

Electronic cigarette research briefing – June 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 by emailing tobaccocontrol@cancer.org.uk

1. Electronic Cigarettes Efficacy and Safety at 12 Months: Cohort Study

- **Study aims**

These are initial 1 year results from an Italian study evaluating the safety and efficacy of e-cigarettes as a smoking cessation tool. The researchers followed 491 smokers, 236 vapers and 232 dual users. The participants were recruited by a variety of methods but CO monitoring was conducted in a small sub-sample. 29% of participants withdrew or were lost to follow-up.

- **Key findings**

After 12 months, the proportion of people who quit all types of smoking/vaping was not significantly different across groups. However 62% of vapers were still abstinent from tobacco whereas 21% and 22% of smokers and dual users respectively were abstinent from tobacco; vapers were 5 times more likely to be abstinent from tobacco.

The percentage of subjects who reduced tobacco cigarette consumption by 50% or more was similar in dual and tobacco only users but mean consumption significantly decreased for dual users only.

There was no difference in adverse events reporting between groups. A small but significant improvement in self-rated health was observed in vapers only.

- **Limitations**

The cohort nature of the sample meant groups were different in demographic characteristics and the sample was not representative. Furthermore the vapers all previously smoked tobacco so this group was selecting the people who had already succeeded in quitting using e-cigarettes. It's not clear in the group of baseline smokers how they quit smoking, whether they went cold turkey or used aids such as e-cigarettes or NRT.

Adverse events and health/quality of life were self-reported. It is likely to take years of observation comparing quitters with continued vapers before long-term safety can be established.

Manzoli L, Flacco ME, Fiore M, La Vecchia C, Marzuillo C, Gualano MR, Liguori G, Cicolini G, Capasso L, D'Amario C, Boccia S, Siliquini R, Ricciardi W, Villari P. 2015. Electronic Cigarettes Efficacy and Safety at 12 Months: Cohort Study. *PLoS One*. 10(6):e0129443. doi: 10.1371/journal.pone.0129443.

2. [Smokers' and ex-smokers' understanding of electronic cigarettes: a qualitative study.](#)

- **Study aims**

This Scottish study aimed to explore how e-cigarettes are perceived and used and how this relates to smoking perceptions. 12 focus groups and 11 qualitative interviews were conducted with a total of 64 smokers and ex-smokers in central Scotland, focussing on individuals in disadvantaged areas or those with mental health problems.

- **Key findings**

E-cigarettes and NRT were viewed as very separate, with NRT viewed as a medical product (a safe albeit not very effective one) but e-cigarettes seen as an ambiguous product somewhere between smoking and quitting. Safety, uncertainty and lack of trust in providers were seen across groups. Four key themes were identified for how e-cigarettes were viewed:

- A more satisfying smoking replacement – advocated by those already using or most interested in using e-cigarettes, those who were concerned about the impact of smoking on their health but unable to quit. This group included most of those with mental health problems. There was ambiguity over whether they still saw themselves as smokers.
- An ambiguous but potentially useful device – more diverse group who thought they might use e-cigarettes, perhaps short-term to wean themselves off smoking. They raised uncertainties including how to use the products and the potential for over-use.
- A less desirable cigarette – this group were happy smoking and did not see the point in switching. There was some confusion about whether e-cigarettes were healthier than smoking and the known harms of smoking seemed preferable to the unknown of e-cigarettes.
- A threat to smoking cessation – recent ex-smokers who were concerned about the health effect of smoking and felt e-cigarettes were too similar to smoking. This group were concerned about nicotine and addiction more broadly.

- **Limitations**

Although this provides a useful snapshot of perceptions and behaviours, this was a qualitative study and experiences and views may differ in a larger sample, at a population level, in various areas or groups and over time. Use of different types of devices was not explored.

Rooke C, Cunningham-Burley S, Amos A. 2015. Smokers' and ex-smokers' understanding of electronic cigarettes: a qualitative study. *Tob Control*. pii: tobaccocontrol-2014-052151. doi: 10.1136/tobaccocontrol-2014-052151.

