



# The effects of cigarette price and the amount of pocket money on youth smoking initiation and intensity in Canada

Yang Cui<sup>1,2</sup> · Evelyn L. Forget<sup>1,3</sup> · Yunfa Zhu<sup>4</sup> · Mahmoud Torabi<sup>1</sup> · Umut Oguzoglu<sup>3</sup>

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## Abstract

**Objectives** To investigate the price and income elasticities of adolescent smoking initiation and intensity to determine the extent to which increased pocket money leads to greater smoking among youth, and whether higher taxes can mitigate this effect.

**Methods** We used the 2012/2013 Canadian Youth Smoking Survey including students in grades 7–12. The multivariable logistic regression was used to examine the probability of smoking initiation, and a linear regression to examine the smoking intensity determined by province-level prices of cigarettes, pocket money, and a vector of individual characteristics, including age, sex, race, and school-related and psychosocial factors.

**Results** Of respondents, 28.8% have tried cigarette smoking. More than 90% of these initiated smoking between age 9 and 17. Male smokers consumed a higher average number of whole cigarettes daily than did females. The price elasticity of smoking initiation and intensity for youth in the full sample were  $-1.13$  and  $-1.02$ , respectively, which means that a 10% increase in price leads to an 11.3% reduction in initiation and a 10.2% reduction in intensity. The income elasticity of smoking initiation and intensity for youth in the full sample were 0.07 and 0.06, respectively, which means that a 10% increase in income leads to a 0.7% increase in initiation and a 0.6% increase in intensity.

**Conclusion** Economic measures such as taxation that raise the price of cigarettes may be a useful policy tool to limit smoking initiation and intensity.

## Résumé

**Objectifs** Explorer l'élasticité par rapport au prix et au revenu de l'initiation au tabagisme et de son intensité chez les adolescents pour déterminer dans quelle mesure la quantité accrue d'argent de poche mène au tabagisme chez les jeunes et si une taxe supérieure peut atténuer cet effet.

**Méthodes** Nous avons utilisé l'Enquête canadienne 2012-2013 sur le tabagisme chez les jeunes comprenant les étudiants des 7<sup>e</sup> à 12<sup>e</sup> années. On a eu recours à une régression logistique multivariée pour examiner la probabilité de l'initiation au tabagisme et une régression linéaire pour examiner son intensité déterminée par province selon le niveau du prix des cigarettes, de l'argent de poche et du vecteur des caractéristiques individuelles, dont l'âge, le genre, la race, et les facteurs scolaires et psychosociaux.

**Résultats** 28,8 % des répondants ont essayé de fumer la cigarette. Plus de 90 % d'entre eux ont été initiés au tabagisme entre l'âge de 9 et 17 ans. Les fumeurs consommaient un nombre de cigarettes complètes par jour supérieur aux fumeuses. L'élasticité du prix de l'initiation et de l'intensité du tabagisme chez les jeunes de l'échantillon complet était de  $-1,13$  et de  $-1,02$ , respectivement, ce qui signifie qu'une augmentation de 10 % du prix mène à une réduction de l'initiation de 11,3 % et à une réduction de l'intensité de 10,2 %. L'élasticité du revenu de l'initiation au tabagisme et de son intensité chez les jeunes de l'échantillon complet était de 0,07 et de 0,06, respectivement, ce qui signifie qu'une augmentation de 10 % du revenu mène à une augmentation de l'initiation de 0,7 % et à une augmentation de l'intensité de 0,6 %.

✉ Yang Cui  
umcui@myumanitoba.ca

<sup>1</sup> Department of Community Health Sciences, Max Rady College of Medicine, Rady Faculty of Health Sciences, University of Manitoba, Winnipeg, MB R3E 0T6, Canada

<sup>2</sup> George & Fay Yee Centre for Healthcare Innovation, University of Manitoba, Winnipeg, MB, Canada

<sup>3</sup> Department of Economics, Faculty of Arts, University of Manitoba, Winnipeg, MB, Canada

<sup>4</sup> Statistics Canada, Ottawa, ON, Canada

**Conclusion** Les mesures économiques telles la taxation qui augmente le prix de la cigarette peuvent être un instrument politique utile pour limiter l'initiation et l'intensité du tabagisme.

**Keywords** Youth smoking · Cigarette price · Pocket money

**Mots-clés** Tabagisme chez les jeunes · Prix de la cigarette · Argent de poche

## Introduction

Despite strong suggestions from economic theory that higher prices will lead to less consumption of cigarettes, decades of empirical studies from around the world have not shown conclusively that higher prices will lead to lower rates of smoking initiation or less consumption among young people (Bader et al. 2011; Azagba and Sharaf 2011). A large body of research has investigated the impact of either an increased cigarette tax or income on smoking behaviour. To our knowledge, no studies have examined the relative sizes of both price and pocket money effects on youth smoking initiation and intensity. Given that little is known about the relative sizes of the effects, the purpose of this paper is to use the 2012/2013 Youth Smoking Survey (YSS) in Canada to answer the following questions: (1) what are the proportion and characteristics of Canadian youth in grades 7–12 who reported smoking initiation in Canada and each province? (2) What is the price and income elasticity of cigarette smoking initiation and intensity? (3) What is the effect of more pocket money on the amount smoked (conditional on initiation) and on smoking initiation rates?

