**Everything you wanted to know about e-cigarettes and vaping but were afraid to ask.**

**A guide for mental health clinicians.**

Learning objectives

By the end of the manuscript, the reader will be able to :

1 Provide a balanced overview of e-cigarette use.

2 Understand the risk reduction approach in the use of e-cigarettes versus tobacco smoking in patients with mental illness.

3 Demonstrate the principles of taking a ‘vaping history’.

Abstract

Mental health clinicians are expected to offer support and advice to service users to promote smoking cessation. Alongside this is the relatively new and increasingly popular phenomenon of electronic cigarette use. The absence of any long term evidence regarding safety is recognised and clinician awareness of e-cigarettes may be limited to personal experience or media publications leading to uncertainty in their confidence discussing e-cigarettes with patients, both in general and as an aid to quitting smoking.

This article provides a historic and contemporary overview of e-cigarettes. The reader will gain an understanding of e-cigarette usage, risks and benefits, the current position on use of e-cigarettes in mental health settings and tips on how to take an e-cigarette history and how to offer advice about using them. This is achieved within the context of recent publications and national recommendations.

Whilst the focus is primarily on the mental health patient, the article is of benefit to all health and social care professionals to help them develop an understanding of e-cigarettes as a tobacco smoking cessation or harm reduction aid.

Biography

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Declaration of interests

Susan Bonner – none

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Emily Peckham – none

**The rise and rise of e-cigarettes**

In 1963, Herbert Gilbert patented the first smoke-less, tobacco-free electronic cigarette (Gilbert, 1963). However the modern electronic cigarette (“e-cigarette”) can be traced back to the invention by a Chinese pharmacist, Hon Lik, in response to his father dying of lung cancer. E-cigarettes were introduced in Europe in 2006 then the USA in 2007 (Pepper and Brewer, 2013). Their growth since this time has been rapid and in 2010 Action on Smoking and Health (ASH) started collecting information on e-cigarette use in the UK. In 2012, they estimated that there were 700,000 UK adult users, tripling to 2.1 million within 2 years. More recently the number of e-cigarette users has started to stabilise: there were 3.2 million users by 2018(Action on Smoking and Health, 2018a).

Between August 2012 and December 2013, 215 new brands of e-cigarette were created. By January 2014 there were 466 brands and 7764 flavours of e-cigarette liquid on the market(Zhu et al., 2014).

E-cigarettes are consumer products, not licensed medications. In 2016, a European Union regulation known as the Tobacco Product Directive came in to effect, imposing restrictions on safety, packaging and labelling and setting out requirements regarding the monitoring and reporting of developments in e-cigarettes (European Commission, 2016). E-cigarette liquid contents and vapour emissions must now be reported to a designated authority, in the UK this is the Medicines and Healthcare Products Regulatory Agency.

E-cigarettes can be bought from specialist vape shops, on-line, and in some pharmacies. In the UK, sale is restricted to people aged 18 or older.

**What is an e-cigarette?**

E-cigarettes are devices that heat liquid held in a cartridge or reservoir, converting it in to an aerosolised solution, or vapour, which the user inhales through a mouthpiece. The liquid contains water, propylene glycol and/or vegetable glycerine (as a base carrier) and flavouring.

E-cigarette liquids do not necessarily contain nicotine but in those that do, strength can vary to beyond 20mg/ml which is the limit set by the Tobacco Products Directive. Often, the company selling e-cigarette liquid will classify it as being of low, medium or high nicotine content, but the dose inhaled varies depending on type of e-cigarette and each person’s method of inhalation. Speed of nicotine delivery to the brain is slower than inhaling tobacco smoke which means users do not receive the virtually instant “hit” of nicotine that is experienced when smoking a cigarette.

Of the thousands of flavour choices on the market, the most popular are menthol and tobacco, followed by fruit, sweets, alcohol and other drink flavours (Zhu et al., 2014). More unusual examples include crab legs, beer and hot dog (online search 5/10/18). The inclusion of a flavour in e-cigarette liquid may be important for the acceptability of e-cigarettes to smokers who are trying to quit. However, some flavourings may have cytotoxic effects (Farsalinos et al., 2014).

