Original Research

The effect of branded versus standardized e-cigarette packaging and device designs: an experimental study of youth interest in vaping products

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A B S T R A C T

Objectives: Standardized ('plain') packaging is effective in reducing the appeal of cigarettes among young people. This study examined the impact of plain packaging and brand imagery on interest in trying e-cigarettes among youth.
Study design: Experimental design.
Methods: Two online experiments were conducted in February 2020 as part of the ITC Youth Tobacco & Vaping Survey, conducted with 13,624 16- to 19-year-olds in Canada, England, and the USA. In the between-group Experiment 1, participants were randomized to view a set of 3 e-cigarette brands, in either their original external packaging ('branded' condition) or standardized olive-green packaging ('standardized' condition), and asked to select the product they would be most interested in trying. The within-group Experiment 2 examined brand imagery directly on devices, including potential differences in appeal among subgroups. Each participant viewed 4 pod-style e-cigarette devices: one 'plain' and 3 in colourful 'skins'. Logistic regression models were conducted to test the effect of condition, adjusting for demographics, smoking and vaping status.
Results: In Experiment 1, participants in the 'standardized' packaging condition were significantly more likely to indicate 'I have no interest in trying any of these products' (72.3%) than those in the 'branded' condition (66.9%, AOR 1.45, 95% CI 1.33–1.59). Experiment 2 results indicated differences in e-cigarette appeal by sex in the selection of male- and female-oriented designs, and by cannabis use for a Rastafarian-themed design.
Conclusions: Brand imagery on e-cigarettes can target products to specific subgroups. Removal of imagery, in the form of standardized packaging, has the potential to reduce interest in trying e-cigarettes among young people.

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Introduction

The e-cigarette market is diverse, with thousands of different brands and varieties of e-liquids and device types.[1,2] Package design is an integral means through which manufacturers convey differences between e-cigarette brands and varieties. For example, a retail scan of the Canadian market identified a wide range of images and designs, including extensive use of colours, nature-related themes, playful font styles such as bubble fonts, as well as lifestyle references (e.g., references to persons or characters).[3,4] Images related to flavours (e.g., pictures of fruit) were common, while approximately 10% of e-liquid packages featured a real or fictional person, character, or animal.[3] Packaging can also be used to highlight attributes with particular appeal to young people, including references to flavours.[5] In addition, several e-cigarette manufacturers offer customizable 'over-wrapping' or 'skins'—which can be purchased separately and are wrapped around the device using adhesives—to further increase consumer appeal and personalize a product.[6] The designs on these skins feature a wide range of imagery, including references to cannabis-related imagery. There is a

strong association between the use of nicotine e-cigarettes and vaping cannabis products, particularly among young people.[7,8] Indeed, in some cases, the same device can be used to vape both nicotine and cannabis-containing cartridges.

There is an extensive evidence base indicating that brand imagery on tobacco packaging is an important source of promotion that can enhance the appeal of products to young people and minimize perceptions of risk.[9,10] Brand imagery on packages is also an effective means of targeting tobacco products to specific sub-populations, such as the use of female-oriented branding to promote smoking to young females.[11,12] In recognition of the promotional role of tobacco packaging, several countries have implemented standardized packaging regulations for tobacco products (also referred to as 'plain packaging').[13] Standardized packaging typically prohibits brand imagery from appearing on packages and requires a uniform colour and font size, such that all packages have the same general appearance.[14,15]

Evidence on the impact of e-cigarette packaging is still emerging. As is the case for tobacco products, exposure to e-cigarette promotions has been found to influence the appeal of vaping, particularly among young people.[14,16] A range of experimental studies have also indicated that exposure to advertisements and promotions increases interest in vaping among young people.[17–22] To date, three experimental studies have examined the appeal of exterior e-cigarette packaging among youth; generally, these studies found standardized packaging less appealing to youth.[14,23,24] One study in Great Britain compared perceptions of standardized packaging between youth and adults, finding that standardized packaging reduced the appeal of e-cigarettes among youth participants without reducing the appeal among adult participants.[14] Another study found that British youth were less interested in e-cigarette products in plain (white) packaging with no brand descriptors compared to branded products; however, there was no difference in interest when comparing branded products to plain packages with brand descriptors, indicating that brand descriptors likely enhance the appeal of e-cigarettes to youth.[23]

Packaging for e-cigarettes differs from conventional tobacco packaging in an important respect. Cigarette packages are typically carried by people who smoke and are displayed to others at the time of smoking and often left out on tables and other surfaces for display.[9] In contrast, the outer packaging of e-cigarette devices and e-liquids is often discarded after purchase, such that visibility is much higher for the device itself.[3,4] Branding on e-cigarette devices themselves is likely to be particularly important to young people given the sharing of vaping devices that often occurs, particularly among novel users.[25] To date, all studies on e-cigarette packaging have focussed on exterior packaging, with little research on the impact of brand imagery on the device itself.[14,23,24]

This study examined the impact of e-cigarette packaging and brand imagery on youth interest in trying e-cigarette products, including brand imagery on exterior packaging (Experiment 1) and the device itself (Experiment 2). More specifically, this study examined the appeal of brand imagery and device 'skins' in terms of targeting subgroups of young people, including the use of traditional gendered colours, as well as cannabis-related imagery (Experiment 2). The study also examined whether standardized package designs were associated with reductions in appeal among young people (Experiment 1).

