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Assessment of Swedish snus for tobacco harm reduction: an epidemiological modelling study

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Summary

Background Swedish snus is a smokeless tobacco product that has been suggested as a tobacco harm reduction product. Our aim was to assess the potential population health effects of snus.

Methods We assessed the potential population health effects of snus in Australia with multistate life tables to estimate the difference in health-adjusted life expectancy between people who have never been smokers and various trajectories of tobacco use, including switching from smoking to snus use; and the potential for net population-level harm given different rates of snus uptake by current smokers, ex-smokers, and people who have never smoked.

Findings There was little difference in health-adjusted life expectancy between smokers who quit all tobacco and smokers who switch to snus (difference of 0·1–0·3 years for men and 0·1–0·4 years for women). For net harm to occur, 14–25 ex-smokers would have to start using snus to offset the health gain from every smoker who switched to snus rather than continuing to smoke. Likewise, 14–25 people who have never smoked would need to start using snus to offset the health gain from every new tobacco user who used snus rather than smoking.

Interpretation Current smokers who switch to using snus rather than continuing to smoke can realise substantial health gains. Snus could produce a net benefit to health at the population level if it is adopted in sufficient numbers by inveterate smokers. Relaxing current restrictions on the sale of snus is more likely to produce a net benefit than harm, with the size of the benefit dependent on how many inveterate smokers switch to snus.

Introduction

Premature deaths attributable to tobacco smoking are expected to rise from 5·4 million in 2005 to 6·4 million in 2015, and to 8·3 million in 2030.[1] The Lancet's call for a global goal of an annual 2% reduction in chronic disease mortality will require a concerted worldwide effort to reduce smoking prevalence, the leading cause of such mortality.[2]

Government policies and actions such as increased taxation, comprehensive advertising bans, restrictions on smoking in public and workplaces, and health information and counter-advertising have reduced the burden of smoking by preventing initiation, promoting cessation, and reducing exposure to passive smoking. Nevertheless, smoking prevalence and its associated health burden remains high in countries where these policies have been most widely and aggressively implemented. In Australia, for example, 2·9 million individuals aged 14 years and over continue to smoke daily,[3] and tobacco still accounts for 8% of the total disease burden.[4]

The key to reducing the health burden of tobacco in the short to medium term is to increase cessation among current smokers. However, only about 5% of smokers who try to quit unassisted achieve long term abstinence in any year.5 Cessation aids such as behavioural programmes, nicotine replacement therapy, and bupropion are both effective and cost-effective,[6] but their effect at the population level has been modest.

Tobacco harm reduction strategies—ie, switching to other, lower risk tobacco products—have been suggested as a complementary policy to reduce tobacco-related harm.[7] Advocates of such strategies argue that the public-health burden of smoking could be substantially reduced if sufficient smokers make the change to less hazardous products.[8]

Contemporary advocates of tobacco harm reduction have focused on promoting the use of Swedish moist oral snuff, or snus. Snus might be more attractive to smokers than pharmaceutical nicotine as a long-term alternative to cigarettes because the nicotine delivery and social aspects are much closer to that of smoking.[9] Epidemiological studies suggest that the health risks associated with snus use are much lower than those of smoking.[10] It has been suggested that the low rates of tobacco-related mortality in Sweden reflect the lower risks of snus compared with smoking.[11]

Tobacco harm reduction is controversial in the global tobacco control community.[12] Although critics concede that a less hazardous tobacco product might reduce risk for individuals compared with continuing to smoke, they argue that promotion of these products might increase population-level harm if non-smokers started using such products because they believed that the risk of these new products was low.[7] Whether such use by non-smokers would produce harm at the population level depends on both the relative risk of snus and the relative rate of uptake in the smoking and non-smoking populations.[13]

The sale of snus and related products was banned in Australia in 1991; in 2004, the European Court of Justice upheld a 1992 ban on such products.[14] A careful and comprehensive assessment of the potential harms and benefits of snus on population-level health would contribute substantially to current debate. Using Australia as an example, our aim was to estimate the effect of snus at the individual level for each smoker and non-smoker who becomes a snus user. We also aimed to estimate the potential for net population-level harm due to snus use by ex-smokers and people who have never smoked.

