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Baseline assessment of noticing e-cigarette health warnings among youth and young adults in the United States, Canada and England, and associations with harm perceptions, nicotine awareness and warning recall

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ABSTRACT

Health warnings on tobacco products can inform users of potential risks. However, little is known about young people's exposure to health warnings on e-cigarette products. This baseline assessment of young people's noticing e-cigarette warnings uses nationally representative data from three countries.

Data were collected under Wave 1 of the ITC Youth Tobacco and E-cigarette Survey, conducted in Canada, England, and the US. Online surveys were completed by 16–19-year-olds in July/August 2017 (n = 12,064), when warnings were either newly required (England) or voluntarily carried by some manufacturers (US, Canada). Analyses examined prevalence and correlates of noticing warnings and associations between noticing warnings and product perceptions, adjusting for country, sex, age, race/ethnicity, and cigarette/e-cigarette use status.

About 12% reported noticing warnings on e-cigarette packaging in the past 30 days. Noticing warnings was significantly more likely among youth in England (AOR = 1.3, $p < .01$) and the US (AOR = 1.3, $p < .01$) versus Canada, and was most likely among dual e-cigarette/cigarette users (AOR = 4.69, $p < .001$) versus nonusers. Unaided recall of the keyword "nicotine" was low among those who noticed warnings (7.5%). However, ever e-cigarette users who noticed warnings had higher odds of knowing whether e-cigarettes contained nicotine (AOR = 2.26, $p < .001$). Noticing warnings was significantly associated with higher odds of believing e-cigarettes cause at least some harm to users (AOR = 1.19), are as harmful as cigarettes (AOR = 1.45), and can be addictive (AOR = 1.43).

Baseline assessment reveals that youth's noticing of e-cigarette warnings and recall of nicotine-addiction messages was low. Research should track exposure over time as warning requirements are implemented across different countries.

1. Introduction

In recent years, the use of electronic cigarettes (or "e-cigarettes") has been increasingly prevalent among young people (Johnston et al., 2017). While e-cigarettes are less harmful than combustible cigarettes (National Academies of Sciences, Engineering, and Medicine, 2018), the public, and youth in particular, should still be informed of their potential health risks. For example, studies continue to show that substantial numbers of young people who use or experiment with e-cigarettes do not know whether their product contains nicotine (Willett et al., 2018).

The use of health warnings is one potentially effective strategy for communicating with the public about e-cigarette risks (Thrasher et al., 2018). Ideally, warnings for e-cigarettes should communicate the potential harms without promoting the false belief that e-cigarettes are equally harmful as combustible cigarettes (Cox et al., 2018; Wackowski et al., 2017). Previous research has shown public support for e-cigarette warnings, and that they can be informative (Wackowski et al., 2019; Mendel et al., 2018), and influence product risk beliefs and use intentions (Cox et al., 2018; Czoli et al., 2016). For example, one study found that consumers who viewed a warning for e-cigarette addiction reported higher risk beliefs and lower willingness to try e-cigarettes compared to those not exposed (Berry et al., 2017). An experimental study with adolescents found that a text-only nicotine addiction warning led to a decrease in e-cigarette susceptibility relative to a no warning control (Andrews et al., 2019).

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Although studies have begun testing the influence of exposure to e-cigarette warnings in controlled experimental settings, there is little population-level data about the extent to which young people notice health warnings on e-cigarette packaging, an important first step in their potential impact (Noar et al., 2016). This study aims to provide baseline data about young people's noticing of e-cigarette warnings in three countries (Canada, England, and the United States) with different policies at different stages of regulation, including before impending regulations or at the beginning of implementation. It is important to track noticing warnings before standard regulation to provide a basis for comparison after implementation to evaluate changes and policy effectiveness and provide evidence-based support for such regulation.

