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How are adolescents getting their vaping products? Findings from the international tobacco control (ITC) youth tobacco and vaping survey



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HIGHLIGHTS

- We report sources of vaping products reported from a 2017 web-based survey of 12,128 adolescents.
- 7.5% of adolescents had purchased a vaping product in the past year.
- Vape shops were the mostly commonly reported location for buying a vaping product.
- Purchasing was more common by those who vape more frequently and by those of legal age.
- A regulatory balance is needed to restrict access to nonsmokers while allowing access to smokers.

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ABSTRACT

Objective: To examine the sources of vaping products reported by adolescents, and the characteristics of adolescents who reported purchasing a vaping product in the past year in the United States (US), Canada (CA), and England (EN).

Methods: Data were from the 2017 ITC Youth Tobacco and Vaping Survey, a web-based survey of 12,128 respondents aged 16–19 years recruited from commercial panels in the US, CA, and EN. Respondents who have vaped in the past 12 months were asked whether they had purchased a vaping product, and from where (vape shop, online, retail), as well as whether anyone refused to sell them a vaping product because of their age. Respondents who reported vaping in the past 30 days were asked where they had obtained their vaping product from a social and/or commercial source.

Results: Only about 7.5% of respondents reported having purchased a vaping product in the past year. Among those who had vaped in the past year, 32.6% reported having purchased a vaping product in the past year. Purchasing prevalence was significantly higher among US respondents compared to those from CA and EN; purchase prevalence was also higher among Canadian adolescents than respondents from England. The most commonly reported purchase location for vaping products in all counties was vape shops. Among past 30-day vapers, 42.5% reported getting their vaping products only from social sources, 41.4% only from commercial sources, and 13.4% from both types of sources. Purchasing a vaping product in the past year was associated with being male, of legal age to buy tobacco and vaping products, and greater frequency of smoking and vaping in the past 30 days.

Conclusions: Most adolescents have not purchased a vaping product, but among those who had, vape shops were the mostly commonly reported location for buying a vaping product. Purchasing of a vape product was more commonly reported by those who vape more frequently and by those of legal age to buy a vaping product.

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1. Introduction

The sales of nicotine vaping products, also referred to as e-cigarettes, have increased exponentially over the past decade, and such products have become popular aids to support smokers in transitioning off cigarettes in some countries (Beard et al., 2016; Caraballo et al., 2017; Gravely et al., 2014; McMillen et al., 2015). One concern with the rapid increase in popularity of nicotine vaping is that non-smokers, and those who would otherwise never have taken up smoking, may transition to smoking if they begin vaping (Hammond et al., 2019). Several studies have shown a positive association between vaping and later trying smoking, although it is unclear if the association is causal or due to a common shared characteristic of adolescents who are more prone to take risks and experiment with smoking, nicotine vaping, and other drugs (Leventhal et al., 2015; Hammond et al., 2017; Levy et al., 2019; Vanyukov et al., 2012). It is widely recognized that while people smoke for the nicotine, the toxic smoke in combustible tobacco products is the main cause of tobacco-related diseases which are responsible for 1 in 2 premature deaths in long-term smokers (Center and for Chronic Disease Prevention and Health Promotion (US) Office on Smoking and Health, 2014). While nicotine vaping is not harmless, two recent comprehensive reviews of the scientific evidence concluded that nicotine vaping is less risky than using combustible tobacco cigarettes (National Academies of Sciences, Engineering, and Medicine, 2018; McNeill et al., 2018). However, these reviews and other studies have made it clear that the use of nicotine in any form, but especially aerosolize nicotine inhaled into the airways, is a concern for nonsmokers of any age since it could lead to nicotine addiction with unknown long-term health consequences (National Academies of Sciences, Engineering, and Medicine, 2018; McNeill et al., 2018; Song et al., 2019). On the other hand, an addicted smoker who is struggling to get off cigarettes, might find a nicotine containing e-cigarette an acceptable trade-off to continued smoking. Randomized trials have demonstrated that some nicotine-containing e-cigarettes are as/or more effective for smoking cessation compared to nicotine patches (Hartmann-Boyce et al., 2016; Walker et al., 2020; Hajek et al., 2019). Therefore, while substitution of e-cigarettes has potential for reducing smoking among adults who are already addicted to nicotine, in the context of youth, the question is how to maintain reductions in smoking without increase use of other nicotine products.

