Electronic Cigarette Research Briefing – July - August 2018

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 text below provides a critical overview of each of the selected studies then puts the study findings in the context of the wider literature and research gaps.

The studies selected and further reading list do not cover every e-cigarette-related study published each month. Instead, they include high profile studies most relevant to key themes identified by the UK Electronic Cigarette Research Forum; including efficacy and safety, smoking cessation, population level impact and marketing. For an explanation of the search strategy used, please see the end of this briefing.

Past research briefings can be found at www.cruk.org/UKECRF. If you would prefer not to receive this briefing in future, just let us know.

1. Electronic cigarettes: A longitudinal study of regular vapers

- **Study aims**

  This study used an online survey of 3868 regular vapers to assess the change in vaping and smoking behaviours over time. Respondents were invited to complete surveys at 5 time points over 12 months.

  The study also looked at patterns specifically amongst exclusive e-cigarette users, daily e-cigarette users who stopped vaping, and former smokers who relapsed to smoking.

- **Key findings**

  Most respondents were former smokers (77%) and daily users of e-cigarettes (89%).

  Any and daily e-cigarette use significantly decreased over time ($p < 0.001$) whilst smoking remained stable.

  Among baseline daily smokers (i.e. dual users), 28% had quit after 12 months, whilst among baseline former smokers, 9% had relapsed back to smoking.

Those who identified as an exclusive e-cigarette user at all time points reported significantly reduced e-liquid nicotine concentration, money spent on e-cigarettes, perceived addiction to e-cigarettes, urges to vape, and most tobacco withdrawal symptoms between baseline and follow-up at 12 months ($p < 0.001$). Vaping for enjoyment increased significantly whilst most other reasons for vaping decreased ($p < 0.001$).

Among daily e-cigarette users at baseline who stopped vaping at follow-up, the proportion of daily smokers increased from 8% to 26% ($p = 0.03$). Compared to those who continued vaping, this group used their e-cigarette less each day and used a lower e-liquid nicotine concentration at baseline ($p < 0.001$).

Among former smokers who relapsed, the proportion of daily vapers decreased from 96% at baseline to 65% at follow-up ($p = 0.014$).

In dual users, smoking behaviour and motivation to quit smoking did not significantly change over time.

- **Limitations**

  This study only sampled current e-cigarette users. This excludes individuals who have already stopped using e-cigarettes and have either successfully stopped smoking or relapsed back to smoking. Therefore, this sample may not reflect all patterns of e-cigarette use.

  This sample had been using e-cigarettes for a median of 5 months before baseline and were followed up for a up to 12 months. This may not capture any patterns during the first 5 months of use or over a longer period of time.

  Only 15% of participants who completed the baseline survey completed all 5 surveys. Therefore, this study may be vulnerable to attrition bias.

  This study was unable to compare exclusive e-cigarette users to dual users due to the small sample of those who were dual users at all five time points.

  Participants in this study were from a range of countries. It's unclear how applicable these users may be to e-cigarette users in the UK.

  This study sample was recruited online via smoking cessation and e-cigarette websites and forums. These individuals may not be representative of all e-cigarette users.

  This review relied largely on self-reported data, which may be subject to bias.

Etter, J.F. (2018). Electronic cigarette: A longitudinal study of regular vapers. Nicotine and Tobacco Research, 20 (8): 912-922, doi: 10.1093/ntr/ntx132

2. Socioeconomic disparities in electronic cigarette use and transitions from smoking

- **Study aims**

  This US study aimed to assess socioeconomic differences in current regular smoking and e-cigarette use in a sample of 50,306 across 3 cross-sectional surveys.

  The researchers also analysed ever-smokers to test differences in transitions from smoking to exclusive e-cigarette use, as well as differences in product use by mental health score.

- **Key findings**

  17.2% of respondents were exclusive smokers, compared to 1.4% exclusive e-cigarette users and 2.7% dual users.

  College education and income were not significantly associated with exclusive e-cigarette use. In ever smokers, transition to exclusive e-cigarette use was significantly associated with college education (0.9 percentage points), but not higher income or poor mental health.

