The UK Electronic Cigarette Research Forum

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Electronic Cigarette Research Briefing – May 2023

This research briefing is part of a series of quarterly 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 do not cover every e-cigarette-related study published each quarter. 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.

Let's talk e-cigarettes – University of Oxford podcasts

Jamie Hartmann-Boyce and Nicola Lindson discuss emerging evidence in e-cigarette research. In the January 2023 episode, Jamie Hartmann-Boyce interviews Professor Jonathan Foulds from the Center for Research on Tobacco & Health, Penn State College of Medicine. Professor Foulds discusses his randomised controlled study of the effect of electronic nicotine delivery systems (ENDS) or e-cigarettes on combustible cigarette abstinence in people who use combustible cigarettes with no plans to quit.

This podcast is a companion to the Cochrane living systematic review of e-cigarettes for smoking cessation and shares the evidence from the monthly searches.

Subscribe with iTunes or Spotify to listen to regular updates or find all episodes on the University of Oxford Podcasts site.

This podcast series is funded by Cancer Research UK (CRUK).

Cochrane Living Systematic Review of E-cigarettes for Smoking Cessation update

The latest update to the CRUK-funded Cochrane Living Systematic Review of E-cigarettes for Smoking Cessation was published in November 2022 and includes 17 new studies. Visit the website (https://www.cebm.ox.ac.uk/research/electronic-cigarettes-for-smoking-cessation-cochrane-living-systematic-review-1) for full information on the review, including briefing documents, and new studies found since the update.

You can find our previous research briefings at www.cruk.org/UKECRF.

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

Commentary

This month, we cover five studies, four of which are related to vaping in youth. **Parnham et al** conducted a modelling study in UK youth, and found that 14-17 years old were most likely to initiate nicotine product use. There was a 14% probability that those using e-cigarettes would go on to smoking one year later, rising to 25% after three years. They were also more likely to transition into non-current use (26.6%; 95% CI 24.9%, 28.6%) than into cigarette smoking (14.3% probability 95% CI 12.7%, 16.2%) after 1 year.. Like many other studies in this area, this shows a positive association between vaping and subsequent smoking in young people, but does not infer causation.

Tattan-Birch et al use data from the Smoking Toolkit Study to demonstrate a rapid growth in use of disposable e-cigarettes among young people in England – this increase was most pronounced in young adults. Despite this increase, the overall prevalence of inhaled nicotine use remained stable over the time period studied. In their focus groups with UK youth, **Smith et al** explore reasons for the popularity of disposable e-cigarettes in young people, including their small size (making them discreet and easy to conceal) and low cost. Focus group participants perceived disposable e-cigarettes as being targeted at their demographic, and attractive to youth. **Taylor et al** investigated one possible way to make e-cigarettes less appealing – namely by testing standardized packaging via an online survey in British youth and adults. Their findings suggest that standardized packaging may reduce the appeal of e-cigarettes among youth, without reducing their appeal amongst adults.

This latter finding speaks to the importance of understanding the impact of e-cigarette interventions and policies on different groups. Though the rise in disposable vaping amongst youth has justifiably caused concern, the final study by **Hardie et al** serves as a reminder that about the role of vaping as smoking cessation tool. Via the UK Household Longitudinal Survey, Hardie et al found that respondents without degrees were less likely to quit smoking and more likely to relapse to smoking – but that this association was not present in people who also vaped. They conclude that vaping may be a particularly useful tool for supporting smoking cessation in less advantaged groups.

Parnham *et al.* Multistate transition modelling of e-cigarette use and cigarette smoking among youth in the UK

- **Study aims**

This modelling study used data from 10,229 participants aged 10-25 in the UK Household Longitudinal Study between 2015 and 2021. A Markov multistate model was used to predict the probabilities of transitions between different nicotine use states (never use, non-current use, e-cigarette use only, and cigarette smoking/dual use) over the course of five years.

- **Key findings**
    - Participants who had never used nicotine products were most likely to maintain non-use a year later (92.9% probability; 95% CI 92.6%, 93.2%) and more likely to transition to using e-cigarettes (4.0% probability; 95% CI 3.7%, 4.2%) than cigarettes (2.2% probability; 95% CI 2.0%, 2.4%).
    - Participants who used e-cigarettes were most likely to continue using them a year later (59.1% probability; 95% CI 56.8%, 61.1%). E-cigarette users were also more likely to transition into non-current use (26.6%; 95% CI 24.9%, 28.6%) than into cigarette smoking (14.3% probability 95% CI 12.7%, 16.2%) after 1 year.
    - Among participants who smoked cigarettes, there was a 73.8% probability of smoking after one year (95% CI 72.2%, 75.4%). Of those who transitioned, there was a slightly

higher likelihood of transitioning from cigarette smoking to non-current use (15.3%; 95% CI 14.0%, 16.6%) than e-cigarette use (10.9%; 95% CI 9.8%, 12.2%).

