Waterpipe use among high school students in Ontario: Demographic and substance use correlates

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ABSTRACT

OBJECTIVE: To examine waterpipe use and its association with demographic factors, tobacco cigarette smoking, ever use of electronic cigarettes (e-cigarettes) and alcohol use among high school students.

METHODS: Data were derived from the 2013 Ontario Student Drug Use and Health Survey, a school-based survey of 7th to 12th grade students. This province-wide survey was based on a stratified two-stage cluster design. Analyses were based on a subsample of 2,873 high school students and included adjustments for the complex sample design.

RESULTS: Overall, 12.5% of high school students (grades 9-12) had used a waterpipe in the previous year. Awareness of waterpipes was high – 68.4% of students reported that they were aware of waterpipes but had not used one in the past year; 19.1% had never heard of waterpipes or hookah. The percentage of high school students reporting waterpipe use in the past year was similar to reports of tobacco cigarette use (12.5% and 11% respectively). Waterpipe use was highly associated with past-year tobacco cigarette and regular alcohol use as well as ever use of e-cigarettes. In multivariate analyses, males and females had similar odds of waterpipe use, and non-White students and those in higher grades had greater odds of use after controlling for other substance use.

CONCLUSION: These findings suggest that waterpipe use among high school students should be of some concern and suggest the need for policy measures to address potential risks associated with use.

KEY WORDS: Waterpipe smoking; hookah smoking; adolescents; tobacco use

La traduction du résumé se trouve à la fin de l'article.

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Public health efforts targeting the reduction of tobacco cigarette smoking have generally been successful, cigarette smoking being at a low point among youth.[1] There are increasing concerns, however, that other forms of tobacco consumption, such as waterpipe smoking, are increasing along with associated health risks.[2,3]

The health risks associated with waterpipe tobacco smoking are generally expected to be similar to those of tobacco cigarette smoking.[4,5] Research indicates that the smoke from waterpipes contains large amounts of toxic ingredients, including carbon monoxide and polycyclic aromatic hydrocarbons (benzene), as well as tar and nicotine.[5,6] Health risks associated with waterpipe smoking include cancer,[3,7–9] respiratory disease,[7–10] nicotine dependence,[7,9,10] periodontal disease[8] and low birth weight or other adverse fetal outcomes.[7–9] Research suggests that tobacco-free waterpipe products are also associated with health risks, such as damage to lung cells.[11] In addition, communicable diseases are a concern when a waterpipe mouthpiece is shared if smoking occurs in groups.[7,9]

Despite concerns about waterpipe smoking, there are limited data on the demographic characteristics associated with waterpipe use in younger populations. The introduction of highly flavoured tobacco mix, the advent of waterpipe stores and hookah bars, and the marketing of waterpipe smoking as a social event have contributed to the popularity of waterpipes.[12] US research suggests that approximately 28% of college students had smoked a waterpipe in the previous year, with lifetime use as high as 46%.[13] There is also evidence that males, users of tobacco cigarettes and individuals of Arab ethnicity have greater odds of waterpipe smoking.[14]

There is less research on waterpipe use among younger students, but figures from a 2006 study indicate that 7% of middle and high school students in Canada had used a waterpipe to smoke tobacco in their lifetime and 3% had done so in the previous 30 days.[15] US research shows that 4% of middle and 11% of high school students had smoked tobacco from a waterpipe in their lifetime[16] and 18% to 21% of high school seniors had engaged in waterpipe tobacco smoking in the previous year.[17,18] Prevalence of use among

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adolescents is particularly important to consider, because the increase in the popularity of waterpipe use among their slightly older peers[13] heightens the risk that adolescents will adopt the behaviour, thus increasing concerns about associated health risks including the impact of nicotine on brain development in adolescents.[19] There is also little research on the association between waterpipe smoking and the use of other common substances, with the exception of tobacco cigarettes. Given that substance use tends to cluster within individuals[20] and that waterpipe smoking often occurs in social groups and settings,[21] it is important to examine the association of this type of smoking with alcohol and electronic cigarette (e-cigarette) use, the latter of which is also increasing in popularity.[22] This study examines the prevalence of waterpipe smoking among Ontario high school students as well as the demographic and substance use correlates.