3. Knowledge, Attitudes, and Practice of Electronic Cigarette Use Among Pregnant Women

- **Study aims**

This US survey explored pregnant women's knowledge, attitudes, and use of e-cigarettes. 316 women responded to the convenience sample survey. Questions on tobacco and e-cigarette use and perception were listed with multiple choice responses.

- **Key findings**

66% of women had heard of e-cigarettes, 13% were ever users and 0.6% were current daily users. Only one ever user of e-cigarettes had never smoked. Three quarters of users agreed that e-cigarettes may help them quit smoking or cut down, half also felt the fact they were able to use e-cigarettes in places where cigarettes are banned was a benefit.

There was no difference between ever and never e-cigarette users in their perception of harms of tobacco but ever users were more likely to believe that e-cigarettes are less harmful to both themselves and their babies than tobacco cigarettes. Ever users were more likely to believe they were cheaper than cigarettes but no more likely to claim they were fashionable.

Only 63% and 55% of ever and never users (respectively) believed e-cigarettes contained nicotine.

- **Limitations**

This was a convenience sample in an American outpatient clinic so is unlikely to be representative of pregnant women in the UK.

Timing or frequency of e-cigarette use was not explored in detail and because of low numbers of current users, the results refer only to ever and never users rather than differentiating between daily and ever use.

The e-cigarette knowledge questions were posed as yes/no responses whereas agreement with statements on perceived risk of smoking was measured on a Likert scale, neither allowed for free-text responses. This may have introduced some difficulties for respondents for example the e-cigarette they have used was a nicotine-free one so they responded negatively to the question around whether e-cigarettes contain nicotine.

Mark KS, Farquhar B, Chisolm MS, Coleman-Cowger VH, Terplan M. 2015. Knowledge, Attitudes, and Practice of Electronic Cigarette Use Among Pregnant Women. *J Addict Med*.

4. E-cigarettes generate high levels of aldehydes only in 'dry puff' conditions.

- **Study aims**

Following a [study earlier this year](#) suggesting that e-cigarette users could be exposed to more formaldehyde than smokers, this Greek study aimed to explore whether users will actually be exposed to these conditions. Seven experienced vapers used two different customisable e-cigarettes – one with a conventional set-up and the other with a double wick to allow better liquid supply – and a liquid with 20mg/ml nicotine and equal parts of glycerol and propylene glycol which was identified in a previous study to generate the highest levels of aldehydes. They followed a prescribed puffing regimen and were asked to report when they experienced overheating of the device and an unpleasant taste – known as the 'dry

puff' phenomenon. Aldehyde presence in the vapour was measured using a smoking machine and compared to previously reported levels in cigarettes.

- **Key findings**

All users identified the 'dry puff' conditions at higher wattage in the conventional set-up but not the double wick set-up. When users identified the 'dry puff' aldehyde levels in the vapour were significantly higher and above the levels in cigarettes in the case of formaldehyde and acrolein.

- **Limitations**

Only two device set-ups and a prescribed puffing regimen were tested so it's not clear if these results would be applicable to all users. Avoidance of significant aldehyde exposure relies on users learning to avoid this dry puff condition. The measurements also rely on smoking machine rather than *in vivo* exposure.

Farsalinos KE, Voudris V, Poulas K. 2015. E-cigarettes generate high levels of aldehydes only in 'dry puff' conditions. *Addiction*. 2015 May 20. doi: 10.1111/add.12942.

Overview

This month we have included four studies focusing on smoking cessation and e-cigarettes, perceptions of the products amongst smokers, ex smokers and pregnant women, and exposure to toxicants.