Price elasticity of demand is a term in economics that is used to measure the relationship between a change in the quantity demanded of a particular good and a change in its price. It measures how much demand is likely to decline if the price paid by consumers increases due to an increase in taxation. Several empirical studies have found that young smokers are more sensitive to tobacco price fluctuation than adult smokers (Azagba and Sharaf 2011; Nargis et al. 2014). Evidence also suggests that gender and ethnicity matter. Males are more responsive to price than females and black youth are more responsive to price than white youth (Azagba and Sharaf 2011). Canadian studies using different surveys also found that decreased cigarette price was significantly associated with higher smoking initiation (Azagba and Sharaf 2011; Zhang et al. 2006). The evidence in the literature, however, is not uniform. For example, two recent studies found that price and tax increases would have little effect on youth smoking initiation (Douglas and Hariharan 1994; Trauras et al. 2001). DeCicca et al. used longitudinal data to examine the dynamics of young adults' decisions about smoking initiation and cessation. They concluded that no evidence was found that higher taxes discourage smoking initiation, but they found some evidence that taxes encourage smoking cessation (DeCicca et al. 2008).

Income elasticity of demand measures the responsiveness of quantity consumed to changes in income. If income elasticity of demand is positive, an increase in income leads to an increase in quantity consumed. Evidence shows that the level of personal income and family socio-economic status (SES) are associated with smoking behaviour among adolescents; that is, adolescents with more pocket money and from low SES background were more likely to be smokers (Perelman et al. 2017; Ma et al. 2013). However, one of these studies (Ma et al. 2013) found that the intensity of smoking is not related to personal income among low SES adolescents. The authors found that adolescents from low SES households were more exposed to smoking by exchanging cigarettes with their friends, weakening the income influence.

This paper investigates the price and income elasticity of demand to determine their relative impacts on smoking initiation and intensity among adolescents in Canada.

## Methods

### Data

This study used nationally representative data collected in 2012/2013 YSS. Detailed information on the survey development, sample design, data collection protocol, and methods of the YSS has been presented elsewhere (Elton-Marshall et al. 2011). The YSS is a biennial, self-reported, nationally generalizable classroom-based, pencil and paper survey that is used to measure the determinants of smoking behaviour among youth. The target population was students in grades 6 to 12 attending public and private schools in the ten Canadian provinces. The survey excludes those living on First Nations reserves, Canada's three northern Territories (Yukon, Nunavut, and Northwest Territories), and those attending special schools (e.g., schools for visually impaired and hearing-impaired individuals) or schools on military bases. The main objective of the YSS is to provide benchmark data on national prevalence rates for students in grades 6 through 12. In addition, it provides a unique opportunity to advance our knowledge of the psychosocial correlates of smoking behaviour, including initiation and cessation. Further, it can assist in exposing individual differences in the influence of tobacco

marketing, purchasing controls, and other policy initiatives. The survey, conducted on behalf of Health Canada by the Propel Centre for Population Health Impact at the University of Waterloo, captured information mainly on tobacco, alcohol, and drug use (Government of Canada 2014).

In the 2012/2013 YSS cycle, nine provinces participated in the survey. Overall, the average school participation rate was 64%, with about 72% of students in these schools completing the questionnaires. The 2012/2013 YSS was administered to 47,203 youths in grades 6 through 12 attending schools (in Quebec, secondary school ends at grade 11). Survey weights were used in the descriptive statistics of student-level characteristics to adjust for differential response rates across regions or groups. As described previously (Elton-Marshall et al. 2011), the development of the survey weight was accomplished in two stages. In the first stage, a weight ( $W_{1j}$ ) was created to account for the school selection within health region and school strata. A second weight ( $W_{2jg}$ ) was calculated to adjust for student non-response. The weights were then calibrated to the provincial gender and grade distribution so that the total of the survey weights by gender, grade, and province would equal the actual enrolments in those groups.

## Measures

### Dependent variables

Students were grouped by grades 7–9 and grades 10–12. The outcome variables in this study included smoking initiation (defined as having ever tried cigarette smoking, even just a few puffs) and smoking intensity. Smoking initiation is a binary variable equal to 1 if the student describes him/herself having ever tried cigarette smoking even just a few puffs, and zero otherwise. Smoking intensity is assessed based on a survey question: “Average number of whole cigarettes smoked on the days that the respondent smoked.” In this sample, the average number of whole cigarettes smoked daily was 5.3 (SD = 5.9).

