

Water-Pipe Tobacco Smoking: An Emerging Health Risk Behavior in Adolescents in the United States

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Abstract: *Objective:* To assess the attitude and practices of adolescents regarding water-pipe smoking (WPS) in a predefined 'perceived' high risk group of youth 12-18 years of age in the Detroit metropolitan area.

Methods: This was a cross-sectional survey (conducted March 1st through June 30th, 2008) in which participants completed a self-reported questionnaire, which included demographics, WPS, other types of smoking, and their perception about the hazards of WPS.

Results: A total of 272 [85% response rate (272/320)] surveys were completed. One hundred and sixty seven (61%) were WPS "users". Fifty-six (22%) used WPS at home, 34 (13%) at coffee shops, 74 (29%) at both locations, and 3 (1%) at other locations. Relative to non-users, WPS users were more likely to be cigarette smokers (OR = 1.7, unadjusted OR = 2.5, $p < 0.05$), to have someone else in the household who uses WPS (OR = 2.2), to believe that WPS is safe (OR = 1.4, unadjusted OR = 2.0) and that WPS is less harmful than cigarettes (OR = 1.2 unadjusted OR = 1.6, $p < 0.05$). In addition WPS use was associated with less likelihood of believing that one may acquire an infection (OR = 0.9) and that the toxicity of the inhalants was equivalent to cigarette smoking (OR = 0.8).

Conclusions: WPS represents a growing public health issue for adolescents in the US. Aggressive education of adolescents is essential in combating the misperception associated this form of smoking.

Keywords: Water-pipe smoking, argile, shisha, hoka.

INTRODUCTION

Water-pipe tobacco smoking (WPS) is known by a number of different names, including argileh, hookah, goza, and shisha [1, 2]. A water-pipe consists of a hose with a mouthpiece, water bowl, body, and a "head" that is filled with sweetened and flavored tobacco and then heated with charcoal [2]. During inhalation from the mouth piece, the smoke from the charcoal and tobacco passes through the body, bowl, and hose into the smoker's lungs.

The use of WPS is spreading worldwide [1]. Limited data show that use of WPS may be on the rise in the USA [3]. This phenomenon has been attributed to the perception that WPS is less dangerous than cigarette smoking, combined with easy availability and relatively low cost [2-4]. WPS is usually a social activity, engaged in by peer groups and families, and is often practiced in special cafes [2]. The expanding influence of globalization places WPS as a

potentially important public health issue for adolescents [1, 2]. There is a paucity of epidemiological research regarding the use of WPS in general and in adolescents in particular in the US [3].

The purpose of this descriptive, self-reported survey was to assess the attitude and practices of adolescents regarding WPS in a predefined 'perceived' high risk group of youth 12-18 years of age in the Detroit metropolitan area.

METHODS

Children 12-18 years of age who resided in the Detroit metropolitan area were eligible for enrollment in the study. Individuals were invited by research assistants to participate in the study at coffee shops, social organizations, and two university campuses on weekend days (Friday, Saturday, and Sunday). Weekend days were chosen, because users of WPS tend to use it on weekends. The survey was conducted March 1st through June 30th, 2008.

Because participants remain anonymous and since there was no risk to subjects as a result of enrollment in this study, only a verbal consent was obtained from the legal guardian prior to participation in this study. Participants completed a self-reported questionnaire.

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Questionnaire

The questionnaire consisted of 20 questions, some open ended and some multiple choice, aimed at collecting data on the individuals' demographic characteristics and their smoking behavior with regard to WPS. The following data were collected pertaining to each individual: age, sex, place of family residence, WPS pattern of the individual and his or her family members, other types of smoking, and the individual's perception regarding the hazards of WPS.

Each individual's smoking status was classified according the World Health Organization criteria [5]:

- Daily smokers, defined as individuals who at the time of the survey used WPS daily; these individuals were considered current "users" for the purpose of this study
- Occasional smokers, individuals who smoked water-pipes, but less than once a day
- Former smokers, individuals who smoked daily for at least six months, but did not smoke at the time of the survey
- Never smokers, individuals who had never used WPS and they were considered "non-users" for the purpose of this study

Statistical Analyses

Logistic regression was used to compare the two groups (current users and non-users). Covariates included age, gender, other forms of tobacco smoking, and perceptions related to harmful effects of WPS. Bivariate logistic analyses were conducted as a first step, after which age, gender, and ethnicity were forced into a multivariate logistic model. All variables that were statistically significant ($p < 0.05$) in bivariate analyses were then entered as a block and non-significant variables were removed using backward elimination to arrive at a final model. Odds ratios (ORs), adjusted and unadjusted (crude), and 95% confidence intervals (95% CI) were reported for variables in the final model. All statistical analyses were conducted using SAS version 9.1 (SAS Institute, Cary, NC, USA).

