



King's Research Portal

Document Version
Peer reviewed version

[Link to publication record in King's Research Portal](#)

Citation for published version (APA):

East, K., Taylor, E., Simonavicius, E., Nottage, M., Reid, J. L., Burkhalter, R., Brose, L., Wackowski, O. A., Liber, A. C., McNeill, A., & Hammond, D. (in press). Noticing education campaigns or public health messages about vaping among youth in the US, Canada, and England from 2018 to 2022. *Health Education Research*.

Citing this paper

Please note that where the full-text provided on King's Research Portal is the Author Accepted Manuscript or Post-Print version this may differ from the final Published version. If citing, it is advised that you check and use the publisher's definitive version for pagination, volume/issue, and date of publication details. And where the final published version is provided on the Research Portal, if citing you are again advised to check the publisher's website for any subsequent corrections.

General rights

Copyright and moral rights for the publications made accessible in the Research Portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognize and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the Research Portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the Research Portal

Take down policy

If you believe that this document breaches copyright please contact librarypure@kcl.ac.uk providing details, and we will remove access to the work immediately and investigate your claim.

Noticing education campaigns or public health messages about vaping among youth in the US, Canada, and England from 2018 to 2022

Katherine East PhD*¹, Eve V. Taylor MSc¹, Erikas Simonavičius PhD¹, Matilda Nottage MSc¹, Jessica L. Reid MSc², Robin Burkhalter MMath², Leonie Brose PhD¹, Olivia A. Wackowski PhD³, Alex C. Liber PhD⁴, Ann McNeill PhD¹, David Hammond PhD²

* Corresponding author - katherine.east@kcl.ac.uk

¹ National Addiction Centre, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, UK

² School of Public Health Sciences, Faculty of Health, University of Waterloo, Ontario, Canada

³ School of Public Health, Rutgers, The State University of New Jersey, NJ, USA

⁴ Cancer Prevention and Control, Lombardi Comprehensive Cancer Center, Georgetown University, Washington, DC, USA

Running title. Youth noticing of vaping campaigns and messages.

Key words. Vaping; Education; Messaging; Youth; Survey

Funding. This work was supported by: the US National Institutes of Health (NIH; 1P01CA200512); Health Canada's Substance Use and Addictions Program (SUAP); Canadian Institutes of Health Research (CIHR)–Public Health Agency of Canada (PHAC) Applied Public Health Research Chair (to DH); the UK Society for the Study of Addiction (SSA; to KE); Cancer Research UK (PPRCTAGPJT\100008; to KE, EVT, ES, MN, AM); NIH (R37CA222002; to OAW). The views expressed herein do not necessarily represent the views of any of the funding agencies.

Conflicts of interests. DH has served as a paid expert witness on behalf of public health authorities in response to legal challenges from tobacco, vaping, and cannabis companies. No other authors have any potential conflicts of interest to disclose.

Word count. 3860/4000

ABSTRACT (199/200 words)

Purpose. Public health campaigns have the potential to correct vaping misperceptions. However, campaigns highlighting vaping harms to youth may increase misperceptions that vaping is equally/more harmful than smoking. Vaping campaigns have been implemented in the US and Canada since 2018, and in England since 2017, but with differing focus: youth vaping prevention (US/Canada) and smoking cessation (England). We therefore examined country differences and trends in noticing vaping campaigns among youth and, using 2022 data only, perceived valence of campaigns and associations with harm perceptions. **Methods.** Seven repeated cross-sectional surveys of 16–19-year-olds in US, Canada, England (2018-2022, N=92,339). **Results.** Over half of youth reported noticing vaping campaigns, and noticing increased from Aug'18-Feb'20 (US:55.2-74.6%,AOR=1.21,95%CI=1.18-1.24; Canada:52.6-64.5%,AOR=1.13,1.11-1.16; England:48.0-53.0%,AOR=1.05,1.02-1.08) before decreasing (Canada) or plateauing (England/US) to Aug'22. Increases were most pronounced in the US, then Canada. Noticing was most common on websites/social media, school, and television/radio. In 2022 only, most campaigns were perceived to negatively portray vaping and this was associated with accurately perceiving vaping as less harmful than smoking among youth who exclusively vaped (AOR=1.46,1.09-1.97). **Conclusion.** Consistent with implementation of youth vaping prevention campaigns in the US and Canada, most youth reported noticing vaping campaigns/messages, and most were perceived to negatively portray vaping.

INTRODUCTION

There is strong scientific consensus internationally that vaping e-cigarettes is less harmful than smoking cigarettes, but is not risk-free and should be discouraged among youth and people who have never smoked [1-3]. Vaping can help people to quit smoking [4] and nicotine-containing e-cigarettes are recommended in some countries, such as the UK and New Zealand, for adults to quit or reduce their smoking [5]. Despite this, there are pervasive misperceptions that vaping is equally or more harmful than smoking [1,6]; for example, among youth, only 38% in the US, 45% in Canada, and 63% in England, accurately perceived that vaping is less harmful than smoking in 2020, a reduction from 61%, 66%, and 77%, respectively, in 2017 [6]. Similar trends have been seen among adults [1]; for example, among adults who smoke in Great Britain, the proportion who held this accurate perception has declined from 60% in 2014 to 34% in 2023 [7].

Education campaigns (strategic, active efforts to educate the public) or public health messages (any public health statements or messages) have provided information about vaping in several countries, including absolute harms (i.e., compared to not vaping) and harms relative to smoking cigarettes [8-18]. However, the content of campaigns and messages, as well as the target audience, differs across countries. In the US and Canada, vaping campaigns and associated messages from public health organisations have focused predominantly on youth vaping prevention [8-15,18]. For example, in the US in 2018, national campaigns aiming to prevent vaping among youth were launched (e.g., ‘The Real Cost’ in September 2018, and the ‘Truth’ campaign which ran from October to December 2018) [8-11] as well as several state and regional campaigns [14,15,18]. Similarly, in Canada, a national campaign aiming to prevent youth from vaping was launched in December 2018, followed by the national ‘Consider the Consequences of Vaping’ campaign in February 2019 [12], as well as provincial youth vaping prevention campaigns over the same period

[13]. In England, since 2017, vaping has featured only in national campaigns aiming to help adults quit smoking [19,20], and, since 2015, there have been regional vaping campaigns [21] and widely publicised annual reports [1] containing messages that vaping is less harmful than smoking but is not risk-free, and that people who have never smoked should not take up vaping.

Expenditures on youth vaping prevention campaigns in the US and Canada have also been greater than expenditures on any vaping campaigns in England [11,12,22]. For example, in the US, ‘The Real Cost’ has been described as ‘a nearly \$60 million effort’ [23] and the advocacy organisation Campaign for Tobacco-Free Kids partnered with Bloomberg Philanthropies in 2019 to launch a US\$160 million campaign entitled ‘Protect Kids: Fight Flavored E-Cigarettes’ [11]. In Canada, CDN\$9 million was invested into Health Canada’s ‘Consider the Consequences of Vaping’ campaign [12]. In England, there has been no specific government expenditure on vaping campaigns, other than the aforementioned smoking cessation campaigns which mention vaping [22].

Understanding the extent to which the public are exposed to vaping campaigns or messages is important because campaigns/messages can change public perceptions of vaping harms [1,24,25] particularly when provided by public health bodies which are viewed as credible sources of information [25-27]. Evidence suggests that vaping campaigns/messages aiming to deter youth vaping and highlighting that vaping is harmful can increase perceptions that vaping is harmful [1,25]; however, they can also result in overestimation of the harms of vaping relative to smoking [1,25]. Conversely, campaigns/messages highlighting that vaping is less harmful than smoking can increase the accurate perception that vaping is less harmful than smoking [1,25,28], but have also been found to increase misperceptions that vaping is safe [28]. It is possible that youth vaping prevention campaigns in the US and Canada have contributed to the increasing misperception that

vaping is equally or more harmful than smoking observed among youth in these countries [6]. It is also possible that vaping campaigns or messages could help to correct misperceptions [1,24,25]. Ideally, messages would convey that vaping is risky, but less so than smoking, in line with current evidence [1-3].

Specific channels may allow for targeted interventions communicating vaping information to either youth, or adults who smoke. National campaigns in the US [8-11] and Canada [12] have attempted to deter youth from vaping through disseminating information via television, online videos, social media, dedicated websites, and schools; for example, in the US, school youth vaping prevention campaigns have been found to increase perceptions of vaping as harmful among school children [29,30]. Conversely, pharmacies/chemists may be ideal settings for communicating the benefits of switching to vaping to adults who smoke [31], particularly because evidence suggests that pharmacy staff are often asked by people who smoke for evidence-based advice around vaping [32] and pharmacies can help to increase the efficacy of smoking cessation interventions [33]. Bars or other adult-only venues could also be used to target vaping information to adults. However, little is known about youth exposure to vaping campaigns or messages across these, or other, channels.

This study therefore aimed to examine country differences (England, Canada, US; Aim 1) and trends (from 2018 to 2022; Aim 2) in the prevalence of noticing vaping campaigns or messages among youth, overall and via individual channels. We had two a-priori hypotheses [34]: first, that noticing any vaping campaigns or messages would be more prevalent among youth in the US and Canada compared with England, because vaping campaigns in the US and Canada predominantly targeted youth and received higher expenditure than those in England; second, that noticing any vaping campaigns or messages would increase between 2018 and February/March 2020 among youth in the US, Canada, and England, because campaigns were launched in all three countries

over this period [8-10,12-15,20,21]. Moreover, the 2019 outbreak of lung injuries associated with vaping contaminated cannabis products in the US led some public health organisations (e.g., the US Centres for Disease Control and Prevention) to warn against the use of e-cigarettes, and also increased public discussions about the health harms of vaping internationally; exposure to public health messaging about vaping may therefore have also increased in late 2019 and early 2020. The second hypothesis is restricted to survey waves up to February/March 2020 because the COVID-19 pandemic impacted vaping behaviours [35], dominated public health messaging, and disrupted education. Using the most recent wave of data (2022) only, we also explored the perceived valence of the vaping campaigns or messages that youth noticed, and associations between noticing negative campaigns and vaping harm perceptions (Aim 3).

