

THE UK ELECTRONIC CIGARETTE RESEARCH FORUM

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Electronic cigarette research briefing – October 2015

This research briefing is part of a series of monthly updates aiming to provide an overview of new studies on electronic cigarettes. The briefings are intended for researchers, policy makers, health professionals and others who may not have time to keep up to date with new findings and would like to access a summary that goes beyond the study abstract. The briefing also aims to provide a critical overview of individual studies and put them in the context of what we already know from previous research.

The studies selected in these briefings do not form an exhaustive list of every e-cigarette-related study published each month. Instead they include those most relevant to key themes identified by the newly formed UK Electronic Cigarette Research Forum. This includes mechanisms and safety, cessation, population level impact, marketing and unintended consequences. For an explanation of the search strategy used, please see the end of this briefing.

The text below provides an overview of the aims, key findings and limitations of each of the highlighted studies. The briefing concludes with a section that puts the study findings in the context of the wider literature and what we know about existing research gaps.

If you would prefer not to receive this briefing in future, just let us know.

1. The Effects of E-Cigarette Visual Appearance on Craving and Withdrawal Symptoms in Abstinent Smokers.

- **Study aims**

This randomised UK lab study asked 63 current smokers who were not using e-cigarettes to use either a red or white coloured 'cig-a-like' e-cigarette in a prescribed way then rate impact on craving and withdrawal symptoms to explore the importance of visual similarity to traditional cigarettes.

- **Key findings**

22 participants had used an e-cigarette previously. For these smokers, following overnight abstinence, there was no difference between alleviation of craving and withdrawal symptoms between the red and white e-cigarettes. However for those who hadn't used an e-cigarette previously there was a significant difference – with lower urges to smoke and withdrawal symptoms in those using the white compared to the red e-cigarette.

- **Limitations**

This was a small study and only one type of e-cigarette was used. Furthermore, only one aspect of the characteristics of e-cigarettes was measured, to control for other potential influencing factors. These findings give an indication of when similarity to cigarettes may be most influential but cannot necessarily be extrapolated to other characteristics or products.

Red e-cigarettes are not common which could unconsciously impact perceived efficacy – it's not clear what conscious or unconscious factors are behind the difference seen. The differences observed were significant but small.

Dawkins L, Munafò M, Christoforou G, Olumegbon N, Soar K. The Effects of E-Cigarette Visual Appearance on Craving and Withdrawal Symptoms in Abstinent Smokers. *Psychol Addict Behav*. 2015. doi: 10.1037/adb0000112

2. Perceived harm of secondhand e-cigarette vapors and policy support to restrict public vaping: Results from a national survey of U.S. adults

- **Study aims**

This representative US survey aimed to explore perceived harm of second-hand e-cigarette vapour and level of support for policies to restrict the use of e-cigarettes in public spaces. 1449 adults who had heard of e-cigarettes were surveyed online in winter 2013 (a response rate of 51 – 56%). Demographic characteristics, tobacco use and political orientation were controlled for.

- **Key findings**

Second-hand vapour was rated as moderately harmful to health (3.78, on a scale ranging from 1 to 7) and respondents tended to favour restricting vaping in public places (2.14 on a scale from 1 to 3). Support was highest for restricting use inside restaurants, where 48% supported a total ban, compared to bars/casinos/clubs (33%) and parks (26%).

Higher ratings of perceived harm of second-hand e-cigarette vapour were associated with stronger support for restricting on the use of e-cigarettes. Those with higher education levels, current smokers, those who had tried e-cigarettes and those who had seen others using e-cigarettes more often were less likely to support restrictions.

- **Limitations**

This survey was conducted a few years ago and in the US, where discourse around e-cigarettes has a different tone to the UK, so it's not clear how applicable this would be to the current situation in the UK.

It's not possible to infer causation between e-cigarette harm and policy support because of the cross-sectional nature of the study. Other potential reasons for support of restrictions were not explored such as unpleasantness or 'renormalisation' of smoking. Perceptions of harm and acceptability of levels of harm may also vary for different people and it's not clear what specific health consequences were of concern.

The perceived harm of second-hand e-cigarette vapour was measured by asking people 'Do you think that breathing vapour from other people's electronic cigarettes is...?' on a 7-point Likert-like scale from 'not at all harmful to my health' to 'very harmful to my health'. This has the potential to be misunderstood to mean trying an e-cigarette that belongs to someone else rather than vapour which another user has exhaled.

