



Youth self-reported exposure to and perceptions of vaping advertisements: Findings from the 2017 International Tobacco Control Youth Tobacco and Vaping Survey

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ABSTRACT

Countries have adopted various regulations to limit youth exposure to vaping product advertising. This study aims to examine youth exposure to and perceptions of vaping ads in Canada, England, and the US, three countries with varying vaping product advertising regulations. Data were analyzed from the 2017 ITC Youth Tobacco and Vaping Survey, an online survey of youth aged 16 to 19 years from a consumer panel ($n = 12,064$). The survey assessed vaping product ad exposure in the prior month, including channels, perceived appeal, and perceived target audience. Most young people reported some vaping product ad exposure in the past 30 days (Canada = 74%, England = 83%, US = 81%). Among those exposed to vaping product ads, more than one-third found them appealing (Canada = 36%, England = 38%, US = 43%). Stores that sell cigarettes were the most common venue for vaping ad exposure, although it was less common in Canada (46%) than in England (60%) or the US (60%), both of which had less restrictive regulatory environments. Ad exposure through websites or social media did not differ by country (Canada = 38%, England = 40%, US = 41%). Compared to those who never smoked or used vaping products, youth who reported smoking and/or vaping were more likely to report ad exposure through most channels. More than one-third of youth perceived that vaping product ads target non-smokers (Canada = 47%, England = 36%, US = 48%). Our study suggests most youth are exposed to vaping product ads, which may promote product use. Except for online channels, cross-country differences in the channels of ad exposure may reflect contrasting regulatory environments.

1. Introduction

Vaping products—also known as electronic cigarettes—have become popular in recent years among youth, including youth in Canada, the UK, and the US (Bauld et al., 2017; Jamal et al., 2017; Montreuil et al., 2017). Within each of these countries, exposure to vaping product advertisements is greater among young adults aged 18 to 24 years compared to older adults (Cho et al., in press; Wadsworth et al., 2018). However, observational data are lacking on exposure to and perceptions of vaping product ads among youth younger than 18 years outside the US (Dai and Hao, 2016; Marynak et al., 2018). The causal effect of cigarette advertising on smoking initiation is well established (US Department of Health Human Services, 2012). Yet, there is little evidence on the association between advertising and vaping, including

dual use with cigarettes, among youth. Perceptions of vaping product ads among youth are also largely unknown. This study addresses these gaps in the literature by providing observational data on exposure to and perceptions of vaping product ads among youth between 16 and 19 years of age, and examining whether exposure to vaping ads is associated with smoking or vaping status in Canada, England and the US, three countries with varying regulatory environments around vaping products.

Vaping product ads may influence youth by using tactics appealing to youth, such as highlighting the range of flavors (e.g., candy, cake) and using social acceptability themes (Grana and Ling, 2014; McCausland et al., 2019; Padon et al., 2017). Vaping product ads are placed in multiple channels to which youth are frequently exposed, such as on television (Duke et al., 2014), at point of sale, and online

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(Barrientos-Gutierrez et al., 2019; Truth Initiative, 2015). In line with these conditions, experimental studies found that brief exposure to vaping product ads increased positive perceptions about vaping products and intentions to use vaping products among youth (Allen et al., 2015; Farrelly et al., 2015; Niaura et al., 2015). Cross-sectional studies also found that self-reported exposure to vaping product ads, including online ads (Hansen et al., 2018; Mantey et al., 2016; Pu and Zhang, 2017; Singh et al., 2016), and marketing at point of sale around schools (Giovenco et al., 2016) were associated with smoking or vaping among youth. A longitudinal study found that exposure to vaping product ads on Facebook, but not other channels (social media other than Facebook, traditional media, or point of sale), was associated with vaping among youth who had never vaped previously (Camenga et al., 2018).

Youth perceptions of vaping products may differ by country, given varying regulations on vaping product ads to limit youth exposure (Institute for Global Tobacco Control, 2018). The US and England have less restrictive regulatory environments around vaping products than Canada. At the time of data collection for the current study, Canada had not authorized any vaping products that contain nicotine (NVPs) for sale or advertising (Health Canada, 2009). The US and the UK allow the sale of NVPs both online and in retail shops, but ban the sales of NVPs to youth under the age of 18, as well as the use of marketing claims for reduced harm or smoking cessation at the time of the study (The Committees of Advertising Practice [CAP], 2017; US Food and Drug Administration, 2016a). The US has allowed NVP ads across media channels but banned the distribution of free samples. The UK has banned NVP advertising through mass media (e.g., TV, magazines), limiting advertising to localized channels (e.g., point of sale), billboards, flyers, and personal blogs (UK Department of Health, 2016). In the UK, it is permissible to provide product information, such as flavor, through retail sites in a non-promotional way. In the UK, vaping product ads must also not 'target, feature, or appeal to children,' and should not 'confuse NVPs with tobacco products' (The Committees of Advertising Practice [CAP], 2017), although ads are still attractively designed and feature young adults vaping (Fig. 1). Vaping product use for smoking cessation is endorsed by Public Health England. As such, countries' varying regulatory environments may have resulted in different advertising messages for vaping products, but no study to date has examined youth perceptions of vaping product ads.

