

# Should electronic cigarette use be covered by clean indoor air laws?

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## ABSTRACT

**Background** Some jurisdictions have passed legislation that bans electronic cigarette (e-cig) use (vaping) in public places similarly to smoking. Many other jurisdictions have not yet determined how to regulate vaping in public places. This study examined the proportion of current e-cig users who find their vaping restricted in public places and further evaluated factors associated with the differences between restricted and unrestricted vapers.

**Methods** 3960 experienced exclusive e-cig users completed an online survey from December 2012 to May 2014 about their e-cig use. Restricted vapers were defined as those who reported not being able to vape in places where smoking is typically banned. Unrestricted vapers were defined as those who reported being able to vape in places where smoking is typically banned.  $\chi^2$  and two-sided t-tests were used as appropriate to determine differences between variables of interest.

**Results** Participants were a mean age of 40.3 years, 72.0% male, 91.8% white and 85.1% were from the USA. 26.1% (n=1034) of users reported restricted vaping, while 73.9% (n=2926) reported unrestricted vaping. Restricted vapers used less frequently ( $p<0.001$ ) and were less dependent compared with unrestricted vapers ( $p=0.001$ ). Of the restricted vapers, only 12% (n=124) reported finding it difficult to refrain from vaping in places where they were not supposed to. These users were more dependent ( $p<0.001$ ) and more likely to experience strong cravings ( $p<0.001$ ), compared with users who did not find it difficult to refrain from vaping.

**Conclusions** This study found that most vapers report unrestricted use of their e-cig. Of the restricted vapers, the majority (88%) do not find it difficult to refrain from vaping in places where they are not supposed to vape.

## INTRODUCTION

Regulatory authorities in many jurisdictions are deciding how to regulate public electronic cigarette (e-cigarette/e-cig) use (vaping).<sup>1–2</sup> Some jurisdictions have applied existing rules that cover smoking to vaping.<sup>3–6</sup> Currently, only 15 countries have completely banned vaping in public spaces.<sup>7</sup>

Justifications proposed for banning vaping in public places include (1) the precautionary principle<sup>1</sup> based on evidence that e-cig aerosol can contain toxicants,<sup>8</sup> although far fewer than in cigarette smoke,<sup>9</sup> that could potentially affect the health of bystanders;<sup>10–14</sup> (2) concerns that it would renormalise smoking in public places or encourage vaping among never smokers;<sup>2 15 16</sup> or (3) concern that non e-cig users may find e-cig aerosol exposure unpleasant, even in the absence of significant health effects.<sup>15 17</sup>

A reason not to ban vaping in public places is that e-cigs seemingly help people quit or reduce traditional smoking, although this finding is controversial.<sup>18 19</sup> For example, Action on Smoking and Health (ASH) UK, a tobacco control advocacy organisation, states, ‘in the absence of evidence of significant harm to bystanders, ASH does not support the inclusion of electronic cigarettes in smoke-free laws which would completely prohibit their use in enclosed public places’.<sup>20</sup> In addition, the US Food and Drug Administration (FDA) has acknowledged that ‘the inhalation of nicotine is of less risk to the user than the inhalation of nicotine delivered by smoke from combusted tobacco products’.<sup>21</sup> If e-cigarettes help smokers to quit and they are less harmful than cigarettes, why create additional barriers and increase the risks that vapers might relapse to smoking by forcing them to stand outside public places to vape alongside smokers?

This study addressed whether bans on public vaping creates barriers to use among current e-cig users by examining the proportion of current users who perceived their vaping to be restricted in public places and whether they find refraining from vaping in these situations difficult.