Nicotine is the substance that causes addiction to tobacco-smoking but it is not one of the components that can kill. Unlike standard cigarettes, e-cigarettes and their vapour do not contain tobacco, tar, carbon monoxide or the thousands of toxins that are in tobacco smoke, in fact as burning is not involved, they do not produce smoke.

**How has the design of e-cigarettes evolved?**

Early e-cigarettes were designed to look like a standard shop-bought cigarette. They contained a battery, cartridge and atomiser and most were intended to be single-use. The development of second generation devices resulted in “Vape-pens”, rechargeable, refillable products that look distinctly and deliberately different to a cigarette. Subsequently, more modular models have been produced, consisting of removable and replaceable components that can be interchanged by the user to produce a personalised product.

The most commonly used e-cigarette type in the UK is currently a rechargeable device with a reservoir (Action on Smoking and Health, 2018a).

**What words are used to relate to e-cigarettes?**

The development of a new phenomenon has brought with it a new language. “Vapour” originates in the Latin “vapor” (steam), and in the early 2000s the verb “to vape” came in to use to describe a particular method of inhaling cannabis. Within a few years, the term was adopted by e-cigarette users. In 2014, “vape” was the Oxford Dictionary’s word of the year.

 *<insert e-cigarette language learning aid box here>*

**Who is vaping and why?**

In Great Britain, 3.2 million adults (6.2% of the adult population) vape. Of these vapers, 52% are ex-smokers, 44% are concurrent tobacco smokers and 4.2% have never smoked(Action on Smoking and Health, 2018a). Vaping among current smokers has stabilised over the past few years whereas there is an upward trend of vapers who are now ex-cigarette-smokers (Brown J, 2019).

Although the most common reason for vaping is to help cut down or quit smoking, 10% of ex-smokers and 15% of current smokers report that saving money is an important factor (Action on Smoking and Health, 2018a).

Vaping among children in Britain is low with 76% of 11-18 year olds having never tried e-cigarettes and 2% vaping at least once per week. (Action on Smoking and Health, 2018b). 99.8% of children who vape regularly have a history of cigarette use. The commonest reason that children vape is experimentation.

**What about vaping in other countries?**

A survey of over 30000 adults in Sweden, where smoking prevalence is 12.3%, found that 2% of the population vape and that 9.8% of cigarette smokers are also vapers. Of the vapers, 66.7% also smoke, 15% are ex-smokers and 18.3% have never smoked (Hedman et al., 2018).

In Canada, where e-cigarettes with nicotine were not been approved for sale until the introduction of their Tobacco and Vaping Products Act in 2018, data from a national survey in 2013 showed that 8.5% of people aged 15 years or older have tried vaping, with the highest proportion of these being current tobacco smokers (37% compared to 3% of never smokers). Vaping is most common among 15-24 year olds with prevalence decreasing by age in those aged 25 or older. The majority of Canadian teenagers who vape have never smoked (Reid et al., 2015).

E-cigarettes have been available in the United States of America for more than a decade. Currently the US Food and Drugs Administration regulates e-cigarettes and has the authority to place health warnings and age restrictions on their sales. A recent study of e-cigarette use in the USA (Mirbolouk et al., 2018) reported a prevalence of 4.5%, corresponding to 10.8 million adult e-cigarette users. E-cigarette use is highest in the 18 to 24 age bracket with 51.2% of current e-cigarette users being younger than 35. In addition, 15% of users reported that they had never been tobacco cigarette smokers.

In Australia e-cigarettes containing nicotine are not currently available for sale however it is possible to import nicotine for use in e-cigarettes with a prescription for up to three months of personal therapeutic use under the Therapeutic Goods Administration’s Personal Importation Scheme (Australian Government Department of Health, 2018)

In New Zealand a recent systematic review found that the current use of e-cigarettes is low (2-5%), with use being strongly predicted by smoking. However investigation of other predictors has been inhibited by low prevalence and small samples (Merry and Bullen, 2018).