### Independent variables

In addition to cigarette price, a variety of individual-level explanatory variables were considered. These included sex (male/female); ethnicity (Caucasian/non-Caucasian); province of residence; the amount of pocket money a student usually receives each week to spend or to save (including all money from allowances and jobs like babysitting, delivering papers, etc); days of school missed because of health in the last 4 weeks; school performance in terms of grades in the past year [ranging from high (mostly A’s and B’s/level 3 and 4), to medium (mostly B’s and C’s/level 3), to low (mostly C’s and below/level 1 and 2)]; school attachment according to whether a student felt a part of the school community (agree/disagree); the rules about smoking

at home (total home smoking ban/no home smoking ban); having at least one parent, sibling, or close friend who smokes; and frequency of having five drinks of alcohol or more on one occasion in the last 12 months. In addition, several other variables were also constructed to reflect the characteristics of each respondent. They are daily physical activity ( $\leq 1$  h/ $> 1$  h), daily food choice behaviour ( $\leq 6$  servings of fruits and vegetables/ $> 6$  servings of fruits and vegetables), and a general score to reflect the student’s overall self-esteem (greater or less than the median score of 8). YSS asked the question: “how many minutes of physical activity you did on each of the past 7 days?” The Canadian Society for Exercise Physiology recommend that children and youth aged 5 to 17 accumulate at least 60 min of moderate-to-vigorous intensity aerobic physical activity (MVPA) per day in order to achieve health benefits (The Canadian Society for Exercise Physiology 2016). According to the Guidelines, we categorized daily physical activity as  $< 1$  h and  $\geq 1$  h at least 6 days a week. Additionally, YSS also collected information on how many servings of fruits and/or vegetables (FV) the respondent ate on a usual day.

The YSS data include the province of residence of each respondent. This information is used subsequently to obtain a match with cigarette price data. Unfortunately, the survey does not contain any cigarette price information directly. In order to find retail cigarette prices, the price of cigarettes in 2012 in each province was obtained from the Non-Smokers’ Rights Association (Smoking and Health Action Foundation 2012). The retail price is the average price of a carton of 200 cigarettes, all provincial and federal taxes (including PST and GST) included (Table 1).

### Economic models

First, we analyzed the elasticity of demand for smoking initiation based on the cigarette prices and the availability of weekly spending money. Equation (1) represents the probability of smoking initiation model based on the function ( $f$ ) of cigarette prices and the amount of weekly spending money. The probability of smoking initiation of cigarette smoking by individual  $i$  is determined by the following independent variables: province-level prices of cigarettes ( $Pt$ ), pocket money ( $Mt$ ), and a vector of individual characteristics, including age, sex, race, province, and school-related and psychosocial factors ( $Di$ ). Second, we analyzed the elasticity of demand for smoking intensity based on the price and the availability of weekly spending money. The dependent variable of Eq. (2) is the log of the average number of whole cigarettes smoked on the days that the respondent smoked ( $Qt$ ), and it is estimated using a linear regression model. The explanatory variables are those described above.

$$\begin{aligned} \text{PROB}(\text{smoking initiation} = 1) & \\ &= f(\log(Pt), M(t), Di) \end{aligned} \quad (1)$$

**Table 1** Cigarette price and tax rates per 200 cigarettes in Canada, as of November 2012

Province	Pre-tax price	Total tobacco tax <sup>a</sup>	Total retail price
Newfoundland and Labrador	\$27.90	\$65.78	\$93.68
Prince Edward Island	\$28.11	\$72.60	\$100.71
Nova Scotia	\$29.35	\$73.45	\$102.80
New Brunswick	\$19.42	\$60.15	\$79.57
Quebec	\$30.49	\$46.46	\$76.95
Ontario	\$29.46	\$50.95	\$80.41
Saskatchewan	\$29.17	\$67.82	\$96.99
Alberta	\$27.48	\$61.22	\$88.70
British Columbia	\$31.13	\$64.22	\$95.35

Source: Smoking and Health Action Foundation, Ottawa, 2012

<sup>a</sup> Including federal excise tax, provincial excise tax, provincial sale tax or harmonized sales tax, and federal GST

$$\log(Qt) = f(\log(Pt), M(t), Di) \quad (2)$$

In order to calculate the elasticity for smoking initiation and intensity, first, we differentiated with respect to price and pocket money from the equations, respectively, aiming to find  $dP/d$  (price). Then, the price elasticity of demand for smoking initiation ( $E_p$ ) is equal to:

$E_p = dP/d$  (price)  $\times$  average cigarette price/the population probability of smoking.

The income elasticity for smoking initiation is:

$E_{inc} = dP/d$  (income)  $\times$  average income/the population probability of smoking.

The elasticity of demand for smoking intensity ( $E_I$ ) is calculated by:

$E_{I1} = d$  (smoking quantity)/smoking quantity/( $d$  (price)/price).

The income elasticity for smoking intensity is:

$E_{I2} = d$  (smoking quantity)/smoking quantity/( $d$  (income)/income).

All regression results and the descriptive analysis are population weighted using the survey weights to produce

population estimates and adjust for unequal probabilities of selection. All analyses were carried out using SAS version 9.3 (SAS Institute Inc., Cary, NC) (SAS Institute Inc 2011).

