Will Smoking Meet its Match?

Continued investment in public health programmes and smoker-centred support services, coupled with the optimal use of ‘stop smoking’ medicines and well-regulated e-cigarette supply, could stop UK tobacco smoking in the 2040s

Summary

- Stopping tobacco smoking is a vital public health priority, nationally and internationally. Smoking is a uniquely destructive phenomenon. It killed a hundred million people in the second half of the twentieth century and disabled many more. In Britain today smoking is the major cause of class-linked health inequalities. World-wide, it will kill up to a billion men and women during this century, unless more effective action is taken to prevent it.

- Cigarettes kill about half of all long term smokers and disable many of their surviving users. Smoking causes conditions ranging from lung, oesophageal and bladder cancers to vascular diseases and events such as heart attacks and strokes, dementias, rheumatoid arthritis and macular degeneration, the leading cause of sight loss in people aged over 50.

- Nicotine causes addiction to tobacco smoking. But other components of tobacco smoke are the known causes of diseases such as lung cancer and COPD, and events such as heart attacks. Although nicotine addiction may exacerbate some forms of mental distress, the nicotine in tobacco is not the immediate cause of smoking related death and disability.

- In England smoking rates in adults have fallen from some 60 per cent of adults at the start of the 1950s to about 18 per cent today. They are still declining in adults and younger people. However, while some 600,000 people stop smoking each year approaching 300,000 start using tobacco, nearly all of whom are in their teens or early twenties.

- The number of cigarettes being sold in England is relatively stable. People who remain smokers today may be more addicted to nicotine than those who have already quit, and so find it harder to stop smoking.

- About half of all quit attempts are made without the use of medicines or other aids, including e-cigarettes. Nicotine replacement and other stop smoking medicines work by relieving cravings for nicotine and giving individuals time to free themselves from the behavioural aspects of smoking.

- There is established evidence that combinations of prescribed medicines and psychological support supplied via NHS Stop Smoking Services or similar professional sources are more likely to facilitate successful quit attempts than other approaches. There is also recent preliminary, not yet conclusive, evidence that using e-cigarettes in supported quit attempts may prove similarly successful. However, at present approaching 90 per cent of e-cigarette users at any one time report continuing tobacco smoking alongside ‘vaping’ and a majority of those who try e-cigarettes stop using them in favour of a return to smoking.

- Non-tobacco nicotine products that are not licensed as medicines do not have to undergo extensive trials. Yet when well manufactured and appropriately marketed e-cigarettes are safe as compared to ‘combustion based’ tobacco products. There is evidence that their use can substitute for smoking and support quit attempts. In Sweden the ‘Snus’ example demonstrates the fact that alternative ‘non-combustion’ based approaches to nicotine delivery can improve public health.
Recent data indicate that e-cigarettes and other unlicensed products promoted an additional 20,000 successful attempts to stop smoking in 2013/14, over and above those which would otherwise have occurred. There are up to 2 million UK ‘vapers’. The number of current smokers using e-cigarettes is now falling, although the number of ex-smokers using them is still rising. Few people who have never smoked use such products.

Some individuals are passionate about the value of e-cigarettes and allied products. Yet there is also evidence that many smokers do not find that ‘vaping’ relieves their craving for tobacco. When this extends the periods during which there is tobacco smoking combined with nicotine use from other sources it is likely to prove less beneficial to health than many consumers hope, unless it opens the way to permanent cessation.

Alone, neither e-cigarettes nor stop smoking medicines can provide ‘magic’ solutions to the problem of tobacco smoking and the harm it causes to individuals, families and communities. If smoking is increasingly confined to relatively small socially and economically disadvantaged groups and self-purchased e-cigarettes use is believed to be a safe and affordable alternative for those who want to protect their health, there will be a danger that the public provision of optimally effective Stop Smoking Services will, unless national action is taken, continue to decline to the detriment of public health.

The number of people using NHS Stop Smoking Services and setting a quit date dropped by 25 per cent between 2011/12 and 2013/14. Recent figures suggest this fall is continuing, and that the decline between 2011/12 and 2014/15 could reach 50 per cent. Such falls have coincided with an increased use of e-cigarettes and NHS re-organisation. Factors such as insufficient investment in advertising to stimulate the use of professional stop smoking support may be significant.

There is a strong public interest case for maintaining optimally effective Stop Smoking Services in every locality, and improving their appeal to people who are unlikely to be able to stop smoking without such help. One challenge to address is that of the ‘failed quitter’ syndrome, which could discourage the uptake of formal cessation services and stop smoking medicines.

There is also a powerful case for improving the use of Nicotine Replacement Therapies (NRT) and other smoking cessation medicines. At present treatments are often under-used in ways that mean that the doses received fail to provide clinical benefit. One way forward is to encourage combination treatments. There could in addition be benefits to be derived from the development of medicines designed to satisfy smokers’ cravings more fully than is presently possible.

Disputes between groups within the public health community about issues relating to smoking cessation and harm reduction using either e-cigarettes or licensed medicines may damage their collective ability to inform policy. From a public interest perspective it is important to seek to optimise the use of all the methods available to pursue the goal of stopping smoking and cutting premature death and disability rates.

In Europe the implementation of the 2014 revised Tobacco Products Directive (TPD) will introduce controls on vaping fluids and products and further regulate their promotion. But without additional actions this will not assure the manufacturing quality of e-cigarettes and allied products, or provide the level of safety protection that medicines regulations offer.

A ‘smoker centred’ approach to stopping smoking in Britain could effectively end the tobacco pandemic in England during the 2040s. Today the most pressing health policy objective is to as rapidly as possible reduce the incidence of conditions such as cancers and COPD associated with cigarette smoking by all effective means available.

It is important to respect individual preferences with regard to using drugs such as nicotine for leisure or related reasons. However, if ‘health’ is seen as achieving a state of optimal mental, physical and social wellbeing, as distinct from simply being free of diagnosed disease, then facilitating mass nicotine addiction throughout the twenty first century could prove a sub-optimal societal choice.
Introduction

Cigarettes have been described as ‘the deadliest artefact in human history’ (Proctor, 2011, 2013). Tobacco has been smoked by people in the Americas for thousands of years, and in Europe, Asia and other regions for approaching half a millennium. But it was only during the twentieth century that easy access to cigarettes made tobacco smoking’s potential to harm human health fully manifest.

The key drivers underlying this transition included nineteenth century innovations in tobacco plant growing and leaf curing – which reduced smoke’s irritant properties and allowed frequent deep lung inhalation of nicotine doses – and the introduction in 1880 of James Bonsack’s pioneering cigarette making machine. Before this cigarettes were hand-rolled. A skilled individual could at best only make between one and two thousand in a long working day. By contrast, a single Bonsack machine could make hundred and twenty thousand a day.

The stresses and social changes associated with World Wars I and II also helped to promote cigarette smoking in men and subsequently women in Europe and North America. It was initially a habit of the relatively successful. By the late 1940s 65 per cent of British males used cigarettes. Another 20 per cent or so used pipes or alternatives like cigars. Smoking rates in British women reached their zenith of 45 per cent in the mid-1960s and have since declined less rapidly than has been so in men. This helps explain why the incidence of lung cancer in females is now at a peak in the UK, while in males it has fallen markedly since the end of the 1970s.

The mass production driven tragedy of modern smoking is such that in the period from the end of the 1940s to the start of the 2000s it is thought to have resulted in 100 million premature deaths world-wide. Some estimates suggest it could be responsible for a billion further early deaths in the present century, unless effective ways to curb tobacco smoking and the early mortality it causes are introduced in all parts of the globe.

Smoking in addition causes many of its survivors to have to live with cardiac, pulmonary, musculoskeletal and other disabilities. No other legally available consumer product, when used in accordance with its maker’s instructions, kills around half of its long term users and ultimately disables many of the remainder. In countries such as Great Britain and the US, which because of their relative wealth and early socio-economic development experienced the full impact of the ‘tobacco pandemic’ before other nations, the negative impacts of smoking were so great that until recently they effectively counterbalanced the health benefits attributable to all the pharmaceutical innovations made since the 1940s.

Against this background, and that of the development of today’s smoking cessation medicines and the social and psychological support programmes available for smokers wishing to stop, the recent introduction of e-cigarettes (which were initially marketed in the Chinese People’s Republic in 2004, and have been sold in the UK since 2007) and the planned release of other new nicotine delivery systems designed for leisure/pleasure use offers both important opportunities for, and possible threats to, public health improvement. The emergence of large scale e-cigarette use – there are now about 2 million ‘vapers’ in the UK alone (ASH, 2014) – presents challenges for not only policy makers but also other stakeholders, from pharmaceutical companies to health professionals such as pharmacists and GPs.

Damage to public interests could result from either the over-regulation of this still new phenomenon, or an unduly lax approach to controlling the quality and promotion of non-tobacco nicotine delivery systems supplied as consumer goods rather than medicines. The objective of this UCL School of Pharmacy analysis is to identify and discuss in the light of the available evidence the main issues to be resolved in relation to supplying, marketing and using all forms of non-tobacco nicotine licensed products to best effect, in order to promote better health without incurring avoidable harm.