METHODS

The analysis plan for this study was pre-registered, and code made available, on the Open Science Framework (osf.io/6c2uz) [34].

Data source

Data were from seven waves (2018 to 2022) of the International Tobacco Control Policy Evaluation Project (ITC) Youth Tobacco and Vaping Survey, a repeat cross-sectional online survey of youth aged 16-19 in England, Canada, and the US. Samples were recruited from the Nielsen Consumer Insights Global Panel and their partners' panels. Respondents were recruited either directly or through their parents via email invitations sent to panelists (after targeting for age criteria) including those known to be parents. The surveys were online and took approximately 20 minutes to complete. This study received ethics clearance through the University of Waterloo Research Ethics Committee (ORE#21847/31017) and the King's College London Psychiatry, Nursing &

Midwifery Research Ethics Subcommittee. A full description of the study methods can be found in the Technical Reports [36]. The 2018 survey wave was selected as the first wave for analyses because this was the first in which respondents asked about their noticing of education campaigns or public health messages about vaping.

A total of N=99,977 respondents completed the surveys, of whom N=92,339 were retained in the analytic sample. Respondents were excluded if they: failed data integrity checks (n=3,450), had missing/incomplete data on variables required for calculating weights or determining smoking or vaping status (n=1,862), were recruited in a previous wave (n=2,220; to maintain repeat cross-sectional data, as some cohort respondents were present in the first few waves), or were an ineligible age (n=106).

Measures

Noticing education campaigns or public health messages about vaping

All respondents were asked, “In the past 12 months, have you noticed education campaigns or public health messages about e-cigarettes / vaping in any of the following places? ...” followed by a list of channels (shown in Table 1), with response options ‘Yes,’ ‘No,’ ‘Don’t know,’ or ‘Refuse to answer’ for each. Respondents who answered ‘Yes’ to any of the channels were coded as having noticed any vaping campaigns or messages in the past 12 months; all other respondents were coded as ‘Other’. Each individual channel was also modelled as an outcome where the proportion who responded ‘Yes’ to noticing via that channel was at least 5% of the overall sample. All channels (1 to 17 listed above) were noticed by at least 5% of the overall sample and so were modelled as outcomes, except ‘other (please specify)’, which was reported by <1% of the sample.

Country and survey wave (independent variables)

Country. England, Canada, US.

Survey wave. August/September 2018, August/September 2019, February/March 2020, August 2020, February/March 2021, August 2021, August/September 2022. Survey wave was treated as categorical to aid interpretation of the findings. Inclusion of the August 2021 and August/September 2022 survey waves was additional to the pre-registration [34] due to the availability of data from these waves at the time of analysis and because a new measure examining perceived valence of vaping campaigns was added in August/September 2022.

Covariates

Age group. 16-17, 18-19.

Sex. Male, female. Sex was coded from sex at birth for most respondents, or imputed from gender where sex at birth was missing [36].

Race/ethnicity. White only, any other race/ethnicity, don't know/refused. Race/ethnicity was derived from country-specific items that are described in the Technical Reports [36].

Perceived family financial situation. Not meeting basic expenses, just meeting basic expenses, meeting needs with a little left over, living comfortably, don't know/refused.

Student status. Yes (enrolled currently or for upcoming year), no, don't know/refused.

Smoking/vaping subgroups

We considered five mutually exclusive use subgroups as a sensitivity analysis, with categories based on prior research [37-40]: 1) exclusive past 30-day vaping (i.e., vaped but did not smoke in the past 30 days); 2) exclusive past 30-day smoking (i.e., smoked but did not vape in the past 30 days); 3) past 30-day vaping/smoking (i.e., vaped and smoked in the past 30 days); 4) ever but not

past 30-day vaping/smoking (i.e., ever smoked and/or vaped, but not in the past 30 days); 5) never vaped/smoked (never smoked and never vaped).

Perceived valence of vaping campaigns and vaping harm perceptions in 2022

Perceived valence of vaping campaigns. Additional to the pre-registration [34], in the most recent (August/September 2022) wave only, a new measure was added examining perceived valence of vaping campaigns. Respondents who selected ‘Yes’ for any of the above channels for noticing vaping campaigns were subsequently asked, “Were the majority of education campaigns or public health messages you noticed about e-cigarettes...” (a) ‘Mostly negative about e-cigarettes,’ (b) ‘Mostly positive about e-cigarettes,’ (c) ‘About the same number of positive and negative,’ (d) ‘Don’t know’, or (e) ‘Refuse to answer’. Responses were coded as mostly negative (a) vs otherwise (b-e).

Vaping harm perceptions. Additional to the pre-registration [34], for this study, we examined harm perceptions of vaping relative to smoking in the most recent (August/September 2022) wave only, using the measure “Is using e-cigarettes/vaping less harmful, about the same, or more harmful than smoking cigarettes?” with response options (a) ‘A lot more harmful than “regular” tobacco cigarettes,’ (b) ‘A little more harmful than “regular” tobacco cigarettes,’ (c) ‘As harmful as “regular” tobacco cigarettes’, (d) ‘A little less harmful than “regular” tobacco cigarettes’, (e) ‘A lot less harmful than “regular” tobacco cigarettes’, (f) ‘Don’t know’, and (g) ‘Refused to answer’. Responses were coded as accurately perceiving vaping as less harmful than smoking (d-e) vs. otherwise (a-c or f-g), consistent with prior research [6,21,31].

ANALYSES

To address Aims 1 and 2, the number and proportion of youth who noticed any vaping campaigns or public health messages, as well as via each individual channel, were reported by country and survey wave. Logistic regression models adjusting for survey wave and demographic covariates were used to predict noticing any vaping campaigns or messages, as well as each individual channel, from country. A country-by-survey wave interaction term was subsequently added to each of the adjusted logistic regression models, and outcomes were contrasted between survey waves within countries using Stata's *margins* post-estimation command. To address our hypotheses, England and August/September 2018 were primarily treated as reference categories for country and survey wave, respectively. These analyses were conducted with the overall sample, as well as sensitivity analyses stratified by each vaping/smoking subgroup.

To address Aim 3, using data from August/September 2022 only, the number and proportion of youth who perceived that campaigns or messages were mostly positive or mostly negative towards vaping were reported by country, and logistic regression models adjusting for demographic covariates were used to predict the perception that campaigns were mostly negative (vs. other) from country. Also using data from August/September 2022 only, logistic regression models adjusting for country and demographic covariates were used to predict accurate (vs. other) relative harm perceptions from the perception that campaigns were mostly negative (vs. other) towards vaping. The interaction between perceiving campaigns to be negative and country were explored.

Analyses were conducted in Stata v.17 and applied cross-sectional post-stratification sample weights (see Technical Reports for details) [36].

RESULTS

Sample characteristics

Table S1 (Supporting Information) shows the sample characteristics by wave and country. Most participants identified as White (only) (66.5%), were students (91.9%), and perceived their family's financial situation as meeting needs or living comfortably (68.8%). The majority reported that they had never smoked or vaped (53.4%), while 9.5% reported only vaping in the past 30 days, 4.8% reported only smoking in the past 30 days, 5.4% reported both smoking and vaping in the past 30 days, and 26.7% reported ever vaping and/or smoking but not in the past 30 days.

Noticing education campaigns or public health messages about vaping

Over most years, more than half of youth in England, Canada, and the US reported noticing vaping campaigns or public health messages (Figure 1).

Country differences (Aim 1)

Table 1 shows the country differences in noticing vaping campaigns or messages, overall and via 17 individual channels, aggregated across survey waves. As hypothesised, when aggregating data across survey waves, compared with England (52.5%), noticing any vaping campaigns or messages was more prevalent among youth in the US (72.1%; AOR=2.34, 95% CI=2.24-2.44, $p<.001$) and Canada (65.3%; AOR=1.62, 1.56-1.68, $p<.001$). Noticing was also greater in the US than Canada (AOR=1.45, 1.39-1.51, $p<.001$).

Considering the 17 individual channels, those most commonly selected were websites/social media, school, and television/radio (Table 1). Compared with England, noticing on most channels was more prevalent among youth in both the US and Canada. However, noticing in leaflets/flyers, kiosks/temporary sales locations, and bars/pubs was more prevalent in England than Canada. Comparing the US and Canada, noticing on most channels was more prevalent in the US, although noticing in taxis or buses/public transit was more prevalent in Canada.

Trends over time (Aim 2)

Figure 1 shows the trends in noticing any vaping campaigns/messages within each country, and Table 2 shows the associations in detail and in each of the 17 individual channels. As hypothesised, noticing any vaping campaigns increased between 2018 and February/March 2020 in each country (England: 48.0% to 56.5%, AOR=1.09, 1.07-1.12, $p<.001$; Canada: 52.7% to 74.2%, AOR=1.25, 1.22-1.28, $p<.001$; US: 55.2% to 74.6%, AOR=1.21, 1.18-1.24, $p<.001$) before decreasing (Canada) or plateauing (England, US) between February/March 2020 and August 2022 (Figure 1 and Table 2).

