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Hypothetical flavour ban and intention to vape among vape shop customers: the role of flavour preference and e-cigarette dependence

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ABSTRACT

Introduction E-cigarette users typically initiate vaping with flavoured e-liquids. People who vape flavours tend to underestimate the harm of vaping. We examined the inter-relationship between flavour preference, vaping for cessation purposes, e-cigarette dependence, e-cigarette harm perception and purchase/use intention, given a hypothetical flavour ban. We hypothesised that non-tobacco flavour preference and vaping for cessation would be negatively associated with harm perception of e-cigarettes and intention to continue vaping if a flavour ban occurred and that these effects would be mediated by e-cigarette dependence.

Methods From July 2019 to March 2020, we conducted intercept interviews with 276 customers at 44 vape shops in California. The predictor variables were flavour preference and vaping for cessation. The outcome variables were harm perception of e-cigarettes and intention to purchase/use, given a hypothetical flavour ban. Multilevel structural equation modelling tested whether e-cigarette dependence mediates the effects of flavour preference on hypothetical continued vaping and purchase.

Results Those who preferred flavours showed significantly lower intention to purchase e-liquids ($\beta=-0.28$, $p<0.001$) and to continue vaping ($\beta=-0.17$, $p=0.001$), given a hypothetical flavour ban. Those who vaped for smoking cessation indicated greater intention to purchase e-liquid ($\beta=0.10$, $p=0.016$) and to continue vaping ($\beta=0.17$, $p=0.001$), given a hypothetical flavour ban. E-cigarette dependence significantly mediated these effects ($ps<0.04$).

Discussion Flavour preference was negatively related to intention to continue to vape within a hypothetical flavour ban. Our results also highlight the importance of e-cigarette dependence and use of e-cigarettes as smoking cessation methods. Implications for future flavour bans are discussed.

INTRODUCTION

E-cigarette vaping prevalence increased dramatically over the past decade.[1–5] While vaping might lead to harm reduction among combustible tobacco users who are unable or unwilling to quit nicotine, the drastic increase in the prevalence of vaping accompanied by the emergence of vape shop retailers[6–8] may undermine decades of anti-tobacco efforts and policies in denormalising tobacco use.[9] Marketing strategies employed by the industry promote a rapid evolution of products, including numerous flavours.[10 11]

Systematic reviews have found that most vapers prefer flavours.[10 11] Sweet and fruity flavours contribute to reduced harm perception of e-cigarettes,[10] increased willingness to initiate vaping[10] and subsequent escalation in vaping frequency[12]; however, tobacco flavour is associated with increased harm perception.[11] Non-nicotine, flavour-only vaping is associated with approval of vaping.[13] Vaping non-traditional, 'trendy' flavours (eg, fruit, dessert or combinations) was prospectively related to continued vaping and taking more puffs per vaping session, relative to vaping tobacco or menthol flavours.[14]

Most adult vapers report that their first e-cigarette purchases were flavoured products.[15–18] Compared with adult users aged ≥25 years, the appeal of the variety of flavours is a salient reason for vaping for younger adults (aged 18–24 years), who are more likely to use fruit, candy or concurrent multi-flavours.[19] While older adults often indicate vaping as a way to quit smoking,[20 21] younger adults tend to vape for socialisation[22] and enjoyment/recreation,[23] citing flavours as a reason.[21–23] Findings on whether flavoured vaping helps with smoking cessation are inconclusive.[11]

Given the role of flavour in vaping, laws to ban or restrict flavours have been discussed by Food and Drug Administration[24] and cities/states (eg, Massachusetts,[25] Michigan,[26] New York,[27] California[28]) with varying success. However, little is known regarding the impact of flavour bans on vapers' opinions or behaviours.[29] The levels of vaping-specific dependence could influence vapers' reactions to such bans because people with higher nicotine dependence might continue vaping even if flavours were banned. Research is needed to elucidate the role of vaping-specific dependence as well as preference for flavours (vs tobacco-only flavour) in shaping vapers' willingness to continue product use in the case of flavour bans.