Mello S, Bigman CA, Sanders-Jackson A, Tan AS. Perceived harm of secondhand e-cigarette vapors and policy support to restrict public vaping: Results from a national survey of U.S. adults. Nicotine Tob Res. 2015 Oct 15. pii: ntv232. doi: 10.1093/ntr/ntv232.

3. E-Cigarette Use Among Never-Smoking California Students

- **Study aims**

This Californian middle and high school survey explored e-cigarette and tobacco use in 2013 – 2014 (California Healthy Kids Survey). 482,179 students participated and the sample was representative of school districts rather than all Californian young people. Ever e-cigarette use was defined as once in their lifetime and current as any use in the last 30 days. Tobacco use included smokeless and conventional cigarettes.

- **Key findings**

24.4% had ever used e-cigarettes and 12.9% were current users, compared with 15.6% who had ever used and 7.8% who currently used tobacco. More than 50% (nearly 60 000 students in the sample) of ever e-cigarette users had never smoked.

Hispanics and those of other races who had never used tobacco were more likely to have ever used e-cigarettes than Whites, whereas Asians were less likely. Non-smoking girls were slightly less likely than boys to have used an e-cigarette but smoking girls were far less likely to have used an e-cigarette than boys. Younger students and those with higher parental educational attainment were less likely to have used an e-cigarette.

- **Limitations**

The cross-sectional nature of this study means it's not possible to know the direction of these associations. It is not clear what the response rate was to this survey and or how applicable these findings may be to the UK.

Timing or frequency of e-cigarette use was not explored in detail and “current use” did not differentiate between ongoing daily use and ever use within the last month.

Bostean G, Trinidad DR, McCarthy WJ. E-Cigarette Use Among Never-Smoking California Students. Am J Public Health. 2015 Oct 15:e1-e3. doi:10.2105/AJPH.2015.302899.

4. Particulate Matter from Electronic Cigarettes and Conventional Cigarettes: a Systematic Review and Observational Study.

- **Study aims**

This Spanish literature review and observational study summarises what is known about the composition of second-hand aerosols from human vaping and the generation of particulate matter (PM2.5). 8 studies were identified; other studies were excluded because they used smoking machines rather than human vaping.

The observational study measured PM2.5 in 4 volunteered home – two of which were non-smoking smoke-free homes, one where an e-cigarette was used and one smoking home. A monitor was placed 2m away from the smoker/vaper for 1 hour and they smoked/vaped *ad lib* (3 cigarettes and 42 puffs respectively) and moving averages were plotted each minute.

- **Key findings**

One study included in the literature review was an observational study conducted previously in Spain by the same team which showed airborne nicotine concentrations were higher in e-cigarette than control homes (though lower than in smoking homes). The other 7 replicated human vaping in an enclosed setting under controlled conditions. Studies showed bystanders could be exposed to some nicotine and PM2.5. Some studies detected propylene glycol, glycerine and other possible contaminants— volatile organic compounds and toxic metals (Ni, Zn and Ag).

The observational study showed median PM2.5 in the e-cigarette home was not significantly different to the non-smoking homes and all 3 were under 10 $\mu\text{g}/\text{m}^3$ which is the threshold concentration for long-term exposures established in the Air Quality Guidelines of the World Health Organization. However there were small peaks around the times when a puff was taken. In comparison, the median measure in the smoking home was 573 $\mu\text{g}/\text{m}^3$ and the peak reached well into the thousands.

- **Limitations**

The studies included in the literature review were not evaluated for methodological quality, they were small and few and cannot necessarily be generalised to apply to all e-cigarette brands and types.

The observational study only measured 4 homes for a short period on a single occasion. Only one e-cigarette home was studied, using a single e-cigarette brand and type. There was no control of other factors that could influence PM2.5 levels such as ventilation, dust, cooking or open fires.

Fernández E, Ballbè M, Sureda X, Fu M, Saltó E, Martínez-Sánchez JM. Particulate Matter from Electronic Cigarettes and Conventional Cigarettes: a Systematic Review and Observational Study. *Curr Environ Health Rep.* 2015 Oct 9. DOI 10.1007/s40572-015-0072-x.

Overview

This month we include four papers, one from the UK, two from the USA and one from Spain.