Trends were similar within each of the 17 individual channels (Table 2). Noticing was most common on websites/social media (range 22-55%, depending on country and survey wave), at school (range 18-51%), and on television/radio (range 14-48%), again with the most pronounced increases observed in the US and Canada between 2018 and February/March 2020.

Tables S3-S7 show the trends stratified by smoking/vaping. In the US and Canada, trends among all subgroups were comparable to the full sample. In England, increases over time in noticing any education campaigns or messages were observed among those who had never smoked/vaped, ever but not past 30-day smoking/vaping, and past 30-day smoking/vaping only.

Perceived valence of vaping campaigns in 2022: country differences and associations with harm perceptions (Aim 3)

Compared with England (54.4%), the perception that campaigns/messages were mostly negative towards vaping (vs. otherwise) was more prevalent in the US (76.3%; AOR=2.78, 95% CI=2.39-3.23, $p<.001$) and Canada (72.0%; AOR=2.23, 1.95-2.55, $p<.001$, Figure 2). Comparing the US and Canada, the perception that campaigns/messages were mostly negative towards vaping was

more prevalent in the US (AOR=1.25, 1.08-1.44, $p=.003$; Figure 2). Table S8 shows the full adjusted logistic regression models and that similar country differences were observed when stratified by smoking/vaping subgroups.

Overall, less than half of youth accurately perceived vaping to be less harmful than smoking (41.6%). The accurate perception that vaping is less harmful than smoking was more prevalent among youth who perceived that campaigns/messages were mostly negative towards vaping (43.0%) compared with youth who did not perceive the campaigns/messages as mostly negative (41.4%) (AOR=1.19, 1.05-1.33, $p=.005$); however, when stratified by smoking/vaping, this association was only significant among youth who had vaped but not smoked in the past 30 days (Table S9). When examining interactions, there was little evidence that the association between noticing negative education campaigns and accurate relative perceptions differed across countries (Canada vs. US difference: AOR=0.87, 0.64-1.19, $p=.389$; England vs. US difference: AOR=0.89, 0.65-1.21, $p=.450$) although accurate relative perceptions were more prevalent overall among youth in England (51.9%) than Canada (43.4%; AOR=0.70, 0.61-0.79, $p<.001$) and the US (34.8%; AOR=0.48, 0.41-0.55, $p<.001$) (Table S9).

DISCUSSION

From 2018 through 2022, between half and three quarters of youth in England, Canada, and the US reported noticing education campaigns or public health messages about vaping. As hypothesised, noticing was most prevalent among youth in the US, followed by Canada, and least prevalent among youth in England. Also as hypothesised, noticing increased between 2018 and February/March 2020 among youth in all three countries, but to a greater extent in the US and Canada than in England. Youth mainly reported noticing vaping campaigns/messages on

websites/social media, at school, and on television/radio. Most campaigns/messages that were noticed were perceived to be mostly negative towards vaping in 2022, particularly in the US.

Findings are consistent with the launch of well-funded national and regional youth vaping prevention campaigns on websites, social media, television, and at schools in the US and Canada [8-15,18]. Noticing increased to the greatest extent in the US, reaching 77% in August 2021, consistent with high expenditures. Findings are also consistent with widespread media coverage of the 2019 outbreak of lung injuries associated with vaping contaminated cannabis products [41-43] and with our previous work finding that misperceptions of the harms of vaping relative to smoking are pervasive among youth, and more pervasive in the US and Canada than in England [6].

Vaping campaigns/messages that were noticed by youth were perceived to be mostly negative, consistent with the content of youth vaping prevention campaigns in the US and Canada, as well as evidence reviews finding that youth-targeted campaigns aim to deter youth from trying vaping, often by highlighting the risks of vaping [1,24,25]. These findings may also reflect negativity bias, such that noticing and recalling negative information is easier than for neutral or positive information, particularly among youth [44]. Unexpectedly, and inconsistent with prior research [1,24,25], perceiving that messages portrayed vaping to be mostly negative was associated with accurate perceptions of vaping as less harmful than smoking, although this was only evident among youth who exclusively vaped, and there was little evidence for any association among youth who exclusively smoked, smoked and vaped, or did neither. This study was cross-sectional and so the direction of associations cannot be established—it is possible that youth who vaped and believed vaping to be less harmful than smoking were more likely to remember negative campaigns because they conflicted with their existing beliefs and behaviours and stimulated feelings of dissonance or counter-arguing [45].

Certain channels may be more suitable for targeted communication of vaping information to youth, or to adults who smoke. Most youth in this study who noticed vaping campaigns/messages did so on websites/social media, at school, and on television/radio. While information communicated via websites/social media and television/radio may also reach adults, schools are a useful venue for carefully-designed interventions, with accurate messages, to deter youth from vaping with minimal impact on adults who smoke, and evidence suggests that interventions in schools can change youth's harm perceptions of vaping [1]. Conversely, campaigns/messages at work, in bars/pubs, and in the post/mail—which were noticed by few youth in this study—could be explored as potential channels for interventions that are intended to encourage adults who smoke to switch to vaping.

This study has limitations. First, the data collection period spanned the COVID-19 pandemic, which impacted behaviours including youth vaping [35], dominated public health messaging, and disrupted education. Our hypothesis regarding trends over time was therefore restricted to the 2018 through February/March 2020 survey waves. Second, the outcome measure was noticing campaigns/messages in the past 12 months, which does not describe frequency or impact, has overlapping time periods for those survey waves that were 6 months apart, and does not distinguish between education campaigns (which are strategic and active) and broader public health messages. Third, the high proportion of youth who reported noticing vaping campaigns/messages—particularly on websites/social media which was the leading channel—could be partially attributable to misreporting and/or conflation with noticing news stories or advertisements/marketing, which also increased over the study period [6,46]. Fourth, samples were not probability based and survey weights differed between countries: data for Canada and the US were weighted to reflect national smoking trends among youth, while data for England were not,

due to lack of national smoking estimates among English youth aged 16-19; however, this would not have impacted within-country trends, and the large country differences that were observed in this study are unlikely to be an effect of survey weighting. Strengths of this study include the use of data from three countries with different expenditures on, and focuses of, vaping campaigns, and a large sample that allowed for subgroup analyses by smoking and vaping behaviours.

This study also has important implications. Vaping campaigns and public health messages were commonly noticed by youth in the US, Canada, and England, and most youth perceived vaping to be negatively portrayed. This suggests that campaigns aiming to deter youth from trying vaping are reaching their target audience. Most youth noticed on websites/social media and at school, and, as mentioned above, schools in particular could be a useful venue for carefully designed vaping campaigns specifically targeting youth. Building on our previous work examining trends in vaping perceptions since 2017 [6], this study found a further drop in the accurate perception that vaping is less harmful than smoking in 2022. Any campaigns or public health messages about vaping should therefore be accurate and balanced so as not to further exacerbate pervasive misperceptions of relative vaping harms.

REFERENCES

1. McNeill, A., et al. *Nicotine vaping in England: an evidence update including health risks and perceptions*, 2022. 2022; Available from: assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1107701/Nicotine-vaping-in-England-2022-report.pdf.
2. Stratton, K., L.Y. Kwan, and D.L. Eaton, *Public health consequences of e-cigarettes (report of The National Academies of Sciences, Engineering and Medicine)*. 2018: Washington (DC).
3. Health Canada. *Vaping and quitting smoking*. 2021; Available from: <https://www.canada.ca/en/health-canada/services/smoking-tobacco/vaping/smokers.html>.
4. Hartmann-Boyce, J., et al., *Electronic cigarettes for smoking cessation*. Cochrane Database Syst Rev, 2021. **4**: p. CD010216 DOI: 10.1002/14651858.CD010216.pub5.
5. The National Institute for Health and Care Excellence. *NICE guideline [NG209] Tobacco: preventing uptake, promoting quitting and treating dependence*. 2018 10th August 2022]; Available from: <https://www.nice.org.uk/guidance/ng209/chapter/Recommendations-on-treating-tobacco-dependence#stop-smoking-interventions>.
6. East, K., et al., *Exposure to negative news stories about vaping, and harm perceptions of vaping, among youth in England, Canada, and the US before and after the outbreak of E-cigarette or Vaping-Associated Lung Injury (EVALI)*. Nicotine Tob Res, 2022 DOI: 10.1093/ntr/ntac088.
7. Action on Smoking and Health. *Headline results ASH Smokefree GB adults and youth survey results*. 2023; Available from: <https://ash.org.uk/uploads/Headline-results-ASH-Smokefree-GB-adults-and-youth-survey-results-2023.pdf?v=1684400380>.
8. Zeller, M., *Evolving "The Real Cost" Campaign to Address the Rising Epidemic of Youth E-cigarette Use*. Am J Prev Med, 2019. **56**(2 Suppl 1): p. S76-S78 DOI: 10.1016/j.amepre.2018.09.005.
9. Truth Initiative. *Youth smoking and vaping prevention*. 2021 [cited 2021 3rd December 2021]; Available from: <https://truthinitiative.org/what-we-do/youth-smoking-prevention-education>.
10. Hair, E.C., et al., *Early evidence of the associations between an anti-e-cigarette mass media campaign and e-cigarette knowledge and attitudes: results from a cross-sectional study of youth and young adults*. Tob Control, 2021 DOI: 10.1136/tobaccocontrol-2020-056047.
11. Tobacco Free Kids, *2020 Annual Report*. 2020.
12. Health Canada, *Youth Vaping Prevention Public Education*. 2019.
13. British Columbia Ministry of Health, *Province implements vaping action plan*. 2020.
14. California Hospital Association, *CDPH Launches Anti-Vaping Ad Campaign Aimed at Young Adults*. 2019.
15. New York State Department of Health, *DOH Launches New TV Ad Campaign to Educate Teens and Their Parents About the Dangers of Vaping*. 2019.
16. Vereen, R.N., et al., *Aided recall of The Real Cost e-cigarette prevention advertisements among a nationally representative sample of adolescents*. Prev Med Rep, 2022. **28**: p. 101864 DOI: 10.1016/j.pmedr.2022.101864.
17. Erku, D.A., et al., *Framing and scientific uncertainty in nicotine vaping product regulation: An examination of competing narratives among health and medical organisations in the*