METHOD

Data

Data for this study were derived from the 2013 Ontario Student Drug Use and Health Survey (OSDUHS), a province-wide survey of students in grades 7 through 12 attending publicly funded schools in Ontario. Conducted every two years since 1977, this repeated cross-sectional survey monitors substance use, mental and physical health, gambling and delinquent behaviour. The 2013 survey, based on a stratified two-stage (school, class) cluster design, consisted of 10,272 students, 198 schools and 671 classrooms. Overall, 61% of selected schools and 87% of selected classes participated in the survey. Sixty-three percent of students in participating classes completed an in-class questionnaire,[1] which is considered above average for a student survey requiring active parental consent.[23] Absenteeism (11%) and parental refusal or unreturned consent forms (26%) were the main reasons for non-completion. Comparisons of drug use prevalence between classes with lower versus higher response rates indicated no appreciable difference in drug use between groups.

Within each classroom, two versions of the questionnaire, with about one-half of the content common to both, were randomly distributed to students. The question on waterpipe use was included in one version of the questionnaire and thus was only asked of a random half-sample of students. The analyses presented here were restricted to 2,873 high school students in grades 9 through 12 who were 19 years of age or younger. Additional information on the study design and methods is provided elsewhere.[1] The 2013 OSDUHS was approved by the Research Ethics Boards of the Centre for Addiction and Mental Health as well as York University.

Measures

Waterpipe use was determined from the question: "In the LAST 12 MONTHS, how often did you smoke a WATERPIPE (also known as a hookah, shisha, hubble-bubble, gouza)?" Response choices ranged from "Only a few puffs once just to see what it's like" to "40 or more times". Additional response choices were "Used, but not in the last 12 months", "Never used in lifetime" and "Don't know what a waterpipe is". A dichotomous measure was constructed to reflect waterpipe smoking one or more times in the preceding 12 months (excludes a few puffs) versus no waterpipe smoking (includes those who had had only a few puffs of a waterpipe and those who had never heard of a waterpipe).

Additional substances were also considered in the analyses. The smoking of tobacco cigarettes was constructed as a dichotomous measure reflecting not smoked versus smoked in the previous 12 months (excludes a few puffs). Ever use of e-cigarettes was a dichotomous measure reflecting use or non-use and was derived from the following question: "Electronic cigarettes, or e-cigarettes, are electronic devices made in the shape of cigarettes that create an inhaled mist without odour. Have you ever smoked at least one puff from an ELECTRONIC CIGARETTE?" Alcohol use in the previous 12 months was constructed as a 3-category measure – non-use, special occasion use and regular use. Students who had never drunk alcohol, had not drunk in the previous 12 months or had only had a sip of alcohol were classified as non-drinkers. Drinking on special occasions only was classified as occasional drinking. Drinking outside of special occasions was classified as regular drinking.

Sex (male/female), grade (9–12), and ethnic and racial background were included as additional covariates in analyses. Ethnic and racial background was constructed from a question asking students to choose one or more of 11 categories that best described their background.[24] For descriptive purposes, students who selected a single response were grouped into five larger categories: White/Caucasian, Black/African, East Asian, South Asian and Other. Multiple responses across the five categories (7.8% of the sample) were coded as "Other". In multivariate analyses, categories were further reduced to two (White/Caucasian versus non-White) because the limited sample precluded more specific racial or ethnic categories.

Statistical analysis

Design-based survey estimation within Stata 13[25] was used in all analyses to adjust for the stratified and clustered complex survey design. Analyses included sampling weights to adjust for unequal probability of selection.[1] The associations between waterpipe smoking and other substance use, as well as demographic covariates, were examined using multivariate logistic regression. Missing data within the logistic regression represented 2.4% (70 cases) of the sample and were handled through listwise deletion.