The first paper is by Lynne Dawkins from the University of East London and colleagues, a team who have an ongoing active programme of e-cigarette research and who are members of the UKECRF. Lynne and team tested whether the colour of first generation e-cigarettes influenced urges to smoke and withdrawal symptoms in 63 smokers. Amongst those who had used e-cigarettes before the colours made no difference to the outcomes of interest. However, amongst the 41 smokers who had never tried e-cigarettes, using the white device resulted in lower levels of standard measures of urges to smoke and tobacco withdrawal symptoms. Although involving a small sample, one of the implications may be that using a first generation device that looks a lot like a cigarette, including in colour, might be a useful first step in switching to vaping and hopefully stopping smoking entirely. It may be that sensory similarity makes the transition easier. Previous studies have shown that most vapers in the UK start with a ‘cig-a-like’ device. There may be a number of reasons for this, however, and more research is needed to understand them.

The second paper involves a public opinion survey from a nationally representative survey in the USA. Questions were added to the equivalent of an omnibus survey and asked adults about the perceived harm of ‘second hand’ e-cigarette vapour and support for public places bans. Although the

question asked on perceived harm was slightly confusing, it showed that most people thought vapour was moderately harmful (in a general sense, it did not ask people to compare this with tobacco smoke). It also showed that those who thought it was harmful were more likely to support bans on using e-cigarettes in public places, particularly in restaurants but less so in outdoor areas such as parks.

The summary above points to some of the limitations of the study. Those aside, it is interesting for a number of reasons. The first is that perceptions of harm (which we can suppose can be created by a range of factors including media coverage) seem to influence support for bans. This underlines the importance of accurate information being given to the public, including information on relative harms compared with tobacco smoke, as public views will influence how likely or unlikely politicians are to argue for restrictions. The second is that those with direct experience of the products (trying them or seeing others using them) are less supportive of restrictions, an interesting example of how the unknown or unfamiliar can shape public views. More highly educated individuals, who may be more sceptical of media stories or other indirect sources of information or less likely to be smokers, were also less supportive of restrictions.

The third paper is the latest in the growing number of cross sectional surveys from many countries that attempt to measure e-cigarette use in young people. It involved a large sample of secondary school pupils in California in 2013-14. The survey included some standard although weak measures of e-cigarette use. Ever trying, and what the authors describe as current use but is any use in the last 30 days, perhaps more accurately described as recent ever use. Ever use was high including amongst more than half (the precise % is not included) of never smoking young people, suggesting experimentation was common. This is consistent with findings from a number of countries where there are few restrictions on e-cigarettes like the USA. Recent ever use was 12.9% which is very similar to the proportion of ever use identified in three UK surveys in the same year. Some socio-demographic differences in both measures were also identified which were again largely consistent with other studies (less experimentation amongst younger pupils, for example).

The final paper explores a still relatively under-researched topic which is the assessment of particulate matter released by e-cigarettes compared with tobacco and also non-smoking environments. The authors reviewed the literature and found 8 studies that looked at the constituents of exhaled e-cigarette vapour and showed it to contain small particles, nicotine and other compounds including some toxicants, but for the toxicants in particular, at a far lower level than tobacco.

[The International Agency for Research on Cancer \(IARC\) has classified PM2.5 as a Group 1 carcinogen](#) and the [WHO have set guideline thresholds for particulate matter](#). The authors took PM2.5 measurements in four homes using similar methods to those employed in previous studies that looked at the impact of introducing smokefree measures and showed reductions in PM2.5 levels to very low and less risky levels. Although the discussion section in the paper is slightly misleading in terms of the implications of the findings, what is clear from the data is that PM2.5 levels in the single home that included an e-cigarette user were very similar to that in the two smokefree homes in the study. In contrast, PM2.5 levels in the smoker's home were much higher and well above the WHO threshold. The dramatic difference is highlighted in the figure from the paper below. It would be

very useful if this type of study could be replicated on a larger scale and in more indoor environments.

