Reducing harm from tobacco use

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Abstract

If current trends in smoking prevalence continue, even with the implementation of enhanced tobacco control measures, millions of smokers will continue to fall ill and die as a direct result of their smoking. Many of these will be from the most deprived groups in society – smoking continues to be one of the strongest drivers of health inequalities. The personal costs of this morbidity and mortality, as well as costs to business and the economy, are unequalled and will therefore remain high for several decades to come. However, there is an addition to the tobacco control armoury that could have a marked impact on public health, but it requires radical action to be taken. This would be to embrace harm reduction, but this approach is as controversial in the case of tobacco as it is in the case of illicit drugs from where it derives. However, harm reduction remains the Cinderella of the three major strategies for reducing smoking-related harm, the others being prevention and cessation. Here we make the case that harm reduction has an important role to play in reducing the health burden of tobacco use.

Introduction

If current trends in smoking prevalence continue, even with the implementation of enhanced tobacco control measures, millions of smokers will continue to fall ill and die as a direct result of their smoking. Many of these will be from the most deprived groups in society – smoking continues to be one of the strongest drivers of health inequalities. The personal costs of this morbidity and mortality, as well as costs to business and the economy, are unequalled and will therefore remain high for several decades to come. However, there is an addition to the tobacco control armoury that could have a marked impact on public health, but it requires radical action to be taken. This would be to embrace harm reduction, but this approach is as controversial in the case of tobacco as it is in the case of illicit drugs from where it derives. In the UK it still remains the Cinderella of the three major strategies for reducing smoking-related harm, the others being prevention and cessation.

Tobacco harm reduction tobacco can be defined as: "*decreasing the burden of death and disease, without completely eliminating nicotine and tobacco use*" (adapted from Stratton et al 2001). There are several aspects to harm reduction which involve two main approaches: reducing the harm to others (through reducing tobacco smoke pollution) and reducing the harm to continuing tobacco users. This latter approach includes: reducing the harmfulness of current smoked tobacco products (which is very unlikely to have any significant effect given the enormous harms of inhaling smoke, McNeill et al, 2012); encouraging smokers to alter their smoking and nicotine use behaviour to make their continued smoking less harmful and draw more smokers into quitting (e.g. reducing cigarette consumption using nicotine replacement therapy (Moore et al, 2009); and encouraging smokers to switch to less harmful forms of nicotine delivery (see Figure 1). We will focus here mainly on the last one of these, switching to less harmful nicotine products, as we believe that this is likely to have the greatest impact.

Switching to less harmful nicotine products

People smoke largely to acquire nicotine, and although this has been known for several decades, the central role of nicotine addiction in smoking has only relatively recently been widely accepted (RCP, 2000); but whilst it is the nicotine that keeps people smoking, it is the other toxins in tobacco (and in particular tobacco *smoke*) that do the vast majority of the damage caused by smoking (RCP, 2007). Essentially there is a continuum of harm across nicotine and tobacco products (see Figure 2) with huge differences in risk across the continuum.

Clean medicinal nicotine products are the least harmful nicotine products available (i.e., nicotine replacement therapies which contain nicotine and a few excipients to ameliorate the delivery of nicotine). These have now been marketed for around 30 years and have been demonstrated to be safe, at least for relatively short term use. Nicotine does have cardiovascular effects, but the current medicinal nicotine products do not appear to produce many of the cardiovascular risks of cigarettes. Nicotine does not seem to cause cancer (Murray et al, 2009) or respiratory diseases, although concerns remain about nicotine use in pregnancy. There is very little evidence on the health effects of long term substitution of nicotine, but a five year study of the use of NRT among quitters and continuing smokers found no adverse effects (Murray et al,

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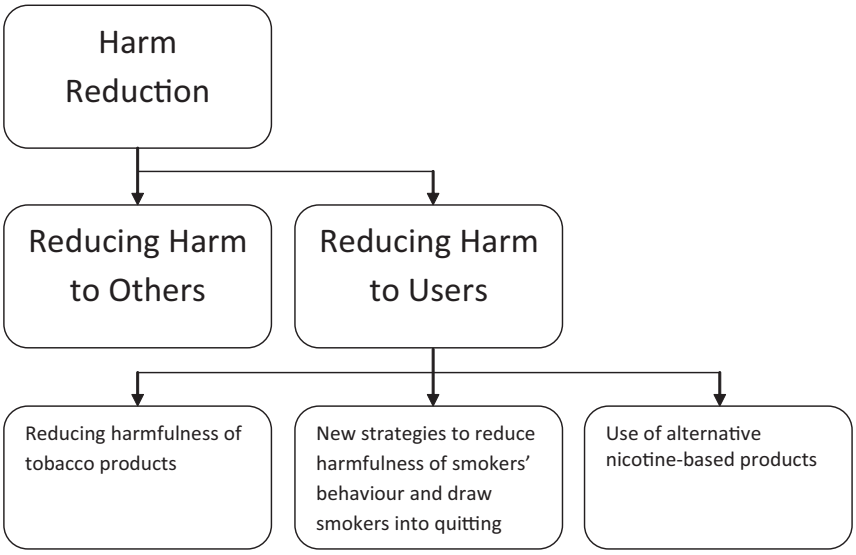

