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The relationship of waterpipe use with cigarette smoking susceptibility and nicotine dependence: A cross-sectional study among Hong Kong adolescents

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HIGHLIGHTS

- Waterpipe use is correlated with cigarette smoking susceptibility in never smokers.
- Waterpipe use is associated with heavier smoking in current cigarette smokers.
- Waterpipe use is correlated with first cigarette within 30 min of waking.

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ABSTRACT

Introduction: Waterpipe smoking has become increasingly popular in adolescents. We examined the association of waterpipe smoking with cigarette smoking susceptibility and nicotine dependence among adolescents in Hong Kong.

Methods: We analyzed the data of School-based Survey on Smoking among Students 2012/13 from a representative sample of 45,857 secondary school students (US grades 7–12) in Hong Kong. Among never cigarette smokers ($n = 37{,}740$), we conducted chi-square test to compare cigarette smoking susceptibility by current (past 30-day) waterpipe smoking status, and used multivariate logistic regression to examine the association between current waterpipe smoking and cigarette smoking susceptibility controlling for age, sex, peer cigarette smoking, and living with a cigarette smoker. Then we conducted chi-square test and multivariate logistic regression among current cigarette smokers ($n = 1694$) to examine the relationship of current waterpipe smoking with two nicotine dependence outcomes, including heavier smoking (≥5 cigarettes/day) and first cigarette within 30 min of waking, controlling for demographics and the number of smoking days in the past 30 days.

Results: Among never cigarette smokers, current waterpipe use was associated with cigarette smoking susceptibility (adjusted odds ratio [AOR] = 3.58, 95% confidence interval [CI]: 1.61–7.97). Of current cigarette smokers, waterpipe use was associated with heavier smoking (AOR = 1.56, 95% CI: 1.00–2.43) and first cigarette within 30 min of waking (AOR = 2.08, 95% CI: 1.35–3.19).

Conclusions: Surveillance, prevention, and intervention programs should address waterpipe use in addition to cigarette smoking. Educational programs need to inform youth about the harmful and addictive effects of waterpipe smoking. Public health campaigns deglamourizing waterpipe use may help reduce waterpipe smoking among youth.

1. Introduction

Waterpipe smoking (also called hookah, shisha, and narghile) has gained popularity among adolescents worldwide, particularly in the Eastern Mediterranean Region (Jawad, Lee, & Millett, 2016; Maziak et al., 2015). In some countries (e.g., Syria, Jordan, and Lebanon), waterpipe is more popular than conventional cigarettes among adolescents (Jawad et al., 2016). In several other countries (e.g., the US, Saudi Arabia, and Egypt), waterpipe has become as common as cigarettes in

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adolescents (Arrazola et al., 2015; Jawad et al., 2016). Adolescents perceive waterpipe smoking as less addictive and less harmful than conventional cigarettes, and this misconception is significantly associated with waterpipe use (Minaker, Shuh, Burkhalter, & Manske, 2015; Smith et al., 2011). However, waterpipe smoke contains nicotine, carbon monoxide and carcinogens (Aboaziza & Eissenberg, 2015; Cobb, Shihadeh, Weaver, & Eissenberg, 2011). Similar to cigarette smoking, waterpipe use impairs respiratory and cardiovascular systems, and is associated with periodontal diseases, low birth weight and lung cancer (Aslam, Saleem, German, & Qureshi, 2014; El-Zaatari, Chami, & Zaatari, 2015; Hakim et al., 2011).

It is concerning that waterpipe smoking may serve as a gateway to cigarette smoking and lead to nicotine dependence. In a longitudinal study of US youth (aged 15–23 years) who had never smoked a cigarette, Soneji et al.(2015) found that waterpipe smoking was an important predictor of cigarette smoking initiation, current cigarette smoking, and higher cigarette smoking intensity. Two longitudinal studies of 7th grade Jordanian cigarette-naïve students found that waterpipe smoking predicted cigarette smoking initiation (Jaber et al., 2015) and current cigarette smoking (Mzayek et al., 2012). Doran et al.(2015) compared cigarette smoking intensity between cigarette-only smokers and dual users (cigarette and waterpipe) among US college students, and found that cigarette consumption decreased in cigarette-only smokers over a 6-month period but increased among dual users. In a longitudinal study of Danish youth, Jensen et al.(2010) found that, among boys, dual users were more likely to report increased cigarette smoking frequency than cigarette-only smokers. These findings suggest that, for never-cigarette smoking youth, waterpipe smoking may lead to cigarette smoking; whereas for cigarette smokers, waterpipe use may lead to a higher level of nicotine dependence.