  Dual use was significantly less likely in those with a college education and a higher income (-1.4 and -1.1 percentage points respectively). This was also found for exclusive smoking (-12.9 and -9.5 percentage points respectively).

  For both education and income, the coefficients for exclusive e-cigarette use and exclusive smoking differed significantly ($p < 0.001$). The coefficients for dual use were significantly smaller than for exclusive smoking but significantly larger than for exclusive e-cigarette use ($p < 0.001$).

  Poor mental health was associated with a higher likelihood of both exclusive smoking and dual use (16 and 4.2 percentage points respectively) but was not significantly associated with exclusive e-cigarette use.

- **Limitations**

  The survey data in this study is cross-sectional and observational. Therefore, it cannot draw causative conclusions, nor tell us about the mechanisms behind the results found.

  This study only measured current product use at single time points. Therefore, it cannot tell us about patterns of use over time. It may also exclude those who have already successfully quit both smoking and e-cigarettes or have tried but stopped using e-cigarettes.

  E-cigarette use in this study was defined as current daily or some day use. This cannot differentiate those who are experimenting with e-cigarettes from long-term users.

  Although this study did control for some confounders, it did not test for all potential confounders that might affect results, such as nicotine addiction.

  Former smokers were defined as those who had not smoked any cigarettes in the last 7 days. This may not capture sustained smoking cessation beyond this.

  The data in this study only included those 25 – 54. Therefore, the results may not be applicable to patterns of use in younger people.

  This study analysed data from the US, which may not be directly applicable to the UK.

  This review relied largely on self-reported data, which may be subject to bias.

Friedman, A.S., Horn, S.J.L. (2018). Socioeconomic disparities in electronic cigarette use and transitions from smoking. Nicotine and Tobacco Research, doi: 10.1093/ntr/nty120.

3. Is prevalence of e-cigarette and nicotine replacement therapy use among smokers associated with average cigarette consumption in England? A time-series analysis

- **Study aims**

This time-series analysis assessed the association between e-cigarette and NRT use with changes in mean cigarette consumption per day in 43,608 smokers between 2006 – 2016 in England.

The researchers also examined product use specifically for smoking reduction or temporary abstinence, and daily e-cigarette or NRT use.

- **Key findings**

  Daily cigarette consumption declined from 13.6 to 12.3 between 2006 and 2016. Current e-cigarette use and daily e-cigarette use increased from negligible to 17.1% and 11.1% respectively, whilst current NRT use declined from 12.2% to 6%.

  Average daily cigarette consumption was not significantly associated with e-cigarette use, daily e-cigarette use, or e-cigarette use specifically for either smoking reduction or temporary abstinence.

  Average daily cigarette consumption was not significantly associated with NRT use, daily NRT use, or NRT use specifically for either smoking reduction or temporary abstinence.

  Calculated Bayes Factors were between one-third and three, suggesting that both daily and any current e-cigarette and NRT use in smokers has not resulted in large reductions in cigarette consumption.

- **Limitations**

  This study only looked at a sample of current smokers. This excludes anyone who has already used an e-cigarette or NRT to successfully quit.

  This was an observational study. Therefore, it cannot draw causative conclusions.

  Although the researchers controlled for confounders such as population-level interventions, it cannot rule out the effect of residual confounding or other unknown factors.

  The data in this study did not differentiate by frequency or duration or e-cigarette or NRT use, so cannot tell us about the effect of different patterns of use.

  The Bayes Factors calculated suggested that the data was insensitive to detect very small reductions in cigarette consumption.

  A small number of data periods in this study relied on estimated data, which may not be a valid reflection of real life trends.

  This survey relied on self-reported data and this could be subject to bias.

Beard, E., Brown, J., Michie, S., West, R. (2018) Is prevalence of e-cigarette use and nicotine replacement therapy use among smokers associated with average cigarette consumption in England? A time-series analysis. BMJ Open, 19; 8 (6): e016046.

4. ‘Developing E-cigarette friendly cessation services in England: staff perspectives’

- **Study aims**

This qualitative study aimed to investigate the uptake and integration of e-cigarettes into smoking cessation services in England. Researchers conducted semi-structured interviews with 25 cessation service staff from the South-West of England. This included advisors, managers and commissioners. A thematic analysis of responses was performed using NVivo software to aid interpretation.