E-cigarette warning label requirements in these countries have only recently evolved. In Canada, e-cigarettes with nicotine were not approved for sale prior to May 2018 (although widely available); therefore, no specific warning regulations existed, although e-cigarette manufacturers may have voluntarily placed warnings pertaining to some aspects of the product, such as the toxicity of mixtures containing nicotine or referring to the electronic components (Buonocore et al., 2017). While no warnings about nicotine and its addictiveness are currently required on e-cigarette packaging, Health Canada proposed new requirements in June 2019 that e-cigarette packaging include a list of ingredients and, depending on the presence of nicotine and its concentration, a health warning that nicotine is highly addictive, the concentration of nicotine, and warnings regarding the toxicity of nicotine when ingested (Vaping Products Labelling and Packaging Regulations, 2019). In England, e-cigarette warning label requirements initially fell under European Union Classification, Labelling and Packaging regulations, which require all chemical substances to be labelled according to their known risks (Health and Safety Executive, 2016). In May 2017, the Tobacco Products Directive (TPD) required new warning labelling rules for e-cigarette and e-liquid packaging for countries within the EU (including England) – i.e., packaging must carry a clear warning that states, “This product contains nicotine which is a highly addictive substance,” sized at 30% of the front and backside of the packaging surface areas (*The Tobacco and Related Products Regulations*, 2016). A similar warning (“This product contains nicotine. Nicotine is an addictive chemical.”) and conspicuous packaging requirements (30% of front and back, 12-point font minimum) was made effective for e-cigarettes in the United States in August 2018, although most e-cigarette manufacturers in the US voluntarily carried some unstandardized form of warning before then (Shang et al., 2018). Content and formatting standards required by regulations are important given that they may enhance warning effectiveness (Hammond, 2011). One experimental study comparing a governmental label and a label produced by an e-cigarette company found that, among college students who viewed the governmental label, e-cigarette risk perceptions increased and use intentions decreased, while the company produced label had no influence (Lee et al., 2018).

This study provides nationally representative baseline-level data from England, United States and Canada examining youth (ages 16–17) and young adults' (ages 18–19) noticing of e-cigarette health warnings before and at the early start of new e-cigarette warning label regulations. It also explores the association between noticing warnings and risk perceptions, awareness of nicotine and unaided warning recall.

2. Methods

2.1. Data source

Data for this study came from Wave 1 of the International Tobacco Control Policy Evaluation Project (ITC) Youth Tobacco and E-cigarettes Survey, conducted in Canada, England, and the United States with youth and young adults aged 16–19 years old. Data were collected via online surveys in July/August 2017, one year before new e-cigarette warning policy regulations were scheduled to be implemented in the United States, and coinciding with the first months of the TPD warning regulation in England (May 20, 2018). At the time of the study, no nicotine-containing e-cigarettes were legally approved for sale in Canada, although they were widely available, and may have carried voluntary manufacturer warnings, as in the United States (Hammond et al., 2014; Health Canada, 2019).

Young adults were recruited directly through Nielson Consumer Insights Global Panel and their partners' panels, while youth were recruited through their parents. Emails that included a link to the survey were sent to a random sample of panelists (after targeting for age criteria); ineligible panelists who did not meet the age criteria (16–19 years old) were not invited to participate. The same survey measures were used across all countries, except for race/ethnicity and education questions, which were based on census questions in each country. Upon providing consent, participants completed the survey then received compensation according to their panel's incentive structure. The study was reviewed by and received ethics clearance through a University of Waterloo Research Ethics Committee (ORE#21847) and the King's College London Psychiatry, Nursing & Midwifery Research Ethics Subcommittee. Sample weights were constructed using a raking algorithm. First, respondents were divided into three broad cigarette smoking categories: never smokers, experimental smokers (smoked $<$ 100 cigarettes lifetime), and current/former smokers (smoked $\geq$100 cigarettes lifetime). Raking was then performed separately for each of the following factors: geographic region (state/province/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). Finally, weights were rescaled to sample size within each country/condition, to allow for comparisons between countries with different population sizes. Estimates reported are weighted unless otherwise specified. All models were adjusted for country, age, sex, and race/ethnicity. A full description of the study methods can be found in the Technical Report (http://davidhammond.ca/projects/e-cigarettes/itc-youth-tobacco-ecig/).

