



Short communication

An examination of quitting smoking as a reason for vaping by the type of nicotine vaping device used most often among adults who smoke and vape: Findings from the Canada, England and the United States 2020 ITC Smoking and Vaping Survey

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ABSTRACT

Several nicotine vaping product (NVP) device types are available to consumers, and many people who smoke report vaping to help them quit. This study included data from the Wave 3 (2020) ITC Smoking and Vaping Survey in the US, Canada, and England and included 2324 adults who were smoking cigarettes and vaping at least weekly. Device types currently used most often (disposables, cartridges/pods, or tank systems) were assessed using weighted descriptive statistics. Multivariable regression analyses were used to compare differences between respondents who reported vaping to quit smoking ('yes' vs. 'no/don't know') by device type, overall and by country. Overall, 71.3% of respondents reported vaping to help them quit smoking, with no country differences ($p = 0.12$). Those using tanks (78.7%, $p < 0.001$) and cartridges/pods (69.5%, $p = 0.02$) were more likely to report this reason for vaping than those using disposables (59.3%); respondents using tanks were also more likely than those using cartridges/pods ($p = 0.001$) to report this reason. By country, respondents in England using cartridges/pods or tanks (vs. disposables) were more likely to report vaping to quit smoking (with no difference between cartridges/pods and tanks). In Canada, respondents using tanks were more likely to report vaping to quit smoking than those using cartridges/pods or disposables (no difference between disposables and cartridges/pods). No significant differences by device type were found in the US. In conclusion, most adult respondents who smoked and vaped reported using either cartridges/pods or tanks, which were associated with greater odds of vaping for the purpose of quitting smoking versus disposables, with some country variations.

1. Introduction

Since their emergence onto the global market, nicotine vaping products (NVPs) have diversified to include a range of devices, including customizable tanks, replaceable pods/cartridges, as well as newer disposable devices (CDCa; CDC, 2022; Danny, 2022; Hammond et al., 2020; McNeill et al., 2022). Device types vary in terms of their

customizability, cost, and convenience, with implications for nicotine delivery and their appeal to different subgroups of vapers (Al-Hamdani et al., 2021; Camenga et al., 2018; Voos et al., 2019).

Across several countries, one of the most common reasons cited by people who smoke for using NVPs is because vaping may help them quit smoking (ASH, 2021; CTNS, 2020; Gravely et al., 2022a; Hairi et al., 2022; Nicksic et al., 2019; Sapru et al., 2020; Soule et al., 2020; Xiao

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et al., 2022; Yong et al., 2019). A previous study from the 2020 (Wave 3) International Tobacco Control Smoking and Vaping (ITC 4CV) Survey in the United States (US), Canada, England, and Australia found that among adults who vaped and smoked cigarettes at least weekly, 73% reported that a reason they were vaping was to quit smoking, with some variation by country, from 68% in the US to 79% in Australia (Gravely et al., 2022a).

As the NVP market continues to evolve, research is needed to examine which vaping products are used by adults seeking a complete alternative to cigarettes or as a short-term smoking cessation aid. A study using 2016 (Wave 1) ITC 4CV data found that people who smoked and vaped and who used tank devices were more likely to endorse quitting smoking as a reason for vaping than those who used pre-filled cartridge or disposable devices (Yong et al., 2019). This study, however, did not include an examination within each country. Notably, the types of disposable and cartridge-based devices that dominate the NVP market have changed considerably since 2016, meriting a re-examination of this pattern. The considerable evolution of NVP devices may have resulted in changes in device preferences. For example, the advent of the sale of nicotine salt e-liquids, which have supplanted freebase nicotine, has made low-wattage non-tank systems deliver nicotine at rates on par with older generation tank systems utilizing freebase nicotine e-liquid. Thus, this study updates and extends the previous ITC 4CV study (Yong et al., 2019) to describe device types currently used most often among adults who smoke cigarettes and vape regularly, and to test whether quitting smoking as a reason for vaping differed by device type, overall and within each of the three countries (Canada, England and the US).