E-cigarette users typically report lower levels of nicotine dependence compared with cigarette smokers.[30] Vaping-specific dependence is negatively associated with willingness to quit vaping among current e-cigarette youth users.[31] Unlike adolescents typically preferring flavours other than tobacco,[12 13] young adult poly-device users (ie, using multiple devices concurrently) frequently used tobacco-flavoured products and other flavours,[32] implying that banning flavours might not deter vape behaviour among young adults. Little is known regarding the relationship between flavour
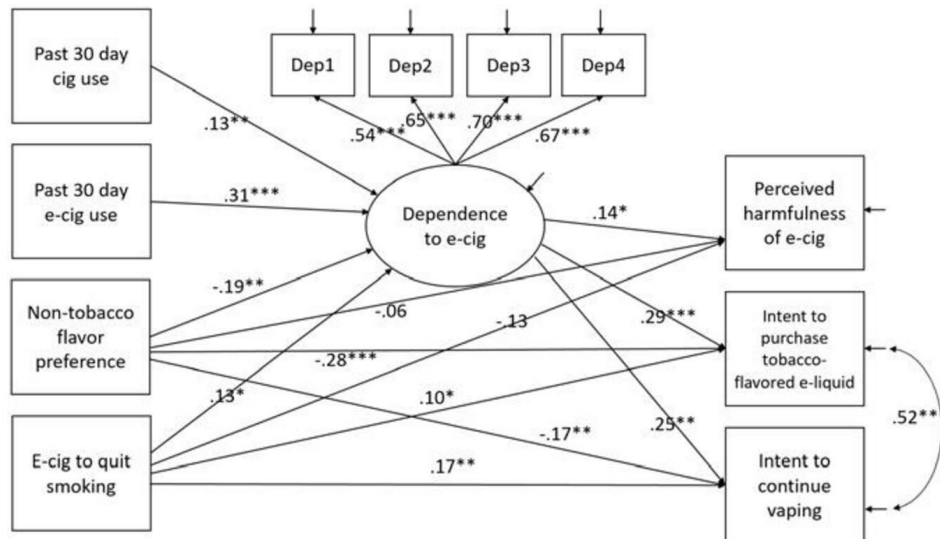
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Figure 1 Multilevel mediational model. The mediation model is adjusted for age, ethnicity, gender and nicotine level (in mg/mL) used in e-cigarette. Standardised coefficients are shown.

preference and vaping-specific dependence, as well as the role of dependence in conjunction with harm perception when considering hypothetical flavour bans.

This study examines the interrelationships between (a) flavour preference, (b) vaping for cessation purposes, (c) e-cigarette dependence, (d) e-cigarette harm perception and (e) purchase/use intention, given enactment of a hypothetical flavour ban among in-person vape shop customers. We hypothesised that non-tobacco flavour preference and vaping for smoking cessation would be negatively associated with e-cigarette harm perception and intention to continue vaping after a hypothetical flavour ban. We also hypothesised that these direct effects would be mediated by e-cigarette dependence.

METHODS
Participants and procedures
From July 2019 to March 2020, trained teams of two to three data collectors visited vape shops in Southern California and received permission to recruit customers from shop owners (15.4% shop refusal rate). Prior to data collection, all data collectors completed extensive training and piloting of protocols and survey measures adapted from previous work.[33–37] Data collectors followed scripts and verbally administered structured survey questions. All vape shop customers present at the time of data collection were approached as they exited the vape shop. Participants were eligible if they had vaped in the last 30 days. Customers were invited to participate in a 15 min intercept interview survey. Customers were assured that the data would be collected anonymously. Of the 431 eligible customers, 28.1% (n=121; average age, 35 years; 77% men; 52% white) declined to participate and 7.8% (n=34) were not surveyed as interviews with other customers were in progress. Participants provided verbal consent and received a $35 gift card. A total of 276 customer interviews from 44 vape shops from diverse neighbourhoods were included in this sample. The study was approved by the USC Institutional Review Board.

Measures
Demographics: Participants reported their age, ethnicity and gender.