## METHODS

Participants completed a 158-item online survey about their e-cig use between December 2012 and May 2014. Links to the survey could be found on <http://www.webMD.com> and sites frequented by users like <http://www.e-cigarette-forum.com>. Questions included participants’ age, race, education and country of residence. Dependence on e-cigarettes, including questions measuring use times per day and time to first use, was measured using the Penn State Electronic Cigarette Dependence Index (PSECDI). Retrospective dependence on cigarettes was measured using the Penn State Cigarette Dependence Index.<sup>22</sup> Craving was measured by asking ‘Do you ever have strong cravings to use an electronic cigarette?’ (yes/no). Advanced generation devices were defined as devices larger than a traditional cigarette or with a button to press prior to inhalation.<sup>23</sup> Previous smoking was measured by asking ‘Have you ever been a traditional cigarette smoker?’ (No, never; Yes, in the past; Yes, current occasional user; Yes, current daily user). Participants reported the time since quitting smoking in days, months or years, based on the participant’s preference, and all answers were converted into months.

Participants were asked, ‘Are you typically able to use your e-cig in places smoking is banned?’ (yes/no) to define restriction of vaping. Restricted

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vapers were defined as vapers who reported not being able to vape in places where smoking is banned and unrestricted vapers were defined as vapers able to vape in places smoking is banned. A second question, 'Is it hard to keep from using an electronic cigarette in places where you are not supposed to?'(yes/no) was used to describe the difficulty users face in refraining from vaping where it is restricted. To compare to the difficulty these vapers faced refraining from smoking as cigarette smokers, participants were also asked, 'Think back to a time when you were primarily a cigarette smoker...before you used e-cigs, was it hard to keep from smoking a cigarette in places where you were not supposed to?'. Additional details about the survey can be found elsewhere.<sup>22</sup>

Participants included in this analysis were current users reporting vaping in the past 7 days and for at least 30 days in their lifetime, former cigarette smokers and were not currently using any other tobacco products or nicotine replacement therapy (NRT).

The data were analysed using SAS V9.3 (Cary, North Carolina, USA) statistical package.  $\chi^2$  tests were used to determine differences between groups for categorical variables and two-sided t-tests were used to determine mean differences between groups. A p value of <0.05 was used as the cut-point for determining statistical significance.

**RESULTS**

The sample comprised 3960 participants. Participants were a mean age of 40.3 years, 72.0% male, 91.8% white and 85.1% were from the USA. On average, participants used their ecig 23.5 (SD) times per day and had been vaping for a total of 12.4 (SD=12.4) months. Participants exhibited moderate dependence on their e-cigarette as measured by the PSECDI. Most participants (73.9%) reported unrestricted vaping and few (11%) found it difficult to keep from vaping places where they were not supposed to. In comparison, 63.9% of these participants reported that they had found it difficult to refrain from smoking cigarettes in places where they were not supposed to, when they were a smoker.

Restricted vapers were less dependent on their e-cigarette (t(3958)=3.23, p=0.001), used fewer times per day (t(3958)=3.78, p<0.001) and were more likely to wait 30 min or more

to have the first use of the day (t(3958)=-3.65, p<0.001), compared with unrestricted vapers. Also, restricted vapers were more likely to be older (t(3958)=-5.94, p<0.001) and female (1, n=3960)=6.41, p=0.011), compared with unrestricted vapers (table 1).

When examining the subsample of restricted vapers (n=1034), only 12% (n=124) reported finding it difficult to refrain from vaping where they were not supposed to. Participants, who reported difficulty exhibited greater dependence on their e-cigarette (t(1032)=10.05, p<0.001), were more likely to experience strong cravings to vape ( $\chi^2$  (1, n=1034) =36.33, p<0.001), were more likely to vape in the first 30 min of the day (t(1032)=-2.17, p=0.001) and were less likely to be using an advanced generation device ( $\chi^2$  (1, n=1034)=8.30, p=0.004), in comparison with those not reporting difficulty. In addition, participants who reported difficulty refraining from vaping quit smoking more recently than those reporting no difficulty refraining from vaping (10.1 months and 12.8 months, respectively; t(1031)=-1.98, p=0.017). Finally, the restricted users reporting difficulty refraining from vaping were also more likely to report difficulty refraining from cigarette smoking when they were a smoker ( $\chi^2$  (1, n=1034)=17.6, p<0.001).