Methods

Two experiments were conducted as part of the ITC Youth Tobacco & Vaping Survey (Wave 3.5), conducted online between February 6 and March 2, 2020. Participants included 13,624 16- to 19-year-olds in Canada, England, and the USA who were part of the cross-sectional survey samples.[26]

Participants

Participants were recruited from the Nielsen Consumer Insights Global Panel, either directly or through their parents, via email invitations (with a unique link). Panellists with children aged 16–19 in their household were asked for permission for their child to complete the survey (if more than one child, specifically the one whose birthday was coming up next), and all potential respondents were provided with information about the study and asked to provide consent before participating. Respondents received remuneration in accordance with their panel's usual incentive structure, which could include points-based or monetary rewards (redeemed for catalogue items, as cash or donated) and/or chances to win monthly prizes.

Measures

Sociodemographic variables
Sociodemographic variables include sex (sex-at-birth; inferred from current gender where not stated), age (years) and country (Canada, England or the USA).

Vaping status
Participants were asked: 'Have you ever tried an e-cigarette/vaped, even one or two puffs?' Respondents answering 'Yes' were then asked, 'When was the last time you used an e-cigarette/vaped?' Respondents answering, 'Earlier today, 'Not today but sometime in the past 7 days' or 'Not in the past 7 days but sometime in the past 30 days' were categorized as having used an e-cigarette/vaped within the past month.

Smoking status
Participants were asked: 'Have you ever tried cigarette smoking, even one or two puffs?' Respondents answering 'Yes' were then asked, 'When was the last time you smoked a cigarette, even one or two puffs?' Respondents answering, 'Earlier today', 'Not today but sometime in the past 7 days' or 'Not in the past 7 days but sometime in the past 30 days' were categorized as having smoked a cigarette within the past month.

Cannabis use
Participants were asked: 'When was the last time you used marijuana/cannabis?' Respondents answering, 'Earlier today', 'Not today but sometime in the past 7 days' or 'Not in the past 7 days but sometime in the past 30 days' were coded as having used cannabis within the past month.

Experiment 1

Experiment 1 examined external packaging using a between-group design, where participants were randomized to one of two packaging conditions: 'branded' or 'standardized'. Each participant was presented with a set of 3 images of 'starter kits' (i.e., device and cartridges) from leading e-cigarette brands, according to their assigned condition: either the original external packaging ('branded' condition) or standardized olive-green packaging with plain font and no design elements ('standardized' condition)—see Fig. 1 (Note: the brand names and images used in the study have been blinded at the journal's request; however, all study images are available upon request to the corresponding author or at this
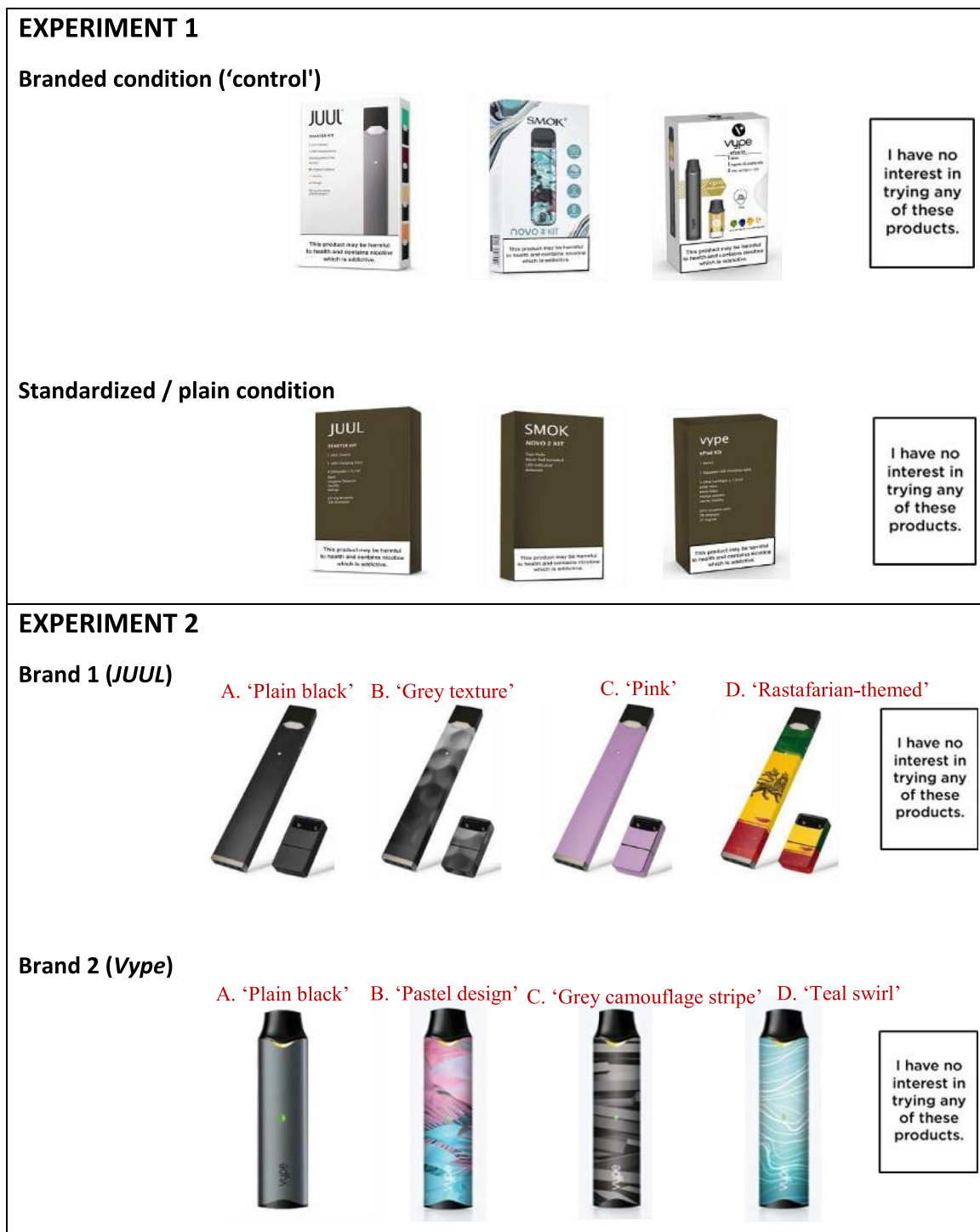
Fig. 1. Experiment 1: E-cigarette starter kit images [brand text and images redacted] by experimental condition. Experiment 2: Description of images of device 'skins'. Note: all text was the same between the branded and standardized version of each starter kit package.