2.2. Measures

All respondents were asked whether they had noticed any health warnings on the packaging of e-cigarettes/vaping devices, cartridges or e-liquids in the past 30 days (yes, no, don't know). “No” and “don't know” were collapsed, as the purpose of this study was to examine associations for those who reported exposure.

Awareness of nicotine presence in e-cigarettes among ever users was measured (“have you ever used an e-cigarette that contained nicotine?”) and results were dichotomized, with “yes/no” responses indicating “awareness” and “I don't know” indicating not having an awareness. Nicotine awareness among past 30 day users was measured (“do the cigarettes or e-liquids you currently use contain nicotine?”) and results were dichotomized, with “yes/no/some have nicotine, some do not” responses indicating awareness and “I don't know” indicating not having awareness. Perceived absolute harm from e-cigarette use was measured with an omnibus absolute harm question (“how much do you think people harm themselves when they use e-cigarettes/vape?”), and results were dichotomized as “no or little harm” versus “some harm or a lot of harm.” Responses for an e-cigarette addiction measure (“how likely is someone to become addicted to e-cigarettes/vaping?”) were dichotomized as “unlikely” or “at least somewhat likely.”Perceived relative harm was measured (“is using e-cigarettes/vaping less harmful, about the same, or more harmful than smoking cigarettes?”), and responses were dichotomized as “less harmful” and “as harmful or more harmful than smoking.”

Unaided recall of warnings was measured among those who indicated noticing warnings. These respondents were asked to describe as many different warnings on e-cigarette packaging/vaping devices, cartridges or e-liquids that they could, and to provide as much detail as

Table 1
Sample characteristics and prevalence of noticing e-cigarette health warnings in past 30 days.

	Sample demographics (n = 12,064)	Prevalence and odds of noticing e-cigarette health warnings in past 30 days, all respondents				
	%	%	AOR	95% CI		p-value
Country						
Canada	33.2	9.9	ref			
US	33.9	13.5	1.31	1.08	1.58	0.005
England	32.9	13.1	1.33	1.09	1.62	0.004
Sex						
Male	53.4	12.8	1.08	0.94	1.24	0.294
Female	46.6	11.4	ref			
Age						
16–17	47.7	10.2	0.76	0.66	0.89	< 0.001
18–19	52.3	14.0	ref			
Race/ethnicity						
White	71.1	11.9	0.78	0.67	0.92	0.002
Other/mixed	28.9	13.0	ref			
Past 30 day tobacco status						
Dual cigarette/ e-cigarette user	6.8	33.9	4.69	3.65	6.02	< 0.001
Exclusive cigarette user	10.0	15.4	1.70	1.32	2.21	< 0.001
Exclusive e-cigarette	3.9	21.4	2.52	1.88	3.36	< 0.001
Non-user of either product	79.3	9.5	ref			

possible for each one. We conducted a content analysis of open-ended recall responses to describe the main themes and keywords recalled. Ten percent of responses were double coded by two researchers to assess inter-coder reliability (average Kappa = 0.86).

All respondents also indicated whether they used e-cigarettes and cigarettes in the past 30 days, with those indicating use of both products defined as past 30 day dual cigarette/e-cigarette users (see Table 1).

2.3. Analysis

Analyses include descriptive reporting of the prevalence and odds of noticing health warning on e-cigarette packages by demographics, country, cigarette and e-cigarette use. We used logistic regression to examine the association between noticing warnings and e-cigarette harm perceptions, relative harm perceptions, addiction likelihood and nicotine awareness, with each of these four models adjusting for country, sex, age, race/ethnicity, and cigarette/e-cigarette use status (except for the nicotine awareness model, which was limited to ever e-cigarette users, including past 30 day users). Adjusted Odds Ratios (AORs) and weighted estimates are shown in all cases. Analyses were conducted using SAS (Version 9.4).

3. Results

3.1. Sample

Table 1 shows demographic characteristics of the sample. Overall, 32.6% of young people had ever used e-cigarettes and 10.7% had used e-cigarettes in the past 30 days.