Given that NVP advertising policies should prevent uptake of vaping among youth, this study assessed whether youth perceived that NVP ads made vaping seem appealing and whether they perceived that the ads target smokers, non-smokers, vapers, and/or non-vapers. We hypothesized that the frequency and channels of the ad exposures will generally follow advertising bans in each country, such that ad exposure in the US and England is more frequent than in Canada (H1), and ad exposure will be less frequent through restricted channels than through unrestricted channels (H2). Furthermore, we expected that exposure to vaping product ads will be associated with smoking or vaping behavior among youth (H3). We also expected that youth in England will perceive vaping to be less appealing in ads (H4a) and will be less likely to report that ads target non-smokers (H4b), because England regulates the content of ads so that it does not appeal to children, and public health bodies endorse NVP use among smokers for smoking cessation.

2. Methods

2.1. Data source

We analyzed data from Wave 1 of the ITC Youth Tobacco and Vaping Survey, a self-administered online survey conducted in July and August of 2017. Youth aged 16 to 19 years in the US, Canada, and England were recruited from the Nielsen Consumer Insights Global Panel and their partners' panels, both directly and indirectly through their parents. After targeting for age criteria, a random sample of

panelists known to be eligible received e-mail invitations. Detailed study protocol and sample information are provided at: <http://davidhammond.ca/projects/tobacco-control/itc-youth-tobacco-ecig>.

2.2. Sample

A total of 13,468 youth completed the survey and provided consent for the use of their data (Hammond et al., 2018). Our sample included 12,064 youth (Canada $n = 4008$; England $n = 3970$; US $n = 4086$) after removing participants who provided incomplete or invalid data on smoking status, e-cigarette use, or other variables used for weighting ($n = 1022$), as well as those who provided incorrect responses to a data quality check question ($n = 382$). The study received ethical approval from the University of Waterloo Research Ethics Committee (ORE#21847) and the King's College London Psychiatry, Nursing & Midwifery Research Ethics Subcommittee (PNM RESC). There was no separate ethics review for the US, because the ethical review at the University of Waterloo is recognized by the National Institutes of Health (NIH). Informed consent was obtained from respondents included in the study.

2.3. Measures

2.3.1. Self-reported frequency of exposure to vaping ads

Frequency of ad exposure was assessed by asking, 'In the last 30 days, how often have you noticed things that promote e-cigarettes/vaping?' Response options 'Never,' 'Rarely,' 'Sometimes,' 'Often,' 'Very often,' and 'Don't know' were recorded on a scale of 0 to 4, where 0 = never or don't know and 4 = very often. 'Refused' responses were excluded ($n = 19$).

2.3.2. Appeal of vaping ads

Respondents who indicated any exposure to vaping product ads ($n = 9061$) were asked to finish the statement, 'Thinking about the ads you've seen for e-cigarettes, do you think they make e-cigarettes/vaping seem...' with one of the following responses: 'Very unappealing,' 'Unappealing,' 'Neither unappealing or appealing,' 'Appealing,' or 'Very appealing.' After excluding 'refused' responses ($n = 11$), responses were recoded to range from 1 = very unappealing to 5 = very appealing, where 'don't know' was combined with 3 = neither unappealing nor appealing.

2.3.3. Channels of exposure to vaping product ads

Respondents who indicated any exposure to vaping product ads were asked, 'In the last 30 days, have you noticed e-cigarettes/vaping devices or e-liquid being advertised in any of the following places?' A list of 15 places was given, with 'yes,' 'no,' 'don't know,' and 'refused' options for each, including 'In shops/stores that sell cigarettes,' 'Outside shops/stores that sell cigarettes,' 'On websites or social media,' etc. (see Table 3 for the full list). After excluding 'refused' responses ($n = 13$ to 32, depending on the outcome), responses were dichotomized into 'yes' or 'no'/'don't know.' The channels of 'In shops...' and 'Outside shops...' were combined to create a single channel of 'stores that sell cigarettes,' with 'yes' to either channel coded as 'yes.' Respondents who indicated that they had never noticed vaping ads in the frequency question were coded as 'no exposure' to any channel.