The gateway effect might be explained by the fact that waterpipe tobacco contains nicotine, a highly addictive substance (Cobb et al., 2011). A typical waterpipe session (30–45 min) delivers equal or greater doses of nicotine than a single cigarette smoking episode (Hadidi & Mohammed, 2004; Maziak, Eissenberg, & Ward, 2005). Thus, waterpipe smokers are exposed to a large amount of nicotine during a single session, and could rapidly develop dependence which may lead to cigarette smoking, a more portable and convenient way to relieve nicotine withdrawal symptoms and maintain nicotine addiction. A recent study of school children in Lebanon found that, similar to cigarette smokers, adolescent waterpipe users, even those who initiated waterpipe smoking within a short time period, reported early symptoms of dependence (e.g., craving to smoke, feeling addicted to smoking, and failed quit attempts), and met the dependence criteria of the International Classification of Diseases 10th Revision (ICD-10) (Bahelah et al., 2016). Furthermore, waterpipe use and cigarette smoking share the similar social aspect. Youth often use waterpipe with friends and family to foster social connection (Akl et al., 2015; Alzyoud, Weglicki, Kheirallah, Haddad, & Alhawamdeh, 2013; Hammal, Mock, Ward, Eissenberg, & Maziak, 2008; Maziak et al., 2015), same as cigarette smoking (Acosta et al., 2008; Hoek, Maubach, Stevenson, Gendall, & Edwards, 2013; Nichter, Nichter, Carkoglu, Lloyd-Richardson, & Tobacco Etiology Research Network (TERN), 2010). This environmental influence (i.e., tobacco use among peers and family) is an important determinant of tobacco use among youth (Amrock, Gordon, Zelikoff, & Weitzman, 2014; de Vries, Engels, Kremers, Wetzels, & Mudde, 2003; Jawad et al., 2015), according to Social Cognitive Theory (Bandura, 1986). Therefore it is possible that a waterpipe user later initiates cigarette smoking under certain contexts to meet the social needs.

Most studies on adolescent waterpipe smoking focus on the youth populations from Eastern Mediterranean Region or western countries. Little is known about youth waterpipe smoking in Asia. Hong Kong is the most westernized city of China and has the lowest cigarette smoking prevalence in the developed world. In Hong Kong, 11.4% of residents aged 15 years and older and 3.3% of secondary school students are current (past 30-day) cigarette smokers (The Government of the Hong Kong Special Administrative Region, 2016). Waterpipe is the most popular alternative tobacco product among Hong Kong adolescents, with 1.2% of school students reported current waterpipe smoking (Jiang, Ho, Wang, Leung, & Lam, 2016). In recent years, waterpipe lounges pop up widely in Hong Kong (Du, 2011). Although it is illegal to use waterpipe in smokefree venues (e.g., the indoor areas of restaurants and bars) (The Government of the Hong Kong Special Administrative Region, 2007), many restaurants and bars serve waterpipe in the indoor and outdoor spaces.

No research has examined the association between waterpipe use and cigarette smoking susceptibility or nicotine dependence among Asian adolescents. In this study, we used a large representative sample of school students in Hong Kong to test two hypotheses: first, current waterpipe smoking is associated with cigarette smoking susceptibility among never-cigarette smokers. Second, waterpipe smoking is correlated with higher degree of nicotine dependence among current cigarette smokers.

2. Methods

2.1. Data source

We analyzed the data of Hong Kong School-based Survey on Smoking among Students 2012/13 (hereafter referred to as "the Survey"). This biennial cross-sectional survey was designed to monitor tobacco use patterns in primary (grade 4–6) and secondary (grade 7–12) school students in Hong Kong, and was commissioned by the Food and Health Bureau of the Government of the Hong Kong Special Administrative Region. The Survey was approved by the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong West Cluster. Special schools for adolescents with visual, hearing and other physical impairments or disabilities were excluded from the Survey. The 2012/13 Survey was conducted between October 2012 and April 2013. Proportionate stratified cluster sampling strategy was used to get a representative sample of school children. Schools were randomly selected in each of the 18 districts in Hong Kong. The number of selected schools in each district was proportional to the total number of schools in their district. Details regarding the Survey have been described elsewhere (Jiang et al., 2016).

All students in selected schools were invited to complete an anonymous voluntary self-administered paper-and-pencil questionnaire in class. Trained study personnel went to each class to administer the Survey and collect completed questionnaires. The questionnaire was developed based on the Chinese version of Global Youth Tobacco Survey. Waterpipe smoking was assessed among secondary school students only. Therefore this study was limited to students from secondary schools ($N = 45{,}857$). The response rate was 19% at school level and 96% at student level. School refusals were primarily due to administrative reasons (e.g., busy class schedule). We calculated Cohen's effect size to compare the characteristics of our sample (e.g., sex, grade, and age distribution) with the 2012/13 Hong Kong student enrollment data. The small Cohen's effect size (ranging from 0.05 to 0.21) indicated that our sample was representative of the overall school student population.

2.2. Main measures

Independent variables included students' age and sex.

2.2.1. Cigarette smoking status

Cigarette smoking status was categorized as never smoking (never smoked a cigarette, even one puff), experiment smoking (ever smoked once or a few times), former (smoked in the past but not in the past 30 days) or current smoking (smoke on at least one of the past 30 days).