In the wake of events such as, for example, the 2014 Moscow Conference of the Parties to the WHO Framework Convention on Tobacco Control conference (Box 1) it also seeks to identify actions that will maintain international progress towards freedom from tobacco smoking. From a public health perspective stopping smoking is a less complex challenge than that of combatting more multi-faceted problems such as obesity and excessive alcohol or illicit drug use (Kelly, 2014). Yet despite this and recent progress towards smoking rate reductions in wealthier nations, no other single public health goal is more important in countries like the UK or in many if not all emergent economies.

The introduction of electronic cigarettes has arguably served to focus new energy on the issue of how tobacco smoking related disease can be further reduced. A central conclusion of this analysis is that no single approach will be able to resolve the problem of tobacco smoking. In part because they have (to date at least) only a limited capacity to satisfy many smokers’ cravings for nicotine and the other perceived rewards of using tobacco,
The FCTC is a pioneering international treaty established under the auspices of the World Health Organisation. Its origins date back to the 1980s. But it did not formally come into force until 2005. Presently there are 180 Parties to the FCTC – only a very small minority of the WHO’s total membership have neither signed nor ratified it. Such countries include tobacco producers like Indonesia and Zimbabwe. Seven nations signed the Convention but have not yet ratified it. The most prominent of the latter is the US, in part because of Constitutional concerns.

The FCTC is of unique value in the global public health arena. It places binding legal obligations on its Parties and has hence helped to drive the implementation of progressively more effective and comprehensive policies aimed at reducing tobacco smoking rates on a world-wide basis. The extent to which regulating e-cigarette supply and use lies within its mandate is currently controversial.

In areas such as smoking related harm policy development and implementation the FCTC has not as yet been as successful as some authorities have wished. To date the UK is the only country in the world in which harm reduction defined in terms of substituting the long term ingestion of relatively safe nicotine alternatives to smoking tobacco is a clearly stated element of government tobacco control strategy.

The October 2014 Moscow meeting (the 6th session of the Conference of the Parties to the FCTC) was closed to independent public reporting. However, WHO press releases reported progress in areas such as developing new approaches to tobacco product taxation. With regard to ENDS (electronic nicotine delivery systems) there was support for controlling the marketing of such items to children and the wider public, and for regulating manufacturing quality in order to as far as possible minimise hazards. The final conference Declaration called on the Parties present to strengthen international collaboration on tobacco control and set a voluntary global target of a 30 per cent smoking prevalence reduction by 2025.

But despite this agreement there was in the months before the 2014 FCTC conference high profile correspondence between conflicting expert groups and the WHO Director General Margaret Chan relating to a background paper advocating a precautionary approach to vaping/e-cigarette use (Grana et al, 2013). Some contributors expressed concerns that excessively cautious regulatory approaches could delay progress towards reducing smoking rates (Abrams et al, 2014a; Abrams et al, 2014b; Aktan et al, 2014). This incident has underlined the need for rationality and respect for evidence with regard to achieving overall public health goals in this area of public policy formation.

Box 1. The WHO Framework Convention on Tobacco Control (FCTC)

The FCTC is a pioneering international treaty established under the auspices of the World Health Organisation. Its origins date back to the 1980s. But it did not formally come into force until 2005. Presently there are 180 Parties to the FCTC – only a very small minority of the WHO’s total membership have neither signed nor ratified it. Such countries include tobacco producers like Indonesia and Zimbabwe. Seven nations signed the Convention but have not yet ratified it. The most prominent of the latter is the US, in part because of Constitutional concerns.

The FCTC is of unique value in the global public health arena. It places binding legal obligations on its Parties and has hence helped to drive the implementation of progressively more effective and comprehensive policies aimed at reducing tobacco smoking rates on a world-wide basis. The extent to which regulating e-cigarette supply and use lies within its mandate is currently controversial.

In areas such as smoking related harm policy development and implementation the FCTC has not as yet been as successful as some authorities have wished. To date the UK is the only country in the world in which harm reduction defined in terms of substituting the long term ingestion of relatively safe nicotine alternatives to smoking tobacco is a clearly stated element of government tobacco control strategy.

Box 1. The WHO Framework Convention on Tobacco Control (FCTC)

The FCTC is a pioneering international treaty established under the auspices of the World Health Organisation. Its origins date back to the 1980s. But it did not formally come into force until 2005. Presently there are 180 Parties to the FCTC – only a very small minority of the WHO’s total membership have neither signed nor ratified it. Such countries include tobacco producers like Indonesia and Zimbabwe. Seven nations signed the Convention but have not yet ratified it. The most prominent of the latter is the US, in part because of Constitutional concerns.

The FCTC is of unique value in the global public health arena. It places binding legal obligations on its Parties and has hence helped to drive the implementation of progressively more effective and comprehensive policies aimed at reducing tobacco smoking rates on a world-wide basis. The extent to which regulating e-cigarette supply and use lies within its mandate is currently controversial.

In areas such as smoking related harm policy development and implementation the FCTC has not as yet been as successful as some authorities have wished. To date the UK is the only country in the world in which harm reduction defined in terms of substituting the long term ingestion of relatively safe nicotine alternatives to smoking tobacco is a clearly stated element of government tobacco control strategy.

Box 1. The WHO Framework Convention on Tobacco Control (FCTC)

The FCTC is a pioneering international treaty established under the auspices of the World Health Organisation. Its origins date back to the 1980s. But it did not formally come into force until 2005. Presently there are 180 Parties to the FCTC – only a very small minority of the WHO’s total membership have neither signed nor ratified it. Such countries include tobacco producers like Indonesia and Zimbabwe. Seven nations signed the Convention but have not yet ratified it. The most prominent of the latter is the US, in part because of Constitutional concerns.

The FCTC is of unique value in the global public health arena. It places binding legal obligations on its Parties and has hence helped to drive the implementation of progressively more effective and comprehensive policies aimed at reducing tobacco smoking rates on a world-wide basis. The extent to which regulating e-cigarette supply and use lies within its mandate is currently controversial.

In areas such as smoking related harm policy development and implementation the FCTC has not as yet been as successful as some authorities have wished. To date the UK is the only country in the world in which harm reduction defined in terms of substituting the long term ingestion of relatively safe nicotine alternatives to smoking tobacco is a clearly stated element of government tobacco control strategy.
especially if the specifications and manufacturing quality can be adequately regulated and it leads to a complete as opposed to a merely partial cessation of combustion based tobacco product usage;

- second, given the political difficulties often revealed when controversial issues such as whether or not it is appropriate to condone the use of addictive substances in ways likely to benefit individual users are discussed, it is important to as far as possible prevent or heal divisions in the public health community relating to the use of e-cigarettes and/or any other type of unlicensed nicotine delivery system for harm reduction\(^1\) as opposed to cessation support purposes; and

- third, notwithstanding the above, there is reason to argue that in the long term communities will collectively benefit more from minimising and wherever reasonably possible eliminating all forms of nicotine addiction than they would from encouraging the indefinite commercial exploitation of non-tobacco nicotine containing products for other than medicinal purposes. However, awareness of this should not be permitted to conflict with the immediate (public) health priority of stopping tobacco smoking.

Aspects of these and related issues are discussed later in this report. But with regard to the safety of e-cigarettes it is appropriate to note here that as long ago as the start of the seventeenth century King James V1 of Scotland and I of England observed in his 1604 *Counterblaste to Tobacco* (which was published only a few years before he accepted the financial case for growing tobacco plants in the then new British colony of Virginia) that inhaling polluted air of any kind is unlikely to be good for health.

Recent research has drawn attention to the fact that early generations of ‘e-cig juice’ and the vapour it produces contain trace amounts of various carcinogens and other irritant substances. There is also evidence that ‘over-heating’ such fluids can cause relatively high levels of hazardous chemicals – most notably formaldehyde (Jensen et al, 2015) – to be produced. Other health related problems may also emerge (Sussan et al, 2015).

Even so, there is no substantive reason to contradict the belief that e-cigarette and allied product use is very much safer than the equivalent use of conventional cigarettes to obtain a given dose of nicotine, especially if robust product quality regulations are in place (RCP, 2014; Bullen et al, 2013; Hajek et al, 2014; Kelly, 2014).

Current best estimates are that the direct risks involved in vaping, broadly defined, are probably about a twentieth of those associated with smoking per se (West et al, 2014a). Some sources suggest that even this may prove a high figure (Burstyn, 2014; Bates, 2014). Although e-cigarettes sold as consumer products are not subject to the trials and post marketing surveillance that NRT and other licensed medicines undergo, a logically based recognition of the case in favour of the relative safety of their use as compared with tobacco smoking is a requisite for any constructive policy dialogue. Despite the lack of controlled trial data the available information also indicates that – over and above harm prevention – e-cigarette use can in favourable contexts facilitate smoking cessation (Etter and Bullen, 2014; Brown et al, 2014; Public Health England, 2014).