3.2. Noticing e-cigarette health warnings

Across all countries, 12.2% reported noticing health warnings on the packaging of e-cigarettes/vaping devices in the past 30 days and 87.8% reported either not noticing or did not know if they had noticed warnings.

Noticing e-cigarette warnings was more likely among participants in England (AOR = 1.33, $p < .01$) and the U.S. (AOR = 1.31, $p < .01$) compared to Canada (see Table 1). In terms of demographics, noticing warnings was less likely among 16–17 year olds (AOR = 0.76, $p < .001$) versus 18–19 year olds and among respondents who were 'white' (AOR = 0.78, $p < .01$) versus 'nonwhite'. Noticing warnings was also associated with past 30 day e-cigarette and cigarette use, with noticing most likely among past 30 day dual e-cigarette and cigarette users (AOR = 4.69, $p < .001$), followed by past 30 day exclusive e-cigarette users (AOR = 2.52) and past 30 day exclusive cigarette users (AOR = 1.7) versus nonusers (see Table 1). Noticing e-cigarette warnings was also more likely among past 30 day dual e-cigarette and cigarette users (AOR = 2.75, 95% CI: 1.96, 3.88; $p < .001$) and past 30 day exclusive e-cigarette users (AOR = 1.48, 95% CI: 1.02, 2.14, $p = .004$) compared to cigarette only smokers (contrast not in table).

3.3. Awareness of nicotine in e-cigarettes

Among those who ever used e-cigarettes, including past 30 day users, 27.4% did not know whether they had ever used e-cigarettes or e-liquid that contained nicotine. Ever users who noticed health warnings had greater odds of knowing whether their e-cigarettes contained nicotine (AOR = 2.26, $p < .001$) compared to those who had not noticed warnings (see Table 2). Among past 30 day users who reported ever using e-cigarettes with nicotine, only 2.6% did not know whether the e-cigarettes they currently used contained nicotine. This nicotine awareness was not associated with noticing health warnings (data not in table).

3.4. Perceived absolute harm

Overall, 60% of respondents believed e-cigarettes cause at least some harm to users. Those who noticed e-cigarette health warnings in the past 30 days had slightly greater odds of believing this compared to those who did not notice warnings (AOR = 1.19, see Table 3) after controlling for country, sex, age group, race/ethnicity and past 30 day

Table 2
Association between e-cigarette warning exposure and knowledge of whether e-cigarettes contain nicotine, among ever e-cigarette users.

	Prevalence and odds of knowing whether e-cigarettes used contain nicotine, among ever users				
	%	AOR	95% CI		p-value
Warning exposure					
Yes	84.2	2.26	1.67	3.06	< 0.001
No/don't know	69.8	ref			
Country					
US	76.1	1.06	0.82	1.36	0.673
England	68.0	0.71	0.55	0.92	0.009
Canada	74.0	ref			
Sex					
Male	74.4	1.27	1.06	1.53	0.011
Female	70.2	ref			
Age					
16–17	67.6	0.69	0.57	0.84	< 0.001
18–19	75.6	ref			
Race/ethnicity					
White	73.1	1.14	0.93	1.39	0.209
Other/mixed	71.9	ref			

Table 3
Association between e-cigarette warning exposure and e-cigarette perceptions.

