

# Electronic cigarettes

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## Summary

- Nicotine containing products (NCPs) such as e-cigarettes are evolving and there is increasing evidence to suggest that some if not all products provide effective nicotine delivery.
- There is little real-world evidence of harm from e-cigarettes to date, especially in comparison to smoking.
- E-cigarettes are used by both smokers and ex-smokers, but there is little evidence of use by those who have never smoked or by children.
- ASH supports regulation to ensure the safety and reliability of e-cigarettes but, in the absence of harm to bystanders, does not consider it appropriate to include e-cigarettes under smokefree regulations.
- ASH strongly supports the decision by the Medicines and Healthcare products Regulatory Agency (MHRA) to regulate all nicotine-containing products including e-cigarettes.
- ASH welcomes the guidance by the National Institute for Health and Clinical Excellence (NICE) on harm reduction, which supports the use of licensed nicotine products as an aid to cutting down or quitting smoking and as a substitute for smoking.

## Nicotine Substitution

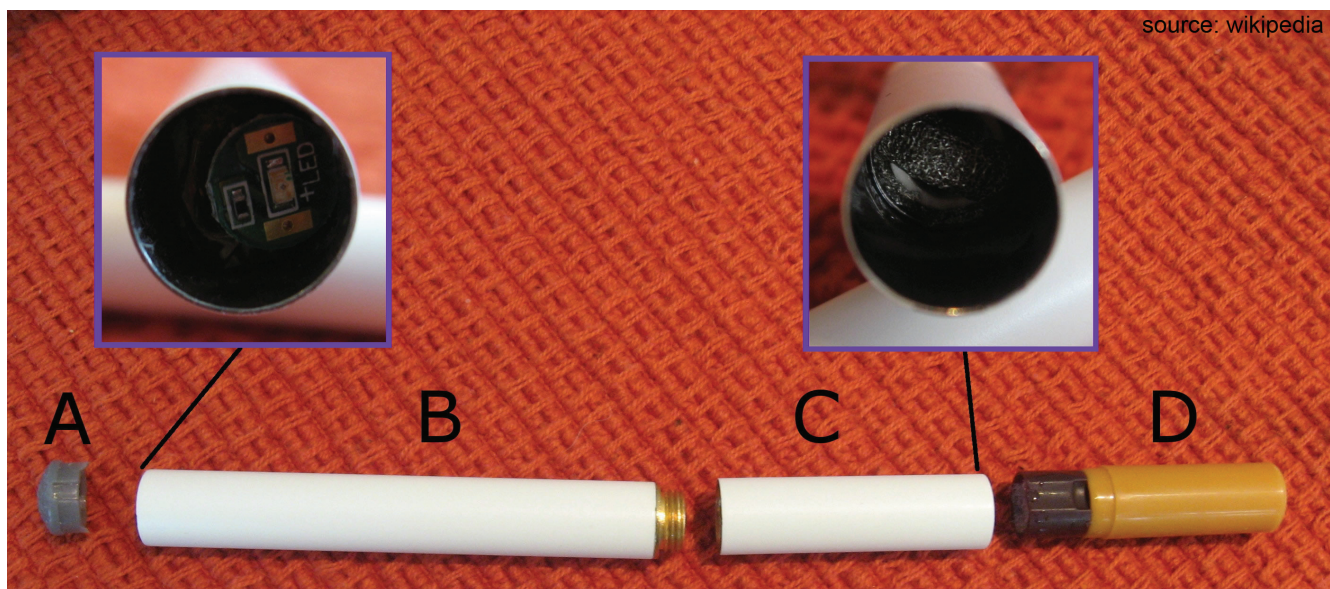
Smoking is the largest, preventable cause of premature mortality in the UK. The goal of public health is to diminish the harm caused by tobacco products. While the ideal remains that people should stop using tobacco completely and permanently, consensus currently supports a properly regulated harm reduction approach<sup>1,2,3</sup> – a framework by which the harmful effects of smoking are reduced without requiring the elimination of a behaviour that is not necessarily condoned. Such strategies have proved successful in the past, for example within the contexts of needle exchange programmes for illicit drug use and the promotion of safer sex to prevent HIV infection.<sup>4,5</sup>