## Results

A total of 41,057 students completed questionnaires in 2012/2013 YSS. Of these, 28.8% have ever tried cigarette smoking, even just a few puffs. The estimated prevalence of current cigarette smoking among youth was 5.1% overall. The prevalence was higher in New Brunswick and Saskatchewan compared to the rates of British Columbia and Ontario (Table 2). Table 3 shows the weighted descriptive statistics of smoking initiation by sex for the key variables used in this study. The weighted sample characteristics showed that 9.4% are current daily smokers and 9.8% are current occasional smokers. More than 90% initiated smoking between age 9 and 17. Male smokers have higher average number of whole cigarette smoking daily than the females. Approximately 63% reported having five or more drinks of alcohol on one occasion during the past 12 months. Compared to other provinces, Ontario has a higher smoking initiation rate.

**Table 2** Weighted prevalence (%) of current smoker among youth in grades 7–12 by provinces and territories

	Weighted prevalence	Lower 95% CI	Upper 95% CI
Newfoundland and Labrador	7.15	4.07	10.22
Prince Edward Island	7.73	5.89	9.57
Nova Scotia	5.98	2.84	9.13
New Brunswick	10.24	7.84	12.65
Quebec	6.07	3.25	8.88
Ontario	4.53	2.19	6.88
Saskatchewan	8.56	3.75	13.36
Alberta	4.42	2.90	5.94
British Columbia	3.97	0.71	7.23
Canada	5.12	3.73	6.50

Data source: 2012/13 Canadian Youth Smoking Survey

**Table 3** Weighted percentage (95% CI) of sample characteristics of smoking initiation, 2012/13 YSS

Characteristics	Male	Female	Total
<b>Demographic</b>			
Grade			
7–9	31.00 (26.16–35.84)	30.18 (25.43–34.93)	30.63 (26.17–35.09)
10–12	69.00 (64.16–73.84)	69.82 (65.07–74.57)	69.37 (64.91–73.83)
Province of residence			
Newfoundland and Labrador	1.48 (1.09–1.87)	1.52 (1.06–1.98)	1.50 (1.10–1.89)
Prince Edward Island	0.58 (0.47–0.68)	0.52 (0.40–0.65)	0.55 (0.45–0.66)
Nova Scotia	2.56 (2.00–3.13)	2.85 (1.91–3.78)	2.69 (2.02–3.36)
New Brunswick	3.18 (2.64–3.71)	3.65 (2.94–4.36)	3.39 (2.83–3.95)
Quebec	25.62 (20.67–30.57)	25.85 (20.21–31.49)	25.72 (20.65–30.79)
Ontario	41.03 (34.85–47.22)	40.58 (32.38–48.78)	40.83 (34.05–47.61)
Saskatchewan	4.35 (3.28–5.42)	4.66 (3.13–6.20)	4.49 (3.24–5.73)
Alberta	10.44 (8.29–12.59)	10.12 (7.07–13.17)	10.30 (7.84–12.76)
British Columbia	10.77 (5.51–16.04)	10.25 (1.26–19.24)	10.54 (3.65–17.42)
Ethnicity/race			
Caucasian	72.08 (66.18–77.97)	75.31 (69.16–81.45)	73.53 (67.84–79.21)
Visible minority	27.92 (22.03–33.82)	24.69 (18.55–30.84)	26.47 (20.79–32.16)
Weekly spending money			
\$0	13.06 (11.19–14.92)	13.06 (11.43–14.68)	13.06 (11.73–14.38)
\$1–\$40	39.13 (36.40–41.85)	39.64 (35.48–43.81)	39.36 (36.49–42.22)
\$41–\$100	12.09 (9.39–14.80)	12.34 (10.70–13.97)	12.20 (10.24–14.17)
More than \$100	21.34 (18.55–24.13)	17.61 (13.75–21.47)	19.67 (16.87–22.46)
Not stated	14.28 (12.10–16.67)	17.35 (15.32–19.34)	15.71 (14.04–17.39)
<b>Smoking-related</b>			
Cigarettes smoking status			
Current daily smoker	10.50 (8.21–12.80)	7.97 (5.85–10.08)	9.36 (7.50–11.23)
Current occasional smoker	10.82 (8.55–13.09)	8.47 (5.87–11.08)	9.77 (7.83–11.71)
Former daily smoker	2.45 (1.29–3.62)	2.22 (1.49–2.94)	2.35 (1.68–3.01)
Former occasional smoker	0.63 (0.12–1.14)	0.14 (0.01–0.28)	0.41 (0.11–0.71)
Experimental smoker	12.96 (11.42–14.51)	16.17 (14.07–18.27)	14.40 (13.01–15.79)
Past experimental smoker	22.11 (20.39–23.82)	22.78 (18.60–26.97)	22.41 (20.43–24.39)
Puffer	40.52 (36.00–45.05)	42.25 (38.43–46.06)	41.30 (38.06–44.53)
<b>Alcohol-related</b>			
Frequency of having 5 drinks of alcohol or more on one occasion in the last 12 months			
Never	38.51 (33.49–43.54)	35.03 (29.26–40.81)	36.95 (31.95–41.96)
Daily	2.15 (1.19–3.12)	0.91 (0.19–1.62)	1.59 (0.93–2.26)
1–5 times a week	11.02 (7.24–14.80)	8.80 (7.19–10.40)	10.02 (7.53–12.52)
Less than once a month	19.28 (16.73–21.82)	25.34 (21.44–29.23)	21.99 (20.12–23.86)
1–3 times a month	29.04 (26.08–32.00)	29.93 (26.08–33.78)	29.44 (26.85–32.03)
Age of initiation (first tried smoking cigarettes, even just a few puffs)			
8 years or younger	8.67 (7.12–10.23)	4.73 (3.48–5.99)	6.86 (5.66–8.06)
9–14	60.64 (57.16–64.11)	59.82 (54.35–65.28)	60.26 (56.36–64.16)
15–17	30.08 (26.74–33.42)	34.81 (29.46–40.15)	32.26 (28.45–36.07)
18 years and older	0.61 (0.15–1.08)	0.64 (0.12–1.15)	0.63 (0.31–0.94)
Smoked 100 or more whole cigarettes in your life			
Yes	24.41 (20.83–27.98)	18.80 (14.90–22.70)	21.89 (18.68–25.10)
No	75.59 (72.02–79.17)	81.20 (77.30–85.10)	78.11 (74.90–81.32)
Average number of whole cigarettes smoking daily			
Mean (SE)	5.29 (3.22)	4.17 (1.48)	4.84 (2.20)
<b>School-related</b>			
Days of school missed in the last 4 weeks because of health			
0 days	65.44 (62.62–68.23)	51.63 (46.67–56.59)	59.23 (56.46–62.00)
1–5 days	30.36 (27.64–33.08)	42.55 (38.18–46.91)	35.84 (33.32–38.37)
6 or more days	4.20 (2.97–5.42)	5.82 (4.35–7.29)	4.93 (3.83–6.03)
School performance (grades)			
Level 4 and 5	54.83 (48.79–60.86)	65.07 (60.32–69.82)	59.43 (54.68–64.17)