There are a number of countries where vaping is banned, for example Turkey and Thailand (where those caught vaping risk imprisonment), and in Brazil the manufacture and sale of e-cigarettes is illegal.

**What are the potential benefits of vaping?**

The main purported benefit of vaping is that it can act as an aid to smoking cessation or to help people reduce the number of cigarettes they smoke. Smoking remains the single greatest threat to the health of individuals and populations. Each smoker dies on average 10 years earlier than someone who does not smoke, and smoking is a risk factor for a limitless range of diseases (Aveyard and West, 2007). The health risks of smoking for people who use mental health services are especially important since smoking contributes disproportionately to health inequalities. Nicotine replacement forms the cornerstone of effective smoking cessation strategies (National Institute for Clinical Excellence, 2008), and vaping has emerged as a very popular form of nicotine delivery for those who are dependent on nicotine and tobacco. Guidance on what might be offered to help people to cut down or quit smoking is offered in the UK by bodies such as Public Health England and its counterparts in devolved nations. Over recent years such guidelines have come to offer specific recommendations on the place of vaping amongst the range of strategies to quit. The latest Public Health England guidance on what clinicians should discuss with patients regarding options for stopping smoking makes reference to vaping being a viable option for self-managed quitting. It states that using an e-cigarette has similar or better results than a quit attempt using Nicotine Replacement Therapy (NRT). Public Health England suggests that, as with standard stop smoking treatment, some people may benefit from using more than one form of nicotine (i.e. vaping and something else such as nicotine patches), that a quit attempt is less likely to be successful if the e-cigarette is used too infrequently (because of the associated increase in nicotine craving) and that the person should continue to vape for as long as is needed for them to remain smoke-free (Public Health England, 2018).

The stance of the US National Academies of Sciences, Engineering and Medicine is that “e-cigarettes are likely to be far less harmful than combustible tobacco cigarettes” (US National Academies of Sciences Engineering and Medicine, 2018) and that of Public Health England is that “e-cigarette use is around 95% safer than smoking” (McNeill et al., 2018). The British Medical Association (BMA)’s current position statement backs this up by declaring that there are clear potential benefits to e-cigarette use, reducing the harms associated with smoking. The association says that that this has “the potential to make an important contribution towards the BMA’s ambition to achieve a tobacco-free society, leading to substantially reduced mortality from tobacco related disease”. However they urge caution that any potential risks associated with vaping must be minimised (British Medical Association, 2018).

**What are the risks associated with vaping?**

The safety of e-cigarettes in terms of product quality and safety testing is variable and there have been reports of exploding devices and fires caused by chargers that do not reach current safety standards (Zhang G, 2018).

Many companies which sell e-cigarettes and related paraphernalia have comprehensive websites. Tapping in to mass appeal, and at times ahead of the generalist clinician’s understanding of vaping, they often serve as sources of support for vapers, citing clinical research and making use of youtube links to report possible risks or adverse effects and what users can do about them. Examples of adverse effects reported on such sites include;

-Vapers tongue – sudden onset reduction in ability to sense the flavours of the vape, lasting 1-3 days (Vaping369, 2018).

-Reminding consumers to keep e-liquid in child-resistant containers (Vapemate, 2018).

Unfortunately there is a lack of research into any longer term health risks associated with vaping. Human research is limited and what we know is mostly based on laboratory findings or animal testing rather than clinical trials. E-cigarettes have not existed long enough for us to have an understanding of long-term risk.