Figure 1. Harm reduction options in tobacco control.
Harm reduction may be achieved via the reduction of harms to others, or the reduction of harms to the user, or both. Bans on smoking in bars and other public places have gone some way to achieving the former. Here we discuss potential strategies for achieving the latter.

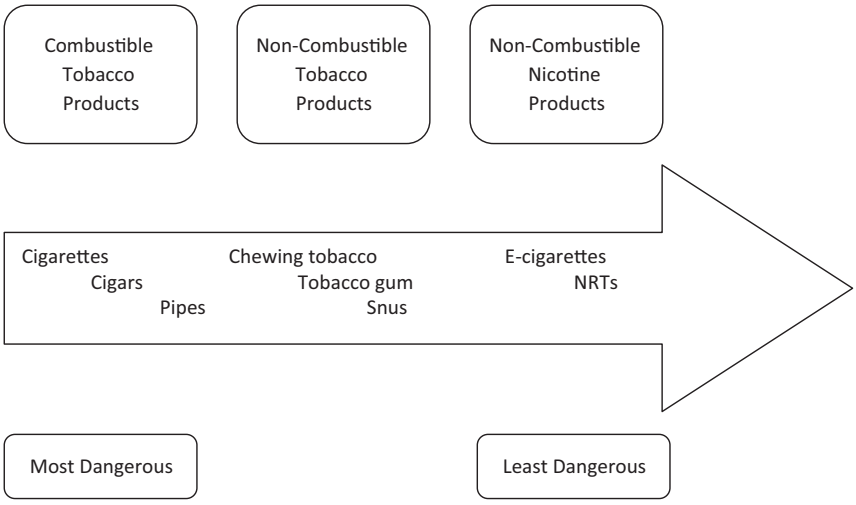

Figure 2. Nicotine harm continuum.
Tobacco and nicotine products vary in the levels of harm associated with their use. The most harmful products are those consisting of tobacco which is burned (e.g., cigarettes). Smokeless tobacco products are likely to be less harmful than smoked products, although there is very wide variation in harms associated with the different smokeless products available worldwide. Nicotine products which are not burned, such as nicotine replacement therapies (NRTs) are the least harmful. The figure illustrates the spectrum of harm, although it is intended as an indicative guide and should not be taken to imply a linear relationship.

1996) and evidence of its harm also comes from Sweden and snus (see below). On balance therefore, medicinal nicotine products are thought to be generally 'safe' apart from in pregnancy where its use however is still preferable to continued smoking (McNeill et al, 2001). So if smokers can be encouraged to switch to similarly less harmful forms of nicotine delivery, then huge public health gains could be realised (Kozlowski, 2001).

Proof of concept for harm reduction

Proof of concept for this approach exists. Sweden has a long tradition of smokeless tobacco use among men in the form of snus, a low nitrosamine form of smokeless tobacco which is estimated to be about 90-95% less harmful than smoking (Levy et al, 2004). Snus cannot be marketed in the rest of the European Union (EU). Overall tobacco use is higher in Sweden than in many other countries in the EU, but Swedish males currently have the lowest rate of respiratory diseases in Europe and one of the lowest rates of oral cancers. Recent reviews have suggested that snus may cause increased risk of death following myocardial infarction (MI), although not increased overall incidence of MI, and have found mixed findings on oral and pancreatic cancer (Lee & Hamling, 2009; Boffeta et al, 2008; EU SCENIHR 2010; Bertuccio et al, 2011).