- **Key findings**

  All services were found to fulfil the broad definition of 'e-cigarette friendly'. None reported turning away e-cigarette users or disapproving of using e-cigarettes as a quitting method. However, most were not publicly advertised as 'e-cigarette friendly' and only one service was currently offering e-cigarettes to service users. There was no clear consensus from staff on what constitutes an 'e-cigarette friendly' service.

  Many staff had seen their job roles change in recent years, alongside the rise in popularity of e-cigarettes.

  Service staff reported several barriers to integrating e-cigarettes into their practice. This included practical barriers, such as e-cigarettes not being available on prescription, restrictions on the structure and funding of services, and concerns about clients developing a dependence on e-cigarettes over time.

  Staff reported challenges around the private status of e-cigarette companies and indirectly supporting the tobacco industry by endorsing their products. This was juxtaposed with the potential benefits of harm reduction for the service user.

  Many staff felt that prescription e-cigarettes would be the best way to incorporate vaping. But others were resistant to this idea of 'supporting their habit'. Concerns about the lack of evidence on long-term use of e-cigarettes and potential negative health effects was also a major theme. Advisors were more likely to express reservations about the move towards e-cigarettes than managers.

  Scientific research and the support of public health bodies were reported to give staff confidence to talk about e-cigarettes, both with colleagues and the public. However, there were also concerns that a judgement had been reached too quickly regarding the safety of e-cigarettes, given the lack of evidence on long-term effects.

- **Limitations**

  This study was conducted in the South-West of England with a relatively small sample of staff. It may not be representative of all services and service staff in the UK.

  This was a self-selected sample who knew they would be asked about e-cigarettes. This may have skewed results. Final questions for the interviews were developed after pilot interviews with just one manger and one advisor. This could have introduced bias in questions that were asked.

  This was a cross-sectional study. Therefore, it cannot tell us about the views of smoking cessation service staff towards e-cigarettes over time.

  The research took longer than expected (a total of 16 months). The views of those interviewed at the start of the data collection period may have changed by the time of completion.

The context of changes to smoking cessation services may have impacted staff's views on further changes to services.

All qualitative studies rely on self-reported information, which may be subject to bias. Although this data can be used to generate hypotheses, cannot be tested to determine significance.

Farrimond, H., Abraham, C. (2018). Developing E-cigarette friendly smoking cessation services in England: staff perspectives. Harm Reduction Journal, 15;38 doi: 10.1186/s12954-018-0244-8

5. Cigarette and e-cigarette dual use and risk of cardiopulmonary symptoms in the Health eHeart Study

- **Study aims**

  This online cross-sectional survey of 39,747 adults, mostly from the United States, aimed to compare smoking behaviour between dual users and exclusive cigarette smokers. It also aimed to compare measures of cardiopulmonary health across dual users, exclusive smokers, exclusive e-cigarette users and non-product users.

- **Key findings**

  1,693 (4.3%) participants reported being a current exclusive smoker, 573 (1.4%) reported using e-cigarettes only, and 514 (1.3%) reported as being dual users. Amongst exclusive e-cigarette users, 118 (21%) reported they had never smoked a single cigarette.

  There was no significant difference in measures of e-cigarette use between exclusive e-cigarette users and dual users. This included number of days of e-cigarette sue in the past month, number of cartridges/refills per day and number of puffs per day ($p=0.27$, $p=0.81$ and $p=0.4$, respectively).

  Dual use was associated with a small but significantly higher median number of cigarettes smoked per day compared to exclusive smokers (10.0 cigarettes per day IQR=3.0-15.0 vs. 9.0 cigarettes per day, IQR=4.0-20.0 respectively, $p<0.0001$)

  Compared to exclusive smokers, dual users exhibited worse median general health ($p=0.002$) and breathing scores, typically and in the past month ($p=0.001$ and $p=0.001$, respectively).

  A history of arrythmia was significantly more common in dual users compared to exclusive smokers (17.8% vs. 14.2% respectively, $p = 0.02$), but no other cardiopulmonary conditions were significantly different between these two groups.