Methods

Patients and procedures

We calculated the expected loss in health-adjusted life expectancy compared with people who have never smoked from four categories of tobacco use: (1) current smokers who continue to smoke; (2) current smokers who switch from smoking to using snus; (3) current smokers who quit all tobacco use; and (4) current snus users who never smoked. These estimates were made for the population of Australians aged 35 years or older in 2000 (the baseline year) with multistate abbreviated life tables for 5-year age-groups up to 100 years. The estimates were based on mortality rates that were calculated from the whole of population figures provided by the Australian Bureau of Statistics. Individual changes in tobacco use (ie, quitting all tobacco or switching to snus) are assumed to occur in the baseline year and remain unchanged from that point on. This model uses a mortality-based approach with the health loss from non-fatal health conditions estimated for the relevant cause as a function of the number of tobacco deaths in each age and sex category.[15]

Tobacco-attributable lung cancer rates in current smokers for each sex and 5-year age-group were estimated to be the difference between Australian Bureau of Statistics age-specific and sex-specific lung cancer mortality rates and lung cancer mortality rates among people who had never smoked in the American Cancer Society Cancer Prevention Study II (CPS-II).[16,17] For other cancers and chronic obstructive pulmonary disease, the smoking impact ratio was determined from Australian lung cancer rates, and mortality rates among smokers and people who have never smoked in CPS-II by use of the methods described by Peto and Lopez.[18] The smoking impact ratio was used instead of prevalence in a standard population-attributable fraction calculation. For cardiovascular diseases and the remainder of tobacco-related diseases, an estimate of Australian smoking prevalence in 1998[19] was used to account for the shorter lag time between exposure and these diseases.[20]

Adjustments were made in the life tables using Sullivan's method[21] for the probability of age-related, severity-weighted age-specific disability that was not attributable to tobacco use. This probability was obtained from the Australian Burden of Disease Study.[4] To account for disability attributable to tobacco-related diseases, a ratio of prevalent years lived with disability before death was used for each tobacco-related cause in the year 2000[4] as an estimate of years lived with disability relative to each smoking-related death.

To determine the effect of quitting smoking at different ages, we applied the risk reversal estimates from CPS-II to age-specific and sex-specific tobacco-related disease risk in current smokers.[20] The tobacco-related mortality risk for lung cancer and heart disease associated with snus use were obtained from the estimates of a panel of international experts.[22] These estimates were expressed as a relative risk of a smoker's excess mortality that would be experienced by current snus users who never smoked (table 1). We conservatively assumed that the panel's estimate for heart disease mortality in snus users also applied to mortality due to stroke, arterial disease, and other cardiovascular diseases. We also assumed that their estimate for oral cancer mortality applied to all upper aerodigestive cancers, and cancer of the pancreas, bladder, and kidney. We assumed that there was no excess mortality from chronic obstructive pulmonary disease or other respiratory diseases for snus users.[24]

These values were applied to the tobacco-related mortality rate in current smokers to obtain the tobacco-related mortality in current snus users who never smoked. Smokers who switched to snus were assumed to have the same rate of tobacco-related mortality as ex-smokers who do not use snus plus the rate of tobacco-related mortality experienced by people who have never smoked who use snus.

Whether increased snus use produces a net health benefit or harm at the population level depends on the effect of snus on health at the individual level and the size and characteristics of the population that initiates snus use. To assess the potential for net harm from snus, we estimated the number of current smokers who would have otherwise quit all tobacco use, who would need to become snus users to offset the health gain from one current smoker (who would have otherwise not quit) who switches to using snus. We also estimated the number of people

who have never smoked (who would not have otherwise started using tobacco) who would need to become snus users to offset the health gain of one new tobacco user becoming a snus user rather than smoking cigarettes.

Statistical analysis

Uncertainty intervals provide a range of values within which the true value of a parameter is likely to fall. Table 2 summarises the assumptions for each of the variables that were used to calculate the expected health-adjusted life expectancies for each tobacco use category examined. These are included for each of the input values and the effect of uncertainty in these values on the main outcome measures was estimated by Monte-Carlo simulation (2000 iterations) using @RISK (Palisade Corporation, NY, USA).

	35–49 year olds	**=50 year olds**
All cardiovascular diseases (including coronary heart disease, stroke, and arterial disease)	0·10 (0·075–0·125)	0·10 (0·075–0·125)
Upper aerodigestive, pancreatic, bladder, and renal cancer	0·15 (0·1125–0·1875)	0·30 (0·225–0·375)
Lung cancer	0·02 (0·015–0·025)	0·034 (0·0255–0·0425)
COPD and other respiratory diseases	0·00	0·00

Data are relative risk (±25% CI). COPD=chronic obstructive pulmonary disease.