Finally, with regard to the politics of nicotine addiction, access to the ‘safe’ smokeless tobacco product Snus in Sweden has since the 1970s been linked to a lowered incidence of conditions such as lung cancer, despite high overall rates of habitual/addictive nicotine use (Ramstrom, 2013). Younger non-smoking Swedes currently appear to be increasing their use of this product, despite cosmetic and other potential disadvantages. The fact that in other parts of the European Union Snus is banned while ‘normal’ tobacco products remain on free sale serves as an illustration of the difficulties political policy makers can have with adequately understanding smoking related harm and the related but distinct issue of nicotine addiction, and taking honestly informed action to protect public health interests.

Similar concerns apply to the public health community. Failures to rationally understand the balance of public interests between, on the one hand, preventing the premature mortality and avoidable disability caused by smoking and, on the other, protecting individual and community freedom to use drugs like nicotine when that is desired and relatively safe could undermine the capacity of the public health lobby to effectively inform policy making and support desirable social change.

\(^1\) This can for the purposes of this report be defined as seeking to reduce the adverse health and other consequences of legal or illegal psychoactive drug use without necessarily reducing consumption of the active substance itself.
Smoking, health and nicotine

Since the publication of the Royal College of Physicians report ‘Smoking and Health’ (RCP, 1962) at the start of the 1960s, tobacco smoking rates in the Britain have fallen by approaching two thirds. In England the latest available figures indicate that today about 18 per cent of the adult population smokes cigarettes – see Figure 1. This implies a current total of in the order of 8-9 million people of all ages whose health remains at risk as a result of their being tobacco product users in England, and approaching 10 million UK wide.

Despite the positive progress of the last half century about 80,000 people a year still die of smoking related diseases in England alone. The equivalent UK figure is 100,000, or one in every six deaths. Many more individuals suffer disabling conditions as a result of tobacco use – see Box 2. Smoking rates remain highest in the poorer and less educated sections of the British community (Figure 2). Variations in tobacco use patterns can in most OECD nations be taken represent the largest single cause of social class related health inequalities.

The available research also indicates that each year around three million adults aged over 18 in England report trying to stop smoking, and that up to 600,000 succeed. Yet because approaching 200-300,000 other people – most of whom are in their teens or early twenties – become smokers every year, the net figure for

Figure 1. Proportion who smoke cigarettes, proportion of smokers who have quit, and the proportion who have never smoked cigarettes, Great Britain, 1974-2015

Box 2. Smoking related diseases and their economic costs

Lung cancer, which in 80-90 per cent of cases in the UK is caused by tobacco smoke inhalation, is perhaps the best known example of smoking related disease. But cigarette and other combustion based tobacco product use is also responsible for oral and oesophageal cancers and those of, for instance, the bladder. Smoking is also a dominant cause of COPD and can contribute to the morbidity associated with conditions such as asthma and diabetes.

In the case of vascular disorders it markedly increases the chance of individuals suffering myocardial infarctions and peripheral vascular disease. It has also been estimated that a man or woman who smokes 20 cigarettes a day is at a six-fold greater risk of having a stroke than a similar individual who is a non-smoker.

Other examples of common conditions in which smoking can play a major role include male impotence, rheumatoid arthritis and macular degeneration. Despite the development of better pharmaceutical treatments, the latter affects around 500,000 people in the UK alone and remains the most common cause of acquired blindness in people aged over 50 years. Smoking is also implicated in up to a third of broadly defined dementia cases.

In the past many governments in even relatively affluent States took the view that because tobacco sales are used to raise taxes and tobacco use normally kills people at around or after the time they start to draw their pensions smoking is ‘economically’ desirable. Some tobacco industry funded commentators were still arguing this at the start of this century (see, for instance, Arthur D Little International, 2000) and such views may be believed by some observers in countries like, say, India even today. But such analyses fail to take into account the full costs of smoking related sickness and disability, including the harm and suffering caused to families by premature deaths, and ignore the ethical obligations of States to protect all their citizens and promote good health.
The decline in the number of cigarette users in England has recently averaged in the order of 300,000. When expressed as a percentage of the total adult population, the overall number of smokers is presently falling by about 0.7 per cent per annum. This is consistent with 5-7 per cent of existing smokers successfully quitting every year, but with others moving forward to take their places.

According to recent Smoking Toolkit Study (see West and Brown, 2012) estimates, access to e-cigarettes may have promoted some 20,000 successful attempts to stop smoking in England in 2014 (West et al, 2015). But at any one time the great majority of e-cigarette users continue to smoke tobacco (Figure 3). At present the use of self-purchased e-cigarettes in efforts to stop smoking is more strongly correlated with a positive outcome than is so in the case of NRT purchased from every day sales outlets, as distinct from products being supplied via a supportive professional source. But this should not be seen as an inherent attribute of either NRT or e-cigarettes. Differences in the outcomes associated with self-purchased use may not be sustained in the longer term, after today’s context has changed and if and when ‘vaping’ has been fully normalised amongst people who intend to go on using nicotine.

The record of affluent States other than Britain with regard to stopping tobacco smoking is also relatively encouraging. If current trends are projected forward it appears possible if not probable that countries like England could – with sufficient investment in stopping smoking – become effectively ‘tobacco smoking free’ during the 2040s. Yet globally the number of smokers is still rising. Currently, some 5-6 million people die prematurely because of cigarette and other smoked tobacco product use each year. This number will go on rising unless effective protective measures are taken.

Such realities underline the importance of understanding why, despite its dangers, tobacco use continues to be popular in many societies and amongst some groups of people in particular. The reasons for this include the marketing power and social influence of cigarette and other tobacco product producers, sociological variables presently in part linked to the need for members of less advantaged and on occasions stigmatised sub-groups to defend their identities (see, for instance, Graham, 2011) and the biological impacts of nicotine in humans.

**The pharmacological properties of nicotine**

Nicotine can be extracted from tobacco and other plants belonging to the genus Nicotiana of the Solanaceae (nightshade) family. It is a plant alkaloid (a naturally synthesised nitrogen containing chemical) named after a French ambassador to Portugal called Jean Nicot de Villemain. He introduced tobacco into France some 450 years ago.

Nicotine was first isolated in pure form in the early nineteenth century. In nature its toxicity enables it to act as a biological weapon against insects. (Most early medicines were also based on substances that evolved in plants because of their need to either defend themselves from microbes and members of the ‘Kingdom Animalia’, or compete against other forms of vegetation.) However, in humans the amount of nicotine ingested as a result of smoking is limited, and is in normal circumstances automatically kept below the level regarded as inherently hazardous.

This explains why nicotine itself is not a direct cause of smoking related disease in men and women. It binds closely to a class of neurological structures known as...
nicotinic acetylcholine receptors. In relatively low doses such as those typically obtained from smoking cigarettes it acts as a neurotransmitter and a stimulant that can help with concentration (Chapman and Wu, 2014; Dawkins and Corcoran, 2014).² It also causes the release of non-nicotinic neurotransmitters, including dopamine and adrenaline, in the nervous system, and influences the actions of the hunger regulating neuropeptide hormone ghrelin. It is as a result of effects associated with the latter that giving up smoking can promote weight gain.

In most instances nicotine enhances (agonises) the action of acetylcholine, so transmitting signals on to other brain centres. In some others it acts as an inhibitor (antagonist). Even brief human exposures to nicotine can change the expression of nicotinic acetylcholine receptors on the surfaces of neurones in the brain for indefinite periods, and so affect the balance of positive (rewarding) and negative feelings experienced by individuals. It is this closely targeted and potentially long term impact on reward/reinforcement mechanisms which makes nicotine highly addictive and marks its use out as being in biological terms a different phenomenon from that of people taking caffeine or alcohol on a regular basis.

The latter, for instance, has generalised sedative actions and is not comparable with nicotine in terms of its addictiveness. Unlike the situation with nicotine, mammals have over many millions of years evolved to metabolise alcohol. While for most people drinking, say, coffee or beer is likely to be – even after they have become used to such beverages – primarily reward and so arguably free choice driven, ‘habitual’ nicotine intake is more probably associated with the anticipation of negative feelings.

Individual and community wide responses to any drug vary. They depend on genetically determined factors and learned behaviours, acquired psychological differences and socially engendered expectations. However, the sensations of pleasure or relaxation that people who are accustomed to using nicotine report can in part be seen as relief from the unwanted sensations caused by falling plasma levels of the substance. That is, the ‘pleasure’ of smoking reflects a recovery from withdrawal symptoms rather than a positive reward.

Nicotine has a ‘half-life’ in the body of around two hours. This is comparable to that of short acting benzodiazepine drugs. These act on gamma amino butyric acid (GABA) receptors in the brain. Although taking benzodiazepine tranquillisers is arguably safe as compared with smoking and can be experienced as pleasurable, no society encourages their sale for leisure use, not least because of their addictive properties. Similar arguments apply in the context of opiate supply. However, for the purposes of this analysis it should be noted that neither opiates nor benzodiazepines have nicotine’s concentration enhancing effects.