RESULTS

The sample of high school students had a mean age of 16 years, 52.1% were male, and 60.4% were of White or Caucasian background. An estimated 12.5% (95% confidence interval [CI]: 10.6%–14.7%) of students reported using a waterpipe in the previous year (excludes a few puffs), compared with 11% (95% CI: 8.8%–13.7%) who reported smoking a tobacco cigarette in the previous year. An additional 68.4% of high school students were aware of waterpipes but had not used one in the previous year, and 19.1% had never heard of waterpipes. The frequency of waterpipe use varied considerably, with 4.5% of Ontario students using 1–2 times and 3.3% using 20 times or more in the previous year (Table 1). An examination of lifetime use found that 14.4% (95% CI: 12.3%–16.7%) of students had used a waterpipe in their

Table 1. Estimates of past-year waterpipe use among Ontario high school students, 2013 Ontario Student Drug Use and Health Survey

	Percentage of total*	95% confidence interval	*n*
Never used in past 12 months (includes 3.4% who reported a few puffs once to see what it was like)	68.4	65.3–71.3	2008
1 or 2 times	4.5	3.6–5.7	134
3 to 9 times	3.6	2.8–4.5	114
10 to 19 times	1.1	0.7–1.8	32
20 or more times	3.3	2.3–4.8	73
Don't know what a waterpipe is	19.1	16.6–21.8	512

* *N* = 2873.

lifetime (not presented in table). Thus, only 1.9% of students had used a waterpipe in their lifetime but not in the previous year.

Bivariate analyses of waterpipe use by demographic characteristics and cigarette and alcohol use showed significant associations (Table 2). Waterpipe use was more prevalent among males (14.4%); among students in higher grades (18.8% among 12th graders); and among those who smoked conventional tobacco cigarettes (44.4%), had ever used e-cigarettes (35.3%) and drank alcohol regularly (25%). Waterpipe use was less prevalent among students of East and Southeast Asian background (7.2%) and Black/African background (estimates suppressed as a result of a high coefficient of variation).

Analyses that examined other substance use among students who reported past-year use of a waterpipe showed that a majority of waterpipe users had not used a tobacco cigarette in the previous year (59.9%, 95% CI: 50.4%–68.8%) and a majority had never used an e-cigarette (58.8%, 95% CI: 51.5%–65.8%). In contrast, only 28.1% (95% CI: 21.8%–35.2%) of past-year waterpipe users had not used alcohol regularly in the previous year.

Results from the multivariate logistic regression analyses, with waterpipe use as a binary measure of use versus nonuse, are outlined in Table 3. Demographic characteristics and tobacco cigarette use were included as covariates in Model 1; ever use of e-cigarette was added in Model 2; and alcohol use was added in Model 3. Whereas the results for most variables remained substantively consistent across the three models, there were some differences for sex and racial background. Findings for sex

Table 2. Estimates of past-year waterpipe use among Ontario high school students by demographic factors and substance use, 2013 Ontario Student Drug Use and Health Survey

Demographic factors/substance use	Never used waterpipe			
	Used waterpipe, %	Heard of but never used, %	Don't know what a waterpipe is, %	Overall % of sample
	n = 353	*n* = 2008	*n* = 512	*n* = 2873
Sex	F(1.9, 190.7) = 3.5†*			
Male	14.4	68.6	17.0	*52.1*
Female	10.5	68.2	21.3	*47.9*
Grade	F(4.5, 439.5) = 6.9†***			
9	4.3	70.7	25.0	*21.3*
10	8.5	70.8	20.7	*22.3*
11	15.1	68.1	16.8	*24.1*
12	18.8	65.4	15.8	*32.4*
Ethnic/racial background	F(6.5, 632.1) = 3.2†**			
White/Caucasian	12.7	68.7	18.7	*60.4*
Black/African	–‡	–‡	–‡	*5.5*
East/Southeast Asian	7.2	64.8	28.0	*8.7*
South Asian	16.1	74.0	9.8	*11.0*
Other	16.2	64.9	18.9	*14.3*
Racial background	F(1.9, 189.6) = 0.1†			
White/Caucasian	12.7	68.7	18.7	*60.4*
Non-White/Other	12.7	67.8	19.5	*39.6*
Tobacco cigarette use, past year	F(2, 195.7) = 56.3†***			
Not used	8.2	71.0	20.7	*89.0*
Used	44.4	49.1	6.5	*11.0*
E-cigarette use, ever	F(1.9, 185.3) = 88.8†***			
Not used	8.6	70.0	21.4	*85.4*
Used	35.3	58.7	6.0	*14.6*
Alcohol use, past year	F(3.6, 351.2) = 36.2†***			
None/sip	4.2	70.9	24.9	*39.0*
Occasional	7.4	68.4	24.2	*25.1*
Regular	25.0	65.7	9.3	*35.9*
Age	F(1, 98) = 45.8§; F(1,98) = 35.4‖; F(1,98) = 3.9¶			
Mean	*M* = 16.7	*M* = 16.0	*M* = 15.8	*M = 16.0*
95% CI	16.5, 16.8	15.9, 16.1	15.6, 16.0	*16.0, 16.1*
Total %	12.5	68.4	19.1	
95% CI	10.6, 14.7	65.3, 71.3	16.6, 21.8	