The first study contains promising findings on e-cigarettes and smoking cessation, although it relies on early results (at one year) from a study that will follow participants for 5 years. This is one of a number of registered trials to address what is a current lack of longer-term data on e-cigarette use and outcomes. In terms of e-cigarette efficacy as a smoking cessation tool over 12 months, dual e-cig and tobacco users showed a similar cessation rate, no difference in self-rated health, and a non-significant reduction in the number of cigarettes smoked daily, compared to tobacco only smokers. In contrast, e-cigarette only users were 5 times more likely to be abstinent from tobacco after one year. These findings, despite being preliminary, are potentially useful in terms of emphasising the importance of making the transition from dual use to vaping only for both smoking reduction and cessation. Simply adding e-cigarettes to smoking didn't facilitate either of these outcomes over the one year period reported.

The second study was conducted in the UK and provides in depth information from a small sample of smokers and ex smokers. Importantly, it focussed on groups of people with the highest smoking prevalence and those least likely to quit: adults from more deprived communities and those with mental health issues. The study clearly outlines the ambiguity and uncertainty surrounding e-cigarettes amongst the public. Participants perceived them as very different from licensed stop smoking aids such as NRT. Where the individuals were positioned in relation to smoking (ie. their enjoyment of, dependence on or wish to quit smoking) was related to how they evaluated e-cigarettes. Four distinct interpretations of e-cigarettes were identified among the interviewees and discussion group members which could provide the basis for future research.

To date there have been no published peer-reviewed studies on e-cigarette use or perceptions amongst pregnant women. The first study on this topic is a modest survey in a prenatal care clinic in Maryland, USA. The survey found some evidence of e-cigarette experimentation (ever use) in pregnant women but very low levels of regular use (0.6% of the 316 respondents). Ever users were

more likely than never users to believe that e-cigarettes are less harmful to both themselves and their babies than tobacco cigarettes. Pregnant women did seem unsure about whether e-cigarettes contain nicotine, but the study was not able to assess nicotine levels in the products they had used. There is a need for research on the use of these products in pregnant women in the UK, particularly as licensed nicotine containing products (NRT) are routinely prescribed to pregnant smokers here.

The final study was conducted following earlier research suggesting that e-cigarette users could be exposed to high levels of formaldehyde. The authors were particularly interested in newer generation devices which can be used at higher power levels, possibly resulting in more aldehyde exposure. The authors explain that "*Aldehydes are emitted by electronic cigarettes due to thermal decomposition of liquid components. Although elevated levels have been reported with new-generation high-power devices, it is unclear whether they are relevant to true exposure of users because overheating produces an unpleasant taste, called a dry puff, which vapers learn to avoid.*" Findings from laboratory studies may not translate into the risk of e-cigarette use by humans and so this study aimed to assess exposure in humans. Just seven vapers tested devices in this study, but reported dry puff conditions at higher wattage in the conventional set-up but not the double wick set-up. When users identified the dry puff aldehyde levels in the vapour were significantly higher, although still lower than the aldehydes than in tobacco smoke. In order to avoid significant aldehyde exposure, e-cigarette users need to avoid this unpleasant dry puff condition.

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

- [Nicotine absorption from electronic cigarette use: comparison between experienced consumers \(vapers\) and naïve users \(smokers\)](#)
- [Young adult e-cigarette users' reasons for liking and not liking e-cigarettes: A qualitative study](#)
- [Comparison of the characteristics of long-term users of electronic cigarettes versus nicotine replacement therapy: A cross-sectional survey of English ex-smokers and current smokers](#)
- [Correlates of use of electronic cigarettes versus nicotine replacement therapy for help with smoking cessation](#)
- [Changes in use of cigarettes and non-cigarette alternative products among college students](#)
- [Electronic Cigarette Use among Irish Youth: A Cross Sectional Study of Prevalence and Associated Factors.](#)
- [Determination of Nicotine Content and Delivery in Disposable Electronic Cigarettes Available in the USA by Gas Chromatography-Mass Spectrometry](#)
- [Are metals emitted from electronic cigarettes a reason for health concern? A risk-assessment analysis of currently available literature.](#)
- [The Impact of Trying Electronic Cigarettes on Cigarette Smoking by College Students: A Prospective Analysis](#)
- [Factors associated with e-cigarette use: a national population survey of current and former smokers](#)

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 UKERCRF 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.