There is some evidence that a smoker’s mental state is likely to improve after they stop smoking (ASH, 2014), although this is not to deny the subjective reality of smoking (and vaping) enjoyment.³ McDermott et al (2013) found in a six month follow up study of nearly 500 smokers attending NHS smoking cessation services that anxiety levels fell significantly from base line amongst those able to stop smoking. In ‘failed quitters’ they rose. The authors concluded that their data contradicts the view that smoking is a stress reliever. They in addition observed that trying to stop smoking but being unable to do so can cause additional psychological distress. This is particularly likely to be so in circumstances experienced as judgemental by would-be quitters.

Such interpretations are reinforced by findings like those of Grucza et al (2014), who noted that smokers have a raised rate of suicide as compared with non-smokers. Whether or not this relationship is causal is unproven. Nevertheless, these authors studied the impacts of US State level public health interventions like raising tobacco excise duties and introducing smoke-free air laws, and found that suicide rates fell in line with tobacco smoking rate declines in the 1990s and early 2000s. Their observations are also consistent with the view that although smoking is subjectively experienced as pleasurable and stress relieving, in fact it has negative impacts on the mental wellbeing of at least some tobacco users. Nicotine addiction lies at the root of such relationships.

**Nicotine delivery**

The introduction of e-cigarettes and allied nicotine delivery systems stems from the work of a Beijing based Chinese pharmacist called Hon Lik (whose father had previously died of lung cancer) in and after 2003 (Pauly, 2007; Besaratinia and Tommasi, 2014). It was also linked to the development of small yet relatively highly powered

---

² Some reports have claimed that using nicotine reduces the risk of developing Parkinson’s Disease. However, this is unproven. Other possible benefits relate to fields such as weight management and the suggestion that a minority of individuals ‘need’ nicotine to maintain their psychological stability for reasons other than managing a strongly established addiction. The view taken here is that if such clinical as distinct from broader social benefits can be demonstrated modern societies should govern the use of all addictive and potentially toxic drugs via regulating their use as medicines, rather than permitting their provision as ‘normal’ consumer goods.

³ ASH also points out that for every year individuals continue smoking after the age of 35 they lose three months life expectancy. ASH was founded by the Royal College of Physicians in 1971, almost ten years after the publication of its seminal report Smoking and Health and in response to a perceived cross-political unwillingness to intervene to save lives in the UK (RCP, 2012). The earliest major governmental acknowledgement of the harm caused by smoking was the provided 50 years ago by the publication of the 1964 US Surgeon General’s report on the health consequences of smoking (Surgeon General, 2014).
lithium-ion batteries. The innovation process leading to their low cost availability from the 1990s onwards for powering mobile electronic devices was (at least by way of analogy) to e-cigarettes and related products what the development of the Bonsack cigarette making machine was to conventional cigarettes manufacturing a hundred years earlier. It opened the way to their affordable production and supply on a mass scale.

As is now widely understood, e-cigarettes and allied devices use lithium-ion batteries to heat and vapourise a (typically) propylene glycol or glycerine based liquid containing nicotine and additives such as flavouring agents. They are breath activated and simulate tobacco smoking to varying degrees. Such systems may either be sold as sealed disposable units or constructed in ways that enable users to individualise their operational characteristics and the liquid vapourised and then inhaled.

As battery technology continues to improve and further developments in vaping device design take place it may be that such products will in future – regulators permitting – be increasingly able to deliver nicotine via the alveoli in the lung. This would allow the rapid arterial transport of nicotine to the brain characteristic of the drug ‘hit’ experienced by conventional cigarette users. However, at present they act mainly to deliver nicotine via buccal cavity, tracheal and bronchial absorption. This means that the drug enters through the venous system and that concentration levels build up relatively slowly in the brain. This to varying degrees mirrors the actions of NRT medicines ranging from patches and gums to inhalators and rapidly dissolving strips.

The extent to which the rapid delivery of nicotine to the brain increases the attractiveness or addictiveness of tobacco smoking as compared with other forms of nicotine ingestion is not fully understood. Although, for instance, there is an association between high levels of nicotine intake and observed addictive behaviours, this does not necessarily mean that fast delivery leading to a sharp peaking in plasma levels makes tobacco smoking uniquely satisfying or dependence inducing.

However, it is worth stressing that to date the objectively assessed performance of e-cigarettes and other new products in terms of nicotine delivery has been variable, and typically not equivalent to that of both ‘real’ cigarettes and some if not all NRT medicines. The data in Figure 4 illustrate this in relation to Voke, a non-electronic nicotine inhaler product recently licensed as a medicine in the UK that is being developed by a subsidiary of British American Tobacco.

Accomplished users of early generation e-cigarettes may achieve relatively high plasma levels by adopting a

**Figure 4. Mean venous plasma nicotine concentrations over time, Voke and various comparators**

![Figure 4. Mean venous plasma nicotine concentrations over time, Voke and various comparators](source: Public Assessment Report for Voke Nicotine 0.45mg Inhaler, MHRA 2014)
rapid ‘short puff’ smoking technique. Yet the fact that e-cigarettes in the hands of unskilled users can lack the capacity to deliver nicotine with the same efficacy as smoked tobacco products may help explain why over a half of the people who try them only do so once, and why the number of ‘vapers’ in England recently fell. On occasions supplying only modest levels of nicotine may permit them to act as a quitting aid. Yet if e-cigarettes and like products fail to satisfy smokers many will either return to tobacco use, or need to access more effective forms of NRT and/or other cessation support – see Box 3 and Fagerstrom and Bridgman, 2014.

When they are used appropriately and at recommended doses NRT medicines such as patches allow users to dissociate nicotine intake from the behaviours linked to ‘normal’ smoking. By contrast, e-cigarettes and related non-combustion nicotine delivery systems to varying degrees simulate or replace the latter. This implies that when the substitution of ‘safe’ for dangerous nicotine use is taken to be the key goal, choosing ‘pleasure pulled’ vaping may have advantages for a significant proportion of smokers. Using products other than medicines (which whether or not prescribed or supplied by professionals can carry traditional ‘problem treating’ health care associations) might also, at least in perceptual terms, protect people who want to stop smoking from the risk of being labelled a ‘failed quitter’ by others, or of judging themselves in a similarly negative manner.

There is what can be described as preliminary evidence indicating that e-cigarettes may in appropriate contexts be as effective in facilitating stopping smoking attempts as licensed medicines (McRobbie et al, 2014; HSCIC, 2015; West, 2014). Nevertheless, if ‘recovery’ from nicotine addiction is part of the intended end point of stopping smoking (which can bring benefits such as long term cost savings and freedom from identity harming ‘addiction stigma’) NRT and other medicines might for some people deliver better outcomes. This is especially likely to be so when they are taken in recommended amounts and/or in combinations, and with psycho-social support (Beard et al, 2015; Carpenter et al, 2013).

Clear evidence on many points such as this is lacking at present. But amongst people who believe – even if in part wrongly – that they will protect their health simply by cutting down on the number of conventional cigarettes they smoke rather than quitting altogether, using presentations that do not simulate smoking could have long term advantages. They might in time help more effectively than ‘ciga-likes’ or other vaping products that can be said to involve ‘ritual paraphernalia use’ to weaken the behavioural components of smoking in ways that allow a continuing shift towards first stopping tobacco use and subsequently ending substitute drug taking (Box 4).

Box 3. NRT and other Smoking Cessation Medicines

The development of nicotine replacement therapy (NRT) stemmed originally from Swedish efforts to maintain the functionality of submarine crews in the 1960s, after a smoking ban instituted by the Royal Swedish Navy. The first NRT medicine was launched in the form of a chewing gum in the 1970s. In the decades that have followed a wide variety of alternative presentations have been developed, from patches and sub-lingual tablets to nasal and oral sprays. There is robust evidence of their safety in use, and the fact that when provided with psychological support they can at least double the success of smoking cessation attempts as compared to unsupported efforts.

Pharmaceutical companies have also produced non-NRT smoking cessation support medicines. They work either by partially ‘switching on’ nicotinic acetylcholine receptors and so controlling the extent to which nicotine acts as a stimulant, or by moderating the later impacts of smoking on the brain’s reward systems. When provided with psychological and medical support the safety and efficacy of these prescription treatments is in aggregate similar to that of NRT. However, individuals may benefit differently from alternative medicines. It is possible that in future genetic and other tests will be available to differentiate between, for example, fast and slow nicotine metabolisers, and so allow more effective forms of smoking cessation drug use (Lerman et al, 2015).

All NRT products supply the drug via buccal cavity and allied venous absorption, rather than via the deep lung and quicker arterial passage to the brain (see main text). Some commentators suggest that pharmaceutical companies have been slow to produce more ‘satisfying’ high dose products for use by people who are either seeking to stop smoking or to reduce their total tobacco use.