Public health authorities are concerned about the apparent surge in e-cigarette use by never smoking adolescents (Hammond et al., 2017; Fairchild et al., 2019). Nicotine exposure from any source is a concern during the teenage years, since the adolescent brain is still developing and is vulnerable to the development of nicotine dependence (Yuan et al., 2015; Slotkin, 2002). However, calls for a complete prohibition on the sale of nicotine containing e-cigarettes may be counterproductive to public health (Fairchild et al., 2019). The recent outbreak of e-cigarette or vaping associated lung injury (EVALI) in the United States provides a cautionary lesson: EVALI is primarily attributable to vitamin E acetate in cannabis oils distributed through illicit channels (Blount et al., 2019). Prohibiting the sale of nicotine containing e-cigarettes may have the effect of driving some consumers back to smoking and/or to acquisition of unregulated products through illicit channels (Fairchild et al., 2019).

In response to the youth vaping problem the United States Congress recently raised the federal legal minimum legal age for buying tobacco products to 21 years in December 2019 (Howard, 2019). Prior to that time 19 states and over 100 jurisdictions had already raised the minimum legal age for the sale of tobacco to 21 years (Public Health Law Center, 2019; Campaign for Tobacco Free Kids, xxxx). In Canada, six provinces have increased the legal age for buying tobacco from 18 to 19 years of age, and one province recently passed legislation to increase the minimum age to 21 years (Non-Smokers' Rights Association/Smoking and Health Action Foundation, 2018; Canadian Cancer Society, 2019).

Prior studies have shown that adolescents and/or young adults starting to purchase cigarettes for themselves is predictive of continued smoking into adulthood, and a sign of smoking dependence (Hawkins et al., 1992). In order to tailor regulations to reduce underage use and purchase of nicotine-containing products, it would be helpful to know where youth get their vaping products. Several recent reports have found shown that youth in the US report getting their vaping products primarily from social sources (Kong et al., 2017; Meyers et al., 2017; Pepper et al., 2019). Among youth who have reported purchasing vaping products the most commonly reported sources for buying vaping devices and/or e-liquids were vape shops and online (Kong et al., 2017; Meyers et al., 2017; Pepper et al., 2019). However, international comparisons on where adolescents report getting their vaping products are lacking. In this study, we examine the sources of vaping products reported by adolescents, the potential impact of minimum purchase age laws on acquiring vaping products, and the potential differences in the characteristics of adolescents who purchased a vaping product in the past year and those who did not, in the US, Canada (CA), and England (EN).

2. Methods

2.1. Survey

Data are from the first wave of the International Tobacco Control Policy Evaluation Project (ITC) Youth Tobacco and Vaping Survey, conducted in the US, CA and EN. The online survey was conducted in July to August 2017. The same methods and recruitment protocols were used in all three countries (Non-Smokers' Rights Association/Smoking and Health Action Foundation, 2018). Respondents were recruited from online panels in each country maintained by Nielsen Consumer Insights. The Nielsen panels are recruited using both probability and non-probability sampling methods in each country. Eligible respondents included adolescents aged 16 through 19. We identified target sample sizes of 4500 for each country. Respondents were recruited either directly or through their parents. Email invitations (with a unique link) were sent to a random sample of panelists (after targeting for age criteria); panelists known to be ineligible were not invited. Nielsen also contacted panelists known to be parents; those who confirmed they had one or more children aged 16–19 living in their household were asked for permission for their child to complete the survey (if more than one, specifically the one whose birthday was next). Of those invited to the study, 9.4% accessed the survey link, and 39% of those who accessed the link completed the survey. After eligibility screening, we provided potential respondents with information about the study and asked them to provide consent to participate. A restriction on small screen size was applied to ensure that images presented in the survey could be viewed with a minimum amount of scrolling or distortion.

A total of 13,468 respondents completed the survey. After performing data integrity checks, the final sample included 12,128 respondents. Additional details of the study methods can be found in the technical report (Hammond et al., 2017).

