



We do not smoke but some of us are more susceptible than others: A multilevel analysis of a sample of Canadian youth in grades 9 to 12



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HIGHLIGHTS

- Smoking susceptibility significantly varied across Canadian secondary schools.
- Smoking susceptibility was associated with having low self-esteem or using alcohol.
- Other factors included marijuana use or holding positive attitudes towards smoking.
- Others were having smoking friends or residing in homes with no smoking bans.
- Tobacco retailer density was not associated with smoking susceptibility.

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ABSTRACT

Background: Smoking susceptibility has been found to be a strong predictor of experimental smoking. This paper examined which student- and school-level factors differentiated susceptible never smokers from non-susceptible never smokers among a nationally representative sample of Canadian students in grades 9 to 12.

Methods: Student-level data from the 2008–2009 Canadian Youth Smoking Survey were linked with school-level data from the 2006 Census, and one built environment characteristic (the density of tobacco retailers surrounding schools). These data were examined using multilevel logistic regression analyses.

Results: The likelihood of a never smoker being susceptible to smoking significantly varied across schools ($p = 0.0002$). Students in this study were more likely to be susceptible never smokers if they reported low self-esteem, held positive attitudes towards smoking, used alcohol or marijuana, had close friends who smoked, and came from homes without a total ban on smoking. The school location (rural versus urban), the socioeconomic status of the neighbourhood surrounding a school, and the density of tobacco retailers that were located within 1-km radius of each school were not associated with students' smoking susceptibility.

Conclusion: These findings underscore the continued need to develop school-based tobacco use prevention policies and/or programs that enhance students' self-esteem, address tobacco use misinformation and substance use, and include strategies targeting friends who smoke, and students who come from homes without a total ban on smoking.

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1. Introduction

Experts agree that tobacco use continues to be the leading global cause of preventable illness and premature death in the world (World Health Organization, 2013). More than 37 000 people in Canada and

443 000 people in the United States of America die annually from tobacco-caused diseases such as cancer, respiratory infections, diabetes, and coronary heart disease (Canadian Lung Association, 2013; U.S. Department of Health & Human Services, 2012). Since nearly all (88%) first use of cigarettes occurs by 18 years of age, and the vast majority of these teens become addicted to nicotine by young adulthood (U.S. Department of Health & Human Services, 2012), an important cancer control priority is preventing adolescents from initiating tobacco use.

Smoking susceptibility has been found to be a strong predictor of experimental smoking (Pierce, Choi, Gilpin, Farkas, & Merritt, 1996; Wilkinson et al., 2008). Considering that the first step of initiating

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smoking involves having the intention or contemplating the idea of trying smoking (U.S. Department of Health & Human Services, 2012), understanding the factors that differentiate a susceptible never smoker from a non-susceptible never smoker is critical to shaping future tobacco control programs that will dissuade students who are never smokers from smoking. The Theory of Triadic Influence (TTI) (Flay & Petraitis, 1994) postulates that youth smoking behaviour is influenced by a complex system of factors that are categorized into three “streams” namely the intrapersonal (individual factors), social context (an individual’s immediate environment factor), and the socio-cultural environment stream (broader societal factors).

Known intrapersonal factors that are associated with smoking susceptibility among never smokers include being younger (Chen, Bottorff, Johnson, Saewyc, & Zumbo, 2008; Leatherdale, Brown, Cameron, & McDonald, 2005; Okoli, Richardson, Ratner, & Johnson, 2009), being in a lower grade (Okoli et al., 2009; Yang, Leatherdale, & Ahmed, 2011), having positive attitudes toward smoking (Leatherdale, Brown, Cameron, & McDonald, 2005), consuming alcohol or illicit drugs (Okoli et al., 2009; Yang et al., 2011) and low self-esteem (Byrne, Byrne, & Reinhart, 1995). The social context factors associated with smoking susceptibility among never smokers mainly include exposure to close friends (Guindon, Georgiades, & Boyle, 2008; Leatherdale, Brown, Cameron, & McDonald, 2005; Okoli et al., 2009; Yang et al., 2011) or family members who smoke (Guindon et al., 2008; Okoli et al., 2009; Yang et al., 2011), and residing in homes where children are exposed to second-hand smoke (Guindon et al., 2008; Szabo, White, & Hayman, 2006). Broader societal factors that are known to be associated with adolescent susceptibility to smoking include the density of tobacco retailers that surround secondary schools (Chan & Leatherdale, 2011), attending a school where there was student smoking on the school periphery (Leatherdale, Brown, Cameron, & McDonald, 2005), and attending schools with high prevalence of tobacco use (Guindon et al., 2008).