https://davidhammond.ca/wp-content/uploads/2024/01/Figure1_withimages.pdf)

Participants were asked, 'Which of these products would you be most interested in trying?' and could select one of the product images, 'I have no interest in trying any of these products' (presented as an image the same size as products), 'don't know' or 'refused' (as text). The main outcome was whether the 'no interest in trying any' option was selected (vs selecting any pack).

It was hypothesized that more youth in the standardized packaging condition would report no interest in any of the products than youth assigned to the branded condition. At the time of the survey, the brands included were among the top 5 brands used by youth in each of the countries, and pod/cartridge devices were the most popular device type among youth in Canada and the USA, second-most popular in England (following refillable tanks).[27]

Table 1
Sample characteristics, youth aged 16–19 years, by country, unweighted % (n).

	Canada (n = 4,217)	England (n = 4,275)	USA (n = 5,132)	Total (n = 13,624)
Age (years); mean (SE)	17.7 (0.02)	17.6 (0.02)	17.5 (0.01)	17.6 (0.01)
Sex				
Male	38.2% (1,612)	37.6% (1,609)	33.2% (1,702)	36.1% (4,923)
Female	61.8% (2,605)	62.4% (2,666)	66.8% (3,430)	63.9% (8,701)
Perceived family SES[a]				
Not meeting basic expenses	4.7% (200)	5.1% (217)	6.9% (355)	5.7% (772)
Just meeting basic expenses	25.7% (1,083)	26.2% (1,119)	26.5% (1,359)	26.1% (3,561)
Meeting needs with a little left over	32.2% (1,358)	32.7% (1,396)	31.2% (1,603)	32.0% (4,357)
Living comfortably	32.5% (1,370)	30.8% (228)	32.5% (1,615)	31.6% (4,300)
Don't know/Refused	4.9% (206)	5.3% (228)	3.9% (200)	4.7% (634)
E-cigarette use				
Used in past 30 days	24.1% (1,016)	15.1% (646)	21.6% (1,106)	20.3% (2,768)
Else	75.9% (3,201)	84.9% (3,629)	78.4% (4,026)	79.7% (10,856)
Cigarette smoking				
Smoked in past 30 days	14.6% (617)	22.1% (943)	12.4% (636)	16.1% (2,196)
Else	85.4% (3,600)	77.9% (3,332)	87.6% (4,496)	83.9% (11,428)
Cannabis use				
Used in past 30 days	25.3% (1,068)	14.1% (604)	22.8% (1,172)	20.9% (2,844)
Did not use in past 30 days	72.5% (3,058)	82.9% (3,543)	74.8% (3,837)	79.6% (10,438)
Don't know/Refused	2.2% (91)	3.0% (128)	2.4% (123)	2.5% (342)

[a] Participants were asked: 'How would you describe your family's financial situation?'

Analysis

A logistic regression model was fit to test for differences between experimental conditions (branded vs standardized packaging) in youth reporting 'no interest in trying any', adjusting for age (years), sex, country, past 30-day e-cigarette use and past 30-day smoking. 'Don't know' (n = 161 for branded, n = 181 for standardized) and 'Refused' (n = 31 for branded, n = 33 for standardized) responses were excluded. In subsequent steps, two-way interaction terms were added to the regression model to test potential interactions between packaging conditions (standardized vs branded) and each of the covariates.