Against this it may be argued that some regulators have been partly been responsible for slowing such innovation, not least because of their desire to ensure even dose delivery capabilities. In the UK the path to developing new smoking cessation medicines has been relatively clear because of the well informed approach of the MHRA. Yet perceived or actual restrictions elsewhere might have influenced decisions as to whether or not to invest in new generations of ‘stop smoking medicines’.

---

4 Nicotine users self-calibrate their drug intake, which is why dosing consistency may be a less important issue than some regulators appear to believe. Conventional cigarettes deliver more nicotine when drawn on deeply. This increases their burn temperature. But with some electronic nicotine delivery devices a long draw cools the heating filament and reduces the amount of drug delivered, as compared with using a multiple short-puff vaping technique. In other instances long draws may lead to over-heating and attendant risks. Some US commentators have on occasions advocated lowering the nicotine content of conventional cigarettes, in order to help wean smokers off the drug. The rationality of this approach is questionable. The reality is that such action is more likely than not to increase the number of cigarettes smoked, along with the amount of tar taken into the lungs with each unit of nicotine ingested. However a different logic may apply with regard to e-cigarette use.
Addiction to tobacco smoking is commonly regarded as having two discrete but mutually reinforcing components. The first is physiological dependence on nicotine. The second is psycho-social habituation to the act of smoking in defined settings, such as when drinking in a pub. These last effects can be much stronger than is sometimes understood. There is long standing research, for instance, that members of mining communities who found it very hard not to smoke when above ground had little difficulty in not doing so when working underground in environments where smoking could cause catastrophic accidents (Berridge, 2007).

The way in which NRT and other cessation medicines enable those taking them to stop using combustion based tobacco products is therefore usually regarded as involving a disassociation between the physically driven and psychologically and socially cued aspects of smoking. When used in adequate amounts NRT treatments can meet users’ physiological needs for nicotine, leaving them free to give up the behavioural aspects of their addiction. When this has been achieved they can then turn back to the challenge of stopping nicotine taking per se.

However, this is not necessarily the end-point that individuals mindful of both their health and the perceived benefits of continuing to take nicotine may rationally decide to seek. E-cigarette use for harm reduction alone stands outside the conventional stop smoking paradigm. It might well prove beneficial to individuals in the short term and perhaps to populations in the longer term. Yet it is also possible it will lead to extended periods of dual tobacco and ‘safe’ alternative nicotine delivery system use, as opposed to either total substitution or achieving full abstinence from nicotine use. There is evidence that the health gains from dual use are likely to be more limited than many ‘partial quitters’ desire.

It is also important to note that stopping smoking is more complex and less consciously rational in its nature than many ‘experts’ have in the past believed. Successful quitters do not necessarily go through an incremental process of cognitive change leading to smoking cessation. Rather, there can be a largely unconscious internal adjustment resulting in what may appear to be a sudden behavioural conversion.

Source: OECD 2014: Health at a Glance
National policy responses

Today, all high income countries recognise the well proven dangers of tobacco smoking at a governmental level and are to varying degrees taking action to protect their citizens. As previously noted, the UK’s performance has been relatively good in recent decades. Yet the data presented in Figure 5 indicate that within the EU it has not been exceptional. In the cases of some other comparator countries – such as, for instance, parts of the US and Australia – greater progress may have been achieved, notwithstanding concerns relating to monitoring data quality and comparability.

In Australia the reported adult smoking rate is now in the order of 12 per cent, with recent falls having been associated with both tax rises on tobacco products and (arguably) the introduction of standardised packaging. In the US the overall smoking rate is now just a little under 18 per cent. But in California and Utah the reported levels are more comparable with the Australian figure, as is the Swedish tobacco smoking rate.

There is a reasonable level of international harmony with regard to the services and public health interventions such as the price based strategies and requirements for no smoking areas needed to promote conventionally defined smoking cessation. Yet different countries have adopted sharply contrasting stances on facilitating public access to e-cigarettes and vaping based cessation.

At one extreme, nations such as Uruguay (which has a generally good health record, and has led the world in legalising cannabis supply), Brazil (which has enjoyed some successes in smoking cessation) and Singapore (which also has a draconian approach to controlling, for instance, cannabis use) have banned them. In other instances, including Australia and Canada, regulatory and public health agencies have warned against the use of unapproved nicotine delivery products and – albeit without visible success – called for their unregulated sale to be halted.

In settings like Europe there has in the recent past been support for requiring all nicotine delivery systems other than tobacco products to be licensed as medicines. (See, for example, MHRA, 2014.) But current policies in the US and in the European Union have now shifted towards alternative models of regulation, which accept that e-cigarettes and allied products will be best controlled as consumer goods which should be at least as easy to obtain as ordinary cigarettes. In America the FDA is now, having failed in attempts to control vaping devices as medicines, seeking to regulate them as tobacco products. However, some fear that this could impose avoidable burdens on the producers of items which if specified appropriately are very much safer than conventional combustion based tobacco goods like cigarettes.

In Britain steps have already been taken to strengthen controls on activities such as e-cigarette advertising (see, for example, CAP and BCAP, 2014). These are set to be further strengthened in the next few years. In the context of the UK legal powers established via the Children and Families Act 2014 (which prohibits smoking in private vehicles carrying children) will enable government action in areas such as controlling the age at which it is legal to purchase ‘leisure’ nicotine products other than tobacco goods.

Although providers of the latter will not be able to make the health claims permitted for licensed pharmaceuticals, or share the tax position enjoyed by medicinal products, they should be well placed within the regulatory structures now evolving to provide affordable goods to the public in ways designed to make them attractive. However, in European Union as a whole much will in future depend on the way in which the 2014 Tobacco Products Directive (TPD – see also page 17) is implemented from 2016 onwards, and the extent to which individual EU Member States elect to go beyond TPD requirements in areas such as regulating the manufacturing quality of e-cigarettes and later generation vaping devices and, for instance, controlling the ways in which vaping liquids are stored.

The exigencies of the single market make it seem likely that over time fairly uniform approaches will be adopted. Nevertheless, there is likely to be continuing public controversy as to balancing the value of relatively restrictive approaches to, for example, e-cigarette use in public spaces against the as yet unproven but nevertheless probable or possible public health advantages of providing smokers with extended, convenient and subjectively enjoyable, access to unlicensed nicotine presentations. The potential costs and potential benefits of precautionary as opposed to ‘liberal’ regulatory strategies are outlined below.

The case for caution

The proponents of comparatively ‘tight’ approaches to e-cigarette regulation emphasise the fact that the long term safety and efficacy of non-tobacco, non-medicinal, nicotine delivery products is yet to be established. They will not prove entirely harmless. Current e-cigarettes and vaping devices deliver, along with nicotine itself and the solvent and additives used, variable amounts of metallic and other pollutants in particulate form. Even breathing in propylene glycol alone (which manufacturers such as Dow Chemical warn has irritant properties) may over decades have unwanted consequences.

Added to this, children and perhaps others can be exposed to poisoning from ‘e-cig juice’, and there have been sporadic reports that (as in other contexts) problems like e-cigarette related lithium-ion battery accidents may
not on occasions have been fully reported. Perhaps more importantly, those urging caution also point out that early adopters of e-cigarette use may be unlike the main body of the smoking population.

In England the e-cigarette market is already showing signs of early maturation and static or falling overall user numbers (Figure 6). This observation may be consistent with the hypothesis that those smokers who most readily shifted to e-cigarettes were atypical, and the view that the ‘silver bullet’ promise of non-medicinal nicotine products to ‘sweep away ordinary smoking’ has in the excitement of their initial introduction sometimes been overstated.

In social settings in which most people have a growing and relatively sophisticated understanding of the lack of value associated with an ‘empty’ addiction to nicotine and a previously unavailable range of options for handling social and psychological insecurities (‘you are never alone with a mobile phone’ might be an apposite slogan for today’s context) the experienced desire for ‘cigarette-like’ items may be less than was the case in, say, 1940s or 1950s Britain. If this is the case, opening the way to the assertive commercial marketing of new strands of addictive nicotine delivery could be seen as a retrograde step.