2.3.4. Perceived target audience for vaping ads

Respondents who indicated any exposure to vaping product ads were asked, 'Thinking about the ads you've seen for e-cigarettes, would you say they are meant for...?' 'People who smoke,' 'People who don't smoke,' 'People who use e-cigarettes,' and 'People who don't use e-cigarettes,' with 'yes,' 'no,' 'don't know,' and 'refused' options for each group. The 'no' and 'don't know' responses were combined, and 'refused' responses were excluded from analysis ($n = 13, 18, 12$, and 19, respectively).

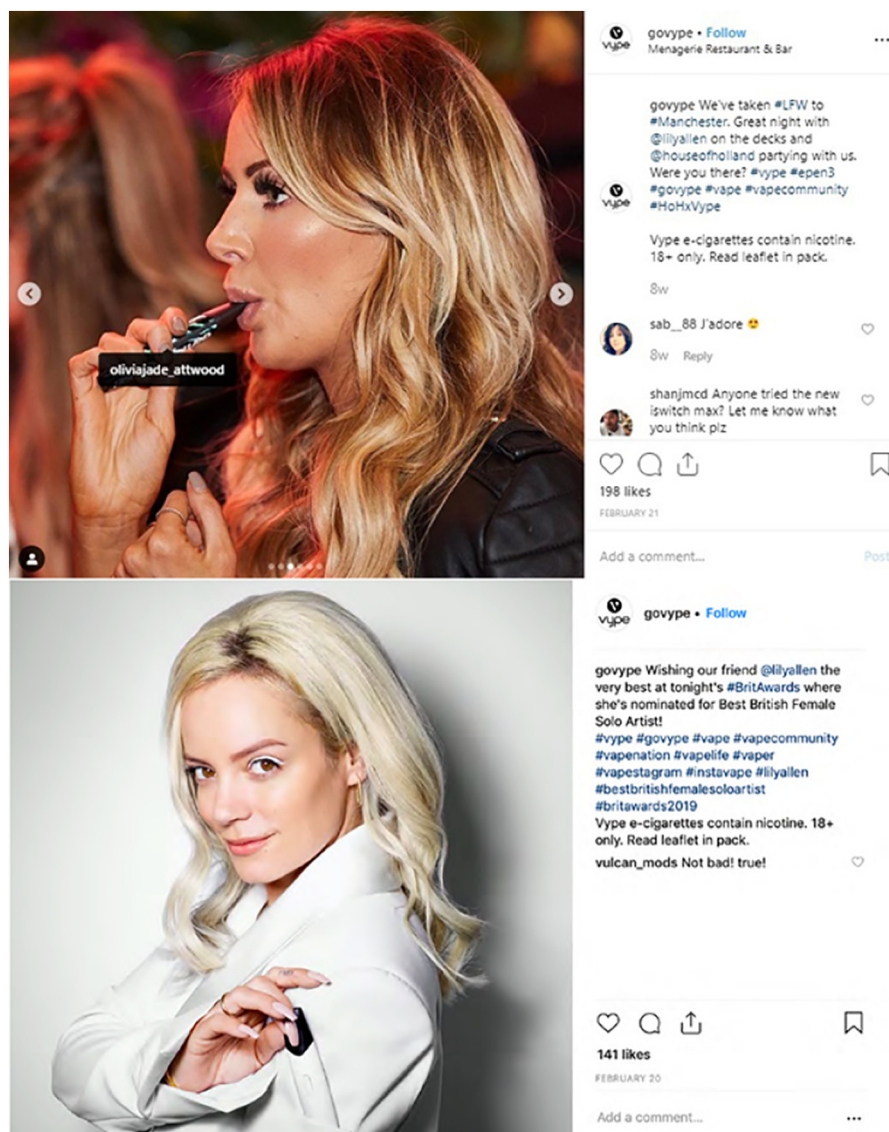


Fig. 1. Vaping ads on social media (Hickman and Delahunty, 2019).

2.3.5. Covariates

Covariates included in the analysis were age, sex, and race/ethnicity (white, other/mixed, not stated), and smoking and vaping product use status. For smoking and vaping product use status, the following user categories were considered: never users (those who never smoked or used vaping products), ever users of either product (those who tried smoking or vaping products but did not smoke or use vaping products in past 30 days), exclusive vapers (used vaping products in past 30 days), exclusive smoker (smoked in past 30 days), and dual users (used vaping products and smoked in past 30 days).