**Table 3** (continued)

Characteristics	Male	Female	Total
Level 3	32.93 (27.38–38.47)	25.44 (22.00–28.89)	29.56 (25.71–33.42)
Level 1 and 2	12.25 (10.38–14.11)	9.49 (7.53–11.45)	11.01 (9.51–12.50)
<b>Psychosocial</b>			
Overall self-esteem score			
≤ 8 (median)	28.81 (25.23–32.38)	55.25 (52.09–58.41)	40.67 (37.90–43.44)
9–12	71.19 (67.62–74.77)	44.75 (41.59–47.91)	59.33 (56.56–62.10)
I feel I am part of my school			
Strongly agree/agree	71.25 (67.54–74.96)	77.67 (74.25–81.08)	74.75 (71.64–77.86)
Strongly disagree/disagree	28.75 (25.04–32.46)	22.33 (18.92–25.75)	25.25 (22.14–28.36)
The rules about smoking in your home			
Total home smoking ban	68.73 (63.31–74.14)	68.83 (64.89–72.78)	68.78 (64.60–72.97)
No total home smoking ban	31.27 (25.86–36.69)	31.17 (27.22–35.11)	31.22 (27.03–35.40)
At least one parent/guardian smokes			
Yes	55.57 (50.95–60.19)	57.48 (51.45–63.52)	56.44 (52.07–60.82)
No	44.43 (39.81–49.05)	42.58 (36.48–48.55)	43.56 (39.18–47.93)
At least one sibling smokes			
Yes	29.79 (25.13–34.46)	33.61 (30.14–37.07)	31.53 (27.74–35.32)
No	70.21 (65.54–74.87)	66.39 (62.93–69.86)	68.47 (64.78–72.26)
At least one close friend smokes			
Yes	66.16 (61.58–70.74)	67.21 (63.30–71.12)	66.64 (62.84–70.44)
No	33.84 (29.26–38.42)	32.79 (28.88–36.70)	33.36 (29.56–37.16)
Daily physical activity at least 6 days in a week (e.g., running, bike riding, soccer, skating, etc.)			
< 1 h	70.97 (67.56–74.38)	87.12 (84.53–89.72)	78.22 (75.46–80.97)
≥ 1 h	29.03 (25.62–32.44)	12.88 (10.28–15.47)	21.78 (19.03–24.54)
Food choice behaviour (servings of fruits and vegetables to eat daily)			
≤ 6	85.56 (82.66–88.46)	87.25 (84.92–89.59)	86.33 (84.37–88.29)
> 6	14.44 (11.54–17.34)	12.75 (10.41–15.08)	13.67 (11.71–15.63)
Weighted observations	326,591	265,801	592,392

Data source: 2012/2013 Canadian Youth Smoking Survey

The price and income elasticity of cigarette initiation is presented in Table 4. We presented the full model for the overall sample and two separate groups based on different school grades. The coefficient estimates for cigarette prices are statistically significant in all equations indicating that the price of cigarettes has a significantly negative impact on smoking initiation. These estimates illustrate that higher cigarette prices will significantly reduce smoking initiation for youth. The price elasticity of smoking initiation for youth in the full sample is  $-1.13$ , showing that a 10% increase in cigarette price would reduce smoking initiation by 11.3%. Compared to students in grades 10–12, the result reveals that students in grades 7–9 are more responsive to cigarette prices. If the price increases 10%, it would lead to a 15.7% reduction in smoking initiation among younger students.