Although previous studies have investigated how student and school factors are associated with adolescent smoking susceptibility, little is known regarding the influence of school location (rural versus urban) and the socioeconomic status (SES) of the neighbourhood surrounding a school on students’ smoking susceptibility when adjusting for student-level factors. Since these school-level factors have previously been found to be associated with *occasional* or *daily* smoking (Chuang, Ennett, Bauman, & Foshee, 2009; Doku, Koivusilta, Rainio, & Rimpela, 2010; McCarthy et al., 2009), we were interested in contributing to literature by assessing whether these factors were also associated with smoking susceptibility among adolescent never smokers.

2. Methods

2.1. Study design

The 2008–2009 Canadian Youth Smoking Survey (2008 YSS) is a machine-readable, pencil and paper nationally representative school-based survey used to measure the determinants of youth smoking behaviour (University of Waterloo, 2009). Detailed information on the sample design, procedures, methods, and survey rates for the 2008 YSS is available (Elton-Marshall et al., 2011; University of Waterloo, 2009). The target populations consisted of all young Canadian residents attending public and private schools in all 10 Canadian provinces (the three territories were excluded). Youth residing in institutions or on First Nation Reserves, and youth attending special schools or schools in military bases were excluded (Elton-Marshall, Leatherdale, Manske, et al., 2011). The sample design was based on a stratified multistage design with schools as primary sampling units and classes as secondary sampling units. Parental permission was required for students to participate. The survey took about 30–40 min to conduct, and to ensure confidentiality, questionnaires were completed anonymously and placed in an envelope that was sealed and placed in a larger classroom envelope.

The University of Waterloo, Office of Research Ethics approved the 2008 YSS methods.

2.2. Participants

The secondary school portion of the YSS survey was administered to 29 296 students in grades 9 to 12 attending 133 secondary schools from all 10 provinces in Canada. The school-level response rate was 59% and the student-level response rate was 73% (Elton-Marshall, Leatherdale, Manske, et al., 2011). This study used the subset of students who were never smokers ($n = 15\,982$).

2.3. Measures

Never smokers were defined as students who reported that they had never smoked a cigarette, not even a puff (University of Waterloo, 2009). Smoking susceptibility was derived using the validated algorithm of Pierce et al. (1996). Only the “never smokers” were eligible to have a smoking susceptibility rating. Susceptibility was measured by asking students: (a) “Do you think in the future you might try smoking cigarettes?” (b) “If one of your best friends were to offer you a cigarette, would you smoke it?” and (c) “At any time during the next year do you think you will smoke a cigarette?” Students responded to these questions on a 4-point Likert Scale. Consistent with Pierce et al. (1996) students who answered ‘definitely not’ to all three questions were considered non-susceptible; the rest were considered susceptible.

The TTI (Flay & Petraitis, 1994) and existing literature were used to guide the selection of the variables that were used in this study. However, variable selection of student-level factors was mainly limited to the variables that were available in the 2008 YSS dataset. The intrapersonal factors (gender, grade, self-esteem, alcohol, marijuana use, tobacco knowledge and attitude measures) and social context measures (friends’ smoking status and rules about smoking in the home) for this study were coded as listed in Table 1. The 2008 YSS dataset was linked with three school neighbourhood characteristics namely (1) school location i.e., rural versus urban data, (2) the density of tobacco retailers that were located within a 1-km radius of each secondary school data, and (3) the median household income data (proxy measure for school neighbourhood SES). Consistent with previous research, (Chuang, Cubbin, Ahn and Winkleby, 2005; Wen, Van Duker, & Olson, 2009) school location (i.e., rural versus urban data) and the median household income data was derived from the school postal codes as described in Table 1. The 2008/09 Desktop Mapping Technologies Inc. [DMTI] and the Enhanced Points of Interest [EPOI] data (ESRI, 2002) provided numeric data regarding the density of tobacco retailers (Table 1). The DMTI-EPOI data was obtained through geocoding the address for each school that participated in the YSS using Arcview 3.3 software (ESRI, 2002). This was followed by creating a 1-km buffer to assess how many tobacco retailers were located within these buffers (i.e., radius surrounding each school in which the different structures of the built environment were quantified). A 1-km radius was selected because it is estimated that it is representative of the distance most high school students would walk to and from their school (Chuang et al., 2005).

3. Data analyses

The multilevel logistic regression analysis was used for this data because it allowed for an understanding of the separate and joint effects of student-level (level-1) and school-level (level-2) factors (Snijders & Bosker, 1999) on susceptibility to smoking among never smokers. Consistent with previous research (Leatherdale, Brown, Cameron, & McDonald, 2005), a three-step modeling procedure was used. Model 1 entailed computing a null model to assess whether there was significant within-cluster interdependence to warrant the use of a multilevel approach. Model 2 was developed to determine the school-level variables that would have a direct effect on the likelihood of a student being a

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