Following on from this, concerns expressed by commentators favouring precautionary approaches to the regulation of vaping products include the possibilities that:

- in future the application of aggressive sales techniques to the provision of technically advanced ‘ciga-likes’ or other nicotine delivery systems will draw more children and psychologically vulnerable young adults into long term nicotine addiction. Given today’s social media, controlling the selling of such products will be at best difficult once vaping device producers have exhausted the potential of the ‘ex-smoker’ market. Perpetuating nicotine addiction may prove welfare reducing in itself, regardless of physical health risks. Some critics of vaping in addition suggest it might expose ‘tobacco naïve’ subjects to risks of not only becoming tobacco users but also – depending on their social situations – other forms of drug addiction (McKee, 2013). However, there is little or no firm evidence for supporting this last assertion;

- the widely criticised involvement of major tobacco companies in e-cigarette supply will provide them, especially if the public health community is divided over the issue of vaping, with opportunities for perpetuating tobacco smoking. For example, vapers might wrongly come to believe that the occasional use of ‘real’ cigarettes or cigars is virtually harmless. Alternatively, rather than using e-cigarettes to attract young adults into smoking, some tobacco interests might seek to convince people that smoking amongst individuals in their teens or twenties is ‘safe’ provided that they become vapers when they reach their thirties;

- the availability of e-cigarettes as leisure/pleasure goods will undermine smoking cessation efforts by ‘re-normalising’ smoking and weakening the effectiveness of measures such as banning smoking in public places. In addition, the availability of what might wrongly be seen as an entirely safe substitute for smoking could undermine the motivation of governments to finance smoking cessation programmes and pursue freedom from all harmful forms of nicotine addiction as a social priority, no least as smoking is increasingly confined to those groups that are least valued in society, and;

- successful e-cigarette marketing could reduce the commercial viability of new NRT and other smoking cessation support medicines. This could harm the interests of individuals and communities currently at the highest risk of tobacco smoking related mortality and morbidity.

Note: prevalence in use of e-cigarettes has taken a downturn.
In the latter context the sales of licensed ‘stop smoking’ pharmaceutical products have fallen in recent years, albeit such trends should not be exaggerated. The data presented in Figures 7 and 8 indicate that the numbers of quit attempts supported by the optimally effective use of stop smoking medicines and professional care has declined in the last few years. However, overall levels of NRT supply have not dropped as much as is sometimes suggested and rates of smoking reduction have been maintained, probably in part because public debate surrounding e-cigarette use has raised levels of dissonance (inner conflict) in the smoking population.

Even so, it should be a matter of concern to policy makers that the number of people using NHS Stop Smoking Services and setting a quit date dropped by about a quarter between 2011/12 and 2013/14 (HSCIC, 2014a). Provisional figures for the first half of 2014 show an additional drop as compared with 2013/14 (HSCIC, 2015). If these data are correct they indicate an overall decline between 2011/12 and 2014/15 of some 50 per cent in the use of the NHS Stop Smoking Service in England.

Whatever their causes and scale, reported falls in the use of NHS Stop Smoking services have received far less public attention than the rapid increase in vaping product item sales seen over the same period. The latter do not appear to have been associated with a corresponding fall in the volume of cigarettes sold. This could be taken to suggest the build-up of a relatively heavily addicted (as implied by the total volume per capita nicotine intake) residual smoker population.

Liberal arguments

Proponents of more liberal approaches to regulating the supply of e-cigarettes emphasise the fact that the total number of smokers in the UK has continued to fall. Further, the percentage of male and female school pupils aged from 11 to up to 16 years who are regular smokers reached a new low of about 3 per cent in 2013 – see Figure 9 (HSCIC, 2014b). At the same time there is, despite some American reports of increasing numbers of children becoming e-cigarette users, no evidence of UK children and young adults who have not already become smokers becoming established e-cigarette users in significant numbers. With respect to this it is important to distinguish between the numbers ‘ever trying’ vaping and the proportion of individuals who go on to be regular vaping device users.

Data such as these can be reasonably interpreted as meaning that at minimum the supply of e-cigarettes has to date done no harm. There is, as yet at least, no UK evidence that e-cigarette use is opening the way to tobacco smoking (ONS, 2014). It rather appears that individuals who become vapers in nearly all instances first become addicted to the use of nicotine as a result of conventional smoking. Commentators who fear over-zealous attempts to regulate e-cigarettes supply have said that ‘hundreds of millions’ of lives could be saved world-wide if they are in future used in place of tobacco products.
This could well prove true if full substitution were achieved and high standards of vaping product quality assured, although even then the actual scale of any such benefit will be a partial function of the time it would take to eradicate smoking without the introduction of new types of recreational nicotine product. Analyses such as that offered by the Royal College of Physicians in key publications such as *Harm Reduction in Nicotine Addiction – helping people who cannot quit* (2007) offer powerful arguments against unduly conservative regulatory strategies (Britton, 2014).

Broadly speaking, opponents of bringing all forms of nicotine containing product under the ambit of medicines legislation have argued that it is a positive advantage that e-cigarettes are consumer goods rather than medicines. This social context, they suggest, helps underline the role of pleasure and what is experienced as personal fulfilment driven free choice, as opposed to directive health professional authority, in the quitting process. Such commentators believe that regulating e-cigarettes as medicines would reduce their appeal to some if not all smokers, and impede ongoing innovation for little or no public benefit.  

Supporters of this ‘pull rather push’ strategic approach in the main acknowledge that seeking to make ‘safe nicotine’ products as attractive to potential users as conventional cigarettes inevitably risks attracting some children and other nicotine naïve ‘virgins’. But they have concluded that this danger is limited and a price worth paying in overall terms. As indicated earlier, they may also criticise NRT medicine manufacturers and regulators for failing to bring pharmaceutical products capable of delivering relatively high doses of nicotine to the market, and/or claim that pharmaceutical companies have not reduced the prices of ‘nicotine substitution’ presentations as rapidly as would have been possible in a more competitive market.

Whether or not such perceptions are valid is debateable, not least because the cost per milligram of delivered nicotine for e-cigarettes may already in some instances be higher than that for NRT medicines. Pharmaceutical industry linked sources indicate that companies have at a high level been influenced by a desire not to become involved in controversial areas and be seen as high volume, low cost, purveyors of addictive nicotine preparations in some way similar to nineteenth century ‘quack’ opiate vendors (Wasserman, 2015). But such concerns apart, what arguably most matters for the future is the extent to which using licensed medicines and support services of well proven effectiveness along with high quality, appropriately regulated, e-cigarette supply can as soon as possible deliver increased benefit to the public in ways consistent with the primary societal goal of reducing the tobacco related incidence of conditions like lung cancer.

There is also some evidence that a proportion of young as well as older people also wish such advances to be made in ways consistent with what some see as the secondary imperative of minimising the risk of nicotine addiction (APPG Primary Care and Public Health, 2014). While further research is needed, it is possible than many younger people (due to better education, a changed environment and perhaps in part because of smart phone facilitated access to social media) may no longer experience the desire for ‘free choice eroding’ smoking products displayed by their grand-parents.

---

6 Without extensive research the validity of hypotheses such as this cannot be proven. It may be argued that the de facto status and functional nature of products such NRT medicines sold on an OTC (over the counter) basis without supportive professional advice is much closer to that of e-cigarettes than is sometimes assumed, notwithstanding presentational and licensing differences. Yet from a consumer perspective it appears to be a social fact the vapers relate to e-cigarettes in different ways from those in which OTC medicine users relate to the products they buy, and may be purchasing them for different reasons.
Achieving smoking harm reduction and freedom from nicotine addiction

There are important elements of truth in both the precautionary and liberal e-cigarette supply regulation arguments outlined above. Moving forward in ways that will maximise public health gains will require the informed acceptance and intelligent management of hazards, rather than permitting stances based on simplistic risk aversion to dominate policy formation. Yet the perspective taken here is that this need not and should not mean giving way without any form of check and balance to what might often be commercially inspired populist pressures to encourage the long term continuation of an exploitive trade based on nicotine addiction.

Some ‘vapers’ are unquestionably passionate and sincere in their defence of their freedom to use nicotine and vaping based paraphernalia in ways that they find enjoyable and judge acceptably safe (Graham, 2015; Thurlow, 2014). But as in other areas of drug taking, this does not mean that seeking to maintain such addictions in circumstances where they cannot be shown to be protective against smoking related harm is necessarily a desirable long term societal (as distinct from individual) choice.

Promoting public health and wellbeing requires different countries to adopt different strategies, depending on their cultures and developmental stages. The situations currently facing nations like, say, the People’s Republic of China, the Russian Federation or even EU Members States such as Poland with regard to tobacco use are very different from those facing the UK countries.

In many parts of the former Soviet Union, for example, some 60 per cent of men still smoke. In the Russian Federation today male life expectancy at birth is (at under 70 years) comparable with the recorded Indian average, despite the greater wealth of the former nation. Coupled with alcohol use and health care delivery problems, this means that health improvement advocates in Russia are facing challenges quite unlike those which exist in countries such as, say, the United States.

In Britain overall smoking levels are now lower than at any time since the 1930s (see Brock et al, 2007) and life expectancy at birth for both males and females is now in excess of 80 years. At current rates of progress tobacco smoking could well be effectively eliminated in England in about 20 years, unless stopping it amongst the remaining minority of smokers proves much more difficult for the individuals involved than it has proved for other community members. In the field of oncology alone this promises to cut current cancer death rates in the population aged under 80 by approaching a quarter by the 2050s (Gill et al, 2015).