In 1976 Professor Michael Russell wrote: “People smoke for nicotine but they die from the tar.”<sup>6</sup> Indeed, the harm from smoking is caused almost exclusively by toxins present in tobacco released through combustion. By contrast, pure nicotine products, although addictive, are considerably less harmful. Electronic cigarettes consequently represent a safer alternative to cigarettes for smokers who are unable or unwilling to stop using nicotine.

The National Institute for Health and Care Excellence (NICE) has developed guidance on a harm reduction approach to smoking.<sup>7</sup> NICE’s recommendations aim to inform on how best to reduce illness and deaths attributable to smoking through a harm reduction approach. As part of this guidance, NICE supports the use of licensed nicotine containing products (NCPs) to help smokers cut down, for temporary abstinence and as a substitute for smoking, possibly indefinitely.

## What are e-cigarettes?

Electronic cigarettes, also known as electronic nicotine delivery systems (ENDS),<sup>8</sup> are often designed to look and feel like cigarettes. They have been marketed as cheaper and healthier alternatives to cigarettes and for use in places where smoking is not permitted since they do not produce smoke.



A. LED light cover | B. battery (also houses circuitry) | C. atomizer (heating element) | D. cartridge (mouthpiece)

A typical e-cigarette consists of three main components: a battery, an atomiser and a cartridge containing nicotine. Most replaceable cartridges contain nicotine suspended in propylene glycol or glycerine and water. The level of nicotine in the cartridges may vary and some also contain flavourings.<sup>9</sup> Some e-cigarettes also have an indicator light at the end that glows when the user draws on the device to resemble a lit cigarette. When a user sucks on the device, a sensor detects air flow and heats the liquid in the cartridge so that it evaporates. The vapour delivers the nicotine to the user. There is no side-stream smoke but some nicotine vapour is released into the air as the smoker exhales.

### Are e-cigarettes safe to use?

A draft review by the WHO's Tobacco Regulatory Group in 2009 notes that the extent of nicotine uptake and the safety of e-cigarettes have yet to be fully established.<sup>8</sup> Certainly, in the absence of thorough clinical evaluation and long term population level surveillance absolute safety of such products cannot be guaranteed. By comparison, the harm from tobacco smoking – the leading cause of preventable death in the UK – is well established.

Most of the safety concerns regarding electronic cigarettes relate to the absence of appropriate product regulation and inconsistencies in quality control. The current lack of any authoritative oversight (although the MHRA is in the process of developing guidelines, see section on regulation) means that there is significant variability in device effectiveness, nicotine delivery and cartridge nicotine content both between and sometimes within product brands.<sup>9</sup> Furthermore, a recent study by the US Food and Drug Administration (FDA) has raised some safety concerns over the presence of toxins, released in low concentrations, from the vaporisation process of certain cartridges.<sup>10</sup> However, one study showed that after switching from tobacco to electronic cigarettes nicotine exposure was unchanged while exposure to selected toxicants was substantially reduced.<sup>11</sup>

There is little evidence of harmful effects from repeated exposure to propylene glycol, the chemical in which nicotine is suspended.<sup>12,13</sup> One study concludes that e-cigarettes have a low toxicity profile, are well tolerated, and are associated with only mild adverse effects.<sup>14</sup>

## Is there a risk to non-users from e-cigarette vapour?

Although e-cigarettes do not produce smoke, users exhale a smoke-like vapour which consists largely of water. Any health risks of secondhand exposure to propylene glycol vapour are likely to be limited to irritation of the throat. One study exposed animals to propylene glycol for 12 to 18 months at doses 50 to 700 times the level the animal could absorb through inhalation. Compared to animals living in normal room atmosphere, no localised or generalised irritation was found and kidney, liver, spleen and bone marrow were all found to be normal.<sup>12</sup>