Experiment 2

Experiment 2 used a within-group design to examine brand imagery directly on e-cigarette devices. Each participant viewed a set of four images of pod-style e-cigarettes, including one solid black device and three devices in 'skins' with colourful designs. Devices within the set were identical other than the colour/design. To increase generalizability, sets of devices from two leading brands were tested, with half of the respondents randomly assigned to

view each brand/set—see Fig. 1. Participants were asked 'Which of these products would you be most interested in trying?', and could select one of the four product images, 'I have no interest in trying any of these products', or text options 'Don't know' or 'Refused'.

The 'skins' tested were commercially available designs from the manufacturer (for *Brand 2*) or a major retailer (for *Brand 1*). Skins were selected to test several hypotheses. First, both the *Brand 1* and *Brand 2* product sets included skins that featured stereotypical 'feminine' vs 'masculine' colours. It was hypothesized that products featuring feminine colours ('pink' and 'pastel design') would be more likely to be selected by females, whereas the darker skins featuring technical patterns ('grey texture' and 'grey camouflage') would be more likely to be selected by males. Second, the *Brand 1* product set included a skin featuring the Rastafarian symbol and colours that are commonly associated with cannabis use, which was hypothesized to be selected to a greater extent by youth who reported cannabis use.

Analysis

The primary outcome was the product selected by respondents. Responses were recoded as 'selected a specific device' vs 'else'.

Table 2
No interest in trying any product, by standardized vs branded packaging condition and participant characteristics (experiment 1).

	Any product selected (ref)	No interest in trying any product		
	% (n)	% (n)	AOR[a] (95% CI)	P
Total				
Branded packaging	33.1% (2,189)	66.9% (4428)	1	ref
Plain packaging	27.7% (1,827)	72.3% (4774)	1.45 (1.33–1.59)	**<.0001**
Country				
Canada	33.7% (1,377)	66.3% (2,707)	0.76 (0.68–0.84)	**<.0001**
England	30.3% (1,257)	69.7% (2,885)	0.75 (0.67–0.84)	**<.0001**
USA	27.7% (1,382)	72.3% (3,610)	1	ref
Sex				
Male	29.7% (1,411)	70.3% (3,336)	1.13 (1.03–1.25)	**.010**
Female	30.8% (2,605)	69.2% (5,866)	1	ref
E-cigarette use				
Used in past 30 days	79.3% (21,21)	20.7% (554)	1	ref
Else	18.0% (1,895)	82.0% (8,648)	13.80 (12.32–15.48)	**<.0001**
Cigarette smoking				
Smoked in past 30 days	66.7% (1408)	33.3% (703)	1	ref
Else	23.5% (2,608)	76.5% (8,499)	3.34 (2.94–3.78)	**<.0001**

Bolding indicates significance at α = 0.05.
[a] From a logistic regression modelling 'no interest in trying any (vs selecting any product), adjusting for age (years), sex, country, past 30-day e-cigarette use, and past 30-day cigarette smoking.

Table 3
Proportion selecting each option for *Brand 1* 'skin' by participant characteristics (experiment 2).

	'I have no interest trying any of these products'	'Plain black'	'Pink'			'Grey texture'			'Rastafarian-themed'		
	% (n)	% (n)	% (n)	AOR[a] (95%CI)	P	% (n)	AOR[b] (95%CI)	P	% (n)	AOR[c] (95%CI)	P
Total selected	65.4% (4322)	7.6% (500)	12.4% (822)	–	–	8.1% (538)	–	–	6.4% (426)	–	–
Sex											
Male	65.0% (1,624)	8.5% (212)	3.1% (78)	1	ref	9.2% (229)	1.29 (1.07–1.56)	**.008**	10.0% (250)	2.56 (2.07–3.16)	**<.0001**
Female	62.5% (2,698)	6.7% (288)	17.2% (744)	7.25 (5.67–9.27)	**<.0001**	7.2% (309)	1	ref	4.1% (176)	1	ref
Country											
Canada	60.1% (1,266)	8.0% (168)	13.0% (275)	1.08 (0.90–1.31)	0.393	8.8% (185)	1.20 (0.96–1.50)	0.109	6.6% (140)	1.05 (0.82–1.35)	0.697
England	62.7% (1,342)	8.5% (182)	11.2% (240)	1.03 (0.85–1.26)	0.732	8.1% (174)	1.23 (0.98–1.55)	0.074	6.3% (135)	1.17 (0.90–1.52)	0.239
USA	66.7% (1,714)	5.8% (150)	12.0% (307)	1	ref	7.0% (179)	1	ref	5.9% (151)	1	ref
E-cigarette use											
Used in past 30 days	20.9% (293)	15.5% (218)	26.1% (366)	3.82 (3.20–4.56)	**<.0001**	19.7% (277)	4.06 (3.28–5.03)	**<.0001**	14.8% (208)	2.06 (1.60–2.67)	**<.0001**
Else	74.4% (4,029)	5.2% (282)	8.4% (456)	1	ref	4.8% (261)	1	ref	4.0% (218)	1	ref
Cigarette smoking											
Smoked in past 30 days	27.8% (309)	14.1% (157)	20.3% (225)	1.43 (1.17–1.76)	**.001**	16.6% (184)	1.57 (1.24–1.99)	**<.001**	16.4% (182)	2.07 (1.61–2.67)	**<.0001**
Else	70.3% (4,013)	6.0% (343)	10.5% (597)	1	ref	6.2% (354)	1	ref	4.3% (244)	1	ref
Cannabis use											
Used in past 30 days	–	–	–	–	–	–	–	–	15.6% (227)	2.89 (2.25–3.72)	**<.0001**
Did not use in past 30 days	–	–	–	–	–	–	–	–	3.7% (194)	1	ref