2.4. Analyses

Sample weights were constructed within each country and study condition using a raking algorithm based on smoking status (never, experimental, current/former), region, language in Canada (English or French), and the following cross-classifications: sex by smoking, age (16–17 or 18–19) by smoking, and age by race/ethnicity in the US (white/Caucasian, African-American, or other). Weights were rescaled to sample size within each country/condition for comparisons between countries with different population sizes. All analyses were weighted. Chi-square tests were used to assess between-country differences in

sample characteristics.

Prevalence estimates for frequency of exposure to vaping product ads and channels of exposure were estimated for each country. Logistic and linear regression models and Wald tests were used to assess between-country differences and covariates of frequency of exposure to vaping product ads and channels of exposure, adjusting for multiple comparisons using the Bonferroni method. Among youth who reported any exposure to vaping product ads, between-country differences and covariates of ad appeal and of perceived target audience were estimated using the same method. For sensitivity analyses, we compared between-country differences in ad exposure by channel in a model including or excluding respondents who had never noticed vaping ads. As a second step, we also conducted all analyses adjusting for being legal age to purchase cigarettes and vaping products (i.e. participants aged 18 and 19 vs. others). All analyses were conducted after excluding those who provided 'don't know' responses unless otherwise specified. In general, no meaningful difference in the results was found from the sensitivity analyses. All analyses were conducted using Stata 13.0.

Table 1
Sample characteristics by country, weighted, 2017 ITC youth survey.

	Canada (n = 4008)	England (n = 3970)	US (n = 4086)	Entire sample (N = 12,064)	p-Value for χ^2
Age					
16	19.3%	19.0%	22.9%	20.4%	< 0.001
17	28.0%	30.0%	23.7%	27.2%	
18	29.4%	29.7%	29.8%	29.6%	
19	23.2%	21.1%	23.3%	22.5%	
Sex					
Male	51.6%	55.2%	53.3%	53.3%	< 0.05
Female	48.3%	44.7%	46.6%	46.6%	
Race/ethnicity					
White (only)	58.7%	78.9%	73.0%	70.2%	< 0.001
Other/mixed	39.5%	19.9%	26.3%	28.6%	
Don't know/refused	1.6%	1.0%	0.6%	1.1%	
Ever smoking ^a	21.6%	38.1%	39.3%	33.0%	< 0.001
Current smoking	13.2%	21.1%	16.3%	16.8%	< 0.001
Ever use of vaping product ^b	26.2%	35.3%	36.2%	32.6%	< 0.001
Current use of vaping product	7.6%	10.5%	14.3%	10.8%	< 0.001
User categories ^c					< 0.001
Never user	67.7%	54.3%	52.4%	58.1%	
Ever user	20.6%	26.6%	30.5%	25.9%	
Exclusive vaper	1.4%	2.2%	3.9%	2.5%	
Exclusive smoker	5.9%	9.7%	4.4%	6.6%	
Dual user	4.5%	7.2%	8.8%	6.8%	

^a Those who had ever tried cigarette smoking, including current smokers.

^b Those who had ever tried an e-cigarette/vaping, including current vapers.

^c Never users are those who never tried smoking or vaping products. Ever users are those tried smoking or vaping products but did not smoke or use vaping products in past 30 days.

Table 2
Correlates of frequency of vaping product ad exposure and appeal of vaping in ads, 2017 ITC youth survey.

	Frequency of exposure ^a					Ad appeal ^b				
	Mean	b	95% CI	Adjusted b ^c	95% CI	Mean	b	95% CI	Adjusted b ^d	95% CI
Country ^c										
US	1.4 ^{*,§}	Ref		Ref		3.1				
Canada	1.2 ^{†,§}	-0.26	-0.32 to -0.20	-0.26	-0.32 to -0.20	3.0	-0.11	-0.18 to -0.04	-0.03	-0.10 to 0.03
England	1.5 ^{*,§}	0.09	0.03-0.15	0.09	0.03-0.15	3.0	-0.06	-0.13 to 0.00	-0.03	-0.09 to 0.03
Age										
16	1.3	Ref		Ref		3.0				
17	1.4	0.11	0.03-0.19	0.11	0.03-0.19	3.0	0.07	-0.01 to 0.16	0.07	-0.00 to 0.15
18	1.4	0.15	0.08-0.23	0.15	0.08-0.23	3.1	0.10	0.02-0.17	0.04	-0.04 to 0.11
19	1.4	0.16	0.08-0.24	0.16	0.08-0.24	3.1	0.12	0.04-0.20	0.01	-0.07 to 0.09
Sex										
Male	1.3	Ref		Ref		3.0				
Female	1.4	0.07	0.01-0.12	0.07	0.01-0.12	3.1	0.12	0.06-0.17	0.09	0.04-0.15
Race/ethnicity										
White (only)	1.4	Ref		Ref		3.0				
Other/mixed	1.4	-0.02	-0.07 to 0.04	-0.02	-0.07 to 0.04	3.1	0.16	0.10-0.21	0.19	0.13-0.24
Don't know/refused	1.0	-0.41	-0.61 to -0.20	-0.41	-0.61 to -0.20	2.9	-0.04	-0.31 to 0.23	0.05	-0.20 to 0.30
User categories ^c										
Never user	1.3	Ref		Ref		2.8				
Ever user	1.4	0.15	0.09-0.21	0.15	0.09-0.21	3.2	0.31	0.25-0.37	0.33	0.27-0.39
Exclusive vaper	1.6	0.29	0.16-0.42	0.29	0.16-0.42	3.5	0.64	0.53-0.76	0.66	0.54-0.78
Exclusive smoker	1.4	0.24	0.13-0.35	0.24	0.13-0.35	3.3	0.42	0.32-0.52	0.43	0.33-0.53
Dual user	1.7	0.51	0.37-0.65	0.51	0.37-0.65	3.6	0.82	0.70-0.93	0.81	0.70-0.93