The fact that e-cigarettes look similar to conventional cigarettes has been said to risk confusion as to their use in public places, such as on public transport.<sup>15,16</sup> However, given that the most distinctive feature of cigarette smoking is the smell of the smoke, which travels rapidly, and that this is absent from e-cigarette use, it is not clear how any such confusion would be sustained. Furthermore, the absence of risk from “secondhand” inhalation of vapour from e-cigarettes has been described as an “often unconsidered advantage” of e-cigarettes.<sup>17</sup> As an alternative to smoking, e-cigarettes are preferable in situations where secondhand smoke poses serious health risks to others, such as in vehicles or in the home.

## Are e-cigarettes effective?

The degree of effectiveness depends on what effect is being measured. Public health professionals may be most concerned about their effectiveness in smoking cessation. There are four benefits most widely perceived by smokers: these are the degree to which they satisfy the desire to smoke (60% of smokers), help to cut down cigarettes (55%), help quit entirely (51%) and eradicate the smell of stale smoke (51%).<sup>18,19</sup> Effectiveness also varies between products and between users according to their experience in use.<sup>20</sup>

Currently in the UK, any nicotine-containing product which claims or implies that it can treat nicotine addiction is considered to be a medicinal product and is therefore subject to regulation by the MHRA. Consequently, e-cigarette manufacturers have avoided making such explicit claims. Furthermore, the WHO has stated that “the electronic cigarette is not a proven nicotine replacement therapy”.<sup>21</sup>

Nevertheless, survey data suggests that about 4 in 10<sup>18</sup> users do use them in an attempt to quit smoking and internet searches for the devices now exceed those for any other smoking cessation or nicotine replacement product.<sup>22</sup> There is some evidence to suggest that e-cigarette use leads to abstinence among some smokers who had not intended to quit.<sup>23</sup>

Empirical data on the effectiveness of e-cigarettes as a stop-smoking aid is limited and the risks and benefits are still being studied. Some reports from the published literature suggest that electronic cigarettes are inefficient nicotine delivery devices and result in only modest and unreliable increases in plasma nicotine levels.<sup>24</sup> Such findings appear to apply particularly to new users whereas studies using participants experienced in e-cigarette use have been found to derive more reliable nicotine intake levels.<sup>14</sup> Whether experienced users are able to use these devices in a way in which their nicotine intake is maximised, or the variability is down to such users preferring certain devices which might significantly differ from those used by inexperienced users, is yet to be determined.<sup>25,26</sup>

Nevertheless, growing evidence suggests that e-cigarettes are becoming more reliable in their nicotine delivery and that they have a beneficial impact in reducing subjective cravings and, in turn, number of cigarettes smoked.<sup>14</sup> Moreover, some studies have demonstrated an ability for certain brands of e-cigarettes to reduce subjective nicotine cravings despite delivering low

plasma nicotine levels.<sup>27</sup>

Another feature of e-cigarettes that apparently lends to their effectiveness is an ability to satisfy the “hand to mouth” behavioural component that is not sufficiently addressed in more traditional nicotine replacement therapies. This has been demonstrated by users exhibiting reduced cravings, withdrawal symptoms and number of cigarettes smoked per day even when given a placebo e-cigarette.<sup>14</sup>