Bolding indicates significance at α = 0.05.
[a] From a logistic regression modelling selecting the 'pink' *Brand 1* device (vs else), adjusting for age (years), sex, country, past 30-day e-cigarette use and past 30-day cigarette smoking.
[b] From a logistic regression modelling selecting the 'grey texture' *Brand 1* device (vs else), adjusting for age (years), sex, country, past 30-day e-cigarette use and past 30-day cigarette smoking.
[c] From a logistic regression modelling selecting the 'Rastafarian-themed' *Brand 1* device (vs else), adjusting for age (years), sex, country, past 30-day e-cigarette use, past 30-day cigarette smoking and past 30-day cannabis use.

Separate logistic regression models were fit to test each of the hypotheses. For example, a logistic regression model was fit to examine the likelihood of selecting the 'pink' device (1 = selected pink device vs 0 = all else), in which age, sex, country, past 30-day e-cigarette use and past 30-day smoking were included as predictor variables. All models included the same set of predictor variables, except for the model predicting the selection of the Rastafarian-themed skin, which also included a variable for past 30-day cannabis use; respondents that answered, 'Don't know' or 'Refused' (n = 167 for *Brand 1* and n = 175 for *Brand 2*) for cannabis use were excluded from this model only.

Results

Sample characteristics, overall and by country, are shown in Table 1. Overall, there was a greater proportion of females (63.9%) compared to males (36.1%) and the average age of respondents was 17.6 years. Among the sample, past 30-day vaping was more prevalent among respondents in Canada and the USA (24.1% and 21.6% respectively) compared with England (15.1%). However, past 30-day smoking was more prevalent among respondents in England (22.1%) compared with Canada and the USA (14.6% and 12.4% respectively). Chi-squared tests indicate that participants were successfully randomized to conditions for Experiment 1, enabling the use of unweighted data (see Supplemental Table S1).

Experiment 1: Starter kits

Table 2 shows the percentages that selected each option, by experimental condition. Participants in the standardized packaging condition were significantly more likely to indicate 'I have no interest in trying any of these products' (72.3%) than those in the branded condition (66.9%; AOR 1.45, 95% CI 1.33 to 1.59).

A significant interaction between packaging condition (standardized vs branded) and country was observed (F = 4.0, P = 0.018). Within each country, youth in the standardized packaging condition were more likely to report 'no interest in trying' (Canada: AOR 1.29, 95% CI 1.10 to 1.52; England: AOR 1.76, 95% CI 1.49 to 2.07; USA: AOR 1.35, 95% CI 1.17 to 1.56—see Supplemental Tables S2 and S3); however, the effect of standardized packaging was greater among youth in England versus Canada and the USA (standardized vs branded in England to standardized vs branded in Canada: AOR 1.36, 95% CI 1.08 to 1.71; standardized vs branded in England to standardized vs branded in the USA: AOR 1.30, 95% CI 1.10 to 1.52). No other significant two-way interactions with packaging condition were observed.

Experiment 2: Device skins

Brand 1

The percentage of youth who selected each option in the *Brand 1* set is shown in Table 3. Three models tested differences in the choice of brand imagery directly on *Brand 1* e-cigarette devices by subgroups: two models by sex and one by past 30-day cannabis use. A greater percentage of females reported interest in trying the 'pink' device than males (17.2% vs 3.1%; AOR 7.25, 95% CI 5.67 to 9.27). Similarly, a greater proportion of males (9.2%) selected the 'grey texture' device compared with females (7.2%; AOR 1.29, 95% CI 1.07 to 1.56). In addition, a greater percentage of youth who used cannabis within the past 30 days reported interest in the Rastafarian-themed device compared with youth who did not use cannabis (15.6% vs 3.7%; AOR 2.89, 95% CI 2.25 to 3.72).

Table 4
Proportion selecting each option for *Brand 2* 'skin' by participant characteristics (experiment 2).