Table 1: **Relative risk of tobacco-attributable mortality in snus users compared with current smokers by cause**

Role of the funding source

The funding source had no involvement in the study design; in the collection, analysis, and interpretation of the data; in the writing of this report; or in the decision to submit the paper for publication. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication. No ethics approval was required because no primary data collection was done.

Results

The difference in health-adjusted life expectancy between a never tobacco user and a current smoker ranged from 2·4 to 5·0 years for men and 1·9 to 4·1 years for women (table 3). The difference in health-adjusted life expectancy between a person who has never used tobacco and a current snus user who has never smoked was small, and ranged from 0·2 to 0·5 years for men and from 0·2 to 0·3 years for women (table 3). Similarly, the difference in health-adjusted life expectancy between a current smoker who quits all tobacco use and a current smoker who switches to snus ranged from 0·1 to 0·3 years for men and 0·1 to 0·4 years for women, depending on the age at which they quit tobacco use or switch to snus (table 3).

For snus use to produce net harm in men, 17 (95% CI 14–21) current smokers who would have otherwise quit all tobacco use would need to start using snus to offset the health gains from each current smoker who switched to snus rather than continuing to smoke. For snus use to cause net harm in women, 21 (17–25) current smokers who would have otherwise quit all tobacco use would need to start using snus to offset the health gains from each current smoker who switched to snus rather than continuing to smoke. Similarly, 17 (14–21) men or 20 (17–25) women who would otherwise have never smoked at any point in their life would need to start using snus to offset the health gains from each new tobacco user who used snus instead of smoking.

	Uncertainty	Type of distribution	Reference
Relative risk of lung cancer, upper aerodigestive cancer, pancreatic cancer, renal cancer, bladder cancer, coronary heart disease, stroke, arterial disease, other cardiovascular diseases, COPD, and other respiratory mortality in smokers compared with people who have never smoked	95% CI	Triangular	Thun et al[23]
Relative risk of mortality in snus users who never smoked compared with smokers	±25%	Triangular	Assumed
Ratio of years lost due to disability to number of deaths	±25%	Triangular	Assumed

COPD=chronic obstructive pulmonary disease.

Table 2: **Uncertainty assumptions and distributions**

Age (years)*	Current smokers who continue to smoke	Smokers who switch to snus	Smokers who quit smoking	Current snus users who never smoked
Men				
35	5·02 (4·72–5·35)	0·63 (0·56–0·69)	0·37 (0·34–0·40)	0·28 (0·23–0·34)
40	5·04 (4·73–5·37)	0·77 (0·70–0·85)	0·53 (0·48–0·57)	0·28 (0·23–0·34)
45	5·03 (4·72–5·36)	0·99 (0·91–1·08)	0·77 (0·71–0·83)	0·28 (0·23–0·34)
50	4·97 (4·65–5·30)	1·43 (1·30–1·57)	1·06 (0·98–1·14)	0·50 (0·40–0·60)
55	4·80 (4·49–5·13)	1·71 (1·56–1·87)	1·40 (1·29–1·52)	0·48 (0·39–0·58)
60	4·45 (4·14–4·77)	1·91 (1·83–2·08)	1·66 (1·53–1·81)	0·44 (0·35–0·53)
65	3·95 (3·65–4·26)	2·01 (1·83–2·21)	1·81 (1·65–1·99)	0·39 (0·32–0·48)
70	3·31 (3·03–3·61)	1·99 (1·80–2·20)	1·88 (1·70–2·08)	0·31 (0·25–0·38)
75	2·36 (2·11–2·62)	1·55 (1·35–1·75)	1·47 (1·29–1·68)	0·22 (0·17–0·27)
Women				
35	4·10 (3·85–4·35)	0·44 (0·40–0·49)	0·26 (0·24–0·29)	0·19 (0·16–0·23)
40	4·09 (3·84–4·34)	0·52 (0·47–0·69)	0·34 (0·31–0·37)	0·19 (0·16–0·23)
45	4·05 (3·80–4·30)	0·63 (0·58–0·69)	0·47 (0·43–0·51)	0·19 (0·15–0·23)
50	3·96 (3·71–4·21)	0·88 (0·80–0·97)	0·59 (0·55–0·64)	0·34 (0·27–0·41)
55	3·78 (3·54–4·03)	1·03 (0·94–1·12)	0·77 (0·71–0·83)	0·33 (0·26–0·39)
60	3·49 (3·25–3·75)	1·12 (1·02–1·22)	0·90 (0·83–0·97)	0·31 (0·24–0·37)
65	3·22 (2·98–3·46)	1·26 (1·15–1·37)	1·06 (0·97–1·15)	0·29 (0·23–0·35)
70	2·56 (2·33–2·79)	1·21 (1·10–1·32)	1·06 (0·97–1·16)	0·24 (0·19–0·30)
75	1·92 (1·69–2·13)	1·12 (0·98–1·25)	1·01 (0·88–1·13)	0·19 (0·14–0·24)