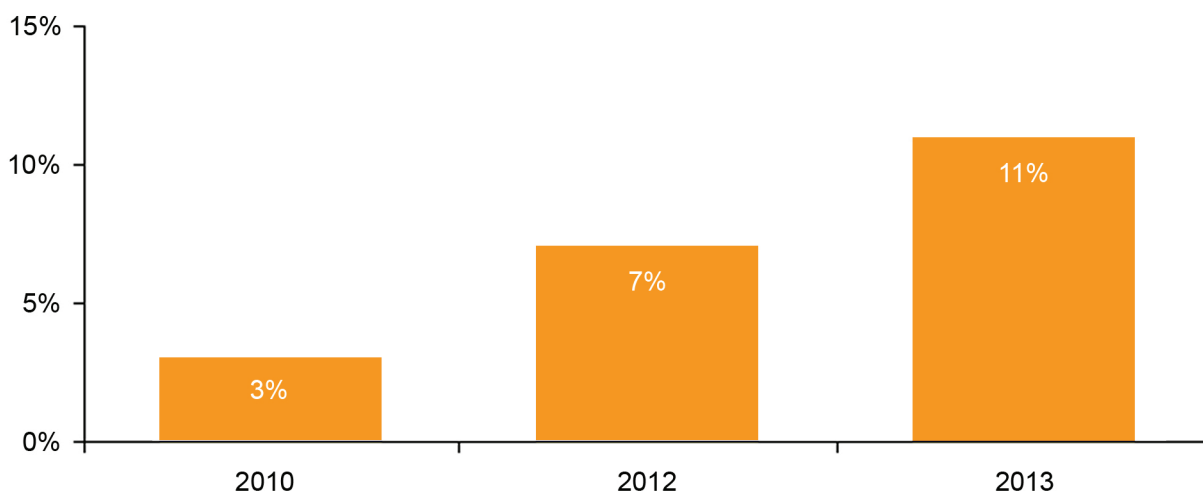
The potential value, and perceived effectiveness, of electronic cigarettes in aiding smoking cessation has been assessed in user surveys. Caution must be exercised with this data as the sample was recruited from e-cigarette users’ websites. However, one such survey conducted internationally reported that 72% of users believed that e-cigarettes were beneficial in reducing cravings and withdrawal symptoms while 92% declared that the devices had reduced the number of conventional cigarettes they smoked. Indeed, in the same survey, 96% of former smokers claimed that e-cigarettes had helped them quit, and 79% reported a fear that if they stopped using them they would start smoking again.<sup>9</sup>

## Who uses e-cigarettes in the UK?

Public awareness of e-cigarettes has grown substantially in recent years with online media playing an integral role in the growing popularity of the product. Between the years 2009 and 2011 searches via the search engine Google using the terms ‘electronic cigarette’ increased by fifty fold,<sup>28</sup> a fact the industry has attempted to capitalise on by funding various online adverts, web-pages and social networking site groups.<sup>29</sup> In addition to the influence of online media, there is also evidence to suggest that tighter tobacco control measures are also positively driving e-cigarette behaviour.<sup>30</sup>

According to a survey commissioned by ASH, 3% of smokers reported using e-cigarettes in 2010, a figure that increased to 7% in 2012 and 11% in 2013 (see figure 1). Similarly, the number of people reporting having tried e-cigarettes has increased significantly, more than doubling from 9% in 2010 to 22% in 2012 and 35% in 2013. Among children, current e-cigarette use is confined to those who have already tried smoking.<sup>31,32</sup> (see figure 2)