- UK, Australia and New Zealand. *Int J Drug Policy*, 2020. **78**: p. 102699 DOI: 10.1016/j.drugpo.2020.102699.
18. Kresovich, A., et al., *What's in the message? An analysis of themes and features used in vaping prevention messages*. *Addictive Behaviors Reports*, 2021 DOI: 10.1016/j.abrep.2021.100404.
 19. Public Health England, *Stoptober 2017: Campaign Evaluation*. 2018.
 20. Public Health England. *PHE Health Harms campaign encourages smokers to quit*. 2018; Available from: <https://www.gov.uk/government/news/phe-health-harms-campaign-encourages-smokers-to-quit>.
 21. Tattan-Birch, H., et al., *Evaluation of the Impact of a Regional Educational Advertising Campaign on Harm Perceptions of E-Cigarettes, Prevalence of E-Cigarette Use, and Quit Attempts Among Smokers*. *Nicotine Tob Res*, 2020. **22**(7): p. 1148-1154 DOI: 10.1093/ntr/ntz236.
 22. All Party Parliamentary Group on Smoking and Health, *Delivering a Smokefree 2030: The All Party Parliamentary Group on Smoking and Health recommendations for the Tobacco Control Plan 2021*. 2021.
 23. Food and Drug Administration. *FDA launches its first youth e-cigarette prevention TV ads, plans new educational resources as agency approaches one-year anniversary of public education campaign*. 2019; Available from: <https://www.fda.gov/news-events/press-announcements/fda-launches-its-first-youth-e-cigarette-prevention-tv-ads-plans-new-educational-resources-agency>.
 24. Janmohamed, K., et al., *Interventions to Mitigate Vaping Misinformation: A Meta-Analysis*. *J Health Commun*, 2022: p. 1-9 DOI: 10.1080/10810730.2022.2044941.
 25. Erku, D.A., et al., *Does the content and source credibility of health and risk messages related to nicotine vaping products have an impact on harm perception and behavioural intentions? A systematic review*. *Addiction*, 2021.
 26. Malterud, A., *Exploring Source Credibility and Message Theme Impacts: Developing e-Cigarette Health Messages for College Students*. 2021.
 27. Lee, D.N. and E.M. Stevens, *Message Source Credibility and E-Cigarette Harm Perceptions among Young Adults*. *Int J Environ Res Public Health*, 2022. **19**(15) DOI: 10.3390/ijerph19159123.
 28. Svenson, M., J. Green, and O.M. Maynard, *Tackling Smoker Misperceptions about E-cigarettes using Expert Videos*. *Nicotine Tob Res*, 2021 DOI: 10.1093/ntr/ntab104.
 29. Gaiha, S.M., et al., *School-based e-cigarette education in Alabama: Impact on knowledge of e-cigarettes, perceptions and intent to try*. *Addictive Behaviors*, 2021. **112**((Gaiha, Razo, Halpern-Felsher) Division of Adolescent Medicine, Department of Pediatrics, Stanford University, Palo Alto, CA, United States(Duemler, Walley) Division of Hospital Medicine, Department of Pediatrics, University of Alabama at Birmingham, Birm): p. 106519 DOI: <http://dx.doi.org/10.1016/j.addbeh.2020.106519>.
 30. Pentz, M.A., et al., *A videogame intervention for tobacco product use prevention in adolescents*. *Addictive Behaviors*, 2019. **91**: p. 188-192 DOI: 10.1016/j.addbeh.2018.11.016.
 31. Erku, D.A., et al., *Nicotine vaping product use, harm perception and policy support among pharmacy customers in Brisbane, Australia*. *Drug Alcohol Rev*, 2019. **38**(6): p. 703-711 DOI: 10.1111/dar.12984.

32. Erku, D.A., et al., *Electronic nicotine delivery systems (e-cigarettes) as a smoking cessation aid: a survey among pharmacy staff in Queensland, Australia*. *Addictive behaviors*, 2019. **91**: p. 227-233.
33. Saba, M., et al., *Meta-analysis of the effectiveness of smoking cessation interventions in community pharmacy*. *Journal of Clinical Pharmacy and Therapeutics*, 2014. **39**(3): p. 240-247 DOI: <https://doi.org/10.1111/jcpt.12131>.
34. East, K., et al. *Trends and country differences in noticing education campaigns or public health messages about e-cigarettes: repeated cross-sectional surveys of youth in England, Canada, and the United States from 2018 to 2021*. 2022; Available from: osf.io/6c2uz.
35. Chaiton, M., et al., *Perceived Impact of COVID on Smoking, Vaping, Alcohol and Cannabis Use Among Youth and Youth Adults in Canada*. *Can J Psychiatry*, 2021: p. 7067437211042132 DOI: 10.1177/07067437211042132.
36. Hammond, D. *ITC Youth Tobacco and Vaping Survey*. 2022 16th May 2022]; Available from: <http://davidhammond.ca/projects/e-cigarettes/itc-youth-tobacco-ecig/>.
37. Stead, M., et al. *E-cigarette marketing in the UK: evidence from adult and youth surveys and policy compliance studies*. 2021; Available from: <https://www.cancerresearchuk.org/sites/default/files/e-cigarette-marketing-in-the-uk-fullreport-march-2021.pdf>.
38. Glasser, A.M., et al., *Youth Vaping and Tobacco Use in Context in the United States: Results From the 2018 National Youth Tobacco Survey*. *Nicotine & Tobacco Research*, 2020. **23**(3): p. 447-453 DOI: 10.1093/ntr/ntaa010.
39. Villanti, A.C., et al., *Frequency of youth e-cigarette and tobacco use patterns in the U.S.: Measurement precision is critical to inform public health*. *Nicotine and Tobacco Research*, 2016 DOI: 10.1093/ntr/ntw388.
40. Cooper, M., et al., *E-cigarette Dual Users, Exclusive Users and Perceptions of Tobacco Products*. *Am J Health Behav*, 2016. **40**(1): p. 108-16 DOI: 10.5993/ajhb.40.1.12.
41. Leas, E.C., et al., *News coverage of the E-cigarette, or Vaping, product use Associated Lung Injury (EVALI) outbreak and internet searches for vaping cessation*. *Tob Control*, 2020 DOI: 10.1136/tobaccocontrol-2020-055755.
42. Algiers, O., Y. Wang, and L. Laestadius, *Content Analysis of U.S. Newspaper Coverage of Causes and Solutions to Vaping-Associated Lung Injury*. *Subst Use Misuse*, 2021: p. 1-7 DOI: 10.1080/10826084.2021.1883663.
43. Jeong, M., et al., *Content Analysis of E-cigarette News Articles Amidst the 2019 Vaping-Associated Lung Injury (EVALI) Outbreak in the U.S*. *Nicotine Tob Res*, 2021 DOI: 10.1093/ntr/ntab203.
44. Carstensen, L.L. and M. DeLiema, *The positivity effect: a negativity bias in youth fades with age*. *Curr Opin Behav Sci*, 2018. **19**: p. 7-12 DOI: 10.1016/j.cobeha.2017.07.009.
45. Festinger, L., *A theory of cognitive dissonance*. 1957, Evanston, IL: Row, Peterson.
46. Cho, Y.J., et al., *Trends in exposure to and perceptions of e-cigarette marketing among youth in England, Canada and the United States between 2017 and 2019*. *Health Education Research*, 2021 DOI: 10.1093/her/cyab039.

Figure 1. Proportion of youth aged 16-19 who reported noticing any education campaigns or public health messages about vaping within England, Canada, and the US, 2018 to 2022 (N=92,339). Data are weighted.