RESULTS

A total of 272 [85% response rate (272/320)] surveys were completed. Participants had a mean age of 16.2 ± 1.4 years. There was no statistically significant difference between the non-responders and responders with regard to age and ethnic background. Table 1 describes the main clinical characteristics of participants. Overall 61% used WPS daily and were current "users", 31% were "non-users", 4% were occasional users, and 3.5% were former users. Seventy-three percent of "users" were boys and 27% were girls. Seventy one percent of Arab-American youth were users, whereas only 40% of Caucasians were current users of WPS.

Water-pipe tobacco smoking users (Table 2) were statistically older (16.1 ± 1.3 vs 16.7 ± 1.2 years, $p < 0.05$). Fifty-six (20%) used WPS at home, 34 (12.5%) at coffee shops, 74 (27.2%) at both locations, and 3 (1%) at other locations.

Table 1. Demographics and Tobacco Use Characteristics of the Study Group (n = 272)

Characteristic	% of Sample
Gender	
Male	73
Female	27
Race/ethnicity	
Arab-American	77
Caucasian	12
African-American	5.4
Hispanic	2.7
Other	1.5
Daily users of WPS*	61
Occasional users of WPS	4.5
Former users of WPS	3.5
Never used WPS	31
Others smoke water-pipe in the household	53
Do you smoke cigarettes	17
Do you smoke cigars	15
Do you smoke marijuana	11

*WPS = water-pipe tobacco smoking.

In a multivariate model (Table 2), Use of WPS (users) was associated with a greater likelihood of also being a cigarette smoker (OR = 1.7, unadjusted OR = 2.5, $p < 0.05$), a greater likelihood of having someone else in the household who also uses WPS (OR = 2.2), a greater likelihood to believe that WPS is safe (OR = 1.4) and that it is less harmful than cigarettes (OR = 1.2, unadjusted OR = 1.6, $p < 0.05$).

In addition WPS was associated with less likelihood of believing that the toxicity of the inhalants from WPS is equivalent to cigarette smoking (OR = 0.8). There was no statistically significant difference between the WPS users and non-users in terms of using marijuana.

DISCUSSION

This survey suggests that use of WPS may be a common practice among adolescents who are of Middle Eastern descent and who reside in the Detroit metropolitan area. Sixty-one percent of adolescents who completed the survey were current users of WPS. This compares to a frequency of 68% in adults from the same geographic area (personal communication). We were incredulous to find that one participant was only 12 years old and 8 others were 13. These figures deserve further epidemiological investigation, and if found to be true would deserve the attention of public health policy makers and academic institutions in the US. The frequency of use of WPS was significantly higher among adolescents of Middle-Eastern background compared to Caucasians (71% vs 40%). This may be related to the

