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# Looking beyond cigarettes: Are Ontario adolescents with asthma less likely to smoke e-cigarettes, marijuana, waterpipes or tobacco cigarettes?

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ABSTRACT

*Objectives:* The purpose of this paper is to examine whether high school students in Ontario with asthma smoke cigarettes, waterpipes, marijuana or e-cigarettes more or less than those without asthma.
*Methods:* The 2013 Ontario Student Drug Use and Health Survey provides self-report data on tobacco cigarettes, waterpipes, marijuana and e-cigarette smoking and asthma rates from 109 high schools in Ontario, Canada. Individual and social characteristics were also collected. Multiple binary logistic regression models measures the association with the various types of smoking in relation to asthma.
*Results:* Adolescents with asthma have higher odds of smoking e-cigarettes or smoking any type including either cigarettes, waterpipes, marijuana or e-cigarettes. Respondents of lower socio-economic status had a higher odds of smoking marijuana or any type. Boys were more likely to smoke waterpipes, e-cigarettes or any type, while students in higher grades had a higher odds of smoking cigarettes, waterpipes, marijuana or any type.
*Conclusions:* Results from this study suggest that adolescents with asthma have a higher odds of smoking e-cigarettes than those without asthma, but no relationship was found for cigarettes, waterpipes or marijuana. Findings present some new challenges as technology changes how adolescents can smoke. Public health campaigns should target adolescents, especially those with asthma, to raise their awareness of the risks of all types of smoking including e-cigarettes.



Tobacco smoke can cause numerous health related issues. While cigarette smoking is associated with the development of certain respiratory diseases [1], the causal link between the onset of asthma and smoking has not been established. To date, studies that examined the association between cigarette smoking and incident asthma have shown mixed results [2–5]. Previous work on the topic has reported an increased risk for adults [6] and adolescents [4,5] but others reported no statistically significant associations [2,3].

Although what causes the onset of asthma is still relatively unknown, experts in the field have reported that cigarette smoking or exposure to second hand smoke can certainly trigger asthma symptoms and severity [7]. Overall cigarette smoking or second hand smoke can relate to many long term respiratory health issues, but it can also influence more immediate issues for people with asthma including increased coughing and airway inflammation [8]. For adults in California, cigarette smoking was associated with asthma severity, worse asthma-specific quality of life and greater hospitalization for asthma [9]. Furthermore, active cigarette smoking for people with asthma can lead to accelerated loss of lung

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function and a decreased response to corticosteroids over time [10].

In the past, studies on smoking behaviour in adolescents was focused on cigarette use; however, more recently other types of smoking such as waterpipes, marijuana or now electronic cigarettes (e-cigarettes) have emerged as a concern. Waterpipes (also known as hookah or shisha) have become more popular in North America in recent years due to the belief that it is a safer alternative to cigarettes [11]. This is a common misconception in young adults [12,13], as a waterpipe smoking session can contain over 100 times the amount of smoke in comparison to a single cigarette [14]. In Ontario, the rate of trying waterpipes in adolescents has more than doubled from 6% in 2006 to 14% in 2013 [15]. Waterpipe smoking is linked to several adverse health outcomes such as cancer, cardiovascular disease and decreased lung function [16–18]. While the causal effect of waterpipe smoke and asthma has not been demonstrated, exposure to tobacco smoke was shown to exacerbate asthma symptoms [19]. Since waterpipes produce tobacco smoke, it can be assumed that it will be harmful especially for those with asthma.

The relationship between marijuana smoking and asthma is somewhat complex. Marijuana has been used as a forbidden medicine to treat asthma symptoms for years as it may have bronchodilator properties [20], while long term marijuana smoking has also been associated with increased respiratory symptoms [21]. Overall, the relationship between marijuana and lung health is somewhat mixed and the connection may not be the same as tobacco smoke [22,23]. Previous research has suggested that adolescents with asthma smoked significantly more marijuana than those without asthma [24]. However, the number of adolescents (aged 15–24) who smoked marijuana in Canada has decreased from 32.7% in 2008 to 24.4% in 2013 [15,25].