Public Health England (Public Health England, 2018) and the latest Cochrane review (Hartmann-Boyce et al., 2016) bothadvise that possible side-effects include throat irritation and dry mouth. Laboratory based research shows potential cellular mechanisms for side effects, for example, Scott et al exposed alveolar macrophages from 8 non-smokers to e-cigarette liquid or vapour. After 24 hours exposed to e-liquid, 79% of cells remained healthy (and 84.5% of cells exposed to nicotine-free liquid) compared to 18% of cells exposed to vaped liquid (and 63% of those exposed to nicotine-free vape liquid) (Scott et al., 2018). This suggests that vaping might have the potential to cause damage to the user’s lungs at a cellular level, however the research did not go on to directly compare these effects with those of smoking. The lungs of mice and human bronchial epithelial cells exposed to vape containing high levels of nicotine have been found to go through changes usually associated with Chronic Obstructive Pulmonary Disease. These changes did not occur in nicotine-free vape (Garcia-Arcos et al., 2016) suggesting that the nicotine content plays a key role in lung changes. There have also been case reports of lipoid pneumonia thought to have been related to inhalation of vape (Britton and Bogdanovica, 2014).

**Is there a risk to others from vaping?**

In 2018 a putative link between vaping in pregnancy and the risk of Sudden Infant Death Syndrome was widely reported in the press. What was less widely reported was that this link was based on laboratory experiments whereby unborn rats were exposed to nicotine in order to study serotonin levels. Those rats who had been exposed to nicotine and were born with a serotonin deficiency had a poorer ability to respond to and recover from oxygen deprivation than rats who were either exposed to nicotine and born with normal serotonin, or who had a serotonin deficiency but were not exposed to nicotine (Lee et al.).

The residue of exhaled vape, including products linked to carcinogenesis, has been found on cotton and paper towels in a business located close to a vape shop, suggesting that vape can travel and settle elsewhere, potentially causing a third-hand exposure environmental hazard (Khachatoorian et al., 2018). However, in other studies, levels of toxins inhaled by people who vape have been found to be well within permitted occupational exposure levels and at much lower levels than those found in cigarette smoke (Royal College of Physicians, 2016) and thus far, laboratory research has found that exposing non-smokers to exhaled vape results in nicotine levels at one tenth that received from a smoked cigarette (Britton and Bogdanovica, 2014).

In amalgamating the current evidence, what is clear is that although vaping is not one hundred percent safe, it remains a much safer alternative to smoking and should be promoted as such. Indeed, the 2016 Cochrane review about the effects of e-cigarettes states that there are no serious side-effects associated with vaping for up to two years (Hartmann-Boyce et al., 2016).

**How should mental health services respond to the rise of vaping?**

As with the wider population, we postulate that large numbers of people who use mental health services will be both smokers and also vapers. There is currently no consensus regarding vaping in inpatient mental health settings in the UK. At present it is left to individual NHS trusts to decide how they approach this issue with some trusts treating vaping in the same way as smoking and banning both on their premises (including grounds), whilst other smoke-free hospitals allow patients to vape as part of a smoking cessation strategy.

Herein lies the crux of the debate. Do we consider vaping to be a popular method of harm reduction, treating nicotine addiction with minimal exposure to toxins, or do we see it as a return to a situation where “smoking” (vaping) in public is considered the norm, encouraging addiction in a new cohort of the population, appealing to teenagers, and becoming the 21st century equivalent of the Big Tobacco industry? In August 2018, following an inquiry in to vaping, a commons select committee took the stance that psychiatric inpatients who smoke should be encouraged to switch to e-cigarettes as a way out of addiction. They advised that NHS England should set a policy to allow patients in mental health facilities to use e-cigarettes and that “it is unacceptable that a third of the 50 English NHS trusts who responded to the Committee’s survey ban them” (Science and Technology Select Committee, 2018).

**What do I need to know about my patients who vape?  How do I take a vaping history?**

Pearson et al(Pearson et al., 2017) recommend asking standardised questions when conducting research about vaping to help strengthen cross-study comparisons and the emerging evidence base in this area. It could be helpful to adopt this approach in day-to-day clinical work.

1 Ask about frequency of use

To establish frequency of vaping, Pearson et al propose asking a question which still allows flexibility in defining a meaningful level of use (as it is currently not know what level of use is of relevance in health outcomes). This also allows for comparison of an individual’s use over time by asking “How often do you currently use an e-cigarette or vaping device?”