- Relative to participants aged 14-17 who had never used nicotine products:
  - Those aged 10-13 were less likely to transition to cigarette smoking (HR 0.69; 95% CI 0.52, 0.92) and e-cigarette use (HR 0.36, 95% CI 0.3, 0.43) from never use.
  - Those aged 18-21 were less likely to transition into cigarette smoking (HR 0.56; 95% CI 0.39, 0.79) and e-cigarette use (HR 0.67; 95% CI 0.56, 0.8) from never use.
  - Those aged 22-25 were less likely to transition into cigarette smoking (HR 0.11; 95% CI 0.04, 0.28) and e-cigarette use (HR 0.42; 95% CI 0.33, 0.53) from never use.
- By year 3, participants who were exclusively using e-cigarettes at year 1 were more likely to have transitioned to no current nicotine product use (45% probability; 95% CI 45%, 47%) than to still use e-cigarettes (probability 30%; 95% CI 28%, 32%). Among participants smoking cigarettes at year 1, the probability of transitioning to non-current use (probability 43%; 95% CI 41%, 45%) did not exceed the probability of still smoking cigarettes (probability 36%; 95% CI 34%, 38%) until year 5.

- **Limitations**
  - Questions about e-cigarette use were only included in the UKHLS from 2015 onwards, which limited the duration of data available.
  - The questions about cigarette smoking are phrased slightly differently for participants aged 10-15 and those aged 16-25, leading to some lack of clarity about participants' previous product use.
  - Due to small sample sizes, participants who smoked cigarettes only and those who used both cigarettes and e-cigarettes were combined into one category, so transitions into and out of dual use could not be modelled.
  - The data do not include intensity of use, so it was not possible to account for this in the model.
  - Smoking status is not biochemically verified, so the data rely on self-reported status.
  - As this is a modelling study, causation cannot be determined.

Parnham JC, Vrinten C, Radó MK, Bottle A, Filippidis FT, Laverty AA. Multistate transition modelling of e-cigarette use and cigarette smoking among youth in the UK. Tob Control. 2023 Mar 10:tc-2022-057777. doi: 10.1136/tc-2022-057777. Epub ahead of print. PMID: 36898842.

Tattan-Birch *et al.* Rapid growth in disposable e-cigarette vaping among young adults in Great Britain from 2021 to 2022: a repeat cross-sectional survey

- **Study aims**

This study used data from the Smoking Toolkit Study to investigate any recent trends (January 2021-April 2022) in inhaled nicotine use among adults (aged 18 and over) in the UK following the increase

in use of disposable e-cigarettes. Participants who vaped were asked which type of device they used. Monthly trends were estimated by age group in relation to prevalence of disposable vaping, inhaled nicotine use (smoking/vaping), smoking and vaping among adults.

- **Key findings**
    - The prevalence of use of disposable e-cigarettes among participants who currently vaped increased from 1.2% to 22.2% (prevalence ratio (PR) 18.0; 95% compatibility interval (CI) = 9.18–49.0).
    - The increase in prevalence of use of disposable e-cigarettes was greatest in younger participants. For example, it increased from 0.4% to 54.8% (PR = 129; 95% CI = 28.5–4520) among participants aged 18.
    - Prevalence of inhaled nicotine use among 18-year-old participants was estimated at 30.2% in January 2021 and 29.7% in April 2022 (PR = 0.99; 95% CI = 0.80–1.22), remaining stable with no significant change.
    - Prevalence of inhaled nicotine use among adults overall was 20.0% in January 2021 and 21.2% in April 2022 (PR = 1.06; 95% CI = 0.92– 1.22).
    - 71.6% of participants who used disposable e-cigarettes currently smoked and 18.8% formerly smoked. 9.6% reported never having smoked regularly.
- **Limitations**
    - Participants could only select one device that they 'mainly' used, so the data would not capture disposable use among participants who used them as a 'secondary' device.
    - As use of disposable e-cigarettes was low in early 2021, there were limited data available, leading to some wide compatibility intervals.
    - The definition of disposable e-cigarettes did not differentiate between older 'cigalike' and modern devices, so it was not possible to determine what type of disposable device participants were using.
    - As the study uses cross-sectional data, causality cannot be confirmed.
    - Usage of other nicotine/smoking cessation products was not included and so could not be taken into account.

Tattan-Birch H, Jackson SE, Kock L, Dockrell M, Brown J. Rapid growth in disposable e-cigarette vaping among young adults in Great Britain from 2021 to 2022: a repeat cross-sectional survey. Addiction. 2023 Feb;118(2):382-386. doi: 10.1111/add.16044. Epub 2022 Sep 11. PMID: 36065820; PMCID: PMC10086805.