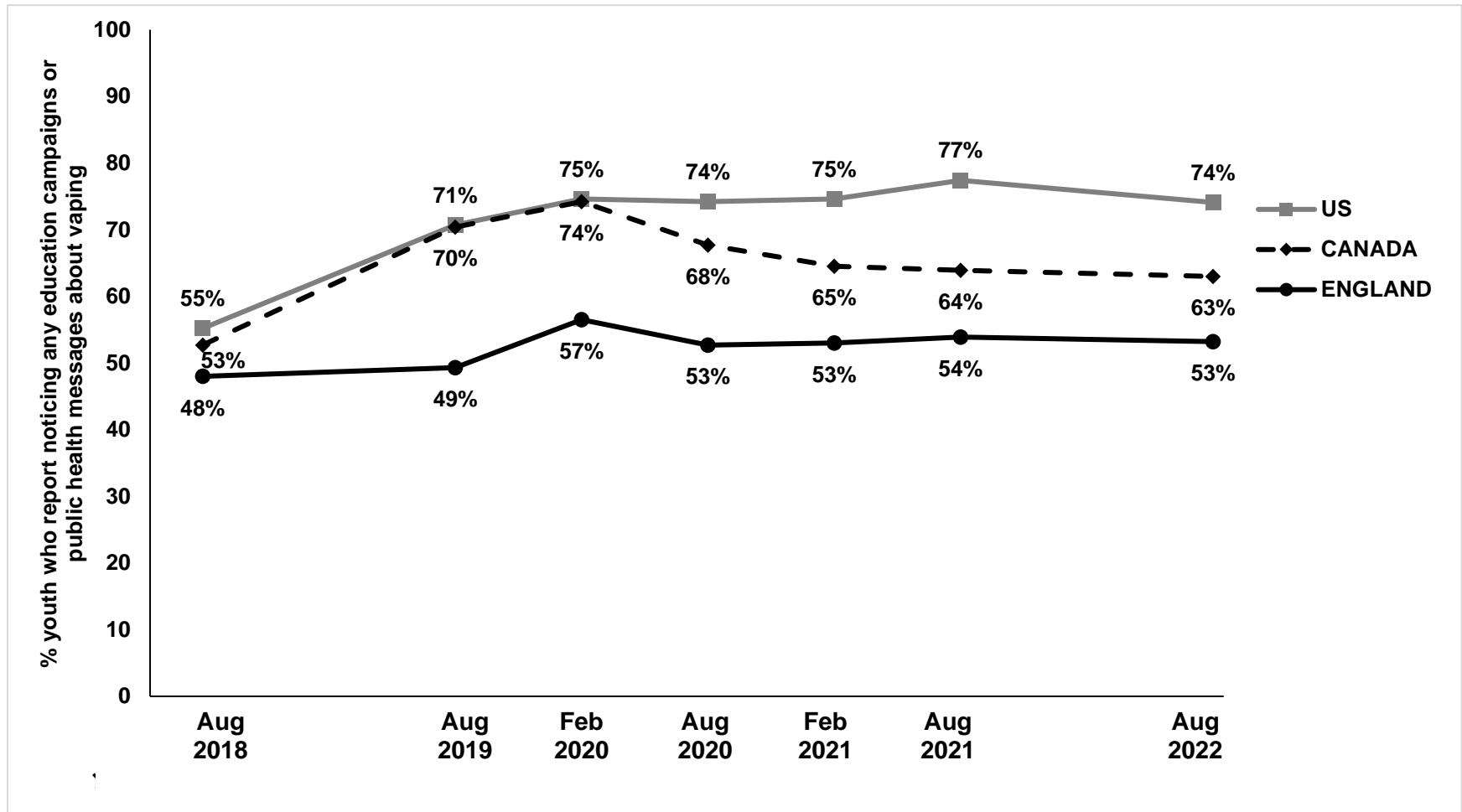


Figure 2. Proportion of youth within each country who perceived that vaping campaigns or public health messages were mostly negative, about the same, or mostly positive, among youth who noticed any vaping campaigns or public health messages in 2022 (n=8,267). Data are weighted.

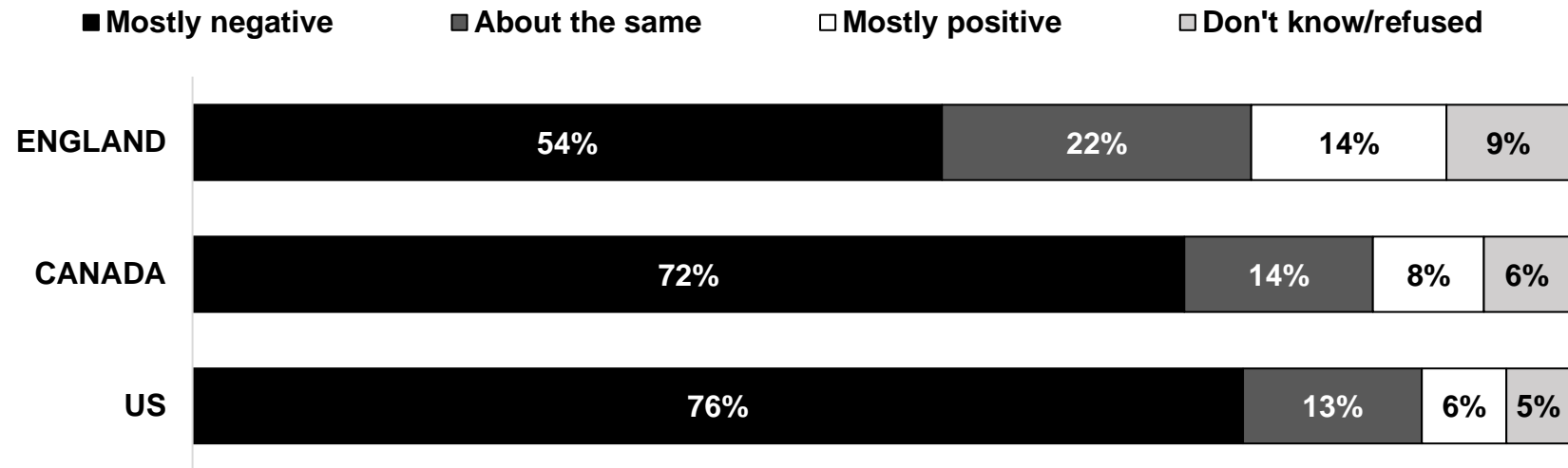


Table 1. Differences between England, Canada, and the US in the proportion of youth who report noticing vaping campaigns or public health messages overall and via individual channels (N=92,339).

	%	England as reference		Canada as reference	
		AOR (95% CI)	p	AOR (95% CI)	p
Any noticing					
England	52.5	REF			
Canada	65.3	1.62 (1.56-1.68)	<.001	REF	
US	72.1	2.34 (2.24-2.44)	<.001	1.45 (1.39-1.51)	<.001
On websites or social media, like Facebook, Twitter, YouTube, Instagram or Snapchat					
England	26.9	REF			
Canada	39.3	1.68 (1.61-1.75)	<.001	REF	
US	48.3	2.57 (2.46-2.68)	<.001	1.53 (1.47-1.59)	<.001
At school					
England	23.3	REF			
Canada	41.9	2.32 (2.23-2.42)	<.001	REF	
US	42.0	2.40 (2.30-2.51)	<.001	1.03 (0.99-1.07)	.099
On television or radio					
England	17.4	REF			
Canada	28.4	1.84 (1.76-1.93)	<.001	REF	
US	42.7	3.56 (3.40-3.73)	<.001	1.93 (1.86-2.01)	<.001
On billboards or posters					
England	14.5	REF			
Canada	21.5	1.54 (1.47-1.62)	<.001	REF	
US	29.4	2.44 (2.33-2.57)	<.001	1.58 (1.51-1.65)	<.001
At a chemist/pharmacy¹					
England	18.5	REF			
Canada	23.6	1.29 (1.24-1.35)	<.001	REF	
US	22.8	1.29 (1.22-1.35)	<.001	0.99 (0.95-1.04)	.774
In shops/stores that sell e-cigarettes/vaping products					
England	17.1	REF			
Canada	17.5	0.98 (0.94-1.03)	.446	REF	
US	18.8	1.10 (1.04-1.15)	<.001	1.12 (1.06-1.17)	<.001
In print newspapers or magazines					
England	14.2	REF			
Canada	16.3	1.10 (1.05-1.16)	<.001	REF	
US	19.4	1.42 (1.35-1.50)	<.001	1.29 (1.23-1.35)	<.001
Outside shops/stores that sell e-cigarettes/vaping products					
England	15.3	REF			
Canada	16.7	1.04 (0.99-1.10)	.105	REF	
US	18.4	1.21 (1.15-1.28)	<.001	1.17 (1.11-1.23)	<.001
In leaflets/flyers¹					
England	15.0	REF			
Canada	13.4	0.81 (0.76-0.85)	<.001	REF	
US	17.7	1.19 (1.13-1.25)	<.001	1.48 (1.40-1.55)	<.001
Taxis or buses/public transit					
England	11.4	REF			
Canada	17.0	1.46 (1.38-1.54)	<.001	REF	
US	14.2	1.25 (1.18-1.33)	<.001	0.86 (0.81-0.90)	<.001
At kiosks or temporary sales locations (in shopping centres, parked in the street, other places, but not at specific events)					
England	11.9	REF			
Canada	11.5	0.90 (0.85-0.95)	<.001	REF	
US	12.5	1.03 (0.97-1.09)	.331	1.15 (1.08-1.22)	<.001

Table 1 continued below.

Table 1 (continued). Differences between England, Canada, and the US in the proportion of youth who report noticing vaping campaigns or public health messages, overall and by individual channels (N=92,339).

	%	England as reference		Canada as reference	
		AOR (95% CI)	p	AOR (95% CI)	p
At events like fairs, markets, festivals, sporting events, or music concerts					
England	8.5	REF			
Canada	10.7	1.19 (1.12-1.27)	<.001	REF	
US	12.6	1.52 (1.43-1.62)	<.001	1.28 (1.20-1.35)	<.001
At the cinema/movies¹					
England	6.7	REF			
Canada	10.4	1.48 (1.38-1.58)	<.001	REF	
US	13.7	2.17 (2.02-2.32)	<.001	1.47 (1.38-1.56)	<.001
In email or text messages					
England	6.4	REF			
Canada	9.1	1.36 (1.27-1.46)	<.001	REF	
US	12.6	2.07 (1.93-2.22)	<.001	1.51 (1.42-1.61)	<.001
At work					
England	7.2	REF			
Canada	9.3	1.22 (1.14-1.31)	<.001	REF	
US	9.6	1.35 (1.26-1.45)	<.001	1.10 (1.03-1.18)	.003
In bars or pubs					
England	8.5	REF			
Canada	8.0	0.87 (0.82-0.94)	<.001	REF	
US	8.3	0.95 (0.88-1.02)	.127	1.08 (1.01-1.16)	.029
In regular postal mail					
England	6.0	REF			
Canada	6.9	1.07 (1.00-1.16)	.066	REF	
US	8.8	1.47 (1.37-1.59)	<.001	1.37 (1.28-1.48)	<.001

All data except n are weighted, and all data are aggregated across all seven survey waves (2018-2022).