Statistically significant values ($p < 0.05$) are in bold. The unadjusted coefficients are based on weighted linear regression models including each covariate separately, and adjusted coefficients are based on weighted linear regression models including all covariates listed in the table.

^a n = 12,045; 1 (Never/Don't know), 2 (Rarely), 3 (Sometimes), -4 (Very often).

^b n = 9050; 1 (very unappealing), 2 (unappealing), 3 (don't know or neither unappealing nor appealing), 4 (appealing), 5 (very appealing).

^c England and the US had less restrictive regulatory policies around nicotine vaping products (NVPs) than Canada, which prohibited NVP sales and marketing of vaping products but had weak enforcement at the time of data collection.

[†] Significant difference between US and Canada samples.

[§] Significant difference between US and England samples.

[§] Significant difference between Canada and England samples in the logistic regression models adjusted for all covariates listed in the table, weights and Bonferroni's correction ($p < 0.05$).

^Ω Never users are those who never tried smoking or vaping products. Ever users are those tried smoking or vaping products but did not smoke or use vaping products in past 30 days.

Table 3

Regulatory policies for nicotine vaping product (NVP) advertising and self-reported exposure to NVP ads in the past 30 days by channel and country, 2017 ITC youth survey ($n = 11,250$).

Channel	US		Canada		England	
	Ban	%	Ban	%	Ban	%
Shops/stores that sell cigarettes ^a	0	60% [†]	✓	46% ^{†,§}	0	60% [§]
Websites or social media	0	41%	✓	38%	0 ^b	40%
Television or radio	0	28% ^{†,¶}	✓	17% ^{†,§}	✓	21% ^{¶,§}
Billboards or posters	0	26% ^{†,¶}	✓	18% ^{†,§}	0	31% ^{¶,§}
Kiosk or temporary sales locations	0	27% [¶]	✓	25% [§]	0	42% ^{¶,§}
Chemist/pharmacy	0	13% [†]	✓	9% ^{†,§}	0	15% [§]
Print newspapers or magazines	0	21% [†]	✓	14% ^{†,§}	✓	20% [§]
Events like fairs, markets, festivals, sporting events, or music concerts	0	20%	✓	18%	0	19%
Bars or pubs	0	14%	✓	11% [§]	0	15% [§]
Leaflets/flyers	0	13%	✓	11% [§]	0	14% [§]
Taxis or buses/public transit	0	11% [¶]	✓	10% [§]	0	18% ^{¶,§}
Email or text messages	0	10% [¶]	✓	7%	✓	6% [¶]
Regular postal mail	0	7% ^{†,¶}	✓	3% [†]	0	3% [¶]
Cinema/movies	0	7% [†]	✓	6%	0	5% [¶]

0: no restrictions, ✓: complete restrictions at the time of data collection.

[†] Significant difference between US and Canada samples.

[¶] Significant difference between US and England samples.

[§] Significant difference between Canada and England samples in the logistic regression models adjusted for age, sex, race/ethnicity, user categories, weights and Bonferroni's correction ($p < 0.05$).

^a Includes "In shops/stores that sell CIGARETTES" and "Outside shops/stores that sell CIGARETTES".

^b England partially banned vaping advertising on the internet. Only the provision of product information in a non-promotional way and the sale of vaping products through retail sites is permitted, but there are no restrictions on vaping advertising through blogs or tweets.