Smith *et al.* Youth's engagement and perceptions of disposable e-cigarettes: a UK focus group study

- **Study aims**

This qualitative study used focus groups to investigate perceptions and behaviours in relation to disposable e-cigarettes among 82 young people aged 11-16 living in the central belt of Scotland. Participants were from a mixture of deprived and affluent backgrounds and included a range of smoking and vaping behaviours and histories. 20 focus groups were conducted between March and May 2022. Transcripts were analysed to derive themes.

- **Key findings**
    - Participants described perceiving disposable e-cigarettes differently from other device types, for example noting that reusable devices were bulkier, being unable to recognise pictures of reusable e-cigarettes and confusing pictures of disposable e-cigarettes as other objects including a highlighter, a lighter and a tin of mints.
    - Attributes of disposable devices described as appealing to young people were their small size, making them more discreet and easier to hide, the range of available flavours (several participants reported being unaware of flavoured e-liquids for other device types) and low cost.
    - Participants reported perceiving disposable e-cigarettes as being aimed at young people (e.g. 'cool', 'trendy' and a 'fashion accessory') and reusable devices as for older people.
    - Participants who vaped perceived disposable e-cigarettes as being less harmful than tobacco cigarettes and those who did not expressed concern about uncertainty regarding their ingredients and health effects.
    - Participants described being able to purchase disposable e-cigarettes, particularly in corner shops but also online.
- **Limitations**
    - Participants were all from the central belt of Scotland, and so findings may not generalise to other parts of the UK.
    - Some of the focus groups were conducted online and some in person, so it is possible that the different formats influenced the results.
    - Some of the focus groups had a teacher or youth worker present, which could have affected participants' responses.
    - Two of the focus groups were recruited through personal networks, which may have affected participants' responses.

Smith MJ, MacKintosh AM, Ford A, Hilton S. Youth's engagement and perceptions of disposable e-cigarettes: a UK focus group study. BMJ Open. 2023 Mar 22;13(3):e068466. doi: 10.1136/bmjopen-2022-068466. PMID: 36948552; PMCID: PMC10040067.

Taylor, *et al.* Association of Fully Branded and Standardized e-Cigarette Packaging With Interest in Trying Products Among Youths and Adults in Great Britain

- **Study aims**

This study used data from the 2021 online Action on Smoking and Health Smokefree Great Britain surveys to compare interest in trying e-cigarettes in standardised white or green packaging with those in branded packaging. 2,469 young people aged 11-18 (2,024 who had never smoked, 321 who formerly smoked and 124 who currently smoked) and 12,046 adults aged 18 or over (6,395 who had never smoked, 4,191 who formerly smoked and 1,460 who currently smoked) were randomised to be shown each set of three e-cigarette packs. Participants aged 11-18 were asked which, if any, product people their age would be interested in trying and participants in the adult survey were asked which, if any, product they would be interested in trying, with "don't know" or "prefer not to say" also

options. Responses were dichotomised into no interest or any other response. Analyses were adjusted for sex, age group, socioeconomic status, vaping status, and smoking status.

- **Key findings**
    - Participants aged 11-18 who were shown e-cigarettes in green (but not white) standardised packaging were significantly more likely than those shown the branded packaging to respond that people their age would have no interest in trying any of the products (aOR 1.37; 95% CI 1.10-1.71; p = .005).
    - Participants aged 11-18 who currently (aOR 0.24; 95% CI 0.10-0.55, p = .001) or had ever (aOR 0.51; 95% CI 0.34-0.78; p = .001) used e-cigarettes were significantly less likely than those who had never used e-cigarettes to report that people their age would have no interest in trying any of the products.
    - Adult participants who were shown e-cigarettes in green (but not white) standardised packaging were significantly less likely than those shown the branded packaging to respond that they were not interested in trying any of the products (aOR 0.85; 95% CI 0.73-0.99; p=.046).
    - Adult participants who currently (aOR 0.15; 95% CI 0.12-0.18; p < .001) or formerly smoked (aOR 0.48; 95% CI 0.39-0.58; p < .001) and currently (aOR 0.09; 95% CI0.08-0.11; p < .001) or had ever (aOR 0.29; 95% CI 0.24-0.35; p < .001) used e-cigarettes were significantly less likely to report no interest in trying any of the products than those who had never smoked.
    - In sensitivity analysis where 'Don't know' was treated as a separate response category, respondents aged 11-18 were significantly more likely to report no interest in trying any of the products in both green (aOR 1.68; 95% CI 1.30-2.17; p < .001) and white aOR 1.32; 95% CI 1.02-1.70; p = .03. Adult respondents were more likely to report no interest in trying any of the products in white standardised packaging (aOR 1.25; 95% CI 1.03-1.52), but there was no longer a significant association between being shown the green standardised packaging and expressing no interest in trying the products.
- **Limitations**
    - Sample sizes of participants aged 11-18 who currently smoked and used e-cigarettes were small, so results may be unreliable for these groups.
    - Although some potential confounding factors were adjusted for, it is possible that other factors were present which have not been included. For example, there may be factors affecting both probability of using cigarettes/e-cigarettes and perception of packaging.
    - The question was phrased slightly differently in the youth and adult surveys, so they are not directly comparable.
    - Participants' vaping status was coded as 'never,' 'ever' or 'current,' whereas smoking status was coded as 'never,' 'former' or 'current,' which may affect the comparability of the findings.
    - As this is a cross-sectional study, causality cannot be determined.