Data are years lost (95% CI). *Age at baseline year (2000); smokers who switch to snus and smokers who quit smoking, switch or quit in the baseline year.

Table 3: **Years of healthy life lost compared with people who have never used tobacco**

Discussion

Individual smokers who switched to snus instead of continuing to smoke and new tobacco users who only used snus rather than smoking would achieve large health gains compared with smokers. Although these individual-level gains of switching to snus are sizeable, the net effect of snus on health at the population level depends on who takes up snus. A net benefit is most likely if snus is used mainly by people who would otherwise have continued (or commenced) smoking. Net harm would only occur if those who become regular snus users were almost exclusively people who would otherwise have remained tobacco free.

According to our analysis, a net harmful effect on the population would only happen if at least 17 men or 20 women who would otherwise have never smoked took up snus for every new tobacco user who chose snus instead of smoking. Alternatively, at least 17 men or 21 women who were ex-smokers would need to become snus users to offset the health gains for each inveterate smoker who switched to snus. Both scenarios (more ex-smokers and people who have never smoked initiating snus use than smokers) were inconsistent with the predictions of a panel of international tobacco control experts about probable patterns of uptake in the USA under a policy in which smokeless tobacco that complied with strict manufacturing standards was promoted and labelled in a way that indicated reduced harm compared with cigarettes. These experts predicted that the uptake of snus would be greatest among current male smokers.[25]

There is one other potential route that could result in net harm which has not been examined in this analysis, namely, if snus users, who would not otherwise have used tobacco, become cigarette smokers. There are conflicting reports of whether smokeless tobacco products—eg, snus—act as a so-called gateway to smoking.[11,26] In the USA, although most adolescent users of smokeless tobacco products do not become smokers, more smokeless tobacco users move to smoking than move from smoking to use of smokeless tobacco products.[25] In Sweden, by contrast, more tobacco users make the transition from smoking to snus rather than vice versa.[11] In no country has snus been actively promoted as a tobacco harm reduction product, a factor that could also affect uptake patterns.

There are several issues that need to be considered before relaxing the restrictions on snus in Australia and other countries in an attempt to reduce tobacco-related mortality. There is substantial concern in the tobacco control and public-health community that tobacco harm reduction products such as snus could undermine existing tobacco control strategies, as happened when light cigarettes were promoted by the tobacco industry in the 1960s and 1970s as safer products. Light cigarettes did not reduce the health risks of smoking because of compensatory smoking (eg, blocking ventilation holes, inhaling more intensely, smoking each cigarette down to a smaller butt length, and smoking a greater number of cigarettes) and undermined cessation attempts in many smokers who continued to smoke in the mistaken belief that these were less hazardous alternatives.[27] By contrast with light cigarettes, there is extensive epidemiological evidence that snus use is much less hazardous than smoking.[10] Moreover, consumer demand for reduced exposure products might be better met by products with real reduced risks (eg, snus) rather than new tobacco products with unknown health risks (eg, low yield or modified cigarettes).

Ethical concerns about the promotion of a harmful and addictive substance like snus must be balanced against the ethical implications of restricting access to a tobacco product with a much lower health risk when the main source of tobacco addiction—cigarettes—is so readily available, when tobacco addiction is so difficult for some smokers to overcome, and in light of evidence from Sweden that suggests smokers who use snus as a cessation aid have a substantially higher success rate than those who use nicotine medications and that primary snus users have a much lower rate of starting smoking than those without previous snus use.[11]

The restrictions on public smoking in Australia and other countries have reduced the visibility of tobacco use, making it an activity restricted to outside of work hours, and increasingly in private spaces. There is a reasonable concern that increasing the availability of snus, which can be used in hospitals, workplaces, and aeroplanes, could undermine the effect of smoking restrictions in motivating smokers to quit tobacco use. Critics have also suggested that snus could be used by tobacco companies to weaken existing advertising bans on tobacco products by

arguing, for example, that smokers need to be informed of the health benefits of switching to snus rather than continuing to smoke.[28] Since the population-level benefit from snus depends on substantial numbers of smokers taking up the product, tobacco companies will have a powerful argument for being permitted to promote it. Because history shows that tobacco companies cannot be trusted to market their products in a manner that prioritises health over profits, any promotion of snus use should arguably be restricted to health departments.