† Pearson chi-square adjusted for the survey design and transformed into an F-statistic (Rao-Scott F-statistic). Decimal degrees of freedom are a consequence of the Rao-Scott second-order design corrections.

‡ Percentage suppressed because of a high coefficient of variation of students who used a waterpipe.

§ Adjusted Wald test showing significant difference between used and not used a waterpipe.

‖ Adjusted Wald test showing significant difference between used and not heard of waterpipes.

¶ Adjusted Wald test showing non-significant difference between not used and not heard of waterpipes.

***$p < 0.001$; **$p < 0.01$; *$p < 0.05$.

Table 3. Logistic regression of waterpipe use among Ontario high school students by demographic factors and substance use, 2013 Ontario Student Drug Use and Health Survey

	Model 1 Demographics & tobacco cigarette AOR (95% CI)*	Model 2 Demographics, tobacco & e-cigarette AOR (95% CI)*	Model 3 Demographics, tobacco, e-cigarette & alcohol AOR (95% CI)*
Sex			
Female	1.00	1.00	1.00
Male	1.40 (1.01–1.94)	1.18 (0.84–1.66)	1.16 (0.81–1.66)
Grade			
9	1.00	1.00	1.00
10	1.61 (0.93–2.79)	1.65 (0.87–3.12)	1.32 (0.71–2.44)
11	2.96 (1.83–4.81)	3.18 (1.89–5.34)	2.29 (1.31–3.97)
12	3.45 (2.23–5.33)	3.75 (2.29–6.12)	2.47 (1.48–4.14)
Racial background			
White/Caucasian	1.00	1.00	1.00
Non-White/Other	1.17 (0.78–1.77)	1.34 (0.87–2.08)	1.89 (1.18–3.01)
Tobacco cigarette use, past year			
Not used	1.00	1.00	1.00
Used	8.20 (5.06–13.29)	5.54 (3.18–9.66)	4.10 (2.36–7.12)
E-cigarette use, ever			
Not used		1.00	1.00
Used		4.32 (3.00–6.21)	3.48 (2.40–5.06)
Alcohol use, past year			
None			1.00
Occasional			1.28 (0.72–2.28)
Regular			3.58 (2.22–5.77)
Constant	0.03 (0.02–0.05)	0.02 (0.01–0.04)	0.01 (0.01–0.03)

* Adjusted odds ratios with 95% confidence intervals. Based on sample that provided non-missing responses to all variables within the table (n = 2803).

differences in Model 1, which included covariates for demographic characteristics and tobacco cigarette use, indicated that males had significantly greater odds of waterpipe use than females (odds ratio [OR] = 1.40, CI = 1.01–1.94). However, sex differences were no longer significant after adjusting for e-cigarette and alcohol use in subsequent models.

The binary measure of racial background was significantly associated with waterpipe use, but only after adjusting for alcohol use. This association is evident in Model 3, in which the odds of waterpipe use were greater among non-White/non-Caucasian students (OR = 1.89, CI = 1.18–3.01). Thus, lower alcohol use among non-White/non-Caucasian students suppressed the association between racial background and waterpipe use in earlier models that failed to show significant differences.

Substantively, the findings for school grade, tobacco cigarette use and ever use of e-cigarettes were similar across the models in Table 3. The findings for school grade indicated a significant association with waterpipe use in each of the three models. This association was highlighted by findings that students in Grades 11 and 12 had more than twice the odds of waterpipe use (OR = 2.29, CI = 1.31–3.97 and OR = 2.47, CI = 1.48–4.14 respectively) than Grade 9 students (see Model 3).