2.2. Measures

Respondents were asked about their use of vaping products. Those who reported having ever vaped were asked, "When was the last time you used an e-cigarette/vaped?" Response categories included: a) earlier today, b) not today but sometime in the past 7 days, c) not in the past 7 days but sometime in the past 30 days, d) not in the past 30-days but sometime in the past 6 months, e) not in the past 6 months, but sometime in the past year, f) 1 to 4 years ago, g) 5 or more years ago, h) don't know, or i) refused. These categories were recoded into vaped in the past 30 days (Yes/No). Those who vaped in the past 30 days were asked how many days they vaped in the past 30 days and coded as vaped ≥ 20 days in the past 30 days. Respondents who reported vaping

in the past 12 months were asked if, in the past 12 months, they had purchased a vaping product, and if they had been refused the sale of a vaping product because of their age. Those who reported purchasing a vaping product in the last 12 months were asked, “Where have you bought an e-cigarette/vaping device, cartridge, or e-liquid in the past 12 months?” with the following multiple response options offered: a) from a vape shop, b) from a regular [store/shop] (convenience, [gas station/newsagents], supermarket, etc.), c) from a [pharmacy/chemist] d) from the internet, e) from a friend or family member, f) from someone else, g) some other place, h) don’t know, and i) refused.

Respondents who had ever vaped were asked, “Which of the following types of e-cigarettes/vaping devices have you ever tried?” Respondents could select any of the three options that applied: a) e-cigarette/vaping device with a tank that you fill with liquid; b) e-cigarette/ vaping device with replaceable pre-filled cartridges or pods; and/or c) disposable (not refillable or rechargeable). We subsequently categorized subjects by product types used: exclusively open-system tank products, exclusively closed-system products, exclusively disposable products, or multiple product types.

At the time of the survey in 2017, the minimum legal age for purchasing tobacco and vaping products was 18 years of age in EN and most areas of CA and the US. However, in some states and localities in the US and provinces in CA, the minimum legal age for purchasing tobacco was either 19 years of age or 21 years of age. Based upon the respondent’s age at the time of the survey and place of residence (i.e., country, state or province), each was classified as being of legal age to purchase tobacco and vaping products or not.

Respondents who had vaped within the past 30 days were asked, “In the past 30 days, how did you get the e-cigarette(s)/vaping device(s), cartridge(s), or e-liquid(s) that you used for vaping?” and could select all that applied from 10 response options: a) someone offered/gave them to me, b) I bought them myself from a store, c) I bought them over the internet/online, d) I gave someone else money to buy them for me, e) I bought them from another person, f) I took them from a store or another person, g) I got a free sample, h) I got them some other way, i) don’t know, and j) refused. Responses were grouped into four categories: 1) only social sources (items a, e, f and g); 2) only commercial sources (items b, c, and d), 3) both social and commercial sources, and 4) any other response (items h, i and j).

Respondents were asked whether they had ever smoked cigarettes, when they last smoked cigarettes, and number of days out of the last 30 days they had smoked (among those who had smoked in the past 30 days). Respondents’ smoking status was categorized as follows: a) current daily smokers, who smoked on 30 of the previous 30 days; b) current non-daily smokers, who reported smoking on 1 to 29 of the last 30 days; c) past smokers, who had not smoked in the last 30 days; or, d) never smokers. Vaping status was structured similarly; all subjects in the subsample had vaped at least once. Smoking and vaping status were also classified as “current” (used within the last 30 days) or “not current” (did not use within the last 30 days, including never users).

2.3. Data analysis

We constructed post-stratification sample weights for each country, based on age, sex, geographic region, language, and race/ethnicity (US only), and rescaled to the sample size in each country ([Non-Smokers’ Rights Association/Smoking and Health Action Foundation, 2018](#)). Proportions, frequencies, odds ratios, and prevalence ratios reported are weighted unless otherwise specified. For multivariate analyses, we used logistic regression, accounting for missing data being missing not at random (i.e., proc surveylogistic with nomcar option), to estimate past year purchasing of a vaping product (Yes/No), with sex, race, smoking frequency, vaping frequency, and legal age of purchase, and country of residence as independent variables. Odds ratios and 95% confidence intervals are reported. All analyses were conducted in SAS 9.4 (SAS Institute, Cary, NC, US).

Table 1
Prevalence of vaping and purchasing of vaping products.