	'I have no interest trying any of these products'	'Plain black'	'Pastel design'			'Grey camouflage stripe'			'Teal swirl'
	% (n)	% (n)	% (n)	AOR[a] (95%CI)	P	% (n)	AOR[b] (95%CI)	P	% (n)
Total selected	66.7% (4,422)	9.0% (600)	14.2% (943)	–	–	5.0% (331)	–	–	5.1% (335)
Sex									
Male	65.6% (1,591)	11.7% (283)	6.7% (162)	1	ref	8.5% (207)	3.35 (2.63–4.26)	**<.0001**	4.3% (104)
Female	64.6% (2,831)	7.2% (317)	17.8% (781)	3.32 (2.75–4.01)	**<.0001**	2.8% (124)	1	ref	5.3% (231)
Country									
Canada	62.7% (1,323)	9.2% (194)	14.7% (310)	1.18 (0.99–1.40)	0.074	5.1% (108)	1.12 (0.84–1.48)	0.447	5.2% (110)
England	61.9% (1,322)	10.9% (233)	14.3% (306)	1.32 (1.10–1.58)	**.003**	5.5% (117)	1.29 (0.97–1.71)	0.084	4.6% (98)
USA	69.3% (1,777)	6.7% (173)	12.8% (327)	1	ref	4.1% (106)	1	ref	5.0% (127)
E-cigarette use									
Used in past 30 days	20.0% (273)	20.6% (281)	32.8% (448)	4.31 (3.64–5.11)	**<.0001**	11.4% (155)	2.91 (2.19–3.88)	**<.0001**	11.4% (155)
Else	76.2% (4,149)	5.9% (319)	9.1% (495)	1	ref	3.2% (176)	1	ref	3.3% (180)
Cigarette smoking									
Smoked in past 30 days	28.5% (309)	19.9% (216)	27.4% (297)	1.75 (1.46–2.12)	**<.0001**	12.2% (132)	2.34 (1.74–3.14)	**<.0001**	8.8% (95)
Else	71.9% (4,113)	6.7% (384)	11.3% (646)	1	ref	3.5% (199)	1	ref	4.2% (240

Bolding indicates significance at $\alpha = 0.05$.

 [a] From a logistic regression modelling selecting the 'pastel design' *Brand 2* device (vs else), adjusting for age (years), sex, country, past 30-day e-cigarette use and past 30-day cigarette smoking.

 [b] From a logistic regression modelling selecting the 'grey camouflage stripe' *Brand 2* device (vs else), adjusting for age (years), sex, country, past 30-day e-cigarette use and past 30-day cigarette smoking.

Brand 2

Table 4 shows the percentage of youth who selected each option in the *Brand 2* set. Two models tested differences in the choice of brand imagery on *Brand 2* devices by sex. A greater proportion of females reported interest in trying the 'pastel design' device than males (17.8% vs 6.7%; AOR 3.32, 95% CI 2.75 to 4.01), whereas more males expressed interest in trying the 'grey camouflage stripe' device compared with females (8.5% vs 2.8%; AOR 3.35, 95% CI 2.63 to 4.26).

Discussion

The current study is among the largest to date to examine the impact of e-cigarette packaging on appeal among youth. The study has three primary findings: (1) brand imagery on e-cigarette packaging increases the number of youth interested in trying vaping; (2) brand imagery directly on vaping devices helps to target products at specific sub-groups; and (3) restricting brand imagery by using standardized packaging reduces interest in trying vaping products among youth. The findings are described in more detail below.

This study adds to the literature that brand imagery and colourful designs displayed on the packaging of vaping products enhance their appeal to young people. Approximately 5% more youth reported interest in trying one of three leading vaping brands when shown products displayed with their usual packaging, with colours and brand imagery. This magnitude of difference is similar to other recent studies conducted with e-cigarettes,[14,23,24] as well as previous studies examining the effect of tobacco packaging among youth.[28]

The current findings also extend the existing literature by testing the impact of design directly on the device itself. As hypothesized, the colours of devices preferentially appealed to different sexes: for example, females were more interested in trying devices with pink and pastel colours than males. These findings are highly consistent with the tobacco literature demonstrating that designs can be used to target subgroups of smokers by attaching attributes related to stereotypical gender (e.g., pink colour).[11,29,30] The study also found that a device with Rastafarian imagery had greater appeal among youth who reported past 30-day cannabis use. This is particularly notable given that using nicotine e-cigarettes and vaping cannabis products are highly

correlated among youth, as noted previously.[7,8] To our knowledge, this is the first study to experimentally test the effect of designs directly on the devices themselves, which may be particularly relevant to young people. Not only is the exterior packaging for vapes often discarded prior to first use, but exposure to the device itself is likely higher during sharing of vapes among young people.[31] This is particularly true in the case of disposable e-cigarettes, which may be sold with little exterior packaging and with brand imagery often displayed directly on the device.

Finally, the findings suggest that standardized packaging of e-cigarettes has the potential to reduce interest in trying among young people. Standardized packaging reduced interest in trying e-cigarettes in all countries but had a greater effect among youth in England compared to youth in Canada and the USA; the reason for this difference is unclear. The uniform colour used in the standardized packaging condition warrants consideration. The current study used a dark olive-green as the standard colour, similar to that used in Canada and the UK for standardized tobacco packaging. Studies of both tobacco and e-cigarette packaging indicate that using darker colours is associated with higher perceived risk and lower appeal than packages that use white as the standard colour.[24,28] In countries that have implemented standardized packaging regulations for tobacco products, using white as a standard colour for e-cigarettes may be appropriate to signal the lower relative risks of vaping versus smoking.