  General health scores and breathing difficulty (typically and in the last month) scores were significantly different across those who smoked or vaped compared to those who reported no product use (adjusted ANOVA $p<0.001$).

- **Limitations**

  This is cross-sectional survey, so cannot draw any conclusions about causality.

  The study did not consider how former smokers who may have used e-cigarettes to successfully quit differ from current smokers and also e-cigarette users who have never smoked. It also did not directly compare exclusive e-cigarette users to exclusive smokers.

This study didn't differentiate by length of time or frequency of e-cigarette use. Therefore, it cannot tell us about results for different types of e-cigarette user

This study did not test for all potential confounders that might affect results, such as intention to quit or nicotine dependency.

The researchers carried out a large number of tests for significance, but didn't adjust for this. It's therefore possible that some of the significant differences that were detected in the study arose by chance.

This study used non-parametric methods, which have lower power to detect a true effect.

This study used self-reported data, which may be subject to recall bias.

The study sample was not representative of the US population. The rate of smoking and e-cigarette use in this sample were lower than that in the general population.

A validated measure of e-cigarette dose was not available to accurately assess the frequency, quantity and type of e-cigarette use.

Wang J.B., Olgin J.E., Nah, G., Vittinghoff, E., Cataldo, J.K., Pletcher, M.J., et al. (2018) Cigarette and e-cigarette dual use and risk of cardiopulmonary symptoms in the Health eHeart Study. PLoS ONE 13(7): e0198681. doi: 10.1371/journal.pone.0198681

Overview

This issue combines the summer months of July and August and thus includes five articles. One from Switzerland, two from the USA and two from England.

Our first paper this month is the latest in a series of articles reporting results from longitudinal surveys of e-cigarette users recruited via a smoking cessation website, Stop.Tabac.ch. The current article examined trajectories of vaping and smoking over one year among a sample of adults who were regular vapers at baseline. Recruited between 2012 and 2015, they were followed up at one, three, six and twelve months although only a small minority of participants (15%) completed survey questions at all follow up points.

What the article found overall is that there were changes in vaping and/or smoking status for some participants. When participants were recruited, the largest group (77%) were vapers who had stopped smoking and most participants were vaping daily (89%). There was a group of dual users at baseline, and around one in four of them had stopped smoking by 12 months, with that proportion increasingly gradually at each follow up point. Among the group who were former smokers and exclusive vapers at baseline, the majority remained non-smokers but some did relapse to smoking - 9% at 12 month follow up. This is a low relapse rate at one year, compared with studies of smokers using NRT to quit - although, as we highlight in the summary above, this survey didn't include a representative sample of vapers and had a high level of attrition over time.

Participants who were vaping exclusively at all follow up points did report some changes in their vaping behaviour. Overall they reduced the nicotine concentration in their e-liquids, decreased the money they spent each month on e-cigarettes, and reported fewer and less strong urges to vape through time, although the number of puffs per day and time to first puff remained stable. They also reported experiencing fewer tobacco withdrawal symptoms as time went on. Their reasons for vaping also changed. Through time, they were less likely to report vaping to deal with urges to

smoke and other tobacco withdrawal symptoms, and instead were more likely to report that they vaped for enjoyment.

The study also found some interesting relationships between stopping vaping and smoking status. Among those who stopped vaping at follow-up, the proportion smoking increased, and stopping vaping and relapsing to smoking was more common among women than men, something the authors suggest should be explored in further research. Among those who relapsed back to smoking, the proportion who were also vaping daily decreased. They point to the possible role of continued vaping for relapse prevention, but again this merits further studies.

The second paper examines socio-economic differences in smoking and vaping in a large sample of American adults aged 25-54 (n=50,306) involved in three cross-sectional waves (2014-2016) of the National Health Interview Survey. This is a general population survey, so a minority of respondents (17.2% (n=8642) were smokers, and a very small proportion of the overall sample were vapers (1.4%, n=688) or dual users (2.7%, n=1338). The authors were interested in determining if the types of socio-economic differences found for smokers in the USA compared to the general population were also true for e-cigarette users.