As e-liquid bottle size and cartridge sizes vary considerably between devices, little information can be gained from asking about amount of e-liquid that is used.

2 Clarify and record the type of e-cigarette used

Seeing as the available products are diverse, it is important to distinguish between different devices as they have different health effects. To find out about device type they recommend asking “What e-cigarette or vaping device do you use (the most)?” then distinguishing between disposable devices, those that are rechargeable and use prefilled cartridges, and those that are rechargeable using tanks that can be refilled with liquid or modular systems.

Of clinical relevance, single use devices and ones that are rechargeable but use prefilled cartridges tend to have less powerful batteries which affects nicotine delivery. The exception to this general rule is the latest pod devices that use nicotine salts resulting in nicotine delivery that is not affected by battery power. It is also important to note that modular devices and those that use a refillable e-liquid may be associated with a risk of accidental poisoning(Farmer, 2018)

3 Are they using any nicotine?

Find out about nicotine by asking “Does the e-cigarette or vaping device that you use most often contain nicotine?” Asking about nicotine strength can be a rough-and-ready way to monitor an individuals’ nicotine intake from vaping using a particular device over time but nicotine dose cannot be compared between different vapers or between different e-cigarette devices because actual intake of nicotine depends on variables such as how the device is used and the type of device (personal correspondence from Ann McNeil).

The National Centre for Smoking Cessation and Training (NCSCT), vaping organisations and tobacco control researchers all advise against making consumption comparisons between e-cigarettes and standard cigarettes (personal correspondence from Ann McNeill).

 **How might I encourage my patients to give up smoking by vaping?**

Smokers with severe mental illnesses such as schizophrenia or bipolar affective disorder are more likely to smoke a higher number of cigarettes and to extract more nicotine from each cigarette than smokers in the general population. They are less likely to be offered support to stop smoking yet are equally as likely to want to quit (Royal College of Physicians, 2013). When mental health clinicians first meet a patient, they have an obligation to ask about and record smoking status. If the patient is a smoker, the clinician must advise that they stop smoking and offer help with smoking cessation. This offer should be at the initial assessment and, if help is declined, during each subsequent clinical contact (National Institute for Health and Care Excellence, 2013).

The method which is most likely to lead to successful cessation of smoking is a combination of stop-smoking medication with behavioural support (National Institute for Heath and Care Excellence, 2018). E-cigarettes are not medically licensed but since 2015 Public Health England has endorsed them as a smoking cessation aid. E-cigarettes containing nicotine can be used instead of, or in conjunction with, licensed nicotine replacement therapy (such as patches, gum, lozenges, mouth sprays or nasal sprays) to replace some of the nicotine that would otherwise have been obtained from tobacco. E-cigarettes are now the UK’s preferred smoking cessation aid.

Research evidence derived from systematic reviews is strongly supportive of the effectiveness of smoking cessation programmes among people with severe mental illness (Peckham et al., 2017a), and a large scale trial of this is underway in the United Kingdom with the results anticipated in 2019 (Peckham et al., 2017b).

Access to stop smoking services for people with severe mental illness is variable in the UK (McNally and Ratschen, 2010), but the gold standard is provision of the National Centre for Smoking Cessation and Training evidence-based combination of a behavioural support programme and smoking cessation medication. The NCSCT advises that stop smoking services should be willing to work with people who want to vape to help them give up smoking, and especially so with people who have previously tried but not managed to quit by using licensed stop smoking medicines (National Centre for Smoking Cessation and Training, 2016). Recent research has confirmed that behavioural support with e-cigarette use is more effective for smoking cessation than when behavioural support is used in conjunction with nicotine replacement medication (Hajek et al., 2019).