With regard to pocket money, the coefficient estimates of pocket money for smoking initiation were also statistically significant for all equations. Therefore, the amount of pocket money is a significant predictor for youth smoking initiation. If a student has more pocket money, it will result in a slightly higher probability of smoking initiation. For example, for all students in grades 7–12, a 10% increase in pocket money would increase

the smoking initiation rate by 0.7%. The elasticity of students in grades 7–9 and grades 10–12 are the same, which means a 10% increase in pocket money would lead to a 0.5% increase in smoking initiation for subgroups. While significant and positive, these effects are much smaller in magnitude than the response of smoking to the price of cigarettes. In addition, factors such as being females, Caucasians, having better school performance, no parent/guardian smokers, no sibling smokers, no close friend smokers, having a home smoking ban, missing fewer school days due to health, and having strong school attachment are found to be significantly associated with the reduction of smoking initiation for the full sample and subgroups.

Turning next to the smoking intensity model, Table 5 shows the price and income elasticity of smoking intensity. The coefficient estimate of price was also significantly negative for the subgroups and the full sample. The price elasticity of smoking intensity for students in grades 7–12 is  $-1.02$ , indicating that a 10% increase in price for a carton of 200 cigarettes would correspond to a 10.2% decrease in the average number of whole cigarettes smoked by smokers. We found greater price sensitivity among younger students, with price elasticity of  $-1.93$  for students in grades 7–9 and  $-0.76$  for students in grades 10–12.

**Table 4** Odds ratio (95% CI) from smoking initiation models

Regression variables	Grades 7–9 OR (95% CI)	Grades 10–12 OR (95% CI)	All OR (95% CI)
Female	0.72*** (0.70–0.75)	0.83*** (0.80–0.86)	0.80*** (0.78–0.82)
Caucasian	0.71*** (0.66–0.76)	0.73*** (0.70–0.77)	0.72*** (0.69–0.74)
Log (cigarette prices)	0.15*** (0.11–0.21)	0.25*** (0.20–0.32)	0.21*** (0.16–0.26)
Weekly pocket money	1.07*** (1.05–1.08)	1.08*** (1.07–1.09)	1.10*** (1.09–1.11)
Province (British Columbia as reference)			
Ontario	1.25** (1.06–1.47)	1.09 (0.93–1.28)	1.10 (0.96–1.27)
Others <sup>a</sup>	2.05*** (1.77–2.38)	1.26*** (1.10–1.44)	1.40*** (1.25–1.58)
School performance (level 1 and 2 as reference)			
Level 3–4	0.43*** (0.38–0.49)	0.41*** (0.38–0.45)	0.42*** (0.40–0.45)
Level 3	0.77*** (0.65–0.90)	0.83*** (0.76–0.90)	0.81*** (0.75–0.89)
Self-esteem score $\leq 8$	1.39*** (1.32–1.46)	1.02 (0.97–1.07)	1.12*** (1.08–1.16)
Frequency of having 5 drinks of alcohol or more on one occasion in the last 12 months (never as reference)			
Daily	22.84*** (16.33–31.95)	9.17*** (6.36–13.22)	11.51*** (8.43–15.82)
1–5 times a week	12.55*** (9.52–16.53)	9.77*** (8.51–11.22)	11.63*** (10.15–13.33)
1–3 times a month	7.27** (6.50–8.13)	6.17*** (5.80–6.57)	7.47*** (7.16–7.80)
Less than once a month	4.21*** (3.90–4.54)	2.94*** (2.77–3.12)	3.71*** (3.52–3.91)
Missing school days due to health (6 or more days as reference)			
No missing school days	0.56*** (0.46–0.67)	0.58*** (0.50–0.68)	0.58*** (0.52–0.65)
1–5 days	0.61*** (0.51–0.72)	0.66*** (0.57–0.77)	0.65*** (0.58–0.73)
Has home smoking ban	0.65*** (0.60–0.70)	0.63*** (0.59–0.67)	0.64*** (0.61–0.68)
No parent/guardian smokes	0.59*** (0.54–0.65)	0.71*** (0.69–0.74)	0.68*** (0.66–0.70)
No one sibling smokes	0.46*** (0.43–0.48)	0.57*** (0.54–0.60)	0.52*** (0.50–0.54)
No one close friend smokes	0.16*** (0.15–0.17)	0.28*** (0.27–0.30)	0.22*** (0.21–0.23)
School attachment (strongly agree/agree)	0.68*** (0.64–0.74)	0.73*** (0.69–0.77)	0.68*** (0.65–0.71)
Daily physical activity < 1 h	1.19*** (1.11–1.28)	0.89*** (0.83–0.96)	0.97 (0.92–1.02)
Fruit and vegetable servings $\leq 6$	1.05 (0.99–1.12)	1.45*** (1.37–1.52)	1.32*** (1.26–1.38)
Price elasticity	–1.57	–0.82	–1.13
Income elasticity	0.05	0.05	0.07
Weighted observations	674,610	717,533	1,392,143