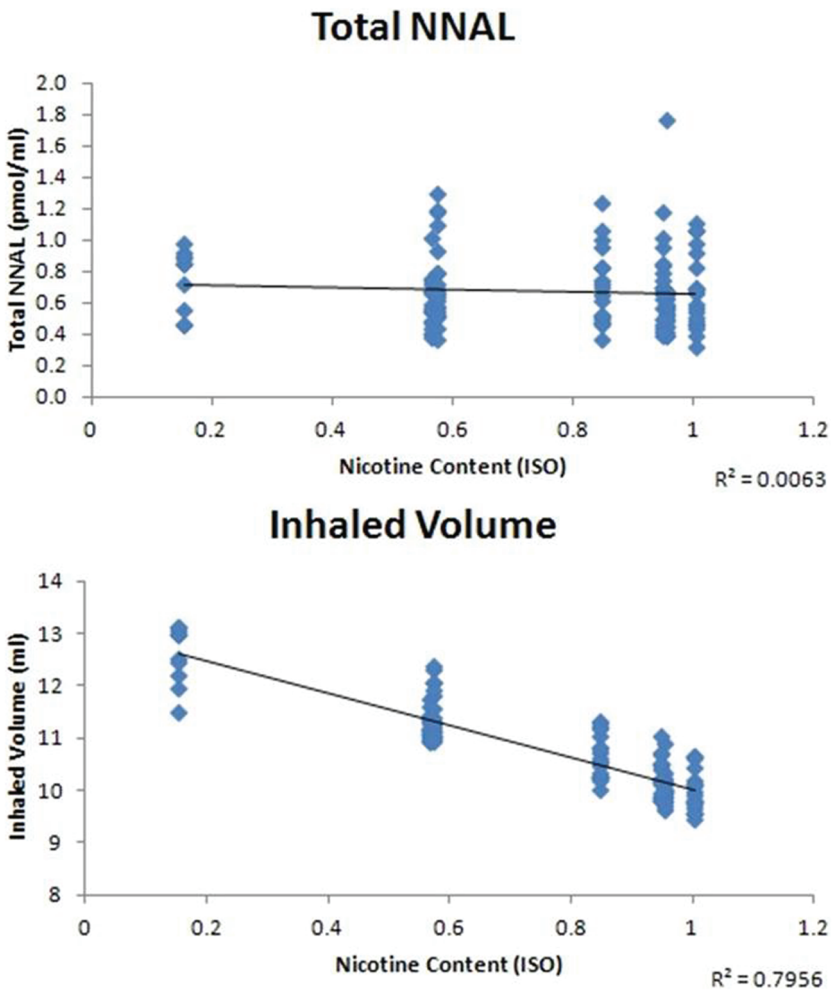

Figure 3. Relationship between nicotine content in cigarettes and toxin and smoke intake.
Machine-measured nicotine content varies considerably by cigarette brand, but this is not associated with levels of exposure to tobacco-specific nitrosamines (NNAL, top panel). This is due to compensatory smoking, whereby the smoker titrates the volume of smoke inhaled to achieve the desired level of nicotine, irrespective of nicotine content (inhaled volume, bottom panel).

Another proof of principle comes from the introduction to the market of electronic cigarettes (e-cigarettes or electronic nicotine delivery systems), commercially available battery operated inhalers that heat a nicotine solution to produce a vapour (although some products are in development which do not produce the vapour). These began emerging on the market in the last decade and are likely to have a similar risk profile to NRT products. As most e-cigarettes make no therapeutic claims, they are unregulated and companies can market them freely in countries where they have not been banned, such as the UK and US. Demand for these has risen markedly over recent years. Evidence from the US suggests that awareness of e-cigarettes doubled, and ever use quadrupled, between 2009 and 2010 (Regan et al, 2011). The most recent study in the UK was carried out in 2009. A survey of over 12 thousand people carried out by YouGov for the charity Action on Smoking and Health found 9% of smokers had tried them and about a third of these (3% overall) had continued to use them (ASH, 2010). E-cigarettes are a heterogeneous array of products which vary in nicotine delivery and site of nicotine absorption (buccal/lungs) but a recent study found similar cotinine levels in some e-cigarette users to those in smokers (Etter and Bullen, 2011).

Controversies

So why is harm reduction so controversial? The first set of concerns focuses on population effects; whilst it is generally universally accepted that switching to a clean nicotine product will reduce harm for individual smokers, there are concerns that advocating harm reduction could have a negative *population* impact. This could happen if a harm reduction message diluted the message to stop smoking abruptly, and hence deter smokers from quitting, or it might entice non- or ex- smokers to take up other nicotine products, or even return to smoking. A harm reduction message may also act against other efforts aimed at denormalising tobacco use. Kozlowski (Kozlowski et al, 2001) was able to demonstrate that concerns about population harm arising from non-smokers using clean nicotine are largely unfounded – even if the whole population took up clean nicotine products (and smokers

switched) the benefits would still far outweigh any risks. Foulds and others have shown that the presence of snus in Sweden does not act as a gateway to smoking uptake (Foulds et al, 2003); instead it seems more likely that it could act as a gateway out of smoking (e.g. Stenbeck et al, 2009; Lund et al, 2010).