Table 2. Characteristics of Non-Users and Current Users of Water-Pipe Smoking

Variable	Response	Non-Users (N = 85)	Users (N = 167)	Unadjusted OR (95% CI) #	Adjusted OR (95% CI) ##
Age	Mean ± SD	16.1 ± 1.3	16.7 ± 1.2	1.40 (1.1 - 1.7)*	1.5 (1.1-2.1)*
Gender	Female	24 (36%)	43 (64%)	1.1 (0.6 - 2.0)	1.3 (0.5 - 3.3)
	Male	61 (33%)	124 (67%)		
Waterpipe smoking is safe	Strongly Disagree	35 (60%)	23 (39%)	2.0 (1.5-2.7)*	1.4 (0.9-2.3)
	Disagree	25 (32%)	53 (67%)		
	Neutral	19 (27%)	49 (72%)		
	Agree	0 (0.0%)	28 (100%)		
	Strongly Agree	3 (23%)	10 (76%)		
Waterpipe is less harmful than cigarette smoking	Strongly disagree	30 (51%)	28 (48%)	1.6 (1.2 - 2.0)*	1.2 (0.9 - 1.7)
	Disagree	24 (42%)	32 (57%)		
	Neutral	15 (28%)	38 (71%)		
	Agree	6 (12%)	43 (87%)		
	Strongly Agree	7 (23%)	23 (76%)		
Waterpipe smoking contains Harmful ingredients	Strongly disagree	10 (24%)	31 (75%)	0.5 (0.4 -0.7)*	0.6 (0.4 - 1.0)
	Disagree	8 (15%)	44 (84%)		
	Neutral	14 (23%)	47 (77%)		
	Agree	20 (42%)	27 (57%)		
	Strongly Agree	24 (70%)	10 (29%)		
I am or can be hooked on water pipe smoking	Strongly Disagree	40 (54%)	34 (45%)	1.4 (1.1 - 1.9)*	1.6 (1.0 - 2.5)*
	Disagree	16 (17%)	78 (83%)		
	Neutral	9 (25%)	27 (75%)		
	Agree	5 (27%)	13 (72%)		
	Strongly Agree	3 (33%)	6 (66%)		
I can get infection from water pipe smoking	Strongly Disagree	10 (24%)	31 (75%)	0.6 (0.4 - 0.7)*	0.9 (0.6 - 1.5)
	Disagree	10 (18%)	44 (81%)		
	Neutral	21 (28%)	53 (71%)		
	Agree	18 (48%)	19 (51%)		
	Strongly Agree	17 (63%)	10 (37%)		
Toxins that I inhale from waterpipe smoking are equivalent to cigarette smoking	Strongly Disagree	6 (14%)	35 (85%)	0.6 (0.4 - 0.7)*	0.8 (0.5 - 1.2)
	Disagree	12 (21%)	44 (78%)		
	Neutral	18 (32%)	38 (67%)		
	Agree	22 (45%)	26 (54%)		
	Strongly Agree	16 (53%)	14 (46%)		
Are there other children at home where you use waterpipe smoking	No	31 (33%)	61 (66%)	1.0 (0.6 - 1.8)	1.6 (0.6 - 3.8)
	Yes	46 (31%)	98 (68%)		
Do You smoke cigarettes	No	70 (35%)	128 (64%)	2.5 (1.0 - 5.9)*	1.7 (0.4 - 7.4)
	Yes	7 (17%)	32 (82%)		
Do You smoke cigars	No	70 (34%)	131 (65%)	2.2 (0.9 - 5.3)	2.9 (0.6 - 14.0)
	Yes	7 (19%)	29 (80%)		
Do you smoke marijuana	No	69 (32%)	143 (67%)	1.0 (0.4 - 2.5)	0.27 (0.04 -1.5)
	Yes	8 (32%)	17 (68%)		
Does anyone else smoke waterpipe at home	No	47 (43%)	62 (56%)	2.6 (1.5 -4.6)*	2.26 (0.9 - 5.6)
	Yes	28 (22%)	97 (77%)		

CI = Confidence Interval, OR = Odds Ratio.

#Odds Ratios are calculated from univariable logistic regression for current water-pipe usage. Categorical variables are referenced to the other category. Age and the scaled variables are referenced to 1 year and 1 level increases, respectively.

##Odds Ratios are calculated from multivariable logistic regression for current water-pipe usage, adjusting for the other variables in the table. Categorical variables are referenced to the other category.

Age and the scaled variables are referenced to 1 year and 1 level increases, respectively.

*p < 0.05.

influence of family members and the availability of WPS in the home or in the community. We also observed significant misperceptions related to the harmful effects of WPS. This may be a contributing factor to the use of WPS and warrants the attention of public health authorities. Further education of these communities about the hazards of WPS is warranted.

Most studies on the use of WPS have been conducted among adults in the Middle-Eastern countries. Only limited studies from these countries have been published about university or high school students [3, 4, 6-10]. A survey of Lebanese university students found that 32% used WPS, with higher rates among men compared to women, and no differences according to socioeconomic status [4]. In another study from Lebanon, WPS rate was 14.6% among adults and 25% among pregnant women [8, 9]. The frequency of use of WPS in our study is much higher compared to previous reports and raises significant concern since 50% of those who start smoking in their adolescent years will go on to smoke for 15-20 years with negative health consequences [1].

In Syria, a cross-sectional survey of 587 university students found that 62.6% of the men and 29.8% of the women had ever used WPS, and 25.5% of the men and 4.9% of the women were current users. The mean age of initiation of WPS was 19.2 and 21.7 years, respectively. Smoking usually took place in dormitories, restaurants and cafes and was almost always practiced in groups [10].