Limitations

The current study did not account for other factors associated with e-cigarette appeal, including flavour descriptors and other product attributes commonly displayed on packages. Research on tobacco packaging has shown that descriptors can interact with package design in terms of their effect on consumer perceptions and brand appeal.[11,30] The current study also did not examine other individual factors, such as additional sociodemographic variables (e.g., socioeconomic status) or more detailed patterns of use of tobacco and vaping products, that may be associated with e-cigarette appeal. In addition, the study did not examine the effect of brand imagery and plain packaging on interest in using e-cigarettes for smoking cessation among adults.

Conclusions

Packaging design is an important promotional channel for e-cigarettes. The experimental findings indicate that the brand imagery on e-cigarettes can increase the overall interest in vaping, as well as target products to specific subgroups. The findings add to the evidence that standardized packaging may be an effective means of reducing the appeal of e-cigarettes to youth. Research from other studies suggests that restrictions on packaging design may have little or no impact on the appeal of vaping as a substitute for smoking among adults.[14] Thus, standardized packaging for vaping products may be used to preferentially target e-cigarettes to adults for the purpose of smoking cessation, while reducing appeal among young people. Israel became the first country to mandate standardized packaging for e-cigarettes in 2020, with other countries proposing to do the same.[13,32,33] Future research should consider post-implementation studies to examine the impact of these regulations.

Author statements

Ethical approval

The study was reviewed 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 (PNM RESC).

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Competing interests

DH has served as a paid expert witness in legal challenges against tobacco companies, including packaging laws for tobacco products. All other authors declare no conflicts of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.puhe.2024.02.001.