Overall, their findings for socio-economic status indicators in exclusive smokers were similar to those identified in previous studies in the USA and other high income countries - i.e. lower levels of household income and/or education among smokers. In contrast, they didn't find any significant differences between exclusive e-cigarette users and the wider survey sample in terms of education or household income. Dual users were located somewhere 'between' exclusive smokers and exclusive vapers/the general population, in terms of education in particular. The authors concluded that, at the time of the surveys, more educated smokers were more likely to transition to exclusive vaping than less educated smokers. This could exacerbate inequalities. The authors also found that those of poor mental health or minority ethnicity were more likely to smoke or dual use, but these characteristics were not significantly associated with exclusive e-cigarette use. These issues should be explored in studies in other countries.

Our third paper aimed to examine if changes in the use of e-cigarette or NRT use alongside smoking were associated with reductions in cigarette consumption at the population level. Dual use of either e-cigarettes or NRT while smoking is not uncommon. Individuals who use these products while smoking often report that they are trying to cut down their tobacco consumption. Indeed, NRT is licensed for this purpose and randomised controlled trials have found that NRT helps people cut down and then subsequently stop smoking. The authors were interested to see if reductions could be ascertained at the population level and whether e-cigarettes also help people cut down.

Data for the study were drawn from the CRUK funded smoking toolkit survey in England between 2006 and 2010. Time-series analysis was used to look at the relationship between daily cigarette consumption and the prevalence of NRT and e-cigarette use in current smokers, including for cutting down and temporary abstinence.

The authors did not find a significant association between the amount smoked per day at the population level and e-cigarette use. This was the case for current or daily vaping and for vaping with the intention of cutting down or for temporary abstinence. Likewise, there was no significant association between daily cigarette consumption and current or daily use of NRT and for using NRT to cut down smoking or temporarily abstain from smoking.

The authors suggest that their findings may mirror an important difference between trials of NRT for cutting down (which do show an effect) and 'real world' studies that show that, in practice, people

using NRT while smoking don't reduce their smoking by a large amount. Trials tend to offer participants additional support beyond a medication or nicotine alternative, and participants in trials may differ from smokers or vapers in the general population. The authors do not rule out, of course, that e-cigarettes may indeed help some smokers to cut down, and indeed dual users of tobacco and e-cigarettes often report that they are vaping with the explicit aim of cutting down. However, even if this works for some individuals the study suggests it is not apparent when you look across the population, at least in England. Of course one of the main reasons for encouraging NRT use to help people who are reluctant to abruptly quit is to cut down with a view to eventually stopping smoking, and there is some evidence that this does occur. Emerging evidence (including some signs in our first study above) suggests this may also be the case with e-cigarettes. Other studies now underway are examining this so more information should be available in the future.

The fourth paper is also from England and examines the process of developing e-cigarette 'friendly' smoking cessation services. It aimed to explore the extent to which national advice on the need to welcome smokers using e-cigarettes to stop smoking services were being implemented in practice. Twenty five stop smoking service staff from eight services in the South West of England were interviewed as part of a wider CRUK funded study.

Findings were organised into three broad themes. The first related to active and passive approaches to becoming e-cigarette friendly. All staff indicated that their service was available to e-cigarette users. At a minimum this involved a passive approach (a tolerance of clients using their own e-cigarettes/vapourisers as a personal choice). However some services had active approaches: one offered a voucher scheme so clients could receive a starter kit alongside access to behavioural support and pharmacotherapies; others had formed relationships with local vape shops to at least be able to give clients information about products and how to obtain them.

The second theme concerned barriers to e-cigarette integration. These related to service funding cuts, staff roles changing and the fact that e-cigarettes were not available on prescription. Staff concerns about 'maintaining a habit' and long term use were also a barrier. Interviewees also expressed uncertainty about negative health effects, safety and quality. Specific examples are presented through interviewee quotes in the article and the authors pointed out that many interviewees felt media scare stories were driving public attitudes towards vaping more than public health (pg 7). Stop smoking service staff were also concerned about the involvement of the tobacco industry in producing some vaping devices and the profit motive of manufacturers and retailers.