2. Methods

2.1. Study design, setting, and population

This cross-sectional study used data from the Wave 3 (2020) ITC 4CV Survey (conducted from February-June 2020) in Canada, England and the US. Australia was excluded due to insufficient data on NVP device type for analysis. In the larger ITC 4CV longitudinal cohort study, adults (≥ 18 years) who currently smoke (\geq monthly), recently quit smoking (quit ≤ 2 years), and/or currently vape (\geq weekly) were recruited from online commercial panels. ITC 4CV Wave 3 respondents included those retained from previous waves (Wave 1: 2016 and/or Wave 2: 2018) and new respondents recruited to replace those lost to follow-up. Study procedures and materials were approved by research ethics boards in all countries, followed the guidelines for protection of human subjects concerning safety and privacy, and all respondents provided informed consent. Further study details are reported elsewhere (ITC Project, 2020).

Eligible respondents for this study included 2324 adults residing in Canada ($n = 796$), England ($n = 1089$), or the US ($n = 439$) who both vaped and smoked cigarettes at least weekly and provided data on the NVP device type they used most often ($n = 8$ missing). Supplemental Fig. S1 displays the study sample selection process.

2.2. Measures

Outcome variable: The survey question about reasons for vaping, “Which of the following are reasons that you use vaping products?” was asked in a grid format, where respondents had to check “yes”, “no”, or “don’t know” for each of 10 reasons. Our primary variable of interest for this study was the reason: ‘vaping might help me stop smoking ordinary cigarettes’. Respondents who selected “yes” were categorized as ‘yes’ ($n = 1625$), and those who selected “no” ($n = 493$) or “don’t know” ($n = 206$) were combined and categorized as ‘no/don’t know’.

Independent variable: “Which of the following best describes the TYPE of vaping device you CURRENTLY USE MOST?”: (1) it is disposable, not refillable (non-rechargeable); (2) it uses replaceable pre-filled

cartridges or pods (rechargeable); or (3) it has a tank that you fill with liquids (rechargeable). Devices were categorized as: disposables; cartridges/pods or tanks (3-level variable), as described in Supplemental Fig. S2.

Covariates: Adjusted models included: age group (18–25; 25–39; 40 + years), sex (male; female), country of residence, vaping frequency (daily; weekly) and smoking frequency (daily; weekly). Income and education data were collected but not included in the models due to missing data ($n = 75$) resulting in model convergence issues in country-specific analyses.

2.3. Analyses

Unweighted percentages were used to describe the study sample. All other analyses were conducted on weighted data. The weight calibration used benchmarks from national surveys from each of the respective countries (ITC Project, 2020). Analyses were conducted in SAS Version 9.4.

First, we used weighted descriptive statistics to examine the proportion of respondents using each device type, among all respondents and by vaping frequency, smoking frequency, country, sex, and age group. Second, we conducted a logistic regression model with all respondents to determine whether quitting smoking as a reason for vaping differed by NVP device type, adjusting for age group, sex, country, and smoking and vaping frequency (Model 1). Third, separate logistic regression models were run for each country to test within-country differences, adjusting for age group, sex, and smoking and vaping frequency (Models 2–4).

3. Results

Unweighted sample characteristics are presented in Table 1.

Table 2 descriptively presents device types used most often, overall and by age group, sex, country, and vaping and smoking frequency. Overall, adults who vaped were over three times more likely to most often use cartridges/pods (43.7%) and tanks (42.6%) than they were to use disposables (13.8%). Overall, 71.3% of respondents stated that they were vaping because vaping might help them quit smoking.

Table 2 also presents estimates for device type from the adjusted logistic regression models. In Model 1 including all countries, quitting smoking as a reason for vaping differed by the device type used most often. Those using tanks (78.7%, $p < 0.001$) or cartridges/pods (69.5%, $p = 0.02$) were more likely than those using disposables (59.3%) to cite help with quitting smoking as a reason for vaping. Respondents using tanks were more likely than those using cartridges/pods ($p = 0.001$) to report this reason.

Supplemental Table S1 presents all estimates from the fully adjusted Model 1. Differences in vaping for reasons of quitting smoking were also found by age ($p = 0.001$), vaping frequency ($p = 0.02$), and smoking frequency ($p = 0.04$). Those aged 18–24 (73.4%) and 40+ (77.2%) were significantly more likely to report vaping might help them quit smoking than those aged 25–39 (65.4%). Those vaping daily (vs. weekly) and those smoking weekly (vs. daily) were more likely to report vaping to help them quit smoking. There were no significant differences by sex ($p = 0.22$) or country ($p = 0.12$).

