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TITLE: Electronic cigarette use in young people in Great Britain 2015-2016

Running head: E-cigarettes in young people

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ABSTRACT

Objectives: To update the evidence on e-cigarette use prevalence and harm perception in youth in Great Britain.

Study design: Two-wave cross-sectional online surveys

Methods: Young people aged 11-18 in Great Britain were surveyed online by YouGov in 2015 and 2016. Use of e-cigarettes and perceived health harms were assessed and compared in relation to cigarette smoking history.

Results: The majority (93%) of young people in Great Britain are aware of e-cigarettes. There was a trend towards reductions in ever use of e-cigarettes, with prevalence shifting from 13.9% (95% CI 12.2-15.7) in 2015 to 11.9% (95% CI 10.4-13.5) in 2016 ($p=0.10$). More than a quarter (27.2%) of current-smokers reported monthly or more use of e-cigarettes in 2016, compared with <1% of never-smokers. Fewer young people now consider e-cigarettes to be less harmful than conventional cigarettes.

Conclusions: In Great Britain, a growing proportion of young people believe e-cigarettes are as harmful as smoking tobacco and, while regular use of e-cigarettes remains largely confined to those who smoke, there was a rise in ever use of e-cigarette in those who had never smoked.

Keywords: E-cigarettes; young people; Great Britain

The proliferation of electronic cigarettes (EC) continues to divide public health opinion¹. Among the leading controversies are the risks to the individual user and the risks to youth. The exact risk reduction to smokers using EC is unknown. Although contested², Public Health England and the Royal College of Physicians estimated that the relative harm from EC is around 5% of that from combustible cigarettes^{3,4}. Risks to youth have been identified by the World Health Organisation if EC act as a gateway to a) nicotine initiation and/or b) smoking via switching from EC⁵.

The gateway hypothesis is ill defined and the use of the term varies; additionally, progression from one drug or drug delivery system to another cannot imply causality given other competing explanations such as common liability. In relation to EC and smoking, non-use of any nicotine product is preferable, but given the relative risks of the products, it would be less harmful for a young person to use EC instead of smoke. Concerns would be realised, however, if the proportion of young people regularly smoking started to increase.

Both proponents and opponents of EC agree, for non-smoking youth in particular, it is important that ongoing monitoring systems are in place to provide the intelligence required for evidence-based policy making. Monitoring frequency of use is important given that experimentation is a common facet of adolescence. Typically in countries where data exist, there is high awareness, increasing experimentation, but very low levels of regular (monthly or more) EC use among youth³. In some studies, for example⁶⁻⁹, EC experimentation among never smokers has been shown to be related to subsequent experimentation with smoking, but little evidence has been found of *regular* EC use among youth who have not previously smoked¹⁰. For example, in the United States, EC use in the last 30 days had tripled for middle and high school students to 13.4% in 2014; however, never smoking youth were highly unlikely to have used EC and those who had, the majority had only used once or twice¹¹. Smoking prevalence reached an all-time low¹², although it appears the reductions in current smoking have now stabilised¹³. The sale of EC to those under the age of 18 became illegal in England in 2015 and it is important to acknowledge differences between regulation and marketing policies when comparing prevalence rates in different countries. Nonetheless, monitoring perceptions of relative risks of EC and smoking is also important; if young people are confused about these, they may be more likely to switch use between the two products indiscriminately.

In Great Britain, in national samples of youth (aged 11-18 years) we recently reported that ever-use of EC rose from 4.6% in 2013 to 8.2% in 2014, with the greatest increase reported in current smokers (from 36.4% to 53.5%)¹⁴. The perception of harm had also shifted: 73.4% considered EC to be less harmful than combustible cigarettes in 2013, falling to nearly 66.9% in 2014¹⁴. This study updates the prevalence of use and perception of harm of EC by recruiting two further samples of youth in March/April 2015 and 2016 using the same recruitment procedure as previously¹⁴. Data were weighted to be nationally representative.

The charity Action on Smoking and Health (ASH) commissioned YouGov PLC to conduct a national internet survey of 11-18 year olds in Great Britain annually from 2013 to 2016. Data from 2013 and 2014 have been reported previously¹⁴ and are included in the present paper for ease of comparison. Respondents who had taken part in either the 2013 or 2014 survey were removed from analyses of 2015 and 2016 data. Respondents who took part in both 2015 and 2016 were randomly assigned to one or other year as in our prior study¹⁴. Data were weighted to be representative of age, gender and region in Great Britain. All analyses were conducted by Public Health England in STATA¹⁵ using

the complex survey package *svy*¹⁶. For brevity, descriptive statistics are reported using weighted percentages only. The Pearson Chi-square statistic is used to test for independence of awareness and use of EC by year of recruitment.