**DISCUSSION**

There are concerns that banning vaping in public places could force e-cig users to stand outside next to smokers to vape, which could lead to a relapse to smoking due to additional exposures to smoking and related cues. Our data do not support this idea and instead suggest that when vapers are faced with restricted vaping in public places, most (88%) do not find it difficult to refrain from vaping. Lower dependence on e-cigarettes in general, compared with cigarette dependence, may be one explanation for how these users were comfortably able refrain from vaping in places where they were not supposed to. This is not surprising since we have previously reported that current vapers are less dependent on their e-cigarette than they retrospectively reported being on cigarettes when they were exclusive cigarette smokers.<sup>22</sup>

The 12% of restricted vapers who reported difficulty refraining from vaping were more dependent on their e-cigarettes and were more likely to experience cravings than those who were

**Table 1** Differences in e-cig related characteristics between unrestricted and restricted vapers

Characteristic	Restricted vapers (n=1034)	Unrestricted vapers (n=2926)	p Value
Age, years (SD)	42.3 (12.5)	39.6 (12.5)	<0.001
% male	69.0	73.1	0.011
% from the USA (n=3959)	82.4	86.1	0.004
% obtained college degree	40.4	39.6	0.622
Mean Penn State Electronic Cigarette Dependence Index score (SD)	7.8 (3.5)	8.2 (3.4)	0.001
Mean number of months vaping (SD) [range]	11.4 (12.1) [1-60]	12.8 (12.7) [1-60]	0.002
Use times per day (SD)	19.8 (17.3)	22.4 (26.7)	<0.001
Mean time to first e-cig use of the day (in minutes) (SD)	48.1 (64.6)	40.6 (54.5)	<0.001
Mean nicotine concentration of liquid (SD) (n=3815)	14.9 (8.2)	15.8 (8.4)	0.005
% using advanced generation e-cig device	82.6	83.5	0.521
% feel e-cigs helped them to quit smoking (n=3948)	95.5	96.2	0.354
Mean number of months since quitting smoking (SD) [range] (n=3957)	12.5 (14.3) [0-60]	13.4 (14.3) [0-60]	0.088
Penn State Cigarette Dependence Index Score (SD)	14.2 (3.7)	14.5 (3.7)	0.011
% have strong cravings to vape	35.4	36.1	0.689
% find it difficult to refrain from vaping in places where they are not supposed to	12.0	10.7	0.253

e-cig, electronic cigarette.

able to refrain from vaping. These participants also reported greater difficulty refraining from smoking cigarettes when they were smokers, suggesting that these participants find it more difficult to refrain from using any product when they are not supposed to. Of interest, participants who recently quit also found refraining from vaping more difficult. Since we know that current vapers reported being less dependent on their e-cigarette than they reported for cigarettes, those recently quit may still be more like smokers with respect to how they handle vaping restrictions. Our data suggest that as time passes, it becomes easier for vapers to refrain from vaping.

It could be argued that the sample excluded the participants with the most difficulty refraining from using (dual users). We excluded dual users because it is difficult to determine which product (cigarettes or e-cigarette) the person finds difficult to refrain from using. Since smokers find it more difficult to refrain from smoking than vapers find it difficult to refrain from vaping, including dual users in the analysis could falsely inflate the number of participants reporting difficulty refraining from vaping. However, of the 970 dual users in the sample, a large proportion (75%) of the restricted vapers also said it would not be difficult to refrain from vaping in places where they were not supposed to. This suggests that among even those who have not successfully switched completely from cigarettes to e-cigarettes, the majority whose vaping in public places is restricted do not find this to be difficult.

In summary, this study found that most vapers reported unrestricted vaping in public places. Of those who experienced restrictions on public vaping, most (88%) do not find it difficult to refrain from vaping where they are not supposed to.

### What this paper adds

This study provides information about how restriction of vaping, similarly to traditional cigarette smoking in public places, affects current e-cig users. This study demonstrated that among ex-smokers who currently vape, most do not find it difficult to refrain from vaping in places where they are not supposed to.

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**Competing interests** JF has done paid consulting for pharmaceutical companies involved in producing smoking cessation medications, including GSK, Pfizer, Novartis, J&J and Cypress Bioscience.

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