Results for device type differed within country-specific models (Models 2–4, Table 2). Vaping might help with quitting smoking as a reason for vaping differed significantly by device type in Canada ($p = 0.002$) and England ($p = 0.003$), but not in the US ($p = 0.11$). In Canada, respondents using tanks were significantly more likely than those using cartridges/pods ($p = 0.01$) or disposables ($p < 0.001$) to report quitting smoking as a reason for vaping. Although more respondents reported vaping to quit smoking among those using cartridges/pods (72.7%) than disposables (63.7%), this was not statistically significant ($p = 0.08$). In England, respondents using tanks ($p = 0.001$) or cartridges/pods ($p = 0.03$) were more likely to report quitting smoking as a reason for vaping

Table 1

Study sample characteristics (unweighted %), overall and by country (Canada, England and the United States) among adult respondents who vaped and smoked at least weekly, 2020.

	All respondents N = 2324		Canada n = 796 (34.3%)	US n = 439 (18.9%)	England n = 1089 (46.9%)
Respondent type	n	%	%	%	%
Cohort	639	27.5	35.4	19.9	44.8
Newly recruited	1685	72.5	71.6	71.1	73.7
Sex					
Male	1363	58.7	57.0	57.2	60.4
Female	961	41.4	43.0	42.8	39.6
Age group (years)					
18–24	916	39.4	38.9	59.0	31.9
25–39	708	30.5	33.7	16.6	33.7
40–54	445	19.2	34.4	12.6	53.0
55+	255	11.0	8.2	11.6	12.8
Income					
Low	518	22.3	24.5	32.4	16.6
Moderate	657	28.3	28.0	27.3	28.8
High	1089	46.9	44.5	40.1	51.3
Not reported	60	2.6	3.0	0.2	3.2
Education					
Low	419	18.0	23.1	29.4	9.7
Moderate	1022	44.0	41.1	41.2	47.2
High	868	37.4	35.43	29.38	41.97
Not reported	15	0.7	0.4	0.0	1.1
Smoking frequency					
Daily smoking	1706	73.4	68.8	69.9	78.2
Weekly smoking	618	26.6	31.2	30.1	21.9
Vaping frequency					
Daily vaping	1236	53.2	46.7	55.4	57.0
Weekly vaping	1088	46.8	53.3	44.7	43.0

Data are weighted and unadjusted. Annual household income is defined as: 'low' (CA: <CAD \$30,000; US: <USD \$30,000; EN: <£15,000), 'moderate' (CA: CAD \$30,000–59,000; US: USD\$30,000–59,000; EN: £15,000–30,000), 'high' (CA: ≥CAD \$60,000; US: ≥USD \$60,000; AU: ≥AUD \$60,000; EN: >£30,000), and 'not reported'; Education is defined as: 'low' (all countries: ≤ high school), 'moderate' (CA: trade school, community college, some university (no degree); US: trade school, community college, associate degree, or some university (no degree) EN: further education/ training college below degree level or some university (no degree)), 'high' (all countries: university degree or post-graduate degree), and 'not reported'.

compared to those using disposables; there was no significant difference between cartridge/pod and tank devices ($p = 0.09$). In the US, although more respondents who used tanks cited quitting smoking as a reason for vaping (77.0%) relative to those using cartridges/pods (63.5%) or disposables (61.9%), these differences were not statistically significant.

4. Discussion

Most adults who frequently use cigarettes and NVPs reported using either cartridges/pods or tanks most often in 2020, with about 1 in 10 using disposables. Although disposables were not the most frequently used device by younger people, a higher proportion of younger people use them relative to older people, and older respondents had a higher proportion using tank devices in all three countries, which is consistent with other studies (CDC, 2022; Hammond et al., 2022; Tattan-Birch et al., 2022; Wang et al., 2020a; Wang et al., 2020b). Our findings are in line with other studies, which have consistently shown that adults commonly use tank systems (ASH, 2021; Cohen et al., 2022; Felicione et al., 2022; Gravely et al., 2022b; Yingst et al., 2019); however, we found a similar proportion of respondents reported using cartridge/pod devices most often. This latter finding differed from a previous ITC 4CV study using 2018 data, where the majority of adults who were vaping used tanks and far fewer used cartridges (Felicione et al., 2022). Thus, between 2018 and 2020, a preference for cartridge-based devices appears to have increased among adults who smoke and vape.