	Canada	US	England	Total
Total Sample	4038	4095	3995	12,128
Number who ever vaped	1182	1283	1348	3816
%(out of total per country)	29.3%	31.3%	33.7%	31.5%
Number who vaped in the past 12 months	846	972	961	2779
%(out of total per country)	20.9%	23.7%	24.1%	22.9%
%(out of ever vaped)	71.6%	75.8%	71.3%	72.8%
Number who vaped in the past 30 days	340	454	347	1141
%(out of total per country)	8.4%	11.9%	8.7%	9.4%
%(out of ever vaped)	28.9%	35.4%	25.7%	29.9%
%(out of vaped in the past 12 months)	40.2%	46.7%	36.1%	41.1%
Number who purchased a vaping products in the past 12-months	270	385	251	906
%(out of total per country)	6.7%	9.4%	6.3%	7.5%
%(out of ever vaped)	22.8%	30.0%	18.6%	23.7%
%(out of vaped in the past 12 months)	31.9%	39.6%	26.1%	32.6%
Number who purchased a vaping product in the past 12-months who vaped in the past 30-days	175	283	166	624
%(out of total per country)	4.3%	6.9%	4.2%	5.2%
%(out of ever vaped)	14.8%	22.1%	12.3%	16.4%
%(out of vaped in the past 12 months)	20.7%	29.1%	17.7%	22.4%
%(out of vaped in the past 30 days)	51.5%	62.3%	47.8%	54.7%

3. Results

Table 1 shows the prevalence of purchasing vaping products, across the entire survey sample and in each country. Overall, only 7.5% of respondents reported having purchased a vaping product in the past year. Of those who had vaped in the past 12 months, 32.6% reported that they had purchased a vaping product during that time. Of those who reported having vaped in the past 30 days, 54.7% reported having purchased a vaping product in the past 12 months.

Table 2 shows the characteristics of past-year vapers by country. Over half of the sample was of legal age to purchase tobacco and vaping products. Most respondents said that they had not purchased a vaping product, although the prevalence of past 30-day vaping was higher among respondents in the US compared to CA and EN (also see [Tables 4 and 5](#)). Fewer than one in five respondents reported having been refused the sale of a vaping product in the past year because of their age, and being refused sale was more commonly reported in the US and EN, compared to CA.

Table 3 shows the purchase locations of vaping products, stratified by country and within country stratified by whether or not the respondents were above or below the minimum legal age to purchase tobacco and vaping products. Vape shops were the most commonly reported purchase location, regardless of whether the respondent was of legal age to purchase tobacco and vaping products. Among respondents who reported having vaped and purchased a vaping product in the past 12 months, the most commonly reported type of device used was a refillable tank (data not shown).

Fig. 1 shows the reported sources of vaping products among past 30-day vapers, by country and overall. Overall, among past 30-day vapers 42.5% reported getting their vaping products only from social sources, 41.4% only from commercial sources, and 13.4% from both types of sources. [Supplemental Table 1](#) shows the reported sources of vaping products stratified by legal age for purchase of tobacco and vaping products. Past 30-day vapers who were of legal age to purchase tobacco and vaping products were slightly more likely to report getting their vaping product from commercial sources compared to those below legal age, but the difference was not statistically significant (PR = 1.07, 95% CI 0.96–1.19).

Tables 4a and 4b show the results of the multivariate models examining predictors of purchase of vaping products for past 12-month ([Table 4a](#)) and past 30-day vapers ([Table 4b](#)), respectively. Purchasing of a vaping product in the past 12 months was associated with being

Table 2
Smoking, vaping and vaping purchasing behaviors among those who vaped in the past 12-months.

