TW008371, R01-CA120142, and R01-DA024876 to TE; and K07-CA114315 to BP) and the Deanship of Research at Jordan University of Science and Technology (129/2008 to OK and MA).

Declaration of Interests

None declared.

Acknowledgments

The authors thank Dr. Amjad AlNasser for his help with initial data processing and Ms. Enas Jaradat for her help with data collection.

References

Al Rashidi, M., Shihadeh, A., & Saliba, N. A. (2008). Volatile aldehydes in the mainstream smoke of the narghile waterpipe. *Food and Chemical Toxicololgy*, *46*, 3546–3549.

Chaaya, M., El-Roueiheb, Z., Chemaitelly, H., Azar, G., Nasr, J., & Al-Sahab, B. (2004). Argileh smoking among university students: A new tobacco epidemic. *Nicotine & Tobacco Research*, *6*, 457–463.

Cobb, C., Ward, K. D., Maziak, W., Shihadeh, A. L., & Eissenberg, T. E. (2010). Waterpipe tobacco smoking: An emerging health crisis in the United States. *American Journal of Health Behavior*, *34*, 275–285.

Eissenberg, T., & Shihadeh, A. (2009). Waterpipe tobacco and cigarette smoking: Direct comparison of toxicant exposure. *American Journal of Preventive Medicine*, *37*, 518–523.

Eissenberg, T. E., Ward, K. D., Smith-Simone, S., & Maziak, W. (2008). Waterpipe tobacco smoking on a U.S. college campus: Prevalence and predictors. *Journal of Adolescent Health*, *42*, 526–529.

Hammal, F., Mock, J., Ward, K. D., Eissenberg, T. E., & Maziak, W. (2008). A pleasure among friends: How narghile (waterpipe) smoking differs from cigarette smoking in Syria. *Tobacco Control*, *17*, e3.

Knishkowy, B., & Amitai, Y. (2005). Water-pipe (narghile) smoking: an emerging health risk behavior. *Pediatrics*, *116*, e113–e119.

Maziak, W., Eissenberg, T., Rastam, S., Hammal, F., Asfar, T., Bachir, M. E., et al. (2004). Beliefs and attitudes related to narghile (waterpipe) smoking among university students in Syria. *Annals of Epidemiology*, *14*, 646–654.

Maziak, W., Fouad, M. F., Asfar, T., Hammal, F., Bachir, M. E., Rastam, S., et al. (2004). Prevalence and characteristics of narghile smoking among university students in Aleppo, Syria. *International Journal of Tuberculosis and Lung Disease*, *8*, 882–889.

Maziak, W., Rastam, S., Ibrahim, I., Ward, K. D., Shihadeh, A., & Eissenberg, T. (2009). CO exposure, puff topography, and subjective effects in waterpipe tobacco smokers. *Nicotine & Tobacco Research*, *11*, 806–811.

Maziak, W., Ward, K. D., Afifi Soweid, R. A., & Eissenberg, T. (2005). Standardizing questionnaire items for the assessment of waterpipe use in epidemiological studies. *BMC Public Health*, *119*, 400–404.

Maziak, W., Ward, K. D., Soweid, R. A., & Eissenberg, T. E. (2004). Tobacco smoking using a waterpipe: A reemerging strain in a global epidemic. *Tobacco Control*, *13*, 327–333.

Memon, A., Moody, P. M., Sugathan, T. N., El-Gerges, N. S., Al-Bustan, M., Al-Shatti, A., et al. (2000). Epidemiology of smoking among Kuwaiti adults: Prevalence, characteristics, and attitudes. *Bulletin of the World Health Organization*, *78*, 1306–1315.

Mohamed, M. K., Gadalla, S., Kato, E., Israel, E., Mikhail, N., & Lofredo, C. (2003, February). *Water-pipe (Goza) smoking among males in rural Egypt*. Society for Research on Nicotine and Tobacco Annual Meeting, New Orleans, LA.

Neergaard, J., Singh, P., Job, J., & Montgomery, S. (2007). Waterpipe smoking and nicotine exposure: A review of the current evidence. *Nicotine & Tobacco Research*, *9*, 987–994.

Oweis, K. (2009). *Syria bans smoking in public places*. Reuters News Service. Retrieved 30 December 2009, from http://www.reuters.com/article/idUSTRE59A22P20091011

Primack, B. A., Fertman, C. I., Rice, K. R., Adachi-Mejia, A. M., & Fine, M. J. (2010). Waterpipe and cigarette smoking among U.S. college athletes. *Journal of Adolescent Health*, *1*, 45–51.

Primack, B. A., Sidani, J. E., Agarwal, A. A., Donny, E. C., Shadel, W. G., & Eissenberg, T. E. (2008). Prevalence of and associations with waterpipe smoking among US university students. *Annals of Behavioral Medicine*, *36*, 81–86.

Primack, B. A., Walsh, M., Bryce, C., & Eissenberg, T. E. (2009). Waterpipe tobacco smoking among middle and high school students. *Pediatrics*, *123*, e282–e288.

Salameh, P., Waked, M., & Aoun, Z. (2008). Waterpipe smoking: Construction and validation of the Lebanon Waterpipe Dependence Scale (LWDS-11). *Nicotine & Tobacco Research*, *10*, 149–158.

Sepetdjian, E., Shihadeh, A., & Saliba, N. (2008). Measurement of 16 polycyclic aromatic hydrocarbons in narghile waterpipe tobacco smoke. *Food and Chemical Toxicology*, *46*, 1582–1590.

Shafey, O., Dolwick, S., & Guindon, G. E. (Eds.). (2003). *Tobacco control country profiles 2003*. Atlanta, GA: American Cancer Society.

Shihadeh, A. (2003). Investigation of mainstream smoke aerosol of the argileh waterpipe. *Food and Chemical Toxicology*, *4*, 143–152.

Shihadeh, A., & Saleh, R. (2005). Polycyclic aromatic hydrocarbons, carbon monoxide, "tar", and nicotine in the mainstream smoke aerosol of the narghile waterpipe. *Food and Chemical Toxicology*, *43*, 655–661.

Smith, S. Y., Curbow, B., & Stillman, F. (2007). Harm perception of nicotine products in college freshmen. *Nicotine & Tobacco Research*, *9*, 977–982.

Smith-Simone, S., Maziak, W., Ward, K. D., & Eissenberg, T. E. (2008). Waterpipe tobacco smoking: Knowledge, attitudes, beliefs, and behavior in two U.S. samples. *Nicotine & Tobacco Research*, *10*, 393–398.

SPSS. (2007). *SPSS for windows. Release 15.0.1*. Chicago: Author.

StataCorp. (2005). *Stata statistical software: Release 9*. College Station, TX: StataCorp LP.

Tamim, H., Terro, A., Kassem, H., Ghazi, A., Khamis, T. A., Hay, M. M., et al. (2003). Tobacco use by university students, Lebanon, 2001. *Addiction*, *98*, 933–939.

World Health Organization. (2005). *WHO advisory note: "Waterpipe tobacco smoking: Health effects, research needs and recommended actions by regulators."* Full text available at: http://www.who.int/tobacco/global_interaction/tobreg/Waterpipe%20recommendation_Final.pdf