When we examined whether quitting smoking as a reason for vaping differed by device type, we found that respondents using tanks or cartridges/pods were more likely to report this reason for vaping than those using disposables, and those using tanks were more likely to report this reason than those who used cartridges/pods. These findings using 2020

data were similar to the Yong et al. study using 2016 data, in that both studies found that those who vaped using tanks had more than twice the odds of those using disposables, and 1.5 times the odds of those using cartridges/pods, to report vaping because it may help them quit smoking. This suggests that tanks have maintained their importance in being used as a possible smoking cessation aid among adults across time, despite the significant evolution and improvement of other device types.

Contrary to Yong et al.'s finding that adults using cartridges/pods did not significantly differ from those using disposables in 2016, the current study found that in 2020, people who used cartridges/pods were more likely to report vaping to quit smoking relative to those using disposables. This could in part be due to the rise in use of cartridge-based systems after 2016 (Gravely et al., 2022b; Huang et al., 2019; Miller, 2019; Tattan-Birch et al., 2021), most notably, JUUL (Truth Initiative, 2018; Sherman, 2019), which had gained a significant market share by 2018–2019 (LaVito, 2018). This was also particularly evident in England—a country that has included NVPs in their smoking cessation clinical practice guidelines (NICE, 2023), and where JUUL gained popularity between surveys (from 3.4% in 2018 to 11.8% in 2020, Tattan-Birch et al., 2021). Additionally, even though use of disposables increased in England between 2019 and 2020, tanks remained the most popular in both 2016 and 2020, followed by cartridges/pods.

While tank systems pose unique challenges for regulation (Eissenberg et al., 2021), our findings showed that adult preference for this type of device is high, particularly in England where half of all adults who vaped and smoked reported that they used a tank device most often. Furthermore, we found older respondents (40+ years) had the highest proportion using tanks (50%), whereas a higher proportion of those aged 18–24 and 25–39 were using disposables most often (20% and 17% respectively) relative to those aged 40+ (9%). Notably, respondents

Table 2

A descriptive and analytical examination of quitting smoking as a reason for vaping by the type of nicotine vaping device used most often among adults who smoke and vape in Canada, England and the United States in 2020.

	Disposable		Pre-filled cartridge/pod		Open-tank system	
	n	Weighted % (95% CI)	n	Weighted % (95% CI)	n	Weighted % (95% CI)
NVP device type currently used most often*						
Overall (N = 2324)	394	13.8 (12.0–15.7)	1041	43.7 (40.9–46.5)	889	42.6 (39.8–45.4)
Age group (years)						
18–24 (n = 916)	197	19.5 (15.8–23.2)	400	42.1 (37.3–46.8)	319	38.5 (33.6–43.4)
25–39 (n = 708)	127	17.3 (13.7–21.0)	342	46.9 (42.0–51.8)	239	35.7 (31.0–40.5)
40+ (n = 700)	70	8.6 (6.2–11.0)	299	41.6 (37.2–46.0)	331	49.8 (45.3–54.3)
Sex						
Male (n = 1363)	258	15.5 (12.9–18.1)	627	45.7 (42.0–49.4)	478	38.8 (35.1–42.5)
Female (n = 961)	136	11.4 (8.7–14.0)	414	40.9 (36.6–45.2)	411	47.8 (43.4–52.2)
Country						
Canada (n = 796)	117	13.7 (11.2–16.3)	397	47.1 (43.2–51.0)	282	39.2 (35.3–43.1)
England (n = 1089)	172	12.2 (9.5–15.0)	446	40.1 (35.8–44.4)	471	47.7 (43.3–52.0)
United States (n = 439)	105	17.0 (12.4–21.6)	198	47.2 (40.6–53.7)	136	35.9 (29.5–42.2)
Vaping frequency						
Daily vaping (n = 1236)	228	14.1 (11.5–16.7)	492	37.8 (34.0–41.7)	516	48.1 (44.1–52.1)
Weekly vaping (n = 1088)	166	13.4 (10.7–16.1)	549	50.3 (46.2–54.4)	373	36.3 (32.3–40.3)
Smoking frequency						
Daily smoking (n = 1706)	299	13.9 (11.7–16.0)	721	41.9 (38.6–45.1)	686	44.3 (41.0–47.6)
Weekly smoking (n = 618)	95	13.5 (9.9–17.1)	320	49.5 (43.7–55.2)	203	37.1 (31.4–42.7)
Vaping might help me stop smoking cigarettes (% yes)[†]						
Model 1: all respondents		59.3 (51.7–66.5)		69.5 (65.3–73.3)		78.7 (74.7–82.2)
aOR (95 %CI)		reference		1.56 (1.09–2.23) [‡]		2.53 (1.73–3.68)
Model 2: Canada		63.7 (53.7–72.6)		72.7 (67.3–77.4)		82.0 (76.3–86.6)
aOR (95 %CI)		reference		1.51 (0.94–2.43) [‡]		2.60 (1.53–4.41)
Model 3: England		55.7 (42.5–68.1)		71.4 (64.7–77.2)		78.2 (72.3–83.1)
aOR (95 %CI)		reference		2.01 (1.10–3.69)		2.90 (1.56–5.37)
Model 4: United States		61.9 (47.0–74.8)		63.5 (53.3–72.5)		77.0 (66.4–84.9)
aOR (95 %CI)		reference		1.07 (0.52–2.22)		2.06 (0.94–4.52)