3. Results

3.1. Sample

Table 1 shows the characteristics of the samples in each country. All sample characteristics assessed differed across countries.

3.1.1. Frequency of exposure to vaping ads

Approximately 81% of participants in the US, 74% of youth in Canada, and 83% of youth in England reported exposure to vaping product ads in the past 30 days. In line with hypothesis H1, participants reported significantly less frequent exposure to vaping product ads in Canada, which prohibited the sales and marketing of vaping products that contain nicotine, as compared to in the US and in England, which had less restrictive regulatory policies around vaping products (see Table 2). More frequent exposure to vaping product ads was reported among older participants than those aged 16, among females vs. males, and among those who had ever smoked or vaped vs. never users.

3.1.2. Exposure to vaping ads by channel

Table 3 shows vaping ad regulations and exposure to vaping product ads in each country by channel. Exposure to vaping product ads among youth across countries was most frequently reported at stores that sell cigarettes, followed by websites or social media.

Table 3 shows that, in line with H2, exposure to vaping product ads through specific channels generally follows advertising bans in each country. For instance, as expected, vaping ad exposure at stores that sell cigarettes was more likely to be reported among participants in the US (60%) and England (60%) than among participants in Canada, which banned vaping product ads in all channels (46%), even though the prevalence of ad exposure in Canada was still high despite the complete ban of vaping product advertising in all channels. Also, as expected,

vaping product ad exposure on television or radio was more likely to be reported in the US (28%) than in Canada (17%) and in England (21%), which prohibited vaping product ads on mass media. Vaping ad exposure on billboards or posters was more likely to be reported in England (31%) and in the US (26%) than in Canada (18%), again as expected given channel-specific bans in each country. The statistical significance of these differences was maintained after adjustment for covariates. However, exposure to vaping ads on websites or social media did not differ by country, despite differences in advertising restrictions by country.

As hypothesized in H3, self-reported exposure to vaping product ads was associated with smoking and vaping behavior among youth. Compared to never users, current dual users were more likely to report exposure to vaping product ads through every channel. For example, dual users were more likely than never users to report ad exposure at stores that sell cigarettes (AOR = 1.83, 95% Confidence Interval [CI] = 1.43, 2.35), on websites or social media (AOR = 2.39, 95% CI = 1.89, 3.04), and at kiosks or temporary sales locations (AOR = 1.88, 95% CI = 1.47, 2.40). Compared to never users, non-current users of either product were more likely to report exposure to vaping ads through some channels (e.g., stores that sell cigarettes [AOR = 1.53, 95% CI = 1.37, 1.70], websites or social media [AOR = 1.53, 95% CI = 1.38, 1.70], and kiosks or temporary sales locations [AOR = 1.33, 95% CI = 1.19, 1.49]), but not through television or radio, billboards or posters, and taxis or buses/public transit. Current exclusive vapers were more likely than never users to report exposure to vaping product ads through most channels (e.g., stores that sell cigarettes [AOR = 1.89, 95% CI = 1.48, 2.41], websites or social media [AOR = 2.57, 95% CI = 2.02, 3.27]). Current exclusive smokers were also more likely than never users to report exposure to NVP ads through most channels (e.g., stores that sell cigarettes [AOR = 1.37, 95% CI = 1.11, 1.67], websites or social media [AOR = 1.47, 95% CI = 1.20, 1.79]).

3.1.3. Perceived appeal of and target audience for vaping product ads

Among those who reported seeing vaping product ads, 43% of participants in the US, 36% of participants in Canada, and 38% of participants in England reported that the ads made e-cigarettes seem 'appealing' or 'very appealing'. As shown in Table 2, US participants perceived e-cigarettes to be more appealing in vaping product ads, compared to participants in Canada, but the difference was not significant when adjusted for covariates. Compared to participants in Canada and in the US, participants in England, which prohibits vaping product ads to appeal to children, did not perceive vaping to be less appealing in vaping product ads, rejecting H4a. Greater appeal of vaping in ads was reported among youth who were female, non-white race/ethnicity, and/or had some cigarette smoking or vaping experience vs. never users.

As shown in Table 4, > 85% of youth across countries who reported any exposure to vaping ads reported that vaping ads target smokers; youth in England (89%) were more likely than youth in Canada (85%) and the US (87%) to report that vaping ads target smokers. Approximately 44% of youth across countries perceived that vaping product ads target non-smokers; youth in England (36%) were less likely to report that vaping product ads target non-smokers, compared to youth in the US (48%) and Canada (47%), consistent with H4b. More than > 70% of youth perceived that vaping product ads target vapers. More than half of youth (56% in the US and Canada, and 58% in England) perceived the target audience for vaping ads was non-vapers.