The third theme captured interviewee accounts of the role of public health leadership in facilitating changing attitudes towards e-cigarettes. Staff mentioned influential researchers, organisations including Public Health England, and key reports. These actors and agencies provided information that allowed staff to reassure clients and others about the relative risks of vaping compared with smoking and the potential of e-cigarettes as a cessation tool. Overall, the researchers found that cessation service staff were generally open towards and positive about working with e-cigarette users in the region where they conducted their fieldwork, but that there was no consensus on what precisely constituted an 'e-cigarette friendly service'.

This month's final article is from the USA and involved secondary analysis of baseline data (collected between 2013 and 2017) from a large cross sectional survey (the Health eHeart Study) involving 39,747 respondents. The authors examined tobacco and e-cigarette use, with a particular focus on whether dual use affected self-reported medical (cardio-pulmonary) conditions and symptoms that might be associated with vaping or smoking.

As data were drawn from a large population survey only a small proportion of participants reported smoking (4.3%, n=1,693), exclusive vaping (1.4%, n=573) or dual use (1.3%, n=514). The authors were interested to see if dual users smoked fewer cigarettes per day than exclusive smokers but this was not the case. Dual users also had poorer general health and a worse score using a measure of breathing difficulty, and were more likely to have a history of arrhythmia (where the heart beats with an irregular or abnormal rhythm) compared to smokers. Compared to people who neither vaped nor smoked, health indicators were poorer across e-cigarette users, dual users and exclusive smokers. This included poorer general health, more breathing difficulty and increased likelihood to report cardio-pulmonary symptoms or conditions including CHD, arrhythmia, COPD and asthma among others. On this basis the authors concluded that e-cigarette use either alone or with smoking may contribute to heart and respiratory health risks.

The study aimed to capture current vapers, smokers and dual users but this included both occasional and daily use of either product. They also note that the survey couldn't assess nicotine dependence, smoking history or reasons for vaping. All of these are relevant to assessing whether the poorer reported health symptoms or conditions in both dual users and exclusive e-cigarette users were due to vaping or whether some of these individuals may have had poorer health in the first place, possibly due to many years of smoking. The authors acknowledge that these individuals may have used e-cigarettes to quit or were trying to stop smoking while vaping. Further research could unpick these relationships, particularly longitudinal studies which measure toxicant exposure and validate self-reported health outcomes.

Other studies from July and August that you may find of interest:

Source credibility and e-cigarette attitudes: implications for tobacco communication

Nicotine delivery to the aerosol of a Heat-Not-Burn tobacco product: comparison with a tobacco cigarette and e-cigarettes

Sharing tobacco and e-cigarette information: predicting its occurrence and valence among youth and young adults

Changes in puffing topography and nicotine consumption depending on the power setting of electronic cigarettes

E-cigarettes and weight loss-product design innovation insights from industry patents

Advice from former-smoking e-cigarette users to current smokers on how to use e-cigarettes as part of an attempt to quit smoking

Content analysis of US news stories about e-cigarettes in 2015

Differences in adolescent e-cigarette and cigarette prevalence in two policy environments: South Korea and the United States

Recall of point-of-sale marketing predicts cigar and e-cigarette use among Texas youth

A randomized trial of the effect of youth appealing e-cigarette advertising on susceptibility to use e-cigarettes among youth

Positive outcome expectations and tobacco product use behaviors in youth

Sugar and aldehyde content in flavored electronic cigarette liquids

Associations of ADHD symptoms with smoking and alternative tobacco product use initiation during adolescence

What factors are associated with electronic cigarette, shisha-tobacco and conventional cigarette use? Findings from a cross-sectional survey of Australian adolescents?

High-wattage e-cigarettes induce tissue hypoxia and lower airway injury: a randomized clinical trial

Thermal injuries from exploding electronic cigarettes

Chronic e-cigarette exposure alters the human bronchial epithelial proteome

Electronic cigarette use and smoking cessation behavior among adolescents in China

Electronic cigarette liquid and device parameters and aerosol characteristics: a survey of regular users

Assessing nicotine dependence in adolescent e-cigarette users: the 4-item patient-reported outcomes measurement information system (promis) nicotine dependence item bank for electronic cigarettes

Prevalence and correlates of adolescents' e-cigarette use frequency and dependence