Data source: 2012/13 Canadian Youth Smoking Survey

\*Significance at 10% level; \*\*significance at 5% level; \*\*\*significance at 1% level

<sup>a</sup>Including Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Saskatchewan, Alberta

This finding suggests that younger smokers are particularly affected by cigarette prices, which means that a higher price will encourage them to smoke fewer cigarettes. Furthermore, school performance, a home smoking ban, parent, sibling, and close friend smoking status, school attachment, fruit and vegetable servings, frequency of excess alcohol consumption, and missed school days due to health are significant in determining smoking intensity for youth in grades 7–12.

Weekly pocket money is found to have a positive and significant impact on smoking intensity in the subgroup and the full sample. We found if individual young smokers have more money available, then they are likely to have higher initiation rates and to smoke more cigarettes ( $p < 0.001$ ). The income elasticity is 0.06, suggesting a 10% increase in pocket money will correspond to a 0.6% increase in cigarette consumption.

The income elasticity estimates for students in grades 7–9 and grades 10–12 are very close, ranging from 0.02 to 0.06.

## Discussion

In this paper, we examined the effects of cigarette prices and the amount of pocket money on youth smoking initiation and intensity among students in grades 7 to 12 in Canada. Our price elasticity measures the degree of responsiveness of cigarette demand with respect to the price changes; our income elasticity measures the responsiveness of cigarette demand with respect to the change in individual student's weekly pocket money. Consistent with several previous studies (Azagba and Sharaf 2011; Zhang et al. 2006; Rudatsikira et

**Table 5** Smoking intensity models

Regression variables	Grades 7–9 Estimate (S.E.)	Grades 10–12 Estimate (S.E.)	All Estimate (S.E.)
Female	−0.37*** (0.04)	−0.15*** (0.02)	−0.20*** (0.02)
Caucasian	−0.06 (0.07)	0.08*** (0.02)	0.08*** (0.02)
Log (cigarette prices)	−1.93*** (0.19)	−0.76 *** (0.12)	−1.02*** (0.14)
Weekly pocket money	0.02** (0.01)	0.06*** (0.01)	0.06*** (0.01)
Province (British Columbia as reference)			
Ontario	−0.42*** (0.08)	0.21*** (0.05)	0.10* (0.05)
Others <sup>a</sup>	−0.19*** (0.05)	0.21*** (0.04)	0.12*** (0.04)
School performance (level 1 and 2 as reference)			
Level 3–4	0.15* (0.08)	−0.33*** (0.03)	−0.21*** (0.03)
Level 3	0.04 (0.06)	−0.21*** (0.04)	−0.15 *** (0.03)
Self-esteem score ≤ 8	−0.31*** (0.05)	0.01 (0.02)	−0.08*** (0.02)
Frequency of having 5 drinks of alcohol or more on one occasion in the last 12 months (never as reference)			
Daily	0.12* (0.06)	−0.01 (0.05)	−0.02 (0.05)
1–5 times a week	−0.03 (0.06)	0.05 (0.05)	0.01 (0.05)
1–3 times a month	0.48*** (0.06)	0.43*** (0.04)	0.42*** (0.04)
Less than once a month	1.12*** (0.17)	0.94*** (0.04)	0.95*** (0.06)
Missing school days due to health (6 or more days as reference)			
No missing school days	−0.13* (0.07)	−0.23*** (0.03)	−0.24*** (0.02)
1–5 days	−0.21*** (0.07)	−0.23*** (0.04)	−0.26 *** (0.04)
Has home smoking ban	0.05 (0.05)	−0.28*** (0.03)	−0.18*** (0.02)
No parent/guardian smokes	−0.40*** (0.05)	−0.21*** (0.03)	−0.25*** (0.02)
No one sibling smokes	−0.25*** (0.06)	−0.07*** (0.02)	−0.11*** (0.02)
No one close friend smokes	0.03 (0.11)	−0.09*** (0.05)	−0.09** (0.05)
School attachment (strongly agree/agree)	0.04 (0.03)	−0.16*** (0.03)	−0.13*** (0.02)
Daily physical activity < 1 h	−0.22*** (0.05)	−0.01 (0.02)	−0.07** (0.02)
Fruit and vegetable servings ≤ 6	0.24*** (0.07)	0.07** (0.03)	0.12 *** (0.03)
Price elasticity	−1.93	−0.76	−1.02
Income elasticity	0.02	0.06	0.06
Weighted observations	19,338	64,297	83,635

Data source: 2012/13 Canadian Youth Smoking Survey

\*significance at 10% level; \*\*significance at 5% level; \*\*\*significance at 1% level

<sup>a</sup> Including Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Saskatchewan, Alberta

al. 2009), our findings suggest that both cigarette prices and amount of pocket money will have a significant impact on youth smoking onset and the quantity of cigarette smoke. The negative price elasticity of smoking initiation suggests that increasing the price of cigarettes would significantly lower the rate of youth smoking initiation. Especially for younger students in grades 7–9, a small change in cigarette price would also result in a big reduction in quantity consumed. For example, the total elasticity of cigarette demand is −3.5 (sum of the elasticities of smoking initiation and conditional demand intensity), implying that the demand is highly price elastic for this subgroup.