Table 1 Sample characteristics of vape shop customers (N=276)

	Mean (SD)	N (%)
Demographics		
Male		211 (76.4)
Age	31.8 (10.5)	
Race/ethnicity		
Hispanic		69 (25.0)
White		115 (41.7)
Black		35 (12.7)
Asian		46 (16.7)
Other		31 (11.2)
Use characteristics		
Ever smoked 100 cigarettes in lifetime		209 (75.7)
Days of e-cigarette use in the past 30 days	26.6 (7.4)	
Days of cigarette use in the past 30 days	2.5 (7.2)	
Nicotine level (mg/mL)	17.0 (18.7)	
Quit smokable tobacco products by using e-cigarettes instead		198 (71.7)
Dependence on e-cigarettes		
I find myself reaching for my e-cigarette without thinking about it	3.4 (1.3)	
I drop everything to go out and buy e-cigarette or e-juice	1.8 (1.0)	
I vape more before going into a situation where vaping is not allowed	3.0 (1.5)	
When I haven't been able to vape for a few hours, the craving gets intolerable	2.1 (1.2)	
Harm perception		
How harmful is e-cigarette to your health (1=no danger/quite safe to 10=dangerous/not safe at all)	4.4 (2.3)	
Intention in case of a hypothetical ban		
If there was a regulation such that only tobacco-flavoured e-juices are allowed and all other flavours are banned (1=not at all to 4=extremely):		
How likely you would purchase tobacco-flavoured e-juices?	1.9 (1.1)	
How likely you would continue to vape?	2.3 (1.2)	

Past 30-day use: Days of cigarette/e-cigarette use in the past 30 days (1–30) were assessed.

Quit status: Participants indicated whether they 'quit all combustible tobacco products by using e-cigarettes instead' (0=no/1=yes).

Nicotine level of e-cigarette: Participants indicated how many *mg/mL* of nicotine their favourite brand/flavour contains.

Dependence: A four-item scale[33] measured e-cigarette dependence (eg, 'I find myself reaching for my e-cigarette without thinking about it' (0=never to 4=almost always).

Harm perception of e-cigarettes: Participants responded to 'How harmful to your health do you think e-cigarettes are on a scale of 1-to-10?'[35] (1=no danger/quite safe to 10=dangerous/not safe at all).

Intention for tobacco-flavoured e-liquid purchase for hypothetical flavour ban: 'Hypothetically, let's say that there was a regulation such that only tobacco-flavoured e-juices were allowed and all other flavours were banned, how likely would you purchase tobacco-flavoured e-juices? (1=not at all to 4=extremely)

Intention for continued vaping after a hypothetical flavour ban: Immediately after the previous question, participants responded to how likely it is that they would continue to vape (1=not at all to 4=extremely).

Non-tobacco flavour preference: Participants 'checked all that apply' to indicate their preferred flavours: fruity, dessert, minty, menthol and tobacco. We reverse-coded preference for tobacco flavour (ie, prefer tobacco flavour=0; prefer non-tobacco flavours=1).

Statistical analysis

We derived a single-factor structure of e-cigarette dependence through multilevel confirmatory factor analysis (CFA). We used multilevel structural equation modelling (SEM) to include the e-cigarette dependence factor and simultaneously test the mediational model[1 38 39] while accounting for potential clustering by vape shops. The outcome variables in our mediational model were harm perception and intention to purchase and continued use of e-cigarettes in a hypothetical flavour ban. The final model adjusted for gender, age and nicotine level of e-cigarettes. All analyses were conducted in Mplus V.8.3.

RESULTS

Descriptive statistics

The sample was largely white (41.7%; Hispanic, 25.0%), men (76.4%) and young adult (mean=31.8 years of age). Most had used 100+ cigarettes in lifetime (75.7%), quit combustible tobacco products by vaping instead (71.7%) and were daily vapers (mean=26.6 days in the past month). All participants had used e-cigarettes 1+ day in the past month; 77.9% had vaped 30 days in the past month; 22.1% were current dual users (ie, 1+ day of cigarette use in the past month) (table 1).

Although the estimates reported here are the results of multi-level modelling, the estimates produced by multilevel modelling were similar as those in single-level models (intraclass correlation coefficients of endogenous variables <0.01; average cluster size, 6.3).

Multilevel CFA

The one-factor CFA for e-cigarette dependence showed good fit, with individual loadings ranging from 0.54 to 0.70 (root mean square error of approximation (RMSEA)=0.07; comparative fit index (CFI)=0.98; standardised root mean

square residual (SRMR)=0.03), controlling for clustering by shops.