In Israel, use of WPS has become a growing phenomenon among Jewish youth. A survey of 388 middle and high school students found that 41% used WPS and 22% of them smoked water pipe at least every weekend. The rate of WPS was 3 folds greater than cigarette smoking and increased by 4 folds as the student advanced from the seventh grade to the ninth grade. Twenty-five percent of users of WPS reported smoking with their parents [11, 12]. The cross-sectional nature of our study limits our ability to draw any conclusions with regard to the changes in the pattern of WPS over time in this population.

In the US, questions regarding use of WPS are not included in national surveys such as the health risk behaviors surveillance systems of the Centers for Disease Control and Prevention (CDC) and there are no national data on the use of WPS [12].

Studies about the use of WPS by adolescents in the US are very limited. Eissenberg *et al.* reported that use of WPS was common among college students in a survey from one university [3]. In this study 20% of college students reported using WPS in the past 30 days [3]. This number is significantly lower than the number of users in the current study and all participants in the study of Eissenberg *et al.* were 18 years and older. Eissenberg *et al.* [3] also noted that those who have used WPS in the past 30 days were more likely to have the perception that WPS was less dangerous and less addictive than cigarette smoking. These results are consistent with the results of the current study. These findings highlight that WPS among youth is becoming a significant public health concern in the US.

In one report where 28 Arab-American adolescents from the state of Michigan participated in a focus group on

smoking, 100% of them reported that they have used WPS in the past [13]. This suggests that use of WPS smoking is a common practice among the youth in this population. Our study confirms these findings. There was a very high frequency of use of WPS among Arab American adolescents. Cultural background and the availability of WPS in the household or in the neighborhood have undoubtedly contributed to these practices in these adolescents.

What is more alarming is the use of WPS among adolescents who are not of Middle-Eastern background. Thirty-one (12% of current users of WPS) Caucasians, 10 (5.4%) African Americans, and 6 (2.7%) Hispanics reported using WPS. Several dozen argileh bars have opened in cities such as Los Angeles, New York, and Detroit. These bars are becoming increasingly popular among high school and college students. With continued immigration and widespread use of the internet these practices are likely to grow in the US since many internet sites praise the practice of WPS and provide sources for buying WPS products.

Pediatricians should be aware of the emerging use of WPS in the western countries including the US and need to be knowledgeable about its many health implications. Pediatricians should be cognizant of the fact that WPS is perceived by the public as less dangerous than cigarette smoking [2]. These misperceptions emanate from the myths that the nicotine content in the WPS is lower than that of cigarettes, that water filters out all dangerous chemicals and that the smoke of WPS is less irritating to the throat, nose and the tracheobronchial tree compared to cigarette smoke [1, 2, 6]. Furthermore, because the WPS tobacco contains fruits such as apples, this adds to the misconception that this is a healthy choice [1, 2, 6].

Like cigarette smoking the initiation of WPS is often the result of peer pressure and the desire to be accepted by peers [2, 11]. In this respect WPS may be seen as meeting certain developmental milestone of adolescence such as attaining autonomy and maturity [2]. In one study most Arab-American adolescents who participated in a focus group used WPS as their initial method of smoking [13].

Our study has limitations in that the vast majority of participants were youth of Middle-Eastern background and we did not have access to their socioeconomic status. A major limitation of the study is that the selection of participants was at random from the various locations where these youth are known to gather. This may have introduced a selection bias and may have led to overestimation of the frequency of the WPS among youth from this population. The results of this study may not be applicable to other metropolitan areas in the US. Another limitation of the study is the nature of the self-reported questionnaire. This may have introduced recall bias and may distort the results of the study.

Public health control measures should be implemented in communities and locations where WPS is commonly practiced. Other measures that have been used in tobacco control such as labeling packages with warning signs about the hazards of smoking, prohibition of sale to minors, and possibly increasing cost of purchasing WPS tobacco products through taxation should also be considered.

Cigarette smoking is the leading preventable cause of morbidity and mortality in the US and its hazards to health has been extensively studied. Less is known about the epidemiology, and toxicology of use of WPS. Since WPS is at least as dangerous [2] as other forms of smoking and since this is a health risk behavior that is enjoying an impressive revival, there is an urgent need to study this subject and need to create a national data on the use of WPS in the US.

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