Success might be even more rapid if sufficiently vigorous policies and practices are adopted. In the UK at present the most urgent stop smoking policy concerns relate to whether and when standardised cigarette packaging can be introduced (Chantler, 2014a; Chantler, 2014b). But beyond that all ‘sides’ involved in the current e-cigarette debate have an interest in agreeing that rapid action can and should be taken to ensure that, regardless of the legal basis of the regulations put in place, all vaping products available on the British and wider European market are manufactured to a high standard and promoted and supplied appropriately, and that the liquids they use are as far as possible safe, free of unwanted substances and sold in a child-safe manner.

It should also be possible to obtain a robust consensus on the advertising of nicotine containing non-tobacco products that do not have licensed medical applications. It is widely agreed that it is unacceptable that any section of the population should be exposed to claims that they can give ‘health cost’ free pleasure to their users or that they are likely to enhance their sexual or social lives. Yet e-cigarettes and allied products can provide nicotine in ways that protect against immediate drug withdrawal symptoms, or ‘cravings’. Legally sanctioned advertising should reflect this reality, regardless of whether or not nicotine containing products are licensed as medicines.

Issues such as those relating to the requirements of the Tobacco Products Directive (Box 5) that may limit the capacity of e-cigarettes to deliver ‘more satisfying’ levels of nicotine for smokers require more research and analysis. So do topics such as the extent to which the ‘mixed’ or dual use of conventional and electronic cigarettes will be harm reducing in the long term, if only because it may on occasions act as a gateway to spontaneous quitting or the use of more effective stop smoking product and service mixes.

However, for the present a key practical priority to be pursued in England is preventing the degradation of the NHS Stop Smoking Services established in the past fifteen years in pharmacy and other primary and secondary care settings. The success of the smoking cessation policies put in place since the publication of the 1998 White Paper Smoking Kills is unquestionable. But the impacts of the recent health service reorganisation, combined with factors such as the possible (and perhaps temporary) consequences of increased e-cigarette use and arguably inadequate levels of publicly funded advertising aimed at directing would-be quitters to NHS Stop Smoking Services and motivating them to use them, appear to have adversely affected demand.

Whatever the government elected in May 2015, a decline of up to 50 per cent in the uptake of the most effective means of smoking cessation support available should be seen as a problem that demands urgent attention. Health policy makers should be aware that it would also
Questions have been expressed about various aspects of reducing smoking rates (West et al., 2013). Nevertheless, Smoking Services made a demonstrable contribution to reducing smoking rates (West et al., 2013). In the first decade or so of their existence NHS Stop Smoking Services made a demonstrable contribution to reducing smoking rates (West et al., 2013). Nevertheless, questions have been expressed about various aspects of their performance, including local cost variations. In current circumstances there is a possible danger that, with the increasing confinement of tobacco use to more disadvantaged individuals and groups and the availability of what may commonly be presumed to be a safe and effective alternative form of recreational nicotine delivery in the form of e-cigarettes, public funding for the supply and/or promotion of the most effective forms of cessation support for adults will incrementally decline.

The evidence available indicates that public interest would be better served by an enhanced provision of cessation support services (Britton, 2014). They should wherever possible be designed to overcome problems such as those applying to medicines as is sometimes feared. Some commentators question the 20mg/ml ceiling on the strength of ‘e juice’ supplied in Europe, and/or the dosing consistency requirement. Yet seen positively this limitation may open up opportunities for products licensed as medicines to provide better relief for smokers’ cravings, ideally in conjunction with the provision of support services known to increase the efficacy of smoking cessation attempts.

Further developments in the supply of both e-cigarettes and existing and new medicines could deliver advantages such as enhancing the propensity of people using self-purchased NRT and other products simply for temporary cessation to quit smoking altogether. To date such effects have been seen in clinical trials but not in ‘real life’ use (Moore et al., 2009; Beard et al., 2015).

Box 5. The revised European TPD

The European Tobacco Products Directive initially came into force in the Spring of 2014. It is due to be implemented in stages through to 2017. After a period of lobbying and discussion in the European Parliament and other fora it was decided against requiring all ENDS (electronic nicotine delivery systems) to be licensed as medicines. However, the Directive contains a number of important requirements relating to e-cigarettes and allied nicotine delivery systems sold as consumer goods rather than as tobacco products or licensed pharmaceuticals. For example, it obliges Member States to ensure that:

- nicotine-containing liquid is only placed on the market in dedicated refill containers not exceeding a volume of 10 ml, in disposable electronic cigarettes or in single use cartridges and that the cartridges or tanks do not exceed a volume of 2 ml;
- the nicotine-containing liquid does not contain nicotine in excess of 20 mg/ml, or any prohibited additives;
- electronic cigarettes deliver the nicotine doses at consistent levels under normal conditions of use;
- electronic cigarettes and refill containers are child and tamper proof, are protected against breakage and leakage and have a mechanism that ensures refilling without leakage.

Consumer goods do not have to undergo costly clinical trials, and the regulations being introduced can be seen as less likely to help assure the safety in long term use of ENDS as could be provided via regulating them as medicines. But the TPD’s controls ought if properly enforced and supported by appropriate discretionary measures aimed at promoting manufacturing quality not fall as far short as those applying to medicines as is sometimes feared. Some commentators question the 20mg/ml ceiling on the strength of ‘e juice’ supplied in Europe, and/or the dosing consistency requirement. Yet seen positively this limitation may open up opportunities for products licensed as medicines to provide better relief for smokers’ cravings, ideally in conjunction with the provision of support services known to increase the efficacy of smoking cessation attempts.

Further developments in the supply of both e-cigarettes and existing and new medicines could deliver advantages such as enhancing the propensity of people using self-purchased NRT and other products simply for temporary cessation to quit smoking altogether. To date such effects have been seen in clinical trials but not in ‘real life’ use (Moore et al., 2009; Beard et al., 2015).

Since the transfer of public health funds to local government in 2013 the availability of clear information on the resourcing of Stop Smoking Services across the country (which in total cost about £80 million in 2012/13) has been restricted. But bodies such as the Public Accounts Committee have recently raised concerns about growing variations in spending on smoking cessation support, and in some instances the movement of money away from public health altogether. Organisations like the British Medical Association have raised similar matters (BMA, 2015). Regardless of austerity pressures, such trends would appear to be in conflict with the priority analyses offered in documents such as NHS England’s Five Year Forward View.

In the first decade or so of their existence NHS Stop Smoking Services made a demonstrable contribution to reducing smoking rates (West et al., 2013). Nevertheless, questions have been expressed about various aspects of their performance, including local cost variations. In current circumstances there is a possible danger that, with the increasing confinement of tobacco use to more disadvantaged individuals and groups and the availability of what may commonly be presumed to be a safe and effective alternative form of recreational nicotine delivery in the form of e-cigarettes, public funding for the supply and/or promotion of the most effective forms of cessation support for adults will incrementally decline.

The evidence available indicates that public interest would be better served by an enhanced provision of cessation support services (Britton, 2014). They should wherever possible be designed to overcome problems such as those applying to medicines as is sometimes feared. Some commentators question the 20mg/ml ceiling on the strength of ‘e juice’ supplied in Europe, and/or the dosing consistency requirement. Yet seen positively this limitation may open up opportunities for products licensed as medicines to provide better relief for smokers’ cravings, ideally in conjunction with the provision of support services known to increase the efficacy of smoking cessation attempts.

Further developments in the supply of both e-cigarettes and existing and new medicines could deliver advantages such as enhancing the propensity of people using self-purchased NRT and other products simply for temporary cessation to quit smoking altogether. To date such effects have been seen in clinical trials but not in ‘real life’ use (Moore et al., 2009; Beard et al., 2015).

Since the transfer of public health funds to local government in 2013 the availability of clear information on the resourcing of Stop Smoking Services across the country (which in total cost about £80 million in 2012/13) has been restricted. But bodies such as the Public Accounts Committee have recently raised concerns about growing variations in spending on smoking cessation support, and in some instances the movement of money away from public health altogether. Organisations like the British Medical Association have raised similar matters (BMA, 2015). Regardless of austerity pressures, such trends would appear to be in conflict with the priority analyses offered in documents such as NHS England’s Five Year Forward View.

In the first decade or so of their existence NHS Stop Smoking Services made a demonstrable contribution to reducing smoking rates (West et al., 2013). Nevertheless, questions have been expressed about various aspects of their performance, including local cost variations. In current circumstances there is a possible danger that, with the increasing confinement of tobacco use to more disadvantaged individuals and groups and the availability of what may commonly be presumed to be a safe and effective alternative form of recreational nicotine delivery in the form of e-cigarettes, public funding for the supply and/or promotion of the most effective forms of cessation support for adults will incrementally decline.

The evidence available indicates that public interest would be better served by an enhanced provision of cessation support services (Britton, 2014). They should wherever possible be designed to overcome problems such as those applying to medicines as is sometimes feared. Some commentators question the 20mg/ml ceiling on the strength of ‘e juice’ supplied in Europe, and/or the dosing consistency requirement. Yet seen positively this limitation may open up opportunities for products licensed as medicines to provide better relief for smokers’ cravings, ideally in conjunction with the provision of support services known to increase the efficacy of smoking cessation attempts.
**Conclusion – towards the tobacco smoking end-game**

Cigarette and allied forms of tobacco smoking are in the modern era an historical anomaly, stemming from a time before its unacceptable dangers were understood. Legislation banning the sale of tobacco products was in fact in place in some US States in the first decades of the twentieth century. But it was withdrawn at around the time it became apparent that American policy on alcohol prohibition was failing the society it was intended to protect and strengthen, in much the same way as subsequent authoritarian approaches to the control of drugs like cannabis may be judged to have failed.