Estimates are from separate logistic regression models (one per outcome) adjusting for demographic covariates (age group, sex, race/ethnicity, perceived family financial situation, student status) and survey wave; see Table S2 for the full models.

'Other' was not modelled as an outcome because it was reported by <1% of the sample.

¹Wording differed according to country: At a [chemist (UK)/ pharmacy (CA, US)]; In [UK=leaflets, CA,US=flyers]; At the [UK=cinema / CA-US=movies].

Table 2. Changes over time in the proportion of youth who report noticing vaping campaigns or public health messages within England, Canada, and the US.

	ENGLAND (n=28,829)			CANADA (n=30,076)			US (n=33,434)		
	%(n)	AOR (95% CI)	p	%(n)	AOR (95% CI)	p	%(n)	AOR (95% CI)	p
Any noticing									
2018 (Aug-Sep)	48.0 (1881)	REF		52.7 (2044)	REF		55.2 (2260)	REF	
2019 (Aug-Sep)	49.3 (1776)	1.01 (0.99-1.04)	.292	70.4 (2906)	1.20 (1.17-1.23)	<.001	70.7 (2886)	1.17 (1.14-1.20)	<.001
2020 (Feb-Mar)	56.5 (2446)	1.09 (1.07-1.12)	<.001	74.2 (3176)	1.25 (1.22-1.28)	<.001	74.6 (3945)	1.21 (1.18-1.24)	<.001
2020 (Aug)	52.7 (2343)	1.05 (1.02-1.08)	<.001	67.7 (2879)	1.17 (1.14-1.19)	<.001	74.2 (4625)	1.21 (1.18-1.24)	<.001
2021 (Feb-Mar)	53.0 (2368)	1.05 (1.02-1.08)	<.001	64.5 (3033)	1.13 (1.11-1.16)	<.001	74.6 (3939)	1.21 (1.18-1.24)	<.001
2021 (Aug)	53.9 (2360)	1.06 (1.03-1.08)	<.001	63.9 (2985)	1.12 (1.10-1.15)	<.001	77.4 (3803)	1.25 (1.22-1.28)	<.001
2022 (Aug)	53.2 (2346)	1.06 (1.03-1.08)	<.001	63.0 (2796)	1.11 (1.08-1.14)	<.001	74.1 (3125)	1.21 (1.18-1.24)	<.001
On websites or social media, like Facebook, Twitter, YouTube, Instagram or Snapchat									
2018 (Aug-Sep)	22.0 (885)	REF		26.7 (1056)	REF		29.7 (1234)	REF	
2019 (Aug-Sep)	24.5 (920)	1.03 (1.00-1.05)	.020	44.1 (1850)	1.19 (1.16-1.22)	<.001	44.7 (1894)	1.16 (1.13-1.19)	<.001
2020 (Feb-Mar)	29.8 (1310)	1.09 (1.06-1.11)	<.001	48.6 (2102)	1.24 (1.22-1.27)	<.001	48.9 (2686)	1.21 (1.18-1.24)	<.001
2020 (Aug)	26.3 (1171)	1.05 (1.02-1.07)	<.001	39.7 (1714)	1.14 (1.11-1.16)	<.001	50.1 (3244)	1.22 (1.20-1.25)	<.001
2021 (Feb-Mar)	27.3 (1233)	1.05 (1.03-1.08)	<.001	39.2 (1855)	1.13 (1.11-1.16)	<.001	53.1 (2800)	1.26 (1.23-1.29)	<.001
2021 (Aug)	28.2 (1239)	1.06 (1.04-1.09)	<.001	37.9 (1785)	1.12 (1.09-1.14)	<.001	55.4 (2771)	1.29 (1.26-1.33)	<.001
2022 (Aug)	29.2 (1312)	1.08 (1.06-1.10)	<.001	37.9 (1678)	1.12 (1.09-1.14)	<.001	52.0 (2282)	1.25 (1.22-1.29)	<.001
At school									
2018 (Aug-Sep)	18.0 (656)	REF		28.9 (1097)	REF		28.3 (1182)	REF	
2019 (Aug-Sep)	20.6 (718)	1.03 (1.01-1.05)	.010	44.3 (1782)	1.17 (1.14-1.19)	<.001	37.2 (1496)	1.10 (1.07-1.12)	<.001
2020 (Feb-Mar)	24.4 (1009)	1.07 (1.05-1.09)	<.001	50.6 (2122)	1.24 (1.21-1.27)	<.001	44.8 (2351)	1.18 (1.15-1.21)	<.001
2020 (Aug)	24.7 (1053)	1.07 (1.05-1.09)	<.001	43.8 (1862)	1.16 (1.13-1.18)	<.001	44.5 (2775)	1.17 (1.15-1.20)	<.001
2021 (Feb-Mar)	24.8 (1076)	1.07 (1.05-1.09)	<.001	41.2 (1946)	1.13 (1.11-1.16)	<.001	44.4 (2306)	1.17 (1.14-1.20)	<.001
2021 (Aug)	24.9 (1078)	1.07 (1.05-1.09)	<.001	40.8 (1893)	1.13 (1.10-1.15)	<.001	47.1 (2214)	1.21 (1.18-1.24)	<.001
2022 (Aug)	24.8 (1071)	1.07 (1.05-1.10)	<.001	42.6 (1873)	1.14 (1.12-1.17)	<.001	44.0 (1813)	1.17 (1.14-1.21)	<.001
On television or radio									
2018 (Aug-Sep)	17.4 (708)	REF		19.9 (784)	REF		27.3 (1117)	REF	
2019 (Aug-Sep)	15.5 (566)	0.98 (0.96-1.00)	.046	31.5 (1308)	1.12 (1.07-1.15)	<.001	44 (1810)	1.18 (1.06-1.21)	<.001
2020 (Feb-Mar)	20.9 (906)	1.04 (1.02-1.06)	<.001	38.5 (1649)	1.20 (1.09-1.23)	<.001	48 (2556)	1.23 (1.09-1.26)	<.001
2020 (Aug)	18.0 (806)	1.01 (0.99-1.03)	.480	29.7 (1271)	1.10 (1.03-1.12)	<.001	43.3 (2772)	1.17 (1.07-1.20)	<.001
2021 (Feb-Mar)	18.8 (846)	1.01 (0.99-1.03)	.156	27.6 (1310)	1.08 (1.04-1.10)	<.001	44.2 (2312)	1.18 (1.11-1.21)	<.001
2021 (Aug)	16.3 (737)	0.99 (0.97-1.01)	.201	26.8 (1268)	1.07 (1.05-1.09)	<.001	46.5 (2271)	1.21 (1.11-1.24)	<.001
2022 (Aug)	14.4 (654)	0.97 (0.95-0.99)	.001	24.8 (1128)	1.05 (1.04-1.07)	<.001	42.7 (1845)	1.17 (1.08-1.20)	<.001
On billboards or posters									
2018 (Aug-Sep)	12.1 (470)	REF		15.7 (627)	REF		17.7 (724)	REF	
2019 (Aug-Sep)	13.0 (445)	1.01 (0.99-1.03)	.279	23.4 (962)	1.08 (1.06-1.10)	<.001	26 (1127)	1.09 (1.06-1.11)	<.001
2020 (Feb-Mar)	16.3 (709)	1.04 (1.03-1.06)	<.001	27.6 (1175)	1.13 (1.10-1.15)	<.001	1.10 (1733)	1.14 (1.12-1.17)	<.001
2020 (Aug)	15.2 (670)	1.03 (1.01-1.05)	<.001	21.6 (916)	1.06 (1.04-1.08)	<.001	30.8 (2015)	1.14 (1.12-1.16)	<.001
2021 (Feb-Mar)	16.0 (715)	1.04 (1.02-1.06)	<.001	20.9 (987)	1.05 (1.04-1.07)	<.001	32.1 (1691)	1.15 (1.13-1.18)	<.001
2021 (Aug)	15.7 (688)	1.04 (1.02-1.05)	<.001	20.7 (958)	1.05 (1.03-1.07)	<.001	33.7 (1712)	1.17 (1.15-1.20)	<.001
2022 (Aug)	12.8 (576)	1.01 (0.99-1.02)	.326	20.5 (930)	1.05 (1.03-1.07)	<.001	31.9 (1346)	1.16 (1.13-1.18)	<.001
At a chemist/pharmacy¹									
2018 (Aug-Sep)	14.8 (595)	REF		18.2 (729)	REF		16.2 (670)	REF	
2019 (Aug-Sep)	17.2 (630)	1.02 (1.00-1.04)	.014	25.7 (1065)	1.08 (1.06-1.10)	<.001	19.8 (890)	1.04 (1.02-1.06)	<.001
2020 (Feb-Mar)	19.2 (861)	1.05 (1.03-1.06)	<.001	28.9 (1277)	1.11 (1.09-1.13)	<.001	21.1 (1264)	1.05 (1.03-1.07)	<.001
2020 (Aug)	19.9 (897)	1.05 (1.03-1.07)	<.001	22.3 (954)	1.04 (1.02-1.06)	<.001	22.6 (1514)	1.07 (1.05-1.09)	<.001
2021 (Feb-Mar)	20.4 (959)	1.06 (1.04-1.08)	<.001	22.7 (1045)	1.05 (1.03-1.07)	<.001	26.8 (1415)	1.11 (1.09-1.13)	<.001
2021 (Aug)	21.1 (931)	1.06 (1.04-1.08)	<.001	24.2 (1126)	1.06 (1.04-1.08)	<.001	28.5 (1428)	1.13 (1.11-1.16)	<.001
2022 (Aug)	16.4 (742)	1.02 (1.00-1.03)	.074	22.8 (1008)	1.05 (1.03-1.07)	<.001	23 (977)	1.07 (1.05-1.10)	<.001
In shops/stores that sell e-cigarettes/vaping products									
2018 (Aug-Sep)	13.7 (496)	REF		14.3 (588)	REF		11.7 (487)	REF	
2019 (Aug-Sep)	13.4 (506)	1.00 (0.98-1.01)	.667	19.4 (836)	1.05 (1.03-1.07)	<.001	18.1 (823)	1.06 (1.04-1.08)	<.001
2020 (Feb-Mar)	17.3 (774)	1.04 (1.02-1.05)	<.001	20.1 (928)	1.06 (1.04-1.08)	<.001	20.4 (1120)	1.09 (1.07-1.11)	<.001
2020 (Aug)	18.4 (833)	1.05 (1.03-1.07)	<.001	17.2 (739)	1.03 (1.02-1.05)	<.001	18.9 (1257)	1.07 (1.06-1.09)	<.001
2021 (Feb-Mar)	20.2 (932)	1.07 (1.05-1.09)	<.001	17.8 (821)	1.04 (1.02-1.06)	<.001	20.1 (1118)	1.09 (1.07-1.11)	<.001
2021 (Aug)	19.4 (871)	1.06 (1.04-1.08)	<.001	17.3 (812)	1.03 (1.02-1.05)	<.001	21.3 (1120)	1.10 (1.08-1.12)	<.001
2022 (Aug)	16.1 (726)	1.02 (1.00-1.04)	.013	16.4 (733)	1.02 (1.01-1.04)	.010	19.4 (865)	1.08 (1.06-1.10)	<.001