Multilevel SEM

Direct effects of flavour preference and quit by vaping on dependence

The dependence factor was used in our subsequent mediation model (figure 1; RMSEA=0.07; CFI=0.87; SRMR=0.06). Current cigarette use and e-cigarette use were positively related to the dependence factor (β=0.13, p=0.008; β=0.31, p<0.001, respectively), controlling for gender, ethnicity, age and e-cigarette nicotine concentration. Non-tobacco flavour preference was negatively related to e-cigarette dependence (β=−0.19, p=0.002). Vaping to quit smoking was positively associated with e-cigarette dependence (β=0.13, p=0.029).

Direct effects of flavour preference and quit by vaping on perceived harm and intentions

Non-tobacco flavour preference was not associated with perceived harm of e-cigarettes (β=−0.06, p=0.236). Those who preferred non-tobacco flavours showed significantly lower intention for continued purchase (β=−0.28, p<0.001) and use of e-cigarettes (β=−0.17, p=0.001) in case of a hypothetical flavour ban. Those who reported vaping to quit indicated greater intention for continued purchase (β=0.10, p=0.016) and use of e-cigarettes (β=0.17, p=0.001) in case of a hypothetical flavour ban. With respect to perceived harm of e-cigarettes, those who vape to quit did not significantly differ from those who vape for other reasons (β=−0.13, p=0.054).

E-cigarette dependence, in turn, was positively associated with harmful perception (β=0.14, p=0.033), greater intention for continued purchase (β=0.29, p<0.001) and use of e-cigarettes (β=0.25, p<0.001) in a hypothetical flavour ban.

Indirect effects

E-cigarette dependence partially mediated the association between preferred flavour and harm perception (p=0.047). It also mediated the relationship between preferred flavour and intention for continued purchase (p=0.013) and use of e-cigarettes (p=0.039) in a hypothetical flavour ban (table 2).

DISCUSSION

Vape shop customers who preferred non-tobacco flavours reported lower intentions to continue to purchase and use e-cigarettes in the case of a flavour ban. E-cigarette dependence mediated this association; non-tobacco flavour preference is related to lower dependence, which, in turn, is related to lower usage/

Table 2 Direct effect, indirect effect and total effect of the model

	Direct effect	Indirect effect	Total effect
Flavour→Dep→Harm	−0.06	−0.03*	−0.01
Flavour→Dep→HypoPurchase	−0.28***	−0.06*	−0.33***
Flavour→Dep→HypoVape	−0.17**	−0.05*	−0.22***
QuitEC→Dep→Harm	−0.13	0.02	−0.11
QuitEC →Dep→HypoPurchase	.10*	.04*	.14**
QuitEC →Dep→HypoVape	.17**	.03*	.20***

*p<.05; **p<.01; ***p<.001.
.Dep, e-cigarette dependence factor; Flavour, preference for non-tobacco flavour; Harm, perceived harm of e-cigarettes to health; HypoPurchase, intention to purchase tobacco-flavoured e-juice in hypothetical flavour ban; HypoVape, intention to continue vaping in hypothetical flavour ban; QuitEC, quit combustible products by using e-cigarettes instead.

What this paper adds

► This paper adds to the literature by providing support that vape-related behaviours would be impacted by flavour bans, emphasizing the role of e-cigarette dependence among vapers.

purchase intention in the case of a flavour ban. However, our results did not support the hypothesis that flavour preference would be associated with harm perception. This may be because vape shop customers are generally older than the participants in past studies.[10][11] An additional analysis revealed that flavour preference was not related to intention to switch to combustible tobacco products in the case of a flavour ban ($p=0.71$, results not shown), suggesting that flavour bans could deter users with flavour preference from using combustible products.

LIMITATIONS

Data were self-reports, and findings might not generalise to vapers who purchase online and do not visit vape shops. It is also unclear whether vapers who prefer flavours would switch to other flavoured tobacco produces after a flavour ban. Future studies should investigate the role of flavour preference and e-cigarette dependence for vapers in other states and countries. Our data collection halted because of COVID-19 restrictions; thus, the effect of COVID-19 on the observed associations remains to be seen.

CONCLUSION

Our findings provide valuable insights about vape shop customers and the potential effects of e-cigarette flavour bans. Customers who preferred flavours were less likely to intend to continue vaping in the case of a flavour ban, suggesting that flavour bans could reduce vaping among experimental tobacco users, without preventing highly nicotine-dependent users from switching from cigarettes to e-cigarettes for harm reduction.

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