The main controversy, however, is the role of the tobacco industry in harm reduction. The tobacco industry has a long history of denying the health risks of smoking, and manipulation and deception around potential harm reducing products such as low tar cigarettes. In the case of low tar cigarettes the industry manipulated cigarettes so that they appeared to result in reductions in smoke intake when smoked by machines, but they used pinprick holes in the filters which smokers could cover up and hence achieve similar nicotine and other smoke intake to when they smoked regular cigarettes. Our research has demonstrated that machine-read nicotine content is associated with less than 1% of the variance in tobacco-specific nitrosamine levels, but 80% of the variance in inhaled smoke volume (see Figure 3). In other words, smokers altered their inhalation patterns to adjust for reduced nicotine content in cigarettes and increased the volume of smoke inhaled, leaving their toxin absorption relatively unchanged. Low tar cigarettes reassured smokers and kept them smoking. In the light of evidence from Sweden, the industry has embraced the non-combustible tobacco market, using similar promotional techniques to attract new users as with cigarettes. The lack of interest from the pharmaceutical sector in producing 'recreational nicotine products' has left a gap which the tobacco industry has moved into, and several clean nicotine products have also now been patented by tobacco companies. The tobacco industry is moving into the e-cigaretttes business, for example, the e-cigarette 'blu' was recently purchased by the US tobacco company Lorillard. Tobacco control advocates have a long history of mistrust of the industry, and have traditionally argued for a tobacco-free world and complete cessation of tobacco and nicotine products. Commentators have recently suggested using psychological principles to understand better the moral and ethical frameworks adopted on both sides of the harm reduction debate to facilitate more productive dialogue (Alderman et al, 2010). Whilst we share the widespread mistrust of tobacco industry practices, our overriding concern is to reduce the death and disease caused by tobacco use as quickly as possible. We believe therefore that the tobacco industry, alongside any other group, should be encouraged to produce clean nicotine delivery products which can be appropriately regulated. Regulators worldwide should then be encouraged to end the sale and marketing of combustible tobacco and subsequently non-combustible tobacco as quickly as possible. Juxtaposing these conditions might help harm reduction opponents to support this approach.

Current UK situation with regard to tobacco harm reduction

To date, there has been no appetite for reversing the EU ban on the marketing of snus, largely due to the concerns described above. In the UK therefore the strategy of advocates has been to argue only for 'clean' (i.e. tobacco free) nicotine products to be considered for harm reduction (ASH, 2008). The development and use of these products is encouraged instead of smoking, either on a temporary basis or as partial or complete substitution for cigarettes (in addition of course to use for short-term cessation). We believe that if a popular and acceptable clean nicotine delivery device can be developed, then there would be minimal or no need for non-combustible tobacco products to be available. However, in the absence of acceptable clean nicotine delivery devices, non-combustible tobacco products should be given active consideration.

The situation regarding the sale of snus in the European Union is unclear. Our understanding is that whilst it is not illegal to sell or buy snus in the EU, its marketing is illegal although this has not been tested in the courts. This does however essentially prohibit its sale on a commercial scale in countries outside Sweden, which has a specific derogation to accommodate the long-standing tradition of snus use within that country. It is therefore entirely possible (and legal) to purchase snus products from Sweden and have them shipped to other parts of the EU. Various websites offer this service, so that in practice there are only very modest barriers to the purchase of snus for most people residing within the EU. This then raises the question of why the restrictions on accessibility to snus remain, in particular if we consider the evidence we have described that greater availability of nicotine-containing products such as snus may serve to reduce the harms associated with tobacco use if this results in even a modest decline in the consumption of smoked tobacco products.

The Medicines and Healthcare products Regulatory Agency (MHRA) signalled a new approach to NRT regulation in 2005 when it recognised the relative safety of NRT compared with smoking and enabled NRT products to be used, inter alia, alongside smoking to reduce cigarette consumption, by adolescents, and by patients with stable coronary heart disease. More recent changes have been to allow NRT for supporting temporary abstinence and for the maintenance of nicotine use instead of smoking (harm reduction indication). However, studies using general practice prescribing data have demonstrated that the 2005 changes to NRT indications did not change prescribing patterns (Langley 2011, 2012). This suggests that either health professionals were not made aware of the changes or did not feel it was appropriate to alter their prescribing behaviour. NICE explicitly stated that NRT should not be prescribed for the purposes of reduction unless part of a research study (NICE, 2008), so a change in prescribing patterns for reduction was not tested. Smokers engaged in reducing their cigarette consumption and wanting to use NRT had to purchase it directly over the counter instead. In addition, however, surveys demonstrate that smokers consistently but incorrectly believe that nicotine causes most of the cancer caused by smoking and a significant minority that NRT might harm their health (e.g. Siahpush et al 2006). Clearly much more education and training is needed both for the general population and for health professionals if the promise of harm reduction approaches is to be realised.