Table 2 continued below

Table 2 (continued). Changes over time in the proportion of youth who report noticing vaping campaigns or public health messages within England, Canada, and the US.

	ENGLAND (n=28,829)			CANADA (n=30,076)			US (n=33,434)		
	%(n)	AOR (95% CI)	p	%(n)	AOR (95% CI)	p	%(n)	AOR (95% CI)	p
In print newspapers or magazines									
2018 (Aug-Sep)	14.0 (545)	REF		13.7 (560)	REF		16.6 (665)	REF	
2019 (Aug-Sep)	13.4 (495)	0.99 (0.98-1.01)	.452	20.9 (850)	1.07 (1.06-1.09)	<.001	19.8 (880)	1.03 (1.01-1.05)	.003
2020 (Feb-Mar)	16.4 (727)	1.02 (1.01-1.04)	.008	22.4 (983)	1.09 (1.07-1.11)	<.001	21.8 (1262)	1.05 (1.03-1.07)	<.001
2020 (Aug)	14.2 (629)	1.00 (0.98-1.02)	.819	15.4 (657)	1.02 (1.00-1.04)	.013	19.0 (1223)	1.02 (1.01-1.04)	.013
2021 (Feb-Mar)	14.1 (635)	1.00 (0.98-1.02)	.983	14.8 (678)	1.01 (1.00-1.03)	.065	20.7 (1089)	1.04 (1.02-1.06)	<.001
2021 (Aug)	14.6 (626)	1.00 (0.99-1.02)	.606	14.0 (655)	1.01 (0.99-1.02)	.487	19.4 (1027)	1.03 (1.01-1.05)	.007
2022 (Aug)	12.7 (579)	0.99 (0.97-1.00)	.120	13.0 (588)	0.99 (0.98-1.01)	.468	17.5 (745)	1.01 (0.99-1.03)	.362
Outside shops/stores that sell e-cigarettes/vaping products									
2018 (Aug-Sep)	11.0 (407)	REF		12.5 (523)	REF		11.4 (457)	REF	
2019 (Aug-Sep)	11.2 (420)	1.00 (0.98-1.02)	.903	19.3 (815)	1.07 (1.05-1.09)	<.001	17.5 (821)	1.06 (1.04-1.08)	<.001
2020 (Feb-Mar)	16.5 (737)	1.06 (1.04-1.08)	<.001	19.2 (878)	1.07 (1.05-1.09)	<.001	19.4 (1094)	1.08 (1.06-1.10)	<.001
2020 (Aug)	16.9 (757)	1.06 (1.04-1.08)	<.001	16.3 (695)	1.04 (1.02-1.06)	<.001	18.2 (1227)	1.07 (1.05-1.09)	<.001
2021 (Feb-Mar)	17.5 (810)	1.07 (1.05-1.09)	<.001	16.5 (770)	1.04 (1.03-1.06)	<.001	20.6 (1128)	1.09 (1.07-1.12)	<.001
2021 (Aug)	18.6 (814)	1.08 (1.06-1.10)	<.001	16.9 (773)	1.05 (1.03-1.06)	<.001	20.8 (1133)	1.10 (1.08-1.12)	<.001
2022 (Aug)	14.2 (664)	1.03 (1.02-1.05)	<.001	15.8 (718)	1.03 (1.02-1.05)	<.001	19.4 (874)	1.08 (1.06-1.11)	<.001
In leaflets/flyers¹									
2018 (Aug-Sep)	13.7 (497)	REF		10.1 (635)	REF		11.7 (751)	REF	
2019 (Aug-Sep)	13.4 (532)	1.00 (0.98-1.01)	.676	15.7 (756)	1.06 (1.04-1.07)	<.001	16 (1108)	1.04 (1.02-1.06)	<.001
2020 (Feb-Mar)	16.0 (497)	1.02 (1.01-1.04)	.009	17.6 (517)	1.08 (1.06-1.09)	<.001	18.9 (1175)	1.07 (1.05-1.09)	<.001
2020 (Aug)	15.5 (713)	1.02 (1.00-1.04)	.039	11.9 (572)	1.02 (1.01-1.03)	.003	17.1 (1088)	1.06 (1.04-1.07)	<.001
2021 (Feb-Mar)	16.3 (715)	1.02 (1.01-1.04)	.008	12.1 (629)	1.02 (1.01-1.04)	.002	20.1 (1111)	1.08 (1.06-1.11)	<.001
2021 (Aug)	16.3 (730)	1.02 (1.01-1.04)	.008	13.7 (567)	1.04 (1.02-1.05)	<.001	20.5 (797)	1.09 (1.07-1.11)	<.001
2022 (Aug)	13.5 (724)	1.00 (0.98-1.01)	.722	12.5 (4090)	1.02 (1.01-1.04)	.001	17.8 (6506)	1.06 (1.04-1.08)	<.001
Taxis or buses/public transit									
2018 (Aug-Sep)	8.7 (341)	REF		11.5 (470)	REF		9.6 (407)	REF	
2019 (Aug-Sep)	9.2 (342)	1.00 (0.99-1.02)	.556	17.9 (743)	1.06 (1.05-1.08)	<.001	12.2 (570)	1.03 (1.01-1.04)	.004
2020 (Feb-Mar)	13.3 (590)	1.05 (1.03-1.06)	<.001	22.2 (949)	1.11 (1.09-1.13)	<.001	14.5 (850)	1.05 (1.03-1.07)	<.001
2020 (Aug)	11.5 (530)	1.03 (1.01-1.04)	<.001	17.7 (757)	1.06 (1.05-1.08)	<.001	14.2 (1006)	1.05 (1.03-1.06)	<.001
2021 (Feb-Mar)	13.0 (602)	1.04 (1.03-1.06)	<.001	16.0 (742)	1.05 (1.03-1.06)	<.001	15.8 (884)	1.06 (1.04-1.08)	<.001
2021 (Aug)	12.8 (580)	1.04 (1.02-1.06)	<.001	16.6 (769)	1.05 (1.04-1.07)	<.001	16.8 (926)	1.07 (1.05-1.09)	<.001
2022 (Aug)	10.5 (482)	1.02 (1.00-1.03)	.019	16.6 (728)	1.05 (1.03-1.07)	<.001	14.8 (658)	1.05 (1.03-1.07)	<.001
At kiosks or temporary sales locations (in shopping centres, parked in the street, other places, but not at specific events)									
2018 (Aug-Sep)	9.0 (336)	REF		8.6 (358)	REF		8.4 (345)	REF	
2019 (Aug-Sep)	9.9 (361)	1.01 (0.99-1.02)	.252	13.6 (556)	1.05 (1.03-1.06)	<.001	11.3 (529)	1.03 (1.01-1.04)	.001
2020 (Feb-Mar)	12.9 (574)	1.04 (1.02-1.06)	<.001	14.7 (640)	1.06 (1.05-1.08)	<.001	8.4 (716)	1.04 (1.02-1.05)	<.001
2020 (Aug)	12.3 (544)	1.03 (1.02-1.05)	<.001	11.3 (481)	1.03 (1.02-1.04)	<.001	11.3 (791)	1.04 (1.02-1.05)	<.001
2021 (Feb-Mar)	14.3 (625)	1.05 (1.04-1.07)	<.001	11.2 (496)	1.03 (1.01-1.04)	<.001	12.3 (820)	1.06 (1.05-1.08)	<.001
2021 (Aug)	13.3 (590)	1.04 (1.03-1.06)	<.001	10.4 (468)	1.02 (1.01-1.03)	.004	11.9 (766)	1.07 (1.05-1.09)	<.001
2022 (Aug)	11.3 (516)	1.02 (1.01-1.04)	.004	10.8 (474)	1.02 (1.01-1.04)	.002	14.7 (572)	1.04 (1.03-1.06)	<.001
At events like fairs, markets, festivals, sporting events, or music concerts									
2018 (Aug-Sep)	6.6 (246)	REF		7.7 (336)	REF		8.5 (351)	REF	
2019 (Aug-Sep)	7.1 (262)	1.00 (0.99-1.02)	.593	14.1 (575)	1.06 (1.05-1.08)	<.001	12.7 (590)	1.04 (1.02-1.06)	<.001
2020 (Feb-Mar)	9.6 (431)	1.03 (1.02-1.04)	<.001	14.3 (637)	1.07 (1.05-1.08)	<.001	14.3 (782)	1.06 (1.04-1.07)	<.001
2020 (Aug)	8.1 (362)	1.01 (1.00-1.03)	.028	10.4 (435)	1.03 (1.02-1.04)	<.001	10.8 (744)	1.02 (1.01-1.04)	.003
2021 (Feb-Mar)	9.0 (399)	1.02 (1.01-1.04)	.001	8.5 (402)	1.01 (1.00-1.02)	.076	13.8 (765)	1.05 (1.03-1.07)	<.001
2021 (Aug)	9.9 (403)	1.03 (1.02-1.05)	<.001	9.3 (436)	1.02 (1.01-1.03)	.003	13.5 (748)	1.05 (1.03-1.07)	<.001
2022 (Aug)	8.9 (412)	1.02 (1.01-1.04)	.001	10.7 (491)	1.03 (1.02-1.04)	<.001	14.5 (612)	1.06 (1.04-1.08)	<.001
At the cinema/movies¹									
2018 (Aug-Sep)	4.9 (174)	REF		7.9 (329)	REF		9.8 (388)	REF	
2019 (Aug-Sep)	5.7 (214)	1.01 (1.00-1.02)	.206	13.2 (538)	1.05 (1.04-1.07)	<.001	13 (557)	1.03 (1.01-1.05)	.001
2020 (Feb-Mar)	7.9 (330)	1.03 (1.02-1.04)	<.001	14.2 (602)	1.07 (1.05-1.08)	<.001	15.4 (779)	1.06 (1.04-1.08)	<.001
2020 (Aug)	6.5 (282)	1.02 (1.00-1.03)	.009	8.6 (361)	1.01 (1.00-1.02)	.086	12.5 (823)	1.03 (1.01-1.04)	.001
2021 (Feb-Mar)	7.3 (302)	1.02 (1.01-1.04)	<.001	9.1 (394)	1.02 (1.00-1.03)	.012	14.9 (762)	1.05 (1.03-1.07)	<.001
2021 (Aug)	7.9 (355)	1.03 (1.02-1.04)	<.001	9.9 (438)	1.02 (1.01-1.04)	<.001	15.2 (774)	1.06 (1.04-1.08)	<.001
2022 (Aug)	6.4 (293)	1.01 (1.00-1.03)	.015	9.6 (408)	1.02 (1.01-1.03)	.003	14.5 (594)	1.05 (1.03-1.07)	<.001