	Canada % (n = 846)	United States % (n = 972)	England % (n = 961)	Total % (n = 2779)	Canada vs US PR* (95% CI)	US vs England PR* (95% CI)	Canada vs England PR* (95% CI)
Smoked in the past 30 days (% yes)	34.9 (2.9 5)	35.8 (3.4 8)	41.5 (3.9 9)	37.5 (1043)	0.97 (0.85–1.12)	0.86 (0.76–0.97)	0.84 (0.74–0.96)
Smoked ≥ 20 days in past 30 days (%yes)	12.6 (1.0 6)	12.6 (1.2 3)	12.7 (1.2 2)	12.6 (3.5 1)	0.99 (0.75–1.32)	0.99 (0.77–1.28)	0.99 (0.75–1.3)
Vaped in the past 30 days (% yes)	40.2 (3.4 0)	46.7 (4.5 4)	36.1 (3.4 7)	41.1 (1142)	0.86 (0.76–0.97)	1.29 (1.15–1.45)	1.11 (0.98–1.27)
Vaped ≥ 20 days in past 30 days (% yes)	8.8 (7.4)	9.1 (89)	6.2 (59)	8 (2.2 2)	0.96 (0.67–1.36)	1.48 (1.04–2.12)	1.42 (0.98–2.07)
Above the legal age to purchase tobacco/vaping products (% yes)	48.1 (4.0 7)	52.4 (5.1 0)	52 (5.0 0)	51 (1416)	0.92 (0.83–1.02)	1.01 (0.92–1.11)	0.93 (0.84–1.03)
Purchased vaping product in the past 12 months (% yes)	31.9 (2.7 0)	39.6 (3.8 5)	26.1 (2.5 1)	32.6 (9.0 6)	0.81 (0.71–0.94)	1.51 (1.31–1.74)	1.24 (1.05–1.45)
Refused sale of vaping product in the past 12 months because of age(% yes)	10.0 (85)	13.5 (1.3 2)	10.1 (97)	11.3 (3.1 4)	0.74 (0.55–0.99)	1.34 (1.02–1.76)	0.99 (0.73–1.35)

*PR: prevalence ratio; CI: confidence interval.

male, of legal age to buy tobacco, and smoking or vaping on at least 20 of the past 30 days. The same pattern of results was also found for past 12-month and past 30-day vapers and consistent across the three countries.

4. Discussion

Approximately 7.5% of adolescents surveyed in 2017 reported having purchased a vaping product in the past 12 months. Of those vaping in the past year, about 1 in 3 said they had purchased a vaping product. Adolescents in the US and CA were more likely to have purchased a vaping product compared to their counterparts in EN. Our findings are like other studies reporting where vapers report buying their vaping products, with vape shops as the most common purchase location, and with open-system refillable tank devices the most commonly reported vaping product used (Braak et al., 2019; Hsu et al., 2019; Kong et al., 2017; Meyers et al., 2017; Pepper et al., 2019).

We observed differences between the characteristics of adolescents who reported having purchased a vaping product in the past year and those who had not. The strongest predictors of purchasing a vaping product in the past year were vaping and smoking frequency (i.e., using on at least 20 of the last 30 days), suggesting that vaping product purchasing may be a marker of more frequent vaping and smoking behavior. Purchasing of a vaping product was also related to being of legal age for purchasing a tobacco/vaping product, which suggests that increasing the legal age for purchasing tobacco and vaping products and enforcing this restriction might help to deter vaping and smoking by adolescents (Kessel Schneider et al., 2016). Among all those who had vaped in the past 12 months, only 11.3% (10–14% depending on country) reported having been refused the sale of a vaping product in the past year because of their age. Of those below the legal age for purchasing of a vaping product, 68.7% reported having been refused sale because of their age. Increasing the minimum legal age for purchase of tobacco and vaping products and enhancing enforcement of legal minimum age laws both online and in retail establishments, has been proposed to deter adolescent vaping and use of other tobacco products (Winickoff et al., 2014; Kwan and Stratton, 2015).

While increasing the minimum legal age for purchasing tobacco and vaping products seems like an obvious and commonsense policy to deter adolescents from using tobacco, it is also unlikely to eliminate all or even most of the tobacco use by adolescents. For example, among adolescents who reported vaping within the past 30 days, 10–20% (depending on country) reported giving money to someone else to purchase vaping products for them. Also, getting products from friends was a commonly reported method for obtaining vaping products by adolescents, especially those who were below the legal age for purchasing tobacco. However, these results regarding adolescents gaining access to vaping products should also be assessed in the broader context of adolescent risk behaviors, where alcohol and marijuana use are still more prevalent risk behaviors, despite decades of efforts to restrict adolescent access to these drugs (Hammond et al., 2019; Miech et al., 2019; Anderson et al., 2019; Lalonde, 2019).