* Data are descriptive (weighted and unadjusted). aOR: adjusted odds ratio. CI: confidence interval. Overall, 71.3% (n = 1625) of respondents selected that quitting smoking was a reason for vaping.

[†] Models are weighted and adjusted. Device type is the independent variable in all models. Model 1 adjusted for age, sex, country, smoking frequency and vaping frequency. Models 2–4 adjusted for age, sex, smoking frequency and vaping frequency.

[‡] Significant difference between pre-filled cartridges/pods and open-tank systems: Model 1: tanks vs. cartridges/pods: aOR: 1.62 (1.21–2.17). Model 2 (Canada): tanks vs. cartridges/pods: aOR: 1.72 (1.13–2.61).

Statistical significance and confidence intervals were computed at the 95% confidence level for all analyses.

aged 25–39 had the highest rate of cartridge/pod device use (both within their age group and across age groups) in our study and they were less likely to report quitting smoking as a reason for vaping relative to those aged 18–24 and 40+. Therefore, it is important to further investigate intentions to quit among sub-groups who most often use these devices.

In our sample, half of respondents who vaped daily were using tanks across the three countries, which is notable because research shows that more frequent vaping is more likely to lead to quitting smoking than vaping less often (Glasser et al., 2021; Gravely et al., 2022c; McDermott et al., 2021). Based on these study findings, regulators should consider both market segmentation and devices commonly used for smoking cessation purposes. Additionally, randomized trials and large cohort studies should examine how age and frequency of vaping interact with quit attempts and success, based on the NVP device used.

The current study identified some country differences, which merit further examination. No significant differences by device type were found for vaping to quit smoking in the US. In particular, a similar proportion of US respondents reported using disposables or cartridges (about 60%) to quit smoking, which differed from Canada and England, where respondents in those two countries had higher proportions of using cartridges and tanks relative to disposables. However, similar to England and Canada, the highest proportion of US respondents were vaping with tanks to quit smoking. Despite some differences in the within-country models, there were no country differences in vaping to quit smoking: the majority of respondents were vaping to quit smoking (>60%) in each country regardless of the device type usually used. This consistency suggests that varying NVP regulatory policies in the three

countries is not necessarily a factor in vaping for the reason of quitting smoking.

A 2022 Cochrane systematic review on using e-cigarettes for smoking cessation found that there is high-certainty evidence that e-cigarettes with nicotine increase quit rates compared to NRT and moderate-certainty evidence that they increase quit rates compared to e-cigarettes without nicotine (Hartmann-Boyce et al., 2022). However, few studies, including RCTs, have evaluated what type(s) of NVP devices are effective for smoking cessation, and none have compared device types. The majority of RCTs have tested cartridges, tanks, or first-generation ‘cig-a-like’ devices (the latter suffering from poor nicotine delivery) for smoking cessation; none have tested newer disposable devices, and only one has tested cartridge/pod devices (Hartmann-Boyce et al., 2022). Some observational studies have investigated whether NVP device types were associated with quit attempts (Sharma et al., 2021) and smoking cessation (Weaver et al., 2018; Bold et al., 2022). Similar to our findings, a study using data from the Population Assessment of Tobacco and Health Study (Sharma et al., 2021) found that adults who used disposable NVPs were least likely to use NVPs as an alternative to quitting tobacco use. They also found that the odds of attempting to quit smoking were higher among those who were vaping daily and using non-refillable cartridges, refillable tanks or refillable mod systems compared to those who used disposables, whereas the likelihood of a quit attempt among those who were vaping on a non-daily basis did not differ by device type. A population-based prospective cohort study in the US found that adults who used cartridge NVPs had a higher probability of attempting to quit smoking, but lower odds of quitting compared to adults who did not use NVPs (Weaver et al., 2018). The odds of quitting