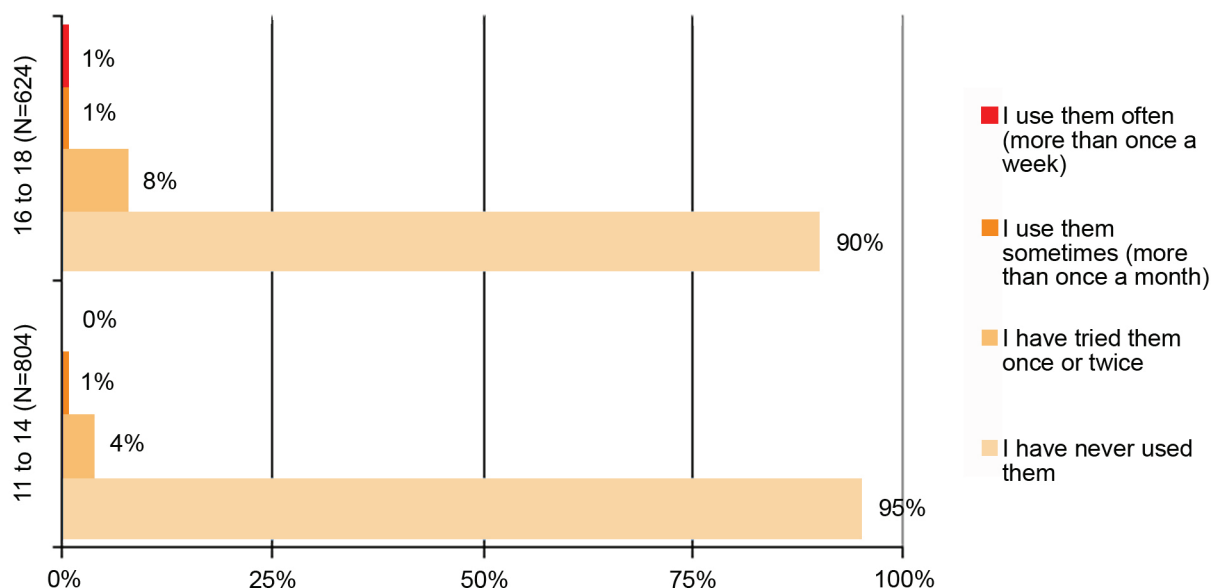
Figure 1: Usage of e-cigarettes amongst adult smokers in Britain



ASH estimates that there are 1.3 million current users of e-cigarettes in the UK. This number is almost entirely made of current and ex-smokers; with perhaps as many as 400,000 people having replaced smoking with e-cigarette use. There is little evidence to suggest that anything more than a negligible number of non-smokers regularly use the product.<sup>33</sup>



Figure 2: Usage of e-cigarettes among children in Britain, 2013



For further information see ASH Factsheet: [Use of e-cigarettes in Great Britain among adults and young people](#) (pdf)

## Regulation

On 12th June 2013 the Medicines and Healthcare Products Regulatory Agency (MHRA) announced that it will regulate electronic cigarettes and other nicotine containing products (NCPs) as medicines.<sup>34</sup> NCPs will not, however, be required to obtain a medical licence until the proposal in the European Commission's revised Tobacco Products Directive<sup>35</sup> is agreed and transposed into UK law. The European Commission has said it expects the new legislation to be adopted in 2014 and to come into effect in Member States such as the UK in 2016. Until then e-cigarettes will continue to be subject to general consumer protection law and it is the responsibility of trading standards officers to rule on their safety.

This followed a public consultation by the MHRA in 2010 about whether NCPs such as e-cigarettes should be regulated.<sup>36</sup> Following this initial analysis a period of further research was commissioned, coordinated by the MHRA, and informed upon by an expert working group of the Commission on Human Medicines (CHM).

As well as the MHRA review, and following a referral from the Department of Health, NICE published guidance on tobacco harm reduction on 5th June 2013.<sup>7</sup> This guidance recommended the use of licensed NCPs, which are nicotine replacement therapy products licensed by the MHRA (and do not at the current time include e-cigarettes) for harm reduction purposes. Such purposes include using licensed NCPs as a substitute for tobacco, possibly indefinitely, to cut down prior to quitting, to smoke less, or to temporarily abstain from smoking.

Currently, e-cigarettes are not regulated under smokefree law in the UK. In general, users are free to use them in most public places such as bars, restaurants and on public transport, although the managers of some premises have prohibited their use.

An oft quoted advantage of smokefree legislation is that it de-normalises smoking, effectively distancing the behaviour from what is an accepted social norm. The ban on smoking in public places has reinforced in many people's minds that such behaviour has gone from a normal, widely accepted activity to one that is abnormal and unaccepted. There are concerns that e-cigarettes will undermine this process, threatening the now established practice of smokefree public places, such as at work or on public transport. However to date there is little evidence to suggest this is the case.