	Prevalence and odds of perceiving e-cigarettes to cause at least some harm to users, among all respondents					Prevalence and odds of perceiving e-cigarette addiction to be at least somewhat likely					Prevalence and odds of perceiving e-cigarettes to be as harmful or more harmful than cigarettes				
	%	AOR	95%CI		p-value	%	AOR	95% CI		p-value	%	AOR	95% CI		p-value
Warning exposure															
Yes	57.0	1.19	1.01	1.40	0.037	60.6	1.43	1.22	1.66	< 0.001	26.8	1.45	1.22	1.73	< 0.001
No/Don't know	60.4	ref				54.4	ref				21.8	ref			
Country															
Canada	65.1	ref				49.6	ref				23.6	ref			
US	64.0	1.01	0.89	1.15	0.838	60.2	1.55	1.39	1.74	< 0.001	28.5	1.33	1.16	1.53	< 0.001
England	50.7	0.54	0.48	0.61	< 0.001	55.4	1.28	1.14	1.44	< 0.001	15.4	0.57	0.48	0.67	< 0.001
Sex															
Male	57.9	0.87	0.79	0.96	0.004	52.5	0.81	0.74	0.88	< 0.001	23.2	1.10	0.98	1.23	0.105
Female	62.4	ref				58.1	ref				21.7	ref			
Age															
16–17	65.0	1.41	1.28	1.56	< 0.001	56.3	1.05	0.96	1.15	0.269	24.9	1.35	1.21	1.52	< 0.001
18–19	55.7	ref				54.1	ref				20.4	ref			
Race/ethnicity															
White	60.4	1.28	1.15	1.43	< 0.001	56.6	1.23	1.15	1.36	< 0.001	22.1	0.98	0.86	1.11	0.726
Other/mixed	58.7	ref				52.1	ref				23.3	ref			
Past 30 day tobacco status															
Exclusive cigarette user	47.7	0.53	0.43	0.65	< 0.001	41.9	0.51	0.42	0.62	< 0.001	25.7	1.29	1.02	1.64	0.036
Exclusive e-cigarette user	31.8	0.24	0.18	0.30	< 0.001	44.2	0.53	0.42	0.67	< 0.001	10.0	0.33	0.22	0.49	< 0.001
Dual cigarette/ e-cigarette user	32.7	0.25	0.20	0.33	< 0.001	49.2	0.61	0.48	0.77	< 0.001	19.0	0.70	0.52	0.95	0.021
Non-user of either product	65.3	ref				57.9	ref				23.1	ref			

cigarette and e-cigarette use. Young people in England had lower odds of this belief compared to those in Canada (AOR = 0.54, Table 3) but not compared to those in the US (*contrast not in table*).

3.5. Perceptions of addiction

Among all respondents, 55.1% believed that it was at least somewhat likely that people could become addicted to e-cigarettes. The odds of this belief were greater among those who reported noticing health warnings versus those who did not (AOR = 1.43) (Table 3). They were also higher among young people in the US compared to those in Canada (AOR = 1.55, Table 3) and in England (AOR = 1.28, 95% CI: 1.2, 1.4, $p < .001$).

3.6. Perceived relative harm

Approximately 22.5% of respondents perceived e-cigarettes to be as harmful or more harmful than cigarettes. This belief was more likely among those who noticed health warnings (AOR = 1.45, p < .001) (Table 3). It was also highest among young people in the US (AOR = 1.33), and lowest among those in England (AOR = 0.57, 95% CI: 0.50, 0.64, p < .001), compared to young people in Canada.

3.7. Unaided recall

Of those that reported noticing e-cigarette warnings ($n = 1464$), only 7.5% recalled "nicotine" and 7.0% recalled "addiction" as mentioned in the warnings (see Table 4), both keywords and themes that have been used in e-cigarette warnings to date. Both keywords/themes were most frequently recalled by young people in England and by e-cigarette users versus non-users (Table 4). Among participants overall, most provided a no recall response or did not recall these keywords/themes.

Recall of "nicotine" and "addiction" was significantly associated with absolute harm perceptions and addiction perceptions. Those who perceived e-cigarettes to be at least somewhat harmful had a lower prevalence of recalling these keywords (3.9% nicotine; 5.3% addiction) than those with perceptions of no/little harm (12.5% nicotine; 9.9% addiction) ($p \leq 0.01$). However, those who perceived addiction to be at least somewhat likely had a higher prevalence of recalling these keywords (9.1% nicotine; 8.4% addiction) than those who perceived no/little addiction harm (5.2% nicotine; 5.0% addiction) ($p \leq 0.05$). Among ever e-cigarette users, those who knew whether their e-cigarettes contained nicotine also had a higher prevalence of recalling nicotine (13.1%) and addiction (11.0%) compared to those who did not (1.7% for nicotine; 5.0% for addiction) ($p < .05$) (data not in table).