4. Discussion

The proportion of youth who reported any exposure to marketing for vaping products was greater among youth living in countries with fewer marketing restrictions, consistent with previous findings among adult smokers (Cho et al., in press; Wadsworth et al., 2018). Compared

Table 4
Correlates of perceived target audience for vaping ads, 2017 ITC youth survey.

	“Thinking about the ads you've seen for e-cigarettes, would you say they are meant for...”											
	Smokers (n = 9048)			Non-smokers (n = 9043)			Vapers (n = 9049)			Non-vapers (n = 9042)		
	% yes	AOR	95% CI	% yes	AOR	95% CI	% yes	AOR	95% CI	% yes	AOR	95% CI
Country ^a												
US	87% [¶]	Ref		41% [¶]	Ref		81% ^{¶,§}	Ref		56%	Ref	
Canada	85% [§]	0.91	0.75–1.09	38% [§]	0.88	0.77–1.00	74% [¶]	0.70	0.60–0.82	56%	0.95	0.83–1.08
England	89% ^{¶,§}	1.31	1.09–1.58	31% ^{¶,§}	0.67	0.59–0.75	76% [¶]	0.74	0.64–0.86	58%	1.05	0.93–1.19
Age												
16	86%	Ref		36%	Ref		77%	Ref		56%	Ref	
17	87%	1.07	0.85–1.34	37%	1.07	0.91–1.26	77%	1.07	0.88–1.29	58%	1.07	0.92–1.26
18	88%	1.18	0.95–1.47	37%	1.09	0.93–1.28	77%	1.05	0.87–1.25	55%	1.00	0.86–1.16
19	86%	1.01	0.79–1.28	37%	1.08	0.91–1.27	77%	0.98	0.81–1.19	58%	1.12	0.95–1.31
Sex												
Male	86%	Ref		37%	Ref		75%	Ref		56%	Ref	
Female	88%	1.31	1.12–1.54	36%	0.96	0.86–1.08	80%	1.38	1.22–1.57	57%	1.03	0.92–1.15
Race/Ethnicity												
White (only)	88%	Ref		36%	Ref		78%	Ref		57%	Ref	
Other/Mixed	86%	0.87	0.74–1.03	39%	1.09	0.97–1.22	75%	0.84	0.74–0.96	57%	1.01	0.90–1.13
Not stated	74%	0.43	0.23–0.79	37%	1.05	0.63–1.75	59%	0.44	0.26–0.75	56%	0.99	0.60–1.64
User categories [‡]												
Never users	87%	Ref		37%	Ref		76%	Ref		57%	Ref	
Ever users	88%	1.14	0.95–1.37	38%	1.02	0.90–1.15	80%	1.25	1.09–1.45	56%	0.95	0.84–1.07
Exclusive vaper	90%	1.42	0.99–2.03	43%	1.19	0.93–1.53	82%	1.38	1.00–1.89	59%	1.04	0.81–1.34
Exclusive smoker	87%	0.93	0.68–1.29	28%	0.65	0.50–0.83	74%	0.91	0.71–1.17	55%	0.88	0.71–1.10
Dual user	86%	0.86	0.61–1.22	35%	0.84	0.65–1.10	81%	1.29	0.94–1.77	53%	0.82	0.64–1.05

Note: Those who responded “don't know” were treated as “no.” AOR = Adjusted odds ratio. Statistically significant values (at $p < 0.05$) are in bold.

[†] Significant difference between US and Canada samples

[¶] Significant difference between US and England samples.

[§] Significant difference between Canada and England samples in the logistic regression models adjusted for all covariates listed in the table, weights and Bonferroni's correction ($p < 0.05$).

^a England and the US had less restrictive regulatory policies around nicotine vaping products (NVPs) than Canada, which prohibited sales and marketing of NVPs but had weak enforcement at the time of data collection. England bans NVP ads that target children and endorses NVP use for smoking cessation.

[‡] Never users are those who never tried smoking or vaping products. Ever users are those tried smoking or vaping products but did not smoke or use vaping products in past 30 days.

to youth in the US and England, where sales and marketing of NVPs were allowed, the prevalence of any ad exposure was lower among Canadian youth, where sales and marketing of vaping products with nicotine were prohibited at the time of data collection. However, exposure to vaping product ads was still reported by nearly half (46%) of Canadian youth despite these regulations (Hammond et al., 2015).