for those who used tank systems was more than twice the odds of quitting compared to disposable ENDS users, but the difference was not statistically significant (Weaver et al., 2018). Another US study found that the use of rechargeable pod devices and mod devices was associated with a longer duration of abstinence from smoking compared to disposables (earlier cig-a-like devices), while there was no difference between JUUL, vape pens or disposable pods relative to the cig-a-like devices (Bold et al., 2022). To understand both short- and long-term smoking cessation outcomes, studies directly comparing NVPs on the basis of their characteristics, including the type (and brand) of device, nicotine concentration and content, and flavors are needed to inform policy regulations.

While this study has many strengths, including the large sample size spanning three countries, there are some limitations to consider. First, although the weights for our data were designed to make the sample as representative as possible of the smoking and vaping population in all three countries, the decision to participate in an online panel is likely to depend on some unmeasured characteristics that may be associated with outcomes or relationships of interest. For example, although we weight for educational attainment, a major influence on response propensity, we recognize that there may be additional ways in which even the weighted sample may have limited representativeness. Second, we focused on self-reported reasons for vaping and did not assess whether smoking cessation attempts were made using specific devices. Third, the generalizability of findings is limited to only those who vape and smoke frequently. Notably, vaping for the purposes of quitting appears to be lower in national population-level surveys, which take into account younger age groups, nonsmokers, and people who smoke and vape less frequently. (ASH, 2021; CTNS, 2020; Soule et al., 2020; Xiao et al., 2022).

5. Conclusion

In 2020, most adults who used NVPs and smoked cigarettes reported usually using either cartridge/pod or tank device types which were associated with greater odds of use to help with smoking cessation, compared to disposables. However, when we assessed this relationship separately within each country, significant associations were found in England and Canada, but not in the US. Adults who were vaping daily were more likely to report vaping to quit smoking, with the majority using tanks most often. As the NVP market continues to evolve, further research is needed to examine the impact of NVP device type on smoking cessation.

6. Data sharing

In each country participating in the International Tobacco Control Policy Evaluation (ITC) Project, the data are jointly owned by the lead researcher(s) in that country and the ITC Project at the University of Waterloo. Data from the ITC Project are available to approved researchers 2 years after the date of issuance of cleaned data sets by the ITC Data Management Centre. Researchers interested in using ITC data are required to apply for approval by submitting an International Tobacco Control Data Repository (ITCDR) request application and subsequently to sign an ITCDR Data Usage Agreement. The criteria for data usage approval and the contents of the Data usage Agreement are described online (<https://www.itcproject.org>).

Informed consent

Informed consent was obtained from all subjects involved in the study.

Ethical approval

Study questionnaires and materials were reviewed and provided

clearance by Research Ethics Committees at the following institutions: University of Waterloo (Canada, REB#20803/30570, REB#21609/30878), King's College London, UK (RESCM-17/18-2240), Cancer Council Victoria, Australia (HREC1603), University of Queensland, Australia (2016000330/HREC1603); and Medical University of South Carolina (waived due to minimal risk).

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CRediT authorship contribution statement

Shannon Gravely: Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft, Writing – review & editing. **Hua-Hie Yong:** Conceptualization, Investigation, Writing – review & editing. **Jessica L. Reid:** Investigation, Writing – review & editing. **Katherine A. East:** Investigation, Writing – review & editing. **Alex C. Liber:** Investigation, Writing – review & editing. **K. Michael Cummings:** Conceptualization, Methodology, Investigation, Funding acquisition, Writing – review & editing. **Anne C.K. Quah:** Methodology, Investigation, Project administration, Writing – review & editing. **Geoffrey T. Fong:** Methodology, Investigation, Funding acquisition, Writing – review & editing. **David Hammond:** Investigation, Writing – review & editing.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: KMC has in the past and continues to serve as a paid expert witness in litigation filed against cigarette manufacturers. DH has served as a paid expert witness on behalf of governments and public health authorities in legal challenges against tobacco and vaping companies. GTF has served as an expert witness or consultant for governments defending their country's policies or regulations in litigation. GTF and SG served as paid expert consultants to the Ministry of Health of Singapore in reviewing the evidence on plain/standardized packaging. None of the other authors have any conflict of interests to declare.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.pmedr.2023.102201>.

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