Table 2 continued below

Table 2 (continued). Changes over time in the proportion of youth who report noticing vaping campaigns or public health messages within England, Canada, and the US.

	ENGLAND (n=28,829)			CANADA (n=30,076)			US (n=33,434)		
	%(n)	AOR (95% CI)	p	%(n)	AOR (95% CI)	p	%(n)	AOR (95% CI)	p
In email or text messages									
2018 (Aug-Sep)	4.3 (156)	REF		7.3 (303)	REF		8.9 (355)	REF	
2019 (Aug-Sep)	4.7 (174)	1.00 (0.99-1.01)	.547	11.9 (492)	1.05 (1.03-1.06)	<.001	12.4 (569)	1.03 (1.02-1.05)	<.001
2020 (Feb-Mar)	7.2 (315)	1.03 (1.02-1.04)	<.001	11.2 (502)	1.04 (1.03-1.05)	<.001	14.1 (772)	1.05 (1.04-1.07)	<.001
2020 (Aug)	6.2 (275)	1.02 (1.01-1.03)	.001	8.0 (330)	1.01 (1.00-1.02)	.106	11.4 (739)	1.03 (1.01-1.04)	.001
2021 (Feb-Mar)	7.4 (313)	1.03 (1.02-1.04)	<.001	8.2 (367)	1.01 (1.00-1.02)	.045	14.3 (740)	1.05 (1.04-1.07)	<.001
2021 (Aug)	7.8 (328)	1.04 (1.02-1.05)	<.001	8.5 (379)	1.01 (1.00-1.03)	.019	14.2 (725)	1.06 (1.04-1.07)	<.001
2022 (Aug)	6.8 (313)	1.03 (1.01-1.04)	<.001	8.7 (376)	1.02 (1.00-1.03)	.014	11.9 (528)	1.03 (1.01-1.05)	.001
At work									
2018 (Aug-Sep)	4.6 (175)	REF		6.6 (277)	REF		6.9 (276)	REF	
2019 (Aug-Sep)	5.9 (221)	1.01 (1.00-1.02)	.039	11 (440)	1.04 (1.03-1.06)	<.001	9.4 (425)	1.02 (1.01-1.04)	.003
2020 (Feb-Mar)	8.2 (365)	1.04 (1.02-1.05)	<.001	12.3 (523)	1.06 (1.04-1.07)	<.001	9.6 (542)	1.03 (1.01-1.04)	<.001
2020 (Aug)	7.1 (322)	1.03 (1.01-1.04)	<.001	7.9 (331)	1.02 (1.00-1.03)	.006	8.0 (550)	1.01 (1.00-1.02)	.139
2021 (Feb-Mar)	7.7 (353)	1.03 (1.02-1.04)	<.001	8.7 (390)	1.02 (1.01-1.04)	<.001	11.3 (607)	1.04 (1.03-1.06)	<.001
2021 (Aug)	8.8 (389)	1.04 (1.03-1.06)	<.001	8.8 (384)	1.02 (1.01-1.04)	<.001	11.6 (611)	1.05 (1.03-1.07)	<.001
2022 (Aug)	7.3 (354)	1.03 (1.02-1.04)	<.001	9.4 (425)	1.03 (1.02-1.04)	<.001	10.2 (442)	1.03 (1.02-1.05)	<.001
In bars or pubs									
2018 (Aug-Sep)	6.6 (231)	REF		6.2 (281)	REF		6.1 (243)	REF	
2019 (Aug-Sep)	6.7 (266)	1.00 (0.99-1.01)	.950	9.7 (391)	1.03 (1.02-1.05)	<.001	7.9 (377)	1.02 (1.00-1.03)	.031
2020 (Feb-Mar)	9.3 (410)	1.03 (1.01-1.04)	<.001	10.7 (484)	1.05 (1.03-1.06)	<.001	8.6 (484)	1.02 (1.01-1.04)	.001
2020 (Aug)	9.5 (420)	1.03 (1.02-1.04)	<.001	7.1 (287)	1.01 (1.00-1.02)	.047	7.1 (494)	1.01 (1.00-1.02)	.146
2021 (Feb-Mar)	9.2 (413)	1.03 (1.01-1.04)	<.001	7.2 (316)	1.01 (1.00-1.02)	.034	10.5 (557)	1.04 (1.03-1.06)	<.001
2021 (Aug)	9.6 (425)	1.03 (1.02-1.04)	<.001	7.4 (347)	1.01 (1.00-1.03)	.009	9.6 (526)	1.04 (1.02-1.05)	<.001
2022 (Aug)	8.3 (391)	1.02 (1.00-1.03)	.023	7.9 (376)	1.02 (1.01-1.03)	.002	8.2 (401)	1.02 (1.00-1.03)	.011
In regular postal mail									
2018 (Aug-Sep)	4.2 (152)	REF		5.3 (225)	REF		6.7 (263)	REF	
2019 (Aug-Sep)	3.9 (159)	1 (0.99-1.01)	.541	9.4 (375)	1.04 (1.03-1.05)	<.001	8.6 (397)	1.02 (1.00-1.03)	.024
2020 (Feb-Mar)	6.6 (291)	1.02 (1.01-1.04)	<.001	8.5 (375)	1.03 (1.02-1.05)	<.001	9.1 (511)	1.02 (1.01-1.04)	.001
2020 (Aug)	5.6 (260)	1.02 (1.00-1.03)	.007	5.8 (241)	1.01 (1.00-1.02)	.078	7.3 (484)	1.01 (0.99-1.02)	.377
2021 (Feb-Mar)	7.2 (303)	1.03 (1.02-1.04)	<.001	6.3 (268)	1.01 (1.00-1.02)	.008	10.1 (547)	1.03 (1.02-1.05)	<.001
2021 (Aug)	7.7 (341)	1.04 (1.02-1.05)	<.001	6.7 (293)	1.02 (1.01-1.03)	.001	10.9 (533)	1.04 (1.03-1.06)	<.001
2022 (Aug)	6.0 (293)	1.02 (1.01-1.03)	.001	6.5 (291)	1.01 (1.00-1.02)	.009	8.4 (370)	1.02 (1.00-1.03)	.040

All data except n are weighted.

Estimates were obtained using Stata's *margins* post-estimation command following a survey wave*country interaction term added to separate logistic regression models (one per outcome) adjusting for demographic covariates (age group, sex, race/ethnicity, perceived family financial situation, student status).

'Other' was not modelled as an outcome because it was reported by <1% of the sample.

¹Wording differed according to country: At a [chemist (UK)/ pharmacy (CA, US)]; In [UK=leaflets, CA,US=flyers]; At the [UK=cinema / CA-US=movies]