4.1. Limitations of this study

Data for this study were derived from non-probability-based web-panel samples in each country, which may limit generalizability. In addition, the survey was designed only for completion on a computer, not a smartphone which could have limited participation in the survey. However, our prevalence estimates for vaping and smoking were consistent with nationally representative benchmark surveys in each country, which lends confidence to our findings. Second, this study is cross-sectional, so any associations reported between reported sources of vaping products and respondent characteristics must be viewed with caution, since the temporality of reported associations is uncertain. Third, our list of predictor variables for purchasing vaping products was

Table 3
Purchase location of vaping products among those who purchased vaping products in the past 12-months, by legal age of purchase of tobacco/vaping products.

	Canada (n = 270)		United States (n = 385)		England (n = 251)	
	Under legal age	Of legal age	Under legal age	Of legal age	Under legal age	Of legal age
Location*	% (n = 86)	% (n = 184)	% (n = 135)	% (n = 250)	% (n = 106)	% (n = 145)
Vape shop	58.1 (59)	76.3 (94)	58.5 (82)	68.9 (161)	58.1 (54)	57.2 (88)
Online	21.6 (22)	18.0 (24)	24.8 (34)	17.6 (39)	26.2 (24)	29.2 (47)
Retail	30.1 (31)	21.0 (30)	36.8 (46)	33.0 (80)	23.1 (22)	30.7 (44)
Other	9.8 (9)	2.9 (4)	4.4 (5)	2.4 (6)	7.6 (7)	1.9 (4)

*Respondents could select multiple locations.

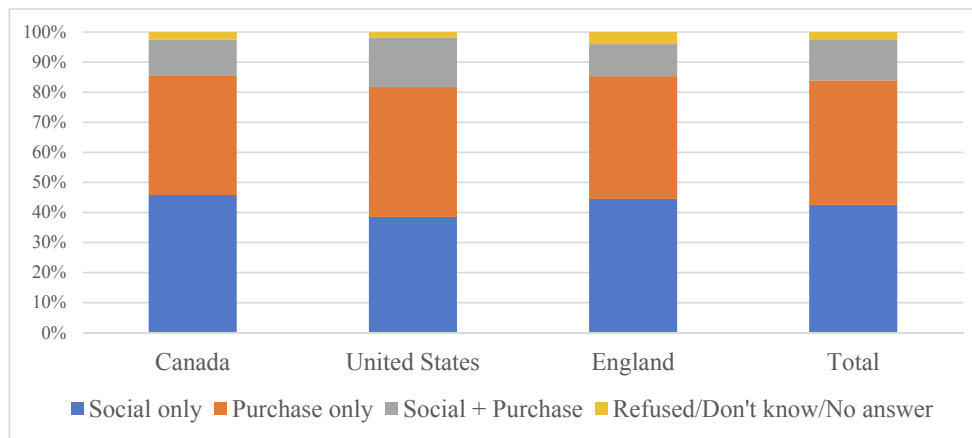


Fig. 1. Reported sources of vaping products among Past30-day vapers.

Table 4a
Purchasing of vaping product among those who vaped in the past 12 months.

	Canada	United States	England	Overall
Predictor Variables	N = 821	N = 960	N = 944	N = 2725
	OR	OR	OR	OR
	(95% CI)	(95% CI)	(95% CI)	(95% CI)
Sex (Male vs Female)	1.76 (1.21–2.54)	1.75 (1.28–2.4)	1.35 (0.96–1.88)	1.61 (1.33–1.95)
Race (Non-White vs White only)	0.92 (0.62–1.39)	0.86 (0.61–1.22)	1.08 (0.7–1.65)	0.94 (0.76–1.18)
Smoked ≥ 20 days in past 30 days (Yes vs No/Unknown)	2.39 (1.38–4.14)	4.38 (2.7–7.11)	3.24 (2.09–5.01)	3.27 (2.48–4.31)
Vaped ≥ 20 days in past 30 days (Yes vs No/Unknown)	27.61 (10.17–75)	42.13 (13.51–131.33)	48.17 (16.45–141.1)	37.49 (20.29–69.27)
Of legal age to purchase tobacco/vaping products (Yes vs No/Unknown)	1.47 (1.01–2.16)	1.52 (1.1–2.1)	1.1 (0.78–1.55)	1.36 (1.12–1.66)
Country (Canada vs US)	NA	NA	NA	0.68 (0.53–0.87)
Country (England vs US)	NA	NA	NA	0.52 (0.41–0.65)

NA: not applicable.