## Conclusion

ASH believes that e-cigarettes, properly regulated to ensure product safety, quality and efficacy, should be made available as part of a harm reduction approach to tobacco. That is, we recognise that whilst efforts to help people stop smoking should remain a priority, many people either do not wish to stop smoking or find it very hard to do so. For this group, nicotine substitution products should be made available that deliver nicotine in a safe way, without the harmful components found in tobacco smoke. Most of the diseases associated with smoking are caused by inhaling smoke which contains thousands of toxic chemicals. By contrast, nicotine is relatively safe.

E-cigarettes, which deliver nicotine without the harmful toxins found in tobacco smoke, are likely to be a safer alternative to smoking. In addition, e-cigarettes reduce secondhand smoke exposure in places where smoking is allowed since they do not produce smoke. Nonetheless, nicotine is an addictive substance, e-cigarettes currently available are of highly variable safety and efficacy, and smokers are uncertain about the effectiveness of the product.

In the UK smokefree legislation exists to protect the public from the demonstrable harms of secondhand smoke. ASH does not consider it appropriate for electronic cigarettes to be subject to this legislation.

## References

- 1 Royal College of Physicians. Harm reduction in nicotine addiction: helping people who can't quit. A report by the Tobacco Advisory Group of the Royal College of Physicians. London: RCP, 2007.
- 2 Action on Smoking and Health. Beyond Smoking Kills: Protecting Children, Reducing Inequalities. London: ASH, 2008
- 3 British Medical Association. E-cigarettes in public places and workplaces. A briefing from the BMA Occupational Medicine Committee and the Board of Science. London: BMA, 2012
- 4 Hurley S, Jolley D and Kaldor J. Effectiveness of needle-exchange programmes for prevention of HIV infection. *The Lancet* 1997; 349:1797-1800
- 5 Weller, S. A Meta-analysis of condom effectiveness in reducing sexually transmitted HIV. *Soc. Sci. Med.* 1993;36:1635-1644
- 6 Russell M. Low-tar medium-nicotine cigarettes: a new approach to safer smoking. *British Medical Journal* 1976;1:1430-1433
- 7 [Tobacco - Harm reduction](#) NICE, 2013
- 8 Draft Abbreviated Advisory of the WHO Study Group on tobacco product regulation (WHO TobReg) concerning Electronic Nicotine Delivery Systems (ENDS), 2009
- 9 Goniewicz ML, Kuma T, Gawron M, Knysak J, Kosmider L. Nicotine levels in electronic cigarettes. *Nicotine Tob Res* 2013;15:158-66
- 10 Westenberger BJ. US Food and Drug Administration: evaluation of e-cigarettes. St Louis, MO: US Food and Drug Administration, Center for Drug Evaluation and Research, Division of Pharmaceutical Analysis. 2009.
- 11 Goniewicz ML, Gawron J, Jacob P, Peng M, Benowitz N. Electronic cigarettes deliver similar levels of nicotine and reduce exposure to combustion toxicants after switching from tobacco cigarettes. Presented at the 18th annual meeting of the Society for Research on Nicotine and Tobacco, Houston, March 13-16, 2012, 40, NIPA-1
- 12 Robertson OH, Loosli CG, Puck TT et al. Tests for the chronic toxicity of propylene glycol and triethylene glycol on monkeys and rats by vapour inhalation and oral administration. *J Pharmacol Exp Ther* 1947; 91: 52–76.
- 13 Electronic cigarettes: A safe substitute? *New Scientist* 11 Feb 2009
- 14 Bullen C, McRobie H, Thornley S, et al. Effect of an electronic cigarette on desire to smoke and withdrawal, user preferences and nicotine delivery: randomized cross-over trial. *Tobacco Control* 2010; 19: 98–103
- 15 King County bans public e-cigarette smoking. *Seattlepi.com* 15 Dec. 2010
- 16 Wirral pensioner kicked off public transport because of his electronic cigarette. *Wirral News*. 20 July 2012
- 17 Wagener TL, Siegel M, Borelli B. Electronic Cigarettes: Achieving a balanced perspective. *Addiction* 2012; 107: 91545-1548
- 18 Survey of smokers' attitudes to e-cigarettes. YouGov 2010. Total sample size was 1380 UK adult smokers. Respondents were pre-screened for e-cigarette use such that 486 respondents had tried e-cigarettes and 894 respondents had not tried e-cigarettes. Fieldwork was undertaken between 9th - 16th April 2010. The survey was carried out online. The figures are unweighted.
- 19 Goniewicz ML, Lingas EO, Hajek P. Patterns and effects of electronic cigarettes use and users beliefs about their safety and benefits. An internet survey. *Drug Alcohol Rev* 2013; in press
- 20 Foulds J, Veldheer S, & Berg A. Electronic cigarettes (e-cigs): Views of aficionados and clinical/public health perspectives. *Int J Clinical Practice* 2011; 65: 1037–1042
- 21 World Health Organization. Report on the scientific basis of tobacco product regulation: third report of a WHO study group. Geneva, World Health Organization, 2009.