In the absence of new medicinal products able to satisfy smokers’ cravings more fully and more acceptably than is presently possible encouraging the discretionary use of combinations of existing medicines is one way forward. As has reportedly been demonstrated in areas such as Leicestershire (which has a long-standing record of innovation in smoking cessation support) a pragmatically informed approach to the self-purchased use of e-cigarettes, combined with the optimal prescription of licensed medicines and psychologically based methods of supporting quit attempts, may also enhance outcomes – see Box 6 and Ross, 2014.

 Arguments in favour of new laws banning tobacco products like cigarettes being introduced may gain strength as the twenty first century unfolds (Proctor, 2013). Yet the barriers to taking such action to protect public health are presently high everywhere, and its likely viability is limited. In free societies, the prohibition of any sort of behaviour that does not cause demonstrable direct harm to others is always problematic.

At the same time the record of most command societies (national socialist/Nazi Germany being a possible exception) is such that decision makers have been prepared to accept the costs of smoking in return for perceived benefits in areas such as the maintenance of discipline and social order, and the generation of tax and other revenues. Even Cuba, with its positive health record and history of medically educated leadership, has proved reluctant to give up its dependence on producing and selling tobacco goods such as Romeo and Juliet cigars, despite the inevitability of tragic outcomes.

**Box 6. NCSCT Recommendations on e-cigarette use**

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Electronic cigarettes can provide some of the nicotine that would otherwise been obtained from smoking regular cigarettes.</td>
<td></td>
</tr>
<tr>
<td>2. Electronic cigarettes are not a magic cure, but some people find them helpful for quitting, cutting down their nicotine intake, and managing temporary abstinence.</td>
<td></td>
</tr>
<tr>
<td>3. There is a wide range of electronic cigarettes available and clients may need to try various brands, flavours, and nicotine dosages before they find a brand that they like.</td>
<td></td>
</tr>
<tr>
<td>4. Electronic cigarette use is not exactly like smoking and users may need to experiment and learn to use them effectively (e.g. longer ‘drags’ are required and a number of short puffs may be needed initially to activate the ‘vapouriser’ and improve nicotine delivery).</td>
<td></td>
</tr>
<tr>
<td>Multi-session behavioural support, as provided by trained stop smoking practitioners, is likely to improve the efficacy of electronic cigarettes in the same way such support markedly increases the efficacy of NRT; and</td>
<td></td>
</tr>
<tr>
<td>If a client seen at a stop smoking service is using an electronic cigarette but also wants to use NRT, then it is OK for them to use the two in conjunction. They do not need to have stopped using the electronic cigarette before they can use NRT.</td>
<td></td>
</tr>
</tbody>
</table>

In the absence of new medicinal products able to satisfy smokers’ cravings more fully and more acceptably than is presently possible encouraging the discretionary use of combinations of existing medicines is one way forward. As has reportedly been demonstrated in areas such as Leicestershire (which has a long-standing record of innovation in smoking cessation support) a pragmatically informed approach to the self-purchased use of e-cigarettes, combined with the optimal prescription of licensed medicines and psychologically based methods of supporting quit attempts, may also enhance outcomes – see Box 6 and Ross, 2014.

 Arguments in favour of new laws banning tobacco products like cigarettes being introduced may gain strength as the twenty first century unfolds (Proctor, 2013). Yet the barriers to taking such action to protect public health are presently high everywhere, and its likely viability is limited. In free societies, the prohibition of any sort of behaviour that does not cause demonstrable direct harm to others is always problematic.

At the same time the record of most command societies (national socialist/Nazi Germany being a possible exception) is such that decision makers have been prepared to accept the costs of smoking in return for perceived benefits in areas such as the maintenance of discipline and social order, and the generation of tax and other revenues. Even Cuba, with its positive health record and history of medically educated leadership, has proved reluctant to give up its dependence on producing and selling tobacco goods such as Romeo and Juliet cigars, despite the inevitability of tragic outcomes.

It may be an inconvenient truth, but the historical record in the UK and elsewhere shows that political interventions are more likely to follow rather than lead changes in the smoking and health related preferences of electorates. Such realities mean that effective measures to curtail the sale of dangerous tobacco products have been slow to be taken in all communities, despite today’s long standing and still expanding knowledge of their health impacts. Even in Europe, Japan and North America progress has been limited, albeit the efforts of, for instance, some
communities and the experiences of groups such as the medical profession in the UK indicate that it is possible to cut population wide smoking rates to 10 per cent or below, despite tobacco products remaining on free sale.  

Even now there is a risk that tobacco smoking will at a residual level continue indefinitely, especially if advocates of better public health are needlessly divided in their views about smoking cessation and tobacco harm related reduction. But if positively informed momentum can be maintained then ongoing personal efforts to stop smoking – coupled with more protective environments, the optimal use of cessation support medicines, well regulated access to well-manufactured e-cigarettes and the psychological help needed to support quitting – promise in coming decades to open the way to further radical progress.

It is possible if not probable that by the end of the 2040s conventional cigarette smoking will be largely seen as a plague of the past in Britain. In the second half of the twenty-first century this could become true globally, if electorates and their governments choose to make smoking cessation a priority and are able to implement well informed – socially, scientifically and economically rational – policies.

However, there may still be future problems of nicotine addiction to be resolved even after tobacco smoking has been effectively eliminated. These will be far less costly in terms of lost quality adjusted life years than the disease burdens imposed by the tobacco pandemic of the twentieth and twenty-first centuries. Yet they could still involve the imposition of significant amounts of avoidable financial and psychological harm.

In the final analysis, therefore, public policy makers should not under-estimate the importance of continuing to invest in understanding the health and wider wellbeing of nicotine consumption. Neither should they neglect to maintain, or when necessary increase, the funding of high quality services to support stopping smoking and, when individuals choose it, end recreational nicotine use.

Seen from this perspective, the ongoing supply and use of effective NRT and other stop smoking medicines and complementary psychological services will be no less important in the e-cigarette era as it was in the closing decades of the twentieth century. The use of appropriately specified ‘vaping’ devices will also have a valuable role to play. Yet for the immediate future checking and reversing the decline in NHS Stop Smoking Service use in England reported in this analysis should be regarded as a key concern. Without such action the country may prove unable to build on the heritage provided by organisations such as the Royal College of Physicians, and fulfil its potential to lead world progress towards ending tobacco smoking.

Democratic principles demand that people should be free to both smoke and ‘vape’ if they elect to do so, provided they are not hurting others. Yet societies ought at the same time to seek to communicate the truth about both tobacco smoking and nicotine use to their members. They should be prepared to help all those who seek protection from the consequences of smoking. It is also reasonable to guard against the socio-economic burdens imposed by unwanted addictions of all types, even if they were to prove close to physically harmless.

The fact that every year over 40,000 British people are still diagnosed with lung cancer alone testifies to the continuing urgency of the challenge to humanity embodied in tobacco smoking. Yet if ‘health’ is seen as achieving a state of optimal mental, physical and social wellbeing, as distinct from simply being free of disease, then creating the social conditions in which nicotine addiction will continue unabated after tobacco smoking has been overcome would almost certainly prove a prescription for a second best future. The ultimate task now facing not just Britain but all societies is to maximise the short term benefits of stopping smoking by all possible means without losing sight of longer term human well-being horizons.

---

7 Some people may derive clinical benefits from taking nicotine. For example, there have been observational (but now questioned) reports of a protective effect against Parkinson’s Disease, as well as the possibility of desirable impacts in areas such as concentration and weight management. In some individuals there may be impacts on mood over and above those associated with the relief of withdrawal symptoms. The view taken here is that if and when specific medical benefits from short or long term nicotine use can be identified licensed medicines should be developed to meet appropriately identified individual needs.
References


Bates, C (2014b) Personal communication


Britton J. (2014a) Personal communication


Chantler S.C. (2014a). Personal communication


Graham D. (2015). Personal communication


Kelly, M. Personal communication


Royal College of Physicians (2012). Fifty Years Since Smoking and Health. London: The Royal College of Physicians


West R. (2014) Personal communication


This analysis was written by Professor David Taylor, Tina Craig, Dr Jennifer Gill and Dr Ralph Hibberd of the UCL School of Pharmacy. The research undertaken was funded by the Proprietary Association of Great Britain (PAGB), whose membership includes manufacturers of NRT and other medicines. Accountability for the content and distribution of this report rests with Professor Taylor, who thanks Deborah Arnott of ASH and all other colleagues who commented on drafts of this document.