Youth were categorised into never-smokers, former-smokers and current-smokers as previously: 'I have never smoked cigarettes, not even a puff or two' (categorised as never-smokers); 'I have only ever tried smoking cigarettes once' and 'I used to smoke sometimes but I never smoke cigarettes now' (categorised as former-smokers); 'I sometimes smoke cigarettes now but less than one a week', 'I usually smoke between one and six cigarettes a week' and 'I usually smoke more than six cigarettes a week' (categorised as current-smokers), and the remainder categorised as 'did not want to say'.

Reflecting the changes in EC models, in 2015, half the sample was asked the previously used EC question ("An e-cigarette is a tube that looks like a normal cigarette, has a glowing tip and puffs a vapour that looks like smoke but unlike normal cigarettes, they don't burn tobacco. Have you ever heard of e-cigarettes?"), while the other half were asked "Have you ever heard of e-cigarettes? They are also sometimes called shisha pens, vaporisers or electronic cigarettes." As there was no difference in awareness of EC by question type ($p=0.21$), only this latter question was used in 2016.

As in earlier surveys, those who had heard of EC were then asked to describe their experience of e-cigarettes with the following responses: "I have never used an e-cigarette" (categorised as "never users"); "I have only tried an e-cigarette once or twice" (categorised as "experimenters"); "I use e-cigarettes sometimes, but no more than once a month", "I use e-cigarettes more than once a month, but less than once a week", "I use e-cigarettes more than once a week but not every day" and "I use e-cigarettes every day" (categorised as "monthly or more users"). A further "Don't want to say" category was available. Individuals who had never heard of e-cigarettes are considered de facto "never-users". Respondents who had heard of e-cigarettes were then asked "Compared to cigarettes, do you think e-cigarettes are more or less harmful to the person using them, or is there no difference?" They were offered a choice of four responses: "More harmful"; "Less harmful"; "About the same", and "I don't know".

A total of 2,291 11-18 year olds were recruited in 2015 and 2,331 recruited in 2016. There were 213 and 178 young people from the earlier waves who also responded in the 2015 and 2016 samples, respectively, and were therefore removed from analyses. A further 269 took part in both surveys; following random assignment of these respondents to one or other year, a total of 1,943 respondents were left in the 2015 group and 2,019 in the 2016 group.

A similar proportion in 2015 and 2016 were aware of EC, 92.9% and 92.5%, respectively ($p=0.81$). Ever use of EC was reported by 13.9% (95% CI 12.2-15.7) of youth in 2015 and 11.9% (95% CI 10.4-13.5) in 2016 ($p=0.10$). Over this period, we observed a significant fall in the prevalence of current smoking ($p=0.02$) from 7.4% (95% CI 6.0-8.7) to 5.4% (95% CI 4.4-6.5). Ever use of EC was highest in current-smokers (70.4% (95% CI 60.6-78.6) and 66.6% (95% CI 56.6-75.3) for 2015 and 2016 respectively, and lowest in never-smokers (4.1% (95% CI 3.2-5.4) and 4.7% (95% CI 3.6-6.1)). In 2016 more than a quarter (27.2%) of current-smokers reported regular (monthly or more) EC use, while less than 1% of never-smokers reported monthly or more EC use (Table 1), similar to previous youth surveys¹⁰.

Compared with 2013 and 2014, more young people had experimented with EC in 2015/16. In 2013, 73.4% (95% CI 71.0-75.7) of young people considered EC to be less harmful to the user¹⁴, and by 2016 this had dropped significantly to 62.3% (95% CI 59.8-64.8).

This study shows a greater proportion of young people in Great Britain had ever used EC in 2015 and 2016 than in either 2013 or 2014¹⁴ and that regular use remains largely confined to current smokers. We observed a reduction in current smoking over the time period consistent with other national surveys¹⁷. Perceived relative harm of e-cigarettes has increased over time.

< Insert Table 1 around here >

Table 1 Percentage (95% CI) of EC use and perception of harm by smoking status in 11-18 years olds in Great Britain, 2013-2016