Young people also recalled warnings related to reproductive health (e.g., not for use when pregnant, breastfeeding) (7.4%) and risk to youth (e.g., "keep away from children") (4.6%). Approximately 3.3% recalled a warning related to exposure/consumption risk (e.g., "poisonous", "don't inhale all at once"), with this most frequently recalled among Canadian youth. Fewer (2.8%) recalled a warning related to explosion risk, and this was least frequently mentioned by youth and young adults in England (1.0%). Approximately 2.0% of exposed participants recalled some comparison to cigarettes (e.g., "Bad for you but less than cigarettes", "E-cigarettes are not safer than regular cigarettes", "More harm than regular cigarettes.").

Responses also suggested that participants may have been thinking about cigarette warnings to some extent when answering the recall question, as substantial numbers of respondents mentioned lung cancer or lung disease (14.8%), some other cancer or cancer in general (15.2%) or some other specific health effect (e.g., heart disease, stroke) (14.8%). A smoking-related term ("smoking", "smoke" or "cigarettes") was present in 15.7%, 16.7% and 11.5% of these responses, respectively (e.g., "smoking causes lung cancer", "smoking may cause cancer", "smoking causes wrinkles and aging"), and was mentioned by 10.9% of all participants reporting e-cigarette warning exposure (e.g., "smoking kills"). A higher percentage of respondents in England referred to a

Table 4
Prevalence of keywords/concepts recalled among those exposed to an e-cigarette warning (N = 1464).

Keywords/concepts	Frequency of responses (%)					
	Overall	Non-users	E-cig users	Canada	US	England
	(n = 1464)	(*n* = 1085)	(*n* = 379)	(*n* = 395)	(*n* = 549)	(*n* = 519)
Nicotine	7.5	4.2	16.9	3.5	7.8	10.2
Addiction	7.0	5.0	12.7	3.0	8.6	8.3
Lung cancer/lung disease	14.8	17.3	7.7	19.2	12.2	14.1
Other cancer/"cancer" in general	15.2	17.1	9.5	13.9	20.0	10.8
Specific health effects (e.g., causes impotence)	14.8	15.5	12.9	15.4	15.3	13.7
Harmful in general (e.g., bad for health, dangerous)	12.5	11.4	15.6	11.9	13.7	11.6
Explosions. (e.g., flammable, may overheat)	2.8	2.9	2.4	4.1	3.6	1.0
Comparison to cigarettes (e.g., not a safe alternative to cigarettes)	2.0	1.9	2.1	0.8	4.0	1.0
Youth risk (e.g., keep away from children)	4.6	4.1	6.1	4.8	2.4	6.7
Age restrictions (e.g., must be 18 or older)	1.8	1.3	3.4	0.8	2.6	1.9
Reproductive health (e.g., causes birth defects, not safe when pregnant)	7.4	6.5	9.8	5.1	13.5	2.7
Chemicals	1.4	1.6	1.1	1.3	2.6	0.6
Provided visual description (e.g., warning used gross pictures)	2.7	3.2	1.1	3.8	0.0	4.6
Death (e.g., "Smoking kills")	9.2	10.7	5.0	5.1	3.8	17.9
Consumption (e.g., poisonous, don't eat)	3.3	2.7	5.3	5.1	2.9	2.5
Included smoke/smoking term (e.g., "Smoking kills, secondhand smoke")	10.9	12.4	6.9	8.1	6.7	17.3
Other keyword/theme (e.g., not FDA approved)	6.4	7.3	4.0	5.8	3.8	9.6

smoking-related term in their response (17.3%) compared to those in Canada (8.1%) or the US (6.7%). A higher percentage of non-users versus users recalled warnings pertaining to lung cancer or lung disease, other cancer and specific health effects, and mentioned a smoking-related term (see Table 4).