References

1. Andrade M de, Hastings G, Angus K. Promotion of electronic cigarettes: tobacco marketing reinvented? *BMJ* 2013 Dec 22;**347**:f7473.
2. Ali FRM, Seidenberg AB, Crane E, Seaman E, Tynan MA, Marynak K. E-cigarette unit sales by product and flavor type, and top-selling brands, United States, 2020-2022. (Cover story). *MMWR Morb Mortal Wkly Rep* 2023 Jun 23;**72**(25): 672—7.
3. East K, O'Connor RJ, Hammond D. Vaping products in Canada. A market scan of e-liquid products, flavours, and nicotine content (2021) [Internet]. University of Waterloo; 2021 Oct. Available from: https://davidhammond.ca/wp-content/uploads/2022/10/2021-E-cigarette-retail-scan-report-East-Hammond.pdf.
4. Hammond D, East K, Wiggers D, Mahamad S. *Vaping products in Canada. A market scan of industry product, labelling and packaging promotional practices* [Internet]. University of Waterloo; 2020 Dec. Available from: https://davidhammond.ca/wp-content/uploads/2022/10/2020-Vaping-Packaging-Final-Report-Hammond-Dec-15.pdf.
5. Laestadius LI, Wahl MM, Pokhrel P, Cho YI. From Apple to Werewolf: a content analysis of marketing for e-liquids on Instagram. *Addict Behav* 2019 Apr;**91**: 119—27.
6. Vape Accessories | Charger, pouch, USB cable | Vuse Canada [Internet]. [cited 2023 Jul 11]. Available from: https://www.vuse.com/ca/en/buy-online/vype-epod-accessories.
7. Moustafa AF, Rodriguez D, Pianin SH, Testa SM, Audrain-McGovern JE. Dual use of nicotine and cannabis through vaping among adolescents. *Am J Prev Med* 2022 Jul 1;**63**(1):60—7.
8. Fataar F, Hammond D. The prevalence of vaping and smoking as modes of delivery for nicotine and cannabis among youth in Canada, England and the United States. *Int J Environ Res Publ Health*. 2019 Nov;**16**(21):4111.
9. McNeill A, Gravely S, Hitchman SC, Bauld L, Hammond D, Hartmann-Boyce J. Tobacco packaging design for reducing tobacco use. Cochrane Tobacco Addiction Group. In: *Cochrane database syst rev [Internet]*; 2017 Apr 27. https://doi.org/10.1002/14651858.CD011244.pub2 [cited 2023 Jul 11];2017(4).
10. National Center for Chronic Disease Prevention and Health Promotion (US) Office on Smoking and Health. *Preventing tobacco use among youth and young adults: a report of the surgeon general [Internet]*. Atlanta (GA): Centers for Disease Control and Prevention (US); 2012 [cited 2023 Jul 11]. (Reports of the Surgeon General). Available from: http://www.ncbi.nlm.nih.gov/books/NBK99237/.
11. Hammond D, Doxey J, Daniel S, Bansal-Travers M. Impact of female-oriented cigarette packaging in the United States. *Nicotine Tob Res* 2011 Jul 1;**13**(7): 579—88.
12. Islam F, Thrasher J, Szklo A, Figueiredo V, Perez C, White C, et al. Cigarette flavors, package shape, and cigarette brand perceptions: an experiment among young Brazilian women. *Rev Panam Salud Públic* 2018:1—9.
13. Moodie C, Hoek J, Hammond D, Gallopel-Morvan K, Sendoya D, Rosen L, et al. Plain tobacco packaging: progress, challenges, learning and opportunities. *Tobac Control* 2022 Mar;**31**(2):263—71.
14. Taylor E, Arnott D, Cheeseman H, Hammond D, Reid JL, McNeill A, et al. Association of fully branded and standardized e-cigarette packaging with interest in trying products among youths and adults in Great Britain. *JAMA Netw Open* 2023 Mar 14;**6**(3):e231799.
15. Federal Laws of Canada. Tobacco Products Appearance, Packaging and Labelling Regulations [Internet]. 2019 [cited 2023 May 11]. Available from: https://laws.justice.gc.ca/eng/regulations/SOR-2019-107/page-1.htm.
16. Cho YJ, Thrasher JF, Reid JL, Hitchman S, Hammond D. Youth self-reported exposure to and perceptions of vaping advertisements: findings from the 2017 international tobacco control youth tobacco and vaping survey. *Prev Med* 2019 Sep;**126**:105775.
17. Duke JC, Allen JA, Eggers ME, Nonnemaker J, Farrelly MC. Exploring differences in youth perceptions of the effectiveness of electronic cigarette television advertisements. *Nicotine Tob Res* 2016 May 1;**18**(5):1382—6.
18. Farrelly MC, Duke JC, Crankshaw EC, Eggers ME, Lee YO, Nonnemaker JM, et al. A randomized trial of the effect of E-cigarette TV advertisements on intentions to use E-cigarettes. *Am J Prev Med* 2015 Nov 1;**49**(5):686—93.
19. Villanti AC, Rath JM, Williams VF, Pearson JL, Richardson A, Abrams DB, et al. Impact of exposure to electronic cigarette advertising on susceptibility and trial of electronic cigarettes and cigarettes in US young adults: a randomized controlled trial. *Nicotine Tob Res* 2016 May 1;**18**(5):1331—9.
20. Vogel EA, Ramo DE, Rubinstein ML, Delucchi KL, Darrow SM, Costello C, et al. Effects of social media on adolescents' willingness and intention to use E-cigarettes: an experimental investigation. *Nicotine Tob Res* 2021 Apr 1;**23**(4): 694—701.
21. Padon AA, Lochbuehler K, Maloney EK, Cappella JN. A randomized trial of the effect of youth appealing E-cigarette advertising on susceptibility to use E-cigarettes among youth. *Nicotine Tob Res* 2018 Jul 9;**20**(8):954—61.
22. Barnes AJ, Bono RS, Rudy AK, Hoetger C, Nicksic NE, Cobb CO. Effect of e-cigarette advertisement themes on hypothetical e-cigarette purchasing in price-responsive adolescents. *Addiction* 2020;**115**(12):2357—68.
23. Taylor E, Simonavičius E, Nottage M, McNeill A, Arnott D, Cheeseman H, et al. Examining the effect of standardised packaging and reduced flavour and brand descriptors of e-liquids among youth in Great Britain. [(Under review)].
24. Simonavičius E, East K, Taylor E, Nottage M, Reid JL, Arnott D, et al. Impact of e-liquid packaging on vaping product perceptions among youth in England, Canada, and the United States; a randomised online experiment. *Nicotine Tob Res* 2023 Aug 5:ntad144. https://doi.org/10.1093/ntr/ntad144 [Epub ahead of print].
25. Seitz CM, Staley ME, Kearley J, Wright L, Bowman R, Phillips C, et al. E-cigarette sharing behavior among college students: an exploratory study. *J Am Coll Health* 2022;**70**(5):1297—300.
26. Hammond D, Reid JL, Rynard VL, Burkhalter R. *ITC youth tobacco and vaping survey: technical report — wave 3.5 (2020- february).* University of Waterloo; 2020 Oct.
27. Hammond D, Reid J, Burkhalter R, Hong D. *Trends in smoking and vaping among young people. Findings from the ITC Youth Surveys [Internet]*. Waterloo, ON: University of Waterloo; 2023 Apr. Available from: https://davidhammond.ca/projects/e-cigarettes-itc-youth-tobacco-ecig/.
28. Hammond D, White C, Anderson W, Arnott D, Dockrell M. The perceptions of UK youth of branded and standardized, "plain" cigarette packaging. *Eur J Publ Health* 2014 Aug 1;**24**(4):537—43.
29. Carpenter CM, Wayne GF, Connolly GN. Designing cigarettes for women: new findings from the tobacco industry documents. *Addiction* 2005;**100**(6):837—51.

30. Doxey J, Hammond D. Deadly in pink: the impact of cigarette packaging among young women. *Tobac Control* 2011 Sep;**20**(5):353.
31. Pepper JK, Coats EM, Nonnemaker JM, Loomis BR. How do adolescents get their E-cigarettes and other electronic vaping devices? *Am J Health Promot* 2019;**33**(3):420–9.
32. This week Israel became the first country to implement plain packaging of e-cigarettes. – Physicians for a Smoke-Free Canada [Internet]. [cited 2023 May 15]. Available from: https://smoke-free.ca/this-week-israel-became-the-first-country-to-implement-plain-packaging-of-e-cigarettes/.
33. Prohibition Of Advertising And Restriction Of Marketing Of Tobacco And Smoking Products Law, 5743-1983 [Internet]. Tobacco Control Laws; Available from: https://www.tobaccocontrollaws.org/legislation/israel/packaging-labeling/health-warnings-messages-features.