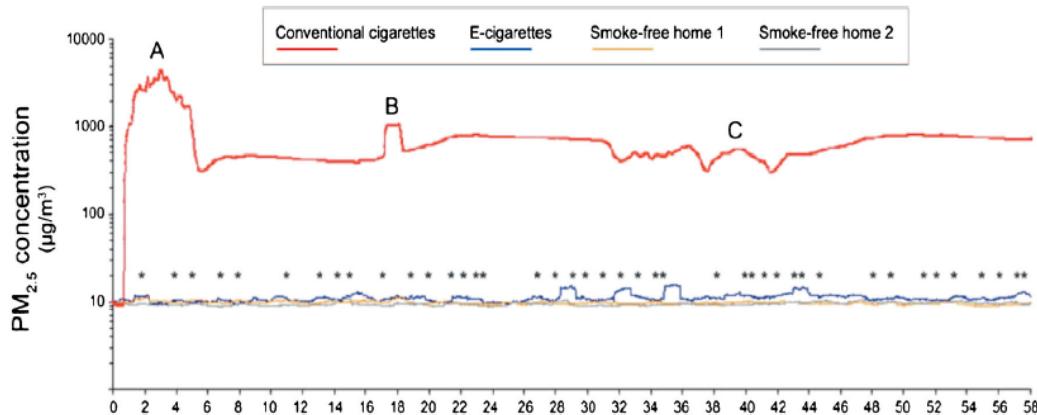


Fig. 2 Real-time PM_{2.5} concentrations (moving average of 60 s) in the e-cigarettes user's home, in a conventional cigarettes user's home, and in two smoke-free homes. Sixty-minute sampling while smoking or using e-

cigarette. a One cigarette smoked for 6 min. b One cigarette smoked for 7 min. c One cigarette smoked for 5 min. *E-cigarette puff (42 puffs during the sampling period)

Figure from the original study: Fernández E, Ballbè M, Sureda X, Fu M, Saltó E, Martínez-Sánchez JM. Particulate Matter from Electronic Cigarettes and Conventional Cigarettes: a Systematic Review and Observational Study. *Curr Environ Health Rep.* 2015 Oct 9. DOI 10.1007/s40572-015-0072-x.

Other studies from the last month that you may find of interest:

- [Short-term effects of a nicotine-free e-cigarette compared to a traditional cigarette in smokers and non-smokers.](#)
- [Susceptibility to e-cigarette use among never-users: findings from a survey of New Zealand adult smokers and ex-smokers.](#)
- [Characterizing Use Patterns and Perceptions of Relative Harm in Dual Users of Electronic and Tobacco Cigarettes.](#)
- [Gender differences in use and expectancies of e-cigarettes: Online survey results.](#)
- [Exploring the e-cigarette e-commerce marketplace: Identifying Internet e-cigarette marketing characteristics and regulatory gaps.](#)
- [Nicotine delivery, retention, and pharmacokinetics from various electronic cigarettes.](#)
- [Nicotine delivery, tolerability and reduction of smoking urge in smokers following short-term use of one brand of electronic cigarettes.](#)
- [Electronic cigarette solutions and resultant aerosol profiles.](#)
- [Licit and Illicit Substance Use by Adolescent E-Cigarette Users Compared with Conventional Cigarette Smokers, Dual Users, and Nonusers.](#)
- [Electronic Cigarettes Among Priority Populations: Role of Smoking Cessation and Tobacco Control Policies.](#)
- [A Snapshot of the Depiction of Electronic Cigarettes in YouTube Videos.](#)
- [Tobacco Attitudes and Behaviors of Vape Shop Retailers in Los Angeles.](#)
- [Adult Behavior in Male Mice Exposed to E-Cigarette Nicotine Vapors during Late Prenatal and Early Postnatal Life.](#)
- [Licit and Illicit Substance Use by Adolescent E-Cigarette Users Compared with Conventional Cigarette Smokers, Dual Users, and Nonusers](#)
- [Strategies to Reduce Tin and Other Metals in Electronic Cigarette Aerosol.](#)

- [Public Support for Selected E-Cigarette Regulations and Associations with Overall Information Exposure and Contradictory Information Exposure about E-Cigarettes: Findings From a National Survey of U.S. Adults.](#)
- [What Online Communities Can Tell Us About Electronic Cigarettes and Hookah Use: A Study Using Text Mining and Visualization Techniques.](#)

Search strategy

The Pubmed database is searched in the middle of each month, for the previous month using the following search terms: e-cigarette*[title/abstract] OR electronic cigarette*[title/abstract] OR e-cig*[title/abstract] OR (nicotine AND (vaporizer OR vapourizer OR vaporiser OR vapouriser))

Based on the titles and abstracts new studies on e-cigarettes that may be relevant to health, the UK and the UKECRF key questions are identified. Only peer-reviewed primary studies and systematic reviews are included – commentaries will not be included. Please note studies funded by the tobacco industry will be excluded.

This briefing is produced by Nicola Smith from Cancer Research UK with assistance from Professor Linda Bauld and Kathryn Angus at the University of Stirling and the UK Centre for Tobacco and Alcohol Studies, primarily for the benefit of members of the CRUK & PHE UK E-Cigarette Research Forum. If you wish to circulate to external parties, do not make any alterations to the contents and provide a full acknowledgement. Kindly note Cancer Research UK cannot be responsible for the contents once externally circulated.