4. Discussion

This baseline study examined the extent to which young people noticed health warnings on e-cigarette packaging in the US, Canada and England at a time when large standardized warnings were either not yet required in these countries or in the initial phase of implementation. Although there were some differences among subgroups and by country, few young people overall noticed e-cigarette warnings. Even among past 30 day e-cigarette users, those most expected to have noticed such warnings, only about one-third reported having noticed e-cigarette warnings in the past 30 days. These findings are consistent with other studies revealing low rates of noticing warnings on tobacco products without mandated warnings. A study conducted a year prior found that only 5.7% of adult participants reported noticing warnings on vaping devices (McDermott et al., 2019). In another study with youth in the US, 35.5% of current users reported exposure to warnings on shisha products prior to warning standardization (King et al., 2018), similar to rates among current e-cigarette users in this study. By comparison, studies that assessed noticing warnings on regulated products with mandated warnings revealed higher rates of exposure. A 2012 national survey of youth in the US found that over 60% of both past 30 day smokers and smokeless tobacco users reported frequent exposure to cigarette and smokeless tobacco warning labels in the past 30 days, respectively. Prevalence of noticing ranged from about 35% to 42% among non-users of these products (Johnson et al., 2014).

These baseline findings underscore the need for standardized warning requirements with respect to size, formatting and content that can help to enhance their noticeability, recall and potential impact, such as those initiated by the Tobacco Products Directive in the European Union and the FDA in the United States. Research should track whether warning exposure changes over time as new requirements are fully implemented. This is important given that noticing warnings is a basic prerequisite in their ability to inform consumers about potential risks [12; 18] and previous research with cigarettes has found that the strengthening of tobacco warnings is associated with increased warning attention and recall (Noar et al., 2016; Hammond, 2011). Preliminary research also suggests that young people's noticing of e-cigarette warnings might be enhanced by the addition of color or pictorials (Sontag et al., 2019; Mays et al., 2019; King et al., 2019) as is the case for other tobacco warnings.

Although noticing of warnings was expectedly low at this baseline assessment, this study also provides some preliminary evidence about the potential associations of exposure to e-cigarette warnings and e-cigarette knowledge and beliefs. Warnings may be effective in informing youth about the presence of nicotine in e-cigarettes, as was found among ever users who noticed warnings. In addition, results may also demonstrate the potential of warnings to influence beliefs that e-cigarettes cause at least some harm and can be addictive, which could deter non-users, especially youth, from starting. However, results also demonstrate the potential for warnings to increase the misconception that e-cigarettes are as harmful as cigarettes. This could be an unintended consequence if it deters current cigarettes smokers from switching to a less harmful alternative. To address misperceptions of relative risk, Health Canada has proposed allowing manufacturers to display regulated relative risk claims on packaging (Health Canada, n.d.).

A limitation of this study is that the data are cross sectional, so causal assumptions cannot be made. It is also possible that the observed associations exist because those with higher risk/addiction perceptions may be more likely to attend to e-cigarette warnings in the first place. It is also not clear from this study to what extent not noticing warnings was due to a lack of inclusion of any warning labels on products, or to use of warnings with poor noticeability. Although warning requirements were in effect at the time of data collection for this study in England, these were the first few months of implementation and young people may have had few opportunities for encounters with new e-cigarette packaging in these first few months if they were not frequent users. Also, some stores may have been non-compliant with the TPD's May 20, 2017 sell-by date, and still carried older inventory without the updated requirements. Additional limitations include self-reported measures and limiting the assessment of exposure to warnings on e-cigarette packaging and not in ads. The use of self-reports may result in overestimates; however, noticing tobacco warnings has long been assessed using self-reports in many population studies (Noar et al., 2016) and on large population surveys such as the National Youth Tobacco Survey in the United States (Johnson et al., 2014).

In the context of changing e-cigarette warning requirements in different countries, tracking whether the public notices warnings is an important step in policy evaluation and research on how e-cigarette warnings may influence perceptions and use. In addition, tracking

warning exposure from countries that vary in warning policies (e.g., voluntarily or mandated) may be useful in informing policymakers as to which types of warnings may be more effective than others. Continued research on this topic is particularly important with respect to young people, who are the priority audience for these warnings.

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Declaration of Competing Interest

The authors declare there is no conflict of interest.

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