	Cigarette smoking status				
	Never	Former	Current	Did not want to say	Total
2013					
E-cigarette status	(n=1,599)	(n=289)	(n=156)	(n=18)	(n=2,062)
Never-user	99.1 (98.4-99.5)	91.2 (87.3-94.0)	63.7 (55.6-71.0)	84.1 (60.2-94.9)	95.0 (93.9-95.9)
Experimenter	0.6 (0.3-1.2)	6.5 (4.2-9.9)	28.6 (22.0-36.2)	5.0 (0.7-28.5)	3.7 (3.0-4.7)
Monthly or more user	0.1 (0.0-0.4)	1.2 (0.4-3.7)	7.8 (4.2-13.9)	4.7 (0.7-27.3)	0.9 (0.5-1.5)
Did not want to say	0.2 (0.1-0.9)	1.1 (0.3-3.8)	0.0 (0.0-0.0)	6.1 (0.9-33.0)	0.4 (0.2-0.9)
Perception of EC harm*	(n=984)	(n=231)	(n=139)	(n=5)	(n=1,359)
Perceives EC as less harmful	70.9 (67.9,73.7)	79.1 (73.2,84.0)	80.8 (73.0,86.7)	82.2 (33.8,97.7)	73.4 (71.0,75.7)
2014					
E-cigarette status	(n=1,519)	(n=271)	(n=136)	(n=26)	(n=1,952)
Never-user	98.1 (97.2-98.7)	77.5 (71.8-82.3)	46.3 (37.9-54.9)	83.2 (65.7-93.0)	91.4 (90.0-92.7)
Experimenter	1.5 (1.0-2.4)	17.1 (12.9-22.4)	40.2 (32.0-48.9)	9.8 (3.1-26.8)	6.5 (5.4-7.7)
Monthly or more user	0.2 (0.1-0.6)	3.9 (2.0-7.4)	13.5 (8.6-20.7)	4.3 (0.6-24.8)	1.7 (1.2-2.4)
Did not want to say	0.2 (0.0-0.6)	1.5 (0.6-4.2)	0.0 (0.0-0.0)	2.8 (0.4-17.3)	0.4 (0.2-0.8)
Perception of EC harm*	(n=1,248)	(n=236)	(n=124)	(n=10)	(n=1,618)
Perceives EC as less harmful	65.3 (62.5,67.9)	73.9 (67.7,79.3)	68.3 (59.2,76.1)	83.5 (51,96.1)	66.9 (64.5,69.2)
2015					
E-cigarette status	(n=1,450)	(n=314)	(n=155)	(n=24)	(n=1,943)
Never-user	95.9 (94.6-96.8)	65.1 (58.5-71.3)	29.6 (21.4-39.3)	79.0 (58.7-90.9)	86.1 (84.3-87.8)
Experimenter	3.6 (2.7-4.8)	27.2 (21.6-33.6)	50.2 (40.7-59.7)	6.9 (1.6-24.7)	10.6 (9.1-12.3)
Monthly or more user	0.6 (0.3-1.1)	7.6 (4.5-12.7)	20.2 (13.6-29.0)	14.1 (5.0-33.9)	3.3 (2.4-4.3)
Did not want to say	-	-	-	-	-
Perception of EC harm*	(n=1,355)	(n=303)	(n=150)	(n=17)	(n=1,825)
Perceives EC as less harmful	65.2 (62.3,67.9)	70.0 (63.4,75.8)	79.1 (71.6,85.0)	71.8 (43.9,89.2)	67.0 (64.6,69.4)
2016					
E-cigarette status	(n=1,533)	(n=308)	(n=147)	(n=31)	(n=2,019)
Never-user	95.2 (93.8-96.3)	67.8 (61.3-73.6)	31.5 (23.1-41.3)	74.9 (53.7-88.5)	87.7 (86.1-89.2)
Experimenter	4.3 (3.3-5.6)	26.9 (21.6-32.9)	39.3 (30.6-48.8)	5.2 (1.6-15.8)	9.3 (8.0-10.7)
Monthly or more user	0.4 (0.1-1.0)	5.3 (2.8-9.9)	27.2 (19.4-36.8)	8.2 (1.8-30.8)	2.6 (1.9-3.6)
Did not want to say	0.1 (0.0-0.6)	0.0 (0.0-0.0)	1.9 (0.3-12.4)	11.7 (3.4-33.5)	0.4 (0.2-0.9)
Perception of EC harm*	(n=1,436)	(n=293)	(n=140)	(n=14)	(n=1,883)
Perceives EC as less harmful	60.7 (57.8,63.5)	67.3 (59.7,74.0)	72.8 (63.3,80.6)	73.0 (44.9,89.9)	62.3 (59.8,64.8)

* Only young people who were aware of EC were asked about their perception of harm

DECLARATION AND CONFLICT OF INTEREST

Brian Eastwood is employed full time at Public Health England (PHE) and has received funding from PHE to support his PhD at the Institute of Psychiatry, Psychology and Neurosciences, King's College London. Deborah Arnott and Hazel Cheeseman are employed full time at ASH, which receives funding for its survey work from the British Heart Foundation, Cancer Research UK and the Department of Health. ASH receives no funding from commercial organisations. Martin Dockrell, Katherine East, Leonie Brose and Ann McNeill and have no interests to declare. AM and LB were authors of the PHE E-cigarette report³ and AM a contributor to the RCP report⁴.

All authors contributed to the analysis plan, which was implemented by B.E. All authors contributed to the drafting of the paper, and all have approved the final version for submission to *Public Health*.

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ETHICS

The body responsible for collecting the data (YouGov) adhere to the code of conduct set out by the Market Research Society (<https://www.mrs.org.uk/pdf/mrs%20code%20of%20conduct%202014.pdf>). Informed consent to take part in the online survey was provided either by the parents of those aged 11-15, or by those individuals aged 16-18.

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