- 22 Etter J & Bullen C. Electronic cigarette: users profile, utilization, satisfaction and perceived efficacy. *Addiction* 2011; 106: 2017–28.
- 23 Polosa R, Caponnetto P, Morjaria JB. et al. Effect of electronic nicotine delivery device (e-cigarette) on smoking reduction and cessation: a prospective 6-month pilot study. *BMC Public Health* 2011; 11: 786. doi: 10.1186/1471-2458-11-786
- 24 Vansickel AR, Cobb CO, Weaver MF, Eissenberg TE. A clinical laboratory model for evaluating the acute effects of electronic 'cigarettes': nicotine delivery profile and cardiovascular and subjective effects. *Cancer Epidemiol Biomarkers Prev* 2010; 19: 1945–53
- 25 Foulds J, Veldheer S, & Berg A. Electronic cigarettes (e-cigs): Views of aficionados and clinical/public health perspectives. *Int J Clinical Practice* 2011; 65: 1037–1042
- 26 Trtchounian A, Williams M, & Talbot P. Conventional and electronic cigarettes (e-cigarettes) have different smoking characteristics. *Nic & Tob Research* 2011; 12: 905–912
- 27 Eissenberg T. Electronic nicotine delivery devices: ineffective nicotine delivery and craving suppression after acute administration. *Tobacco Control* 2010; 19: 87–8
- 28 Yamin CK, Bitton A, & Bates DW. E-cigarettes: a rapidly growing Internet phenomenon. *Ann Intern Med* 2010; 153:607–9
- 29 Noel JK, Rees VW, Connolly GN. Electronic cigarettes: a new 'tobacco' industry? *Tob Control* 2011; 20: 81
- 30 Ayers JW, Ribisl KM, Brownstein JS. Tracking the rise in popularity of Electronic Nicotine Delivery Systems (electronic cigarettes) using search query surveillance. *Am J Prev Med* 2011; 40: 448–53
- 31 Dockrell M, Morrison R & McNeill A. E-cigarettes: Prevalence and attitudes in Great Britain. *Nicotine & Tobacco Research* In press.
- 32 Survey fieldwork dates and sample size:  
Adults:  
March 2010: 2,297 adult smokers  
March 2012: 12,436 adults  
February 2013: 12,170 adults
- Children: March 2013: 2,178 children aged 11-18
- Surveys were conducted online and results weighted to reflect the British population, as appropriate.
- 33 Goniewicz ML, Zielinska-Danch W. [Electronic cigarette use among teenagers and young adults in Poland](#). *Pediatrics* 2012; 130: e879-85.
- 34 [Nicotine containing products](#), MHRA, 2013
- 35 [Proposal for a Directive of the European Parliament and of the Council](#) on the approximation of the laws, regulations and administrative provisions of the Member States concerning the manufacture, presentation and sale of tobacco and related products. Dec. 2012 (pdf)
- 36 Medicines and Healthcare products Regulatory Agency Outcome of consultation exercise MLX364 on the regulation of nicotine containing products (NCPs). London, MHRA, 2011.

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