Effects of electronic cigarette liquid solvents propylene glycol and vegetable glycerin on user nicotine delivery, heart rate, subjective effects, and puff topography

Prenatal exposures to tobacco and cannabis: associations with adult electronic cigarette use

The relationship of e-cigarette use to cigarette quit attempts and cessation: insights from a large, nationally representative U.S. Survey

Compensatory puffing with lower nicotine concentration e-liquids increases carbonyl exposure in e-cigarette aerosols

The association between e-cigarette use characteristics and combustible cigarette consumption and dependence symptoms: results from a national longitudinal study

Sweet taste potentiates the reinforcing effects of e-cigarettes

Comparison of the effects of e-cigarette vapor with cigarette smoke on lung function and inflammation in mice

Triacetin enhances levels of acrolein, formaldehyde hemiacetals, and acetaldehyde in electronic cigarette aerosols

Aldehydes in exhaled breath during e-cigarette vaping: pilot study results

Adolescent e-cigarette, hookah and conventional cigarette use and subsequent marijuana use

Evaluation of e-vapor nicotine and nicotyrine concentrations under various e-liquid compositions, device settings, and vaping topographies

The effect of electronic-cigarettes aerosol on rat brain lipid profile

Longitudinal associations between youth tobacco and substance use in waves 1 and 2 of the population assessment of tobacco and health (PATH) study

National and state-specific unit sales and prices for electronic cigarettes, United States, 2012-2016

Heat or burn? Impact of intrauterine tobacco smoke and e-cigarette vapor exposure on the offspring's health outcomes

How do adolescents get their e-cigarettes and other electronic vaping devices?

Electronic cigarette awareness and use among students at the federal university of Mato Grosso, Brazil.

Acute effects of electronic and tobacco cigarettes on vascular and respiratory function in heathy volunteers: a cross-over study

Nicotine and electronic cigarette (e-cig) exposure decreases brain glucose utilisation in ischemic stroke

E-cigarettes in airports and on flights: Europe and the US

Nicotine absorption from e-cigarettes over 12 months

Assertive communication about others' smoking and vaping in public venues: results from a national survey of US adults

Characterization of puff topography of a prototype electronic cigarette in adult exclusive cigarette smokers and adult exclusive electronic cigarettes users

Perception and current use of e-cigarettes among youth in China

Genetic vulnerability for smoking and cannabis use: associations with e-cigarette and water pipe use

Electronic cigarette use and understanding among a national sample of Australian aboriginal and Torres islander smokers

The effects of electronic cigarette vapor on placental trophoblast cell function

Exploring physician attitudes regarding electronic documentation of e-cigarette use: a qualitative study

Students' cigarette smoking and the perceived nicotine content of their e-cigarettes

Epithelial-to-mesenchymal transition of a549 lung cancer cells exposed to electronic cigarettes

Electronic cigarette harm and benefit perception and use among youth

Evidence based tobacco treatment utilisation among dual users of cigarettes and e-cigarettes

Short-term e-cigarette exposure increases the risk of thrombogenesis and enhances platelet function in mice

Presence of the carcinogen n'-nitrosonornicotine in saliva of e-cigarette users

Physical and chemical assessment of 1,3-propanediol as a potential substitute of propylene glycol in refill liquid for electronic cigarettes

E-cigarette adverts and children's perceptions of tobacco smoking harms: an experimental study and meta-analysis

Comparison of tobacco and electronic cigarette reward value measured during a cue-reactivity task: an extension of the choice-behaviour-under-cued-conditions (CBUCC) procedure

Electronic cigarette use prevalence, associated factors, and pattern by cigarette smoking status in the united states from NHANES (national health and nutrition examination survey) 2013-2014

More than half of adolescent e-cigarette users had never smoked a cigarette: findings from a study of school children in the UK

Maternal e-cigarette exposure results in cognitive and epigenetic alterations in offspring in a mouse model

Social profile of middle school-aged adolescents who use electronic cigarettes: implications for primary prevention

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 OR vaping))

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 Clare Hyde and Sophia Lowes from Cancer Research UK with assistance from Professor Linda Bauld at the University of Stirling and the UK Centre for Tobacco and Alcohol Studies, primarily for the benefit of attendees 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.