Findings for cigarettes indicated that students who used tobacco cigarettes had greater odds of waterpipe use, although the OR estimate was much reduced after controlling for other substance use, specifically e-cigarettes and alcohol (Model 3; OR = 4.10, CI = 2.36–7.12). With regard to e-cigarettes, students who had ever used e-cigarettes had greater odds of waterpipe use. This association between e-cigarettes and waterpipe use remained even after controlling for regular alcohol use (Model 3; OR = 3.48, CI = 2.40–5.06).

The association between regular alcohol use and waterpipe use is highlighted in Model 3. Students who drank alcohol regularly had greater odds of waterpipe use than those who never drank (OR = 3.58, CI = 2.22–5.77). However, there was no significant difference in waterpipe use between those who drank occasionally and those who never drank.

DISCUSSION

The current study found that the prevalence of waterpipe use was similar to that of tobacco cigarette use among high school students. Overall, 12.5% of high school students (1 in 8) had used a waterpipe in the previous year, and 14.4% (1 in 7) had used a waterpipe in their lifetime. The minor difference in prevalence between past-year and lifetime use highlights the popularity of waterpipes, in that most students who had used the device continued to do so; alternatively, the difference suggests a recent diffusion of waterpipe use among these students. These figures are generally higher than in some reports of lifetime[16,26] and current waterpipe tobacco smoking[26] among high school students, although the latter studies tend to focus on 30-day rather than past-year use. Previous research, however, has also indicated a higher prevalence of waterpipe tobacco use among high school students than that reported for waterpipe use generally in the current study.[27]

It is noteworthy that 1 in 5 students had never heard of a waterpipe (or hookah), which is slightly higher than the 17% reported in a recent US study.[27] This suggests a potential for waterpipe use to increase once awareness and popularity expand in this age group. The social aspect of waterpipe use, the increasing number of hookah cafes and the introduction of highly flavored tobacco mixes have increased the appeal of these devices.[28,29] Thus, there is a need to increase awareness of the potential risks associated with waterpipe use.

Past-year prevalence of waterpipe use among high school students was lower than estimates reported for college students in the US.[10,13,14] However, the odds of waterpipe use were found to be greater in older grades, with the prevalence of 19% among

grade 12 students similar to that found among college students. Thus, as with college students, a sizeable proportion of older high school students have embraced the use of waterpipes.

Our findings indicate that, after adjusting for demographic and behavioural factors, waterpipe use did not vary between males and females, but there was some variation by racial background. Research on college students has often reported sex differences,[30] but other studies involving college[10] and high school students have reported no sex differences.[31] The findings that students of non-White or non-Caucasian background had greater odds of waterpipe use are somewhat consistent with those of other research showing broad racial or ethnic differences in waterpipe use,[10,14,30,32] although the categories of race or ethnicity compared often differed between studies. Students of Arab descent, for example, have been found to have higher odds of waterpipe use,[14] which tends to be attributed to their cultural heritage, given the origins of waterpipe use.[28,29] The current study, however, could not examine specific ethnic groups separately within multivariate analyses, and thus the category of non-White or non-Caucasian is a broad group consisting of several different racial or ethnic groups.

The findings of this study indicate that tobacco cigarette, e-cigarette and alcohol use were associated with greater odds of waterpipe use. The findings with regard to tobacco cigarettes are consistent with those of other research.[14,16,26,31,32] Like college students,[10,32] many high school students who have used a waterpipe have not smoked tobacco cigarettes (60%), suggesting that the two behaviours are perceived differently.[14] This may relate to students' heightened awareness of the risks of tobacco cigarette use compared with the portrayal of waterpipe use as safer and a social activity that can be enjoyed with peers.[26,30] Recent prospective research findings that pre-college waterpipe use is associated with later tobacco cigarette use suggest that waterpipe use may be a gateway to tobacco cigarette smoking.[33]

The association between ever use of e-cigarettes and waterpipe use is not surprising given that both e-cigarettes and waterpipes are alternative smoking devices that have grown in popularity through targeted marketing and social media.[12,22] As with tobacco cigarettes, a large percentage (59%) of waterpipe users had never used an e-cigarette. Although differing perceptions may be a factor, the social context of waterpipe use may also differ from that of e-cigarette use.