There are several regulatory options for promoting the use of snus for tobacco harm reduction, including highly regulated and restricted access, free-market competition with cigarettes, or preferable treatment of snus compared with cigarettes (eg, lower taxation or labelling indicating reduced risk). The full range of potential policy options and their implications need careful consideration.[29]

We used expert panel estimates of the health risks of snus. Expert panels have been criticised because of the potential for bias in the selection of participants.[30] Levy and colleagues[22] attempted to exclude experts who were strongly associated with one particular viewpoint on snus to reduce the risk of bias, but a consensus among experts does not mean that the correct answer was necessarily obtained. Our results could underestimate or overestimate the health risks of snus in ways that could be revealed by subsequent research or further analyses. We have, however, incorporated CIs around the panel estimates to allow for some inaccuracy in these values. Our model might need to be modified in light of emerging data on the health risks of snus.

Our study also did not consider a number of fatal and non-fatal adverse health outcomes from tobacco smoking that are avoided by using snus. We did not include fatalities due to cigarette-related fires or morbidity caused by environmental tobacco smoke,[31] two hazards of smoking that are not shared by snus. Although legislation in Australia has afforded protection against exposure to environmental tobacco smoke in a number of public settings (workplaces, restaurants, and now pubs and clubs), there are still many locations in which non-smokers are exposed—eg, private homes and cars. Our model does not include among the benefits of snus use reduced exposure of smokers' families to environmental tobacco smoke. We have also not included the effects to the fetus in pregnant women who smoke tobacco or use snus.

Our results suggest that smokers who switch to snus rather than continuing to smoke can realise substantial health gains. It is unlikely that these health gains would be offset by the adverse health effects of snus use, such as increased mortality due to cancers and cardiovascular diseases, among people who have never used tobacco or current smokers who would have otherwise quit all tobacco use. The actual size of the probable population-health benefit would depend on the relative uptake rates of snus in smokers and non-smokers; further research into the appeal of snus among these groups is required. A detailed consideration of the pros and cons of snus use for tobacco harm reduction, and the most appropriate regulatory options, is necessary before changing current policies regarding snus.

Contributors

CEG took the lead role in adapting the model of tobacco-related disease to assess the health effects of snus for tobacco harm reduction and writing, editing, and revision of the paper. WDH was chief investigator who obtained funding for the study and suggested the use of the tobacco model to assess snus. TV was a co-investigator on the study. MYB, SSL, and TV developed the original tobacco model. TV, MYB, and ALW assisted with adaptation of the model for assessment of snus as a tobacco harm reduction intervention. All authors contributed to writing, editing, and revision of the manuscript.

Conflict of interest statement

We declare that we have no conflict of interest.

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References

1 Mathers CD, Loncar D. Projections of global mortality and burden of disease from 2002 to 2030. PLoS Med 2006; 3: 2011–30.

2 Strong K, Mathers C, Leeder S, Beaglehole R. Preventing chronic diseases: how many lives can we save? Lancet 2005; 366: 1578–82.

3 AIHW. 2004 National Drug Strategy Household Survey: Detailed Findings. AIHW cat. no. PHE 66. Drug Statistics Series No 16. Canberra: Australian Institute of Health and Welfare, 2005.

4 Begg S, Vos T, Goss J, et al. The burden of disease and injury in Australia, 2003. Canberra: AIHW, 2007.

5 Fiore MC, Novotny TE, Pierce JP, et al. Methods used to quit smoking in the United States. Do cessation programs help? JAMA 1990; 263: 2760–65.

6 Woolacott NF, Jones L, Forbes CA, et al. The clinical effectiveness and cost-effectiveness of bupropion and nicotine replacement therapy for smoking cessation: a systematic review and economic evaluation. Health Technol Assess 2002; 6 (16).

7 Stratton K, Shetty P, Wallace R, Bondurant S, eds. Clearing the Smoke: Assessing the Science Base for Tobacco Harm Reduction. Washington, DC: National Academy Press, 2001.

8 Rodu B. An alternative approach to smoking control. Am J Med Sci 1994; 308: 32–34