**Future developments**

Consensus has now started to emerge from the debate surrounding vaping. Increasingly, leading health organisations are concluding that vaping is safer than smoking and should be considered a useful aid to smoking cessation. The UK’s strict Tobacco and Related Products Regulations help ensure consumers have a degree of protection in place and we anticipate it is only a matter of time before a manufacturer puts forward a proposal to make their e-cigarette products a medicinal, prescribable smoking cessation aid in the UK.

It is imperative for clinicians, healthcare settings and policy makers to develop an understanding of the differences between vaping and tobacco smoking. Although Public Health England has provided guidance on how vaping is dealt with in public, clearer national policies or laws need to be implemented to determine how vaping is dealt with in settings such as leisure facilities, work places and on public transport.

National vaping regulations will need to be reviewed and amended in a timely manner to ensure policy can keep apace with technological developments and to avoid it being overly restrictive to a point that it discourages development of newer, healthier e-cigarette products, for example with fewer toxins, or a more stable nicotine content. Some e-cigarettes already have sensors in them to give users quick, easy access to data on their vape consumption. If these increase in popularity and if this information is reliable, it could be shared with clinicians to assist their vape history-taking and advice-giving in their role as advocates of smoking cessation.

However, e-cigarette developments need to be balanced with the vaping industry taking responsibility to stop using marketing, packaging and flavours that appear blatantly directed toward young people (Pepper et al., 2016). Smoking is a major source of ill health and contributes to health inequalities among people using mental health services. Clinicians and services have a responsibility to address smoking and to work alongside people to help them to cut down or quit. Being aware of vaping and ensuring that policies reflect the rapidly evolving knowledge regarding electronic nicotine products are important aspects of this responsibility. When used safely and with support, then vaping can be a useful adjunct to smoking cessation in mental health services.

----------------------------------------------------------------------------

**Learning aid**

E-cigarette glossary

|  |  |
| --- | --- |
| **word** | **definition** |
| aerosol | The scientific term for e-cigarette emissions |
| analogue | A term used by vapers meaning a cigarette |
| carts | Abbreviation of e-cigarette cartridges |
| e-cig / e-cigarette | Abbreviation of electronic cigarette |
| e-liquid | The fluid placed in e-cigarettes before it is converted to vapour |
| ENDS | Electronic Nicotine Delivery System |
| juice | See e-liquid |
| mod | A modified e-cigarette |
| Personal vapouriser (PV) | e-cigarette |
| To vape | To use an e-cigarette |
| vaper | A person who uses an e-cigarette |
| vapouriser | e-cigarette |

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**MCQs**

Select the single best option for each question stem.

1 What is the range of nicotine content permitted for e-cigarette liquids sold in the EU?

            A 5 -20 mg/ml

            B 10-40 mg/ml

            C 0-35 mg/ml

            D 5-15 mg/ml

            E 0-20 mg/ml

2 Which of the following statements about vaping is false?

            A It is less harmful to health than tobacco products

            B Vapers’ tongue is a known side-effect

            C It is recognised as an aid to quitting

            D It is more expensive than smoking

            E Vaping is permitted in some UK hospital

3 When a patient wants to switch to e-cigarettes to help them give up smoking, which of the following should you consider doing?

            A Asking about vaping usage

            B Supporting the option of using an e-cigarette to aid smoking cessation

            C Offering behavioural support

            D Promoting additional NRT product use

            E All of the above

4 Which of the following is true? Taking a good vaping history identifies

            A Frequency, device used, amount of liquid used

            B Frequency, device used, strength of nicotine in liquid used

            C Device, strength of nicotine, amount of liquid used

            D Device, technique, amount of liquid used

            E Frequency, device, technique

5 Which of the following statements is false because it does not reflect current evidence regarding vaping in the UK?

            A Vaping is considered 80% safer than smoking

            B There is limited evidence available on long-term risks associated with vaping

            C E-cigarette products and e-liquid contents are regulated

            D E-cigarettes cannot be prescribed as an aid to stop smoking

            E E-cigarettes are the most commonly used smoking cessation aid in the UK

**MCQ Answers**

1E 2D 3E 4B 5A