Electronic cigarettes are battery powered devices that vaporise nicotine and/or other flavouring mixes, but do not burn tobacco. These products have become popular in recent years and they are perceived as a safer alternative to tobacco cigarettes [26–28]. While preliminary studies suggest that they may be less harmful than cigarettes, the long term health effects and how e-cigarettes relate to asthma symptoms or severity are unknown [29]. The Canadian Tobacco, Alcohol and Drug Survey reported that as many as one in five (20%) adolescents aged 15–19 tried e-cigarettes [15], however, the absolute trend of usage is still unknown as these products are relatively new.

The purpose of this paper is to examine whether adolescents (aged 12–19 or in grades 9 to 12) with asthma smoke cigarettes, waterpipes, marijuana or e-cigarettes more or less than those without asthma. This study adds to the current literature by examining all smoking habits for youth with asthma, rather than focusing just on cigarettes.

## 1. Methods

### 1.1. Data source and study population

The 2013 Ontario Student Drug Use and Health Survey (OSDUHS) is a population based survey conducted every two years and completed by grade 7–12 students at publically funded schools in Ontario, Canada. Ontario is the largest province in Canada with a population of over 13 million residents. Ontario includes major urban centres such as Toronto and Ottawa, several smaller cities and an abundance of rural lands.

The OSDUHS is designed to collect information about drug use and other health related behaviours among students in Ontario. All parents and students gave consent prior to participation. To examine the association between smoking and asthma, we limit our study sample to high school students (grades 9–12, n = 6,159) in 109 schools. These schools were selected with probability proportional to size, to obtain a representative sample within the province.

The survey included questions that captured information on self-reported doctor diagnosed asthma and data on tobacco, alcohol and drug use. The survey used a random split-ballot design where some of the questions change on each of the surveys. The sample is randomly divided into 2 groups to maximize questions included and minimize burden on students, but it reduces the sample size for some questions. In the OSDUHS, approximately half of the full sample answered questions pertaining to asthma and all types of smoking reducing the subsample to 2,840. Data are representative of students in Grades 9 to 12 attending publicly funded schools in Ontario. Ages for respondents range from 12 to 19 years of age (mean: 15.86 years; standard deviation 1.27). In Ontario, the majority of children (92%) attended publically funded schools [30], 5% attended private schools [31], and another 3% were either home schooled, institutionalized for correctional or health reasons, schooled on a First Nation reserve (indigenous communities), military base or lived in remote northern region [30]. This study was approved by the research ethics board at the Research Institute of The Hospital for Sick Children (SickKids) (Toronto, Ontario, Canada).

### 1.2. Variables

#### 1.2.1. Outcome measures

The primary outcome variables in this study are smoking status with regard to cigarettes, waterpipes, marijuana and e-cigarettes. Self-reported frequency and intensity of cigarette, waterpipe, marijuana and e-cigarette smoking in the last 12 months and lifetime use were measured in the survey. Cigarette *non-smokers* were classified as those who never smoked a cigarette or smoked less than (or equal to) one cigarette in the last 12 months, while cigarette *smokers* were those who smoked more than one cigarette in the past 12 months. Similarly, smoking status for waterpipe was also classified as a binary outcome variable. Respondents were asked how often they smoked a waterpipe (or hookah, shisha, bubble-bubble, gouza) in the last 12 months. Those who smoked a few puffs, never smoked, haven't smoked in the past 12 months or didn't even know what it was were considered non-waterpipe smokers. Those who smoked one or more times were defined as smokers. Marijuana smoking is also defined in a similar manner. Students were asked how often they smoked cannabis (or marijuana, weed, pot, grass, hashish, hash) in the past 12 months. If they smoked 1 or more times in the past year they were classified as a marijuana smoker. Respondents who have never or not smoked in the last 12 months were considered to be non-marijuana smokers. Finally, respondents were classified as e-cigarette smokers if they smoked an e-cigarette with or without nicotine in it, while those who have never smoked or never heard of e-cigarettes were considered non-smokers.

#### 1.2.2. Covariates

The primary risk factor of interest is the presence of asthma which is captured by the response to the question “has a doctor or nurse ever told you that you have asthma”. Other potential confounding variables include: grade (9–12), sex and socioeconomic status (SES). SES was measured by a 10-point social ladder. Students were asked to imagine that the ladder represents how Canadian society is set up, where the people at the top of the ladder are the “best off”, meaning they have the best jobs, make the most money and have the highest education. Those at the bottom of the ladder are the “worst off”, with no job, or a job no one wants, little education and the least money. Respondents reported what best