NRT use is however now common in England and whilst mostly used to stop smoking, use for other purposes is also relatively common. A survey of over 11 thousand smokers (Beard et al, 2011) found that 56% of smokers were attempting to reduce smoking, 14% were using NRT for reduction and the same percentage was using NRT for temporary abstinence. These patterns are similar in other industrialised countries (Hammond et al, 2008). These data suggest that the majority of smokers are already engaging in some harm reducing behaviours although many of these are doing so in an unstructured and unsupported manner. More importantly, whilst data are unavailable on NRT users who do not smoke, the slow reduction in smoking prevalence in recent years suggests that large scale switching to clean nicotine sources is simply not happening.

How can the potential of harm reduction be realised?

It appears that alternative nicotine products are of interest to smokers but currently smokers are being given very little guidance and support in how to sustain their nicotine use without smoking. There are two notable recent developments which should address this. The National Institute of Clinical Excellence has convened a Programme Development Group to provide guidance to the NHS on harm reduction approaches for smoking cessation. The MHRA following a recent consultation is carrying out a programme of research and expert gathering on the levels of nicotine which have a significant pharmacological effect, the actual use of existing nicotine products in the marketplace, their effect on smoking cessation and modelling of the potential impact of bringing such products into medicines regulation on public health outcomes and on business. Both these processes are due to report in 2013.

Following social marketing principles, it has been argued that attention needs to be given to the product, price, position, and place of sale so that alternatives become more attractive, accessible and affordable than traditional tobacco product (ASH, 2008). In line with social marketing practice, however we believe far more research with consumers is required in all these areas to indicate how best these tools can be used to engage smokers. For example, whilst the product is important it is not yet clear, simply because research has not been encouraged or funded in this area, what types of products are acceptable and desired by smokers. Research has indicated that consumers value nicotine dose (ASH,2010), but the popularity of e-cigarettes demonstrates that delivery of nicotine to the lungs might not be critically important.

We believe that switching to alternative products could be significantly increased if harm reduction was explicitly adopted by regulators. This will require a clear statement from government that the production of clean nicotine products is to be encouraged and public information campaigns implemented which highlight the importance of stopping combustible nicotine products incorporating clear messages on the relative risks of nicotine, e-cigarettes and other new products compared with smoking. Health professionals will need targeted education and training. A framework for light touch regulation of new nicotine products will need to be developed encompassing minimum safety standards. We strongly believe that the new generation of nicotine products needs to be co-regulated with traditional tobacco products to the extent that a strategy for removing current combustible tobacco products from the market by 2030 could then be developed. New combustible products should not be allowed on the market unless there is evidence of harm reduction. As current marketing of tobacco products is banned, levels of marketing of new nicotine products will need consideration – ideally marketing should be prohibited although some promotion may be necessary to encourage switching. Pricing strategies of new nicotine products will need to be modelled to optimise switching behaviour and modelling studies could also examine the likely use of new nicotine products when within medicines and other regulatory frameworks. Research will be critically important to monitor the impact of such a radical strategy. This would involve developing a surveillance programme based on existing surveys; research with children to assess interest in new nicotine products; testing new products and a programme of consumer research into harm reduction products both currently available and those in the pipeline; assessing packaging and marketing of e-cigarettes and new products to examine perceptions of risks of nicotine and the product overall and how these compare with perceived risks of medicinal nicotine products; and determining what are levels of acceptable risk.

How much of a contribution could harm reduction make to smoking prevention?

The above data demonstrate widespread interest among smokers for alternatives to smoking. A variety of factors are limiting the acceptability of products currently available – minimum safety information, price, accessibility, lack of knowledge in health and other professionals, an ethical stance against the use of nicotine by some advocates and no clear strategic direction from government or regulators. Modelling studies based on the use of snus in Australia (where there is currently a similar ban to the UK) have shown that switching to snus will result in individual and population benefits if enough inveterate smokers do this (Gartner et al, 2007). Combined with cessation and initiation approaches, harm reduction, under appropriate regulatory oversight, has the capacity to have a significant and immediate impact on reducing the death and disease currently caused by tobacco use.

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