Table 4b
Purchasing of vaping product among those who vaped in the past 30-days.

	Canada	United States	England	Overall
Predictor variables	N = 330	N = 451	N = 338	N = 1119
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Sex (Male vs Female)	1.68 (0.95–2.99)	1.91 (1.22–2.99)	1.54 (0.92–2.57)	1.72 (1.29–2.29)
Race (Non-White vs White only)	0.84 (0.44–1.6)	0.86 (0.53–1.4)	1 (0.52–1.91)	0.89 (0.64–1.24)
Smoked ≥ 20 days in past 30 days (Yes vs No/Unknown)	2.63 (1.12–6.17)	2.93 (1.53–5.59)	3.27 (1.62–6.59)	2.94 (1.95–4.45)
Vaped ≥ 20 days in past 30 days (Yes vs No/Unknown)	14.15 (4.95–40.46)	18.86 (5.91–60.14)	20.41 (6.8–61.22)	17.28 (9.24–32.31)
Of legal age to purchase tobacco/vaping products (Yes vs No/Unknown)	1.51 (0.85–2.68)	1.2 (0.76–1.92)	1.07 (0.64–1.78)	1.24 (0.93–1.66)
Country (Canada vs US)	NA	NA	NA	0.59 (0.41–0.85)
Country (England vs US)	NA	NA	NA	0.55 (0.39–0.77)

NA: not applicable.

limited in this study. An important unmeasured variable is socio-economic status which likely relates to the social context for smoking and vaping and the affordability of acquiring tobacco products (McMillen et al., 2015; Hammond et al., 2019; Leventhal et al., 2015; Hammond et al., 2017). Fourth, it is not known whether the vaping products

reportedly purchased by adolescents in this survey contained nicotine, since this was not specifically ascertained. When respondents who had vaped in the past 30 days were asked if the vaping product(s) they currently used contained nicotine, 43% responded either “no” or “don’t know.” In England, legislation has capped the allowable nicotine

concentration at 20 mg/ml, less than half the levels that are typical in newer generation products (e.g.,) sold in the US and Canada, where youth vaping rates have escalated (Hammond et al., 2019; Hammond et al., 2017). It is possible that differences in rates of youth vaping observed in England compared to the US and Canada could be related to differences in how regulations governing the sale and marketing of e-liquids (Hammond et al., 2019; Hammond et al., 2017).

4.2. Conclusions and policy implications

The findings from this study are timely, given the rapidly evolving vaping product market, owing to the growth of JUUL e-cigarettes and similar products which have become popular with adolescents in some countries (Hammond et al., 2019; Hammond et al., 2017). The apparent increase in adolescent vaping has increased pressure on governments to take action to restrict access to vaping products. San Francisco recently became the first city in the US to ban the sale of e-cigarettes to curb the use of these products by adolescents (San, 2019). However, banning the sale of vaping products may have unintended consequences, since it limits access for adult smokers who could benefit by using e-cigarettes to switch away from cigarettes (Fairchild et al., 2019). In addition, our findings suggests that adolescents access vaping products from a variety of sources, not just purchasing them from retail establishments or online.

Governments must find an optimal regulatory balance that allows adult smokers to access alternative nicotine products, while at the same time restricting access and appeal (including though marketing and product features) to nonsmokers, especially adolescents (Cummings and Hammond, 2020). In EN, there are mandatory limits on the nicotine concentration of e-liquids and greater restrictions on vaping product advertising, which may have contributed to preventing increases in adolescent vaping like those recently observed in the US and CA (Hammond et al., 2019; Hammond et al., 2017). This study suggests that increasing and enforcing the minimum age of purchase for tobacco and vaping products may help deter some youth from smoking and vaping and subsequent development of nicotine dependence.

5. Ethics approval and consent to participate

This study was approved by the University of Waterloo research ethics committee (ORE#21847) and the King's College London Psychiatry, Nursing and Midwifery Research Ethics Subcommittee.

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Declaration of competing interests

Drs Cummings and Hammond have served as paid expert witnesses in legal challenges against cigarette companies. Dr. Hammond has been involved as a paid expert in litigation against vaping manufacturers. Otherwise, the authors have no other financial relationships with any organizations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.addbeh.2020.106345>.

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