Compared to the cigarette price, the amount of pocket money is relatively inelastic for cigarette demand. Our findings

show that the amount of pocket money is positively correlated with youth smoking initiation and smoking intensity although the elasticity of smoking initiation and intensity to pocket money is weak compared to price. This suggests that attempts to control smoking among young people by curtailing their access to pocket money will have much less impact on youth smoking rates than will the simple policy expedient of raising prices through taxation.

Cigarette and alcohol consumption often develop concurrently, people who drink alcohol often also smoke and vice versa. We found that the frequency of excessive alcohol consumption is strongly associated with smoking behaviour. Therefore, smoking cessation intervention should also focus on youth with substance abuse problems. Previous studies



(Middaugh et al. 2012; Dubowitz et al. 2008) have shown that FV consumption is positively correlated with family income. We chose FV consumption as a proxy measure of family income because YSS did not contain this information. In addition, research (Haibach et al. 2013) has suggested that higher FV consumption was associated with fewer cigarettes smoked per day and FV consumption may be protective against cigarette smoking. Not surprisingly, we found lifestyle factors such as unhealthy diet and inadequate daily physical activity were also associated with smoking initiation and intensity. These findings suggest that the relationship between lifestyle and smoking could be mediated through social economic status (Wardle and Steptoe 2003; Soteriades and DiFranza 2003). Our study also revealed that school performance and attachment are related to smoking initiation after controlling for individual characteristics and other factors. Those students who do well in school, have high academic performance, and are committed to school are less likely to smoke than students who do not.

In line with other previous studies (Bricker et al. 2006; Bricker et al. 2009), besides controlling for individual characteristics, such as sex and race, this study found social influence is associated with youth smoking behaviour. Having a parent, sibling, and/or close friend who smoke is associated with a significantly higher risk of smoking initiation and intensity in youth. In particular, we found that having close friends who smoke is the strongest predictor of youth smoking initiation. Since the effect size of peer influence on individual's smoking initiation is large, population-based prevention/intervention programs for reducing the smoking burden in youth may need to focus on peer pressure.

There are limitations to this study. First, the YSS is self-reported; thus, recall bias is unknown. For example, the students were asked about events occurring during the past months, and their recall could be incorrect. Second, the YSS does not collect information such as household income, parents' characteristics, student employment status, school tobacco prevention programs, etc., which may be important factors not adjusted in the analysis. Third, this study used cross-sectional data; therefore, the temporal relationship between the outcome and factors cannot be drawn. Fourth, the use of cross-sectional data to derive elasticities could also lead to biased results. Ideally, we would use longitudinal or repeated cross-sectional data to derive elasticities, but our data source was a single cross section. Therefore, we derived price elasticities by exploiting provincial differences in prices at a point in time. However, there could be omitted variables related to cultural or other differences between provinces that are partly responsible for the observed differences. Despite the limitations, this study provides interesting insights that we should note. For example, the levels of physical activity, school performance and attachment, and fruit and vegetable servings are associated with youth tobacco use.

## Conclusion

The findings from this study have important policy implications for smoking initiation and consumption among Canadian youth, and particularly for youth in grades 7–9. The positive income elasticity of demand suggests that youth with access to more spending money are both more likely to be smokers and, among those who are smokers, to smoke more. The effects are modest, but significant. However, our results also suggest that the association between cigarette prices and tobacco use is particularly strong among young people; we found that a 10% increase in cigarette price would reduce smoking initiation by 11.3%. These results are consistent with other studies that focus on smoking initiation and consumption among youth (Zhang et al. 2006; Nargis et al. 2014; Rudatsikira et al. 2009). Since the onset of smoking behaviour usually occurs during the teen years and younger smokers are more price sensitive, economic measures such as taxation that raise the price of cigarettes may be a useful policy tool to limit smoking initiation and intensity. In addition, since family and close friends who smoke are strong predictors for youth smoking behaviour, smoking prevention in the school and community should be designed to increase awareness of healthy lifestyle and help students manage peer pressure and influence on smoking.

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## Compliance with ethical standards

**Ethics approval** Prior to conducting this research project, application for ethics approval was made to the University of Manitoba, Bannatyne Campus, Research Ethics Board in August 2015. The Health Research Ethics Board (HREB) approved it on August 17, 2015 (Ethics Reference number H2015:332)

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