Prevalence of exposure to vaping product ads among youth generally followed channel-specific advertising bans. In all countries, the most frequently-cited source of exposure to vaping product ads was stores that sell cigarettes, as was found among US youth in 2016 (Marynak et al., 2018). The second most frequent channel of exposure was websites or social media. Ad exposure on websites or social media did not differ between countries, possibly because digital media represents the most prominent source of cross-border advertising (US Food and Drug Administration, 2016b). In England, ad exposure was more prevalent at kiosks or temporary sales locations than Canada and the US; this finding is in line with the national policy that allows localized advertising, such as ads on billboards and flyers (UK Department of Health, 2016). Exposure to vaping product ads on television or radio among youth was more prevalent in the US (Duke et al., 2014) compared to Canada and England, where broadcast advertising of NVPs is banned (UK Department of Health, 2016). Overall, these findings suggest that self-reported exposure is a relatively sensitive measure for tracking differences across jurisdictions in marketing activity.

Our findings suggest that exposure to vaping ads was associated with vaping or smoking behavior among youth. Compared to never users, non-current users of either product, exclusive vapers, exclusive smokers, and dual users of cigarettes and vaping products were more likely to report exposure to vaping ads. Our finding adds to the

literature on distinct characteristics of dual users compared to exclusive product users (Azagba, 2018; Kristjansson et al., 2015; Wills et al., 2015), because dual users of cigarettes and vaping products, but not exclusive vapers or exclusive smokers, were more likely than never users to report ad exposure in every channel in our study. Dual users also reported the most frequent ad exposure, which may be linked with more frequent vaping among dual users (McCabe et al., 2017; Smith et al., 2019) because ads can elicit positive attitudes towards vaping products (Allen et al., 2015; Farrelly et al., 2015; Niaura et al., 2015). Yet, our findings may be biased because it is likely that product users are more likely to selectively attend to vaping product ads than non-users.

Compared to youth in Canada, youth in the US reported that vaping product ads made vaping products seem more appealing, although the difference was statistically significant only in the bivariate analysis. In the US, a novel vaping product brand, JUUL, was gaining popularity at the time of data collection (Hammond et al., under review; Willett et al., 2018). It is plausible that the marketing for JUUL may have contributed to the relatively greater appeal of vaping ads among US youth.

Despite the advertising standards in England, which advise that vaping ads must not target or feature children (The Committees of Advertising Practice [CAP], 2017), there was no difference in perceived appeal between youth in the US and England. However, youth in England were less likely than youth in the US or Canada to perceive that vaping ads were meant for non-smokers. It is possible that vaping products are marketed with different messaging campaigns or that vaping product marketing is perceived differently because Public Health England endorses vaping product use for cessation. JUUL was introduced in England only as of July 2018 and in Canada only as of

September 2018, and Canada implemented a new legal framework in May 2018 which permits the sale of vaping products that contain nicotine and restricts youth- and lifestyle-oriented ads (Health Canada, 2018). Given these recent changes, future studies should continue investigating youth perceptions of vaping product ads to develop policies that prevent youth uptake of vaping products.

The current study has several limitations common to population-based surveys, including the use of self-report to assess exposure to vaping product ads. Unsurprisingly, vapers reported more frequent ad exposure than non-users, which may be indicative of selective attention. It is unclear, however, whether our results over- or under-estimate exposure. Nevertheless, our estimates are less sensitive to recall bias compared to other studies that query exposure to vaping product ads without any time frame, such as in the National Youth Tobacco Survey (Marynak et al., 2018), as our questions included a relatively short time frame (past 30 days). The data are cross-sectional, limiting our ability to make any causal inferences. Analysis of follow-up data will allow for a stronger assessment of the potential causal effect of exposure to vaping product ads on vaping or smoking cigarettes. Study samples were recruited using national online commercial panels, but were not probability-based. However, the sample was weighted using age, sex, region and smoking status, and estimates, such as the prevalence of vaping, from the study sample were very similar to national benchmark surveys in each country (Hammond et al., 2018).

5. Conclusions

Most youth in Canada, England, and the US reported some exposure to vaping product advertising in the prior month, and more than one-third of those who were exposed to vaping product ads found the ads appealing. The prevalence of youth vaping product ad exposure by channel generally reflected countries' regulations; yet our findings suggest challenges for complete bans for marketing of nicotine-containing vaping products in Canada, as well as difficulties enforcing bans of marketing through online channels across countries. Although most youth in all three countries perceived that vaping ads target smokers, more than one-third of youth in England and almost half of youth in Canada and the US perceived that vaping ads target non-smokers. Our study suggests that additional efforts are needed to limit youth exposure to vaping product ads and to promote perceptions that NVPs are for established smokers, not non-smokers.

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Declaration of Competing Interest

JFT and DH have served as an expert witness on behalf of governments in litigation involving the cigarette industry.

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