- A substantial proportion of respondents in the young people's survey responded 'Don't know,' particularly in the standardised packaging conditions, suggesting that the question may be difficult for respondents to answer.

Taylor E, Arnott D, Cheeseman H, Hammond D, Reid JL, McNeill A, Driezen P, East K. Association of Fully Branded and Standardized e-Cigarette Packaging With Interest in Trying Products Among Youths and Adults in Great Britain. JAMA Netw Open. 2023 Mar 1;6(3):e231799. doi: 10.1001/jamanetworkopen.2023.1799. PMID: 36917111; PMCID: PMC10015302.

- **Hardie *et al.* Vaping and socioeconomic inequalities in smoking cessation and relapse: a longitudinal analysis of the UK Household Longitudinal Study**

- **Study aims**

  This study used data from the UK Household Longitudinal Study (UKHLS) to investigate the relationship between socioeconomic position (SEP) and smoking cessation and relapse. The smoking status of 25,102 participants aged 16 and over at wave 8 of the UKHLS (2016-2018) was used as baseline. The exposure was SEP (defined by the presence or absence of a degree-level qualification). The outcome measures were smoking status at waves 9 (2017-2019) and 10 (2018-2020). Any effect of regular (at least weekly) vaping at wave 8 on the relationship between SEP and smoking status was explored. Potential confounders adjusted for included sex, age, UK country, ethnicity, vaping history, poverty status, and smoking history.

- **Key findings**

  - Among participants who reported current smoking at wave 8 of the UKHLS, lower SEP (not having a degree) was associated with lower odds of stopping smoking at wave 9 or 10 (OR: 0.65; 95% CI 0.54–0.77).

  - Lower SEP was also associated with lower odds of stopping smoking at wave 9 or 10 among participants who currently smoked but did not vape regularly at wave 8 (OR: 0.62; 95% CI 0.50–0.76), but not among those who did vape regularly.

  - Among participants who reported former smoking at wave 8 of the UKHLS, lower SEP was associated with higher risk of relapse to smoking at wave 9 or 10 (OR: 1.74; 95% CI 1.37– 2.22).

  - The positive association between lower SEP and risk of relapse to smoking was also found among participants who did (OR: 2.13; 95% CI 1.05–4.29) and did not (OR: 1.55; 95% CI 1.09–2.18) vape regularly and the odds of relapse at wave 9 or 10 were higher among people who did.

  - Sensitivity analysis found that people with no qualifications (whether degree-level or not) had lower odds of stopping smoking than those with any qualifications among both those who vaped regularly (OR: 0.30; 95% CI 0.14–0.65) and those who did not (OR: 0.75; 95% CI 0.56–0.99).

- **Limitations**

    - Smoking status of participants was not biochemically verified, and so there was reliance on self-reported smoking status.

    - There may be additional potential unidentified confounders.

    - Although smoking and vaping history were adjusted for, limited data were available based on previous waves of the survey, so measurement of these confounders was crude (for example, it was not possible to assess patterns of use).

    - As the study used cross-sectional data, causality cannot be determined.

    - As the outcome measure was smoking status rather than cessation, the data do not indicate whether any changes in use were in the context of a cessation attempt.

    - Regular vaping was defined as at least weekly, which could encompass a range of patterns of use, including dual use of e-cigarettes and combustible cigarettes.

Hardie I, Green MJ. Vaping and socioeconomic inequalities in smoking cessation and relapse: a longitudinal analysis of the UK Household Longitudinal Study. Tob Control. 2023 Apr 11:tc-2022-057728. doi: 10.1136/tc-2022-057728. Epub ahead of print. PMID: 37041075.

Search strategy

The Pubmed database is searched in the middle of every third month, for the previous three months 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 are not included. Please note studies funded by the tobacco industry are also excluded.

This briefing is produced by Julia Cotterill and Alice Davies from Cancer Research UK with assistance from Associate Professor Jamie Hartmann-Boyce at the University of Oxford, primarily for the benefit of attendees of the CRUK 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.