Greater odds of waterpipe use among students who drink alcohol are consistent with findings from other research.[20,33] Almost 3 of 4 students who used a waterpipe also drank alcohol regularly. While this study cannot address whether waterpipe and alcohol use occurred at the same time, it is consistent with other research that has highlighted a clustering of substance use and other problem behaviours within individuals.[20]

There are several limitations to this study. First, it is based on cross-sectional data, and thus the temporal order of associations between waterpipe use and the use of tobacco cigarettes, e-cigarettes and alcohol cannot be determined. Longitudinal research on these associations would contribute to understanding the temporal order and potential causal pathways. Second, the survey question focused on waterpipe use broadly and did not identify what substance was being smoked in the waterpipe. Thus, it is possible that a substance other than tobacco (e.g., cannabis, herbal waterpipe preparations that do not contain tobacco) was used within the device. Research has indicated, however, that health risks are associated with both tobacco and tobacco-free waterpipe smoke.[11] Research is needed to examine the use of waterpipes with different substances. Third, analyses involving race or ethnicity were limited by sample size. More detailed examinations of racial or ethnic differences would aid in a greater understanding of how predictors of substance use may vary among groups and perhaps how they diffuse across groups.

CONCLUSION

Despite public health concerns about the associated risks, waterpipe use has become popular among high school students. This study indicated that the percentage of students who used a waterpipe was similar to the percentage using tobacco cigarettes. The increasing proportion of students using waterpipes[12,18] indicates a need to address the safety of individual use as well as the risk to others. Increasing use may expose a greater proportion of the population to secondary harms, particularly when tobacco is being smoked within a waterpipe.[5] Direct harm from waterpipe use and concerns that such use may elicit other health risk behaviours, including the use of other substances,[33] are particularly important for high school students. The co-occurrence of substance use behaviours places students at risk of continued use over a longer period of time. As debates about safety concerns and regulation needs continue, more research evidence is necessary to guide policy and public health action.

REFERENCES

1. Boak A, Hamilton HA, Adlaf EM, Mann RE. Drug Use Among Ontario Students, 1977–2013: Detailed OSDUHS Findings (CAMH Research Document Series No. 36). Toronto, ON: Centre for Addiction and Mental Health, 2013.
2. Jawad M, Abass J, Hariri A, Rajasooriar KG, Salmasi H, Millett C, Hamilton FL. Waterpipe smoking: Prevalence and attitudes among medical students in London. *Int J Tuberc Lung Dis* 2013;17(1):137–40. PMID: 23232013. doi: 10.5588/ijtld.12.0175.
3. Maziak W. The waterpipe: An emerging global risk for cancer. *Cancer Epidemiol* 2013;37(1):1–4. PMID: 23196170. doi: 10.1016/j.canep.2012.10.013.
4. World Health Organization. Tobacco Regulation Advisory Note. Waterpipe Tobacco Smoking: Health Effects, Research Needs, and Recommended Action by Regulators. Geneva, Switzerland: WHO, 2005.
5. Maziak W. The waterpipe: Time for action. *Addiction* 2008;103(11):1763–67. PMID: 18778388. doi: 10.1111/j.1360-0443.2008.02327.x.
6. Al Rashidi M, Shihadeh A, Saliba NA. Volatile aldehydes in the mainstream smoke of the narghile waterpipe. *Food Chem Toxicol* 2008;46(11):3546–49. PMID: 18834915. doi: 10.1016/j.fct.2008.09.007.
7. Noonan D, Kulbok PA. New tobacco trends: Waterpipe (hookah) smoking and implications for healthcare providers. *J Am Acad Nurse Pract* 2009;21(5):258–60. PMID: 19432909. doi: 10.1111/j.1745-7599.2009.00402.x.
8. Akl EA, Gaddam S, Gunukula SK, Honeine R, Jaoude PA, Irani J. The effects of waterpipe tobacco smoking on health outcomes: A systematic review. *Int J Epidemiol* 2010;39(3):834–57. PMID: 20207606. doi: 10.1093/ije/dyq002.
9. Knishkowy B, Amitai Y. Water-pipe (narghile) smoking: An emerging health risk behavior. *Pediatrics* 2005;116:e113–e119. PMID: 15995011.
10. Primack BA, Sidani J, Agarwal AA, Shadel WG, Donny EC, Eissenberg TE. Prevalence of and associations with waterpipe tobacco smoking among U.S. university students. *Ann Behav Med* 2008;36(1):81–86. PMID: 18719977. doi: 10.1007/s12160-008-9047-6.
11. Shihadeh A, Eissenberg T, Rammah M, Salman R, Jaroudi E, El-Sabban M. Comparison of tobacco-containing and tobacco-free waterpipe products: Effects on human alveolar cells. *Nicotine Tob Res* 2014;16(4):496–99. PMID: 24302635. doi: 10.1093/ntr/ntt193.
12. Luch A. Waterpipe smoking: A new tobacco pandemic entailing severe health risks? *Arch Toxicol* 2012;86(8):1161–62. PMID: 22684767. doi: 10.1007/s00204-012-0885-4.
13. Barnett TE, Smith T, He Y, Soule EK, Curbow BA, Tomar SL, McCarty C. Evidence of emerging hookah use among university students: A cross-sectional comparison between hookah and cigarette use. *BMC Public Health* 2013;13:302. PMID: 23560649. doi: 10.1186/1471-2458-13-302.

14. Grekin ER, Ayna D. Waterpipe smoking among college students in the United States: A review of the literature. *J Am Coll Health* 2012;60(3):244–49. PMID: 22420702. doi: 10.1080/07448481.2011.589419.
15. Chan WC, Leatherdale ST, Burkhalter R, Ahmed R. Bidi and hookah use among Canadian youth: An examination of data from the 2006 Canadian Youth Smoking Survey. *J Adolesc Health* 2011;49(1):102–4. PMID: 21700168. doi: 10.1016/j.jadohealth.2010.11.250.
16. Barnett TE, Curbow BA, Weitz JR, Johnson TM, Smith-Simone SY. Water pipe tobacco smoking among middle and high school students. *Am J Public Health* 2009;99(11):2014–19. PMID: 19762667. doi: 10.2105/AJPH.2008.151225.
17. Palamar JJ, Zhou S, Sherman S, Weitzman M. Hookah use among US high school seniors. *Pediatrics* 2014;134(2):227–34.
18. Johnston LD, O'Malley PM, Miech RA, Bachman JG, Schulenberg JE. Monitoring the Future National Results on Drug Use: 1975-2013: Overview, Key Findings on Adolescent Drug Use. Ann Arbor, MI: Institute for Social Research, University of Michigan, 2014.
19. Rubinstein ML, Luks TL, Dryden WY, Rait MA, Simpson GV. Adolescent smokers show decreased brain responses to pleasurable food images compared with nonsmokers. *Nicotine Tob Res* 2011;13(8):751–55. PMID: 21454914. doi: 10.1093/ntr/ntr046.
20. Heinz AJ, Giedgowd GE, Crane NA, Veilleux JC, Conrad M, Braun AR, et al. A comprehensive examination of hookah smoking in college students: Use patterns and contexts, social norms and attitudes, harm perception, psychological correlates and co-occurring substance use. *Addict Behav* 2013; 38(11):2751–60. PMID: 23934006. doi: 10.1016/j.addbeh.2013.07.009.
21. Sutfin EL, McCoy TP, Reboussin BA, Wagoner KG, Spangler J, Wolfson M. Prevalence and correlates of waterpipe tobacco smoking by college students in North Carolina. *Drug Alcohol Depend* 2011;115(1–2):131–36. PMID: 21353750. doi: 10.1016/j.drugalcdep.2011.01.018.
22. Corey C, Wang B, Johnson SE, Apelberg B, Husten C, King BA, et al. Notes from the field: Electronic cigarette use among middle and high school students - United States, 2011-2012. *MMWR Morb Mortal Wkly Rep* 2013; 62(35):729–30. PMID: 24005229.
23. Courser MW, Shamblen SR, Lavrakas PJ, Collins D, Ditterline P. The impact of active consent procedures on nonresponse and nonresponse error in youth survey data: Evidence from a new experiment. *Eval Rev* 2009;33:370–95. PMID: 19506295. doi: 10.1177/0193841X09337228.
24. Statistics Canada. Census 2006 – 2B (Long Form). Ottawa, ON: Statistics Canada, 2006.
25. StataCorp. Stata Statistical Software: Release 13.1 [computer program]. College Station, TX: StataCorp, 1985-2013.
26. Primack BA, Walsh M, Bryce C, Eissenberg T. Water-pipe tobacco smoking among middle and high school students in Arizona. *Pediatrics* 2009;123(2): e282–e288. PMID: 19171581. doi: 10.1542/peds.2008-1663.
27. Smith JR, Novotny TE, Edland SD, Hofstetter CR, Lindsay SP, Al-Delaimy WK. Determinants of hookah use among high school students. *Nicotine Tob Res* 2011;13(7):565–72. PMID: 21454909. doi: 10.1093/ntr/ntr041.
28. Akl EA, Jawad M, Lam WY, Obeid R, Irani J. Motives, beliefs and attitudes towards waterpipe tobacco smoking: A systematic review. *Harm Reduct J* 2013;10(1):12. PMID: 23816366. doi: 10.1186/1477-7517-10-12.
29. Roskin J, Aveyard P. Canadian and English students' beliefs about waterpipe smoking: A qualitative study. *BMC Public Health* 2009;9:10. PMID: 19134220. doi: 10.1186/1471-2458-9-10.
30. Smith-Simone SY, Curbow BA, Stillman FA. Differing psychosocial risk profiles of college freshmen waterpipe, cigar, and cigarette smokers. *Addict Behav* 2008;33(12):1619–24. PMID: 18783890. doi: 10.1016/j.addbeh.2008.07.017.
31. Jordan HM, Delnevo CD. Emerging tobacco products: Hookah use among New Jersey youth. *Prev Med* 2010;51(5):394–96. PMID: 20817023. doi: 10.1016/j.ypmed.2010.08.016.
32. Jackson D, Aveyard P. Waterpipe smoking in students: Prevalence, risk factors, symptoms of addiction, and smoke intake. Evidence from one British university. *BMC Public Health* 2008;8:174. PMID: 18498653. doi: 10.1186/1471-2458-8-174.
33. Fielder RL, Carey KB, Carey MP. Hookah, cigarette, and marijuana use: A prospective study of smoking behaviors among first-year college women. *Addict Behav* 2013;38(11):2729–35. PMID: 23934004. doi: 10.1016/j.addbeh.2013.07.006.

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RÉSUMÉ

OBJECTIF : Examiner l'usage des pipes à eau et ses associations avec les facteurs démographiques, l'usage de la cigarette de tabac, l'usage passé ou présent de la cigarette électronique et la consommation d'alcool chez des élèves du secondaire.

MÉTHODE : Nos données provenaient du Sondage sur la consommation de drogues et la santé des élèves de l'Ontario (2013), une enquête menée en milieu scolaire auprès des élèves de la 7e à la 12e année. Ce sondage à l'échelle de la province était planifié selon un échantillonnage en grappe en deux étapes stratifié. Nos analyses étaient fondées sur un sous-échantillon de 2 873 élèves du secondaire et comportaient des ajustements pour tenir compte de la complexité du plan d'échantillonnage.

RÉSULTATS : Globalement, 12,5 % des élèves du secondaire (9e à 12e année) avaient utilisé une pipe à eau l'année précédente. La connaissance des pipes à eau était élevée : 68,4 % des élèves ont dit en connaître l'existence, mais ne pas s'en être servis au cours de l'année précédente; 19,1 % n'avaient jamais entendu parler des pipes à eau ou des narguilés. Le pourcentage d'élèves du secondaire ayant déclaré avoir fait usage de pipes à eau au cours de l'année précédente était semblable à celui des élèves ayant déclaré avoir fait usage de cigarettes de tabac (12,5 % et 11 % respectivement). L'usage des pipes à eau était fortement associé à l'usage de cigarettes de tabac au cours de la dernière année et à la consommation périodique d'alcool, ainsi qu'à l'usage présent ou passé de cigarettes électroniques. Dans les analyses multivariées, les garçons et les filles présentaient des probabilités semblables d'avoir fait usage de pipes à eau, et les élèves non blancs et ceux qui étaient plus avancés dans leur parcours scolaire étaient plus susceptibles d'en avoir utilisé, après prise en compte de la consommation d'autres substances.

CONCLUSION : Ces constatations montrent que l'usage des pipes à eau chez les élèves du secondaire pourrait être un motif de préoccupation, et qu'il faudrait prendre des mesures pour aborder les risques potentiels associés à cet usage.

MOTS CLÉS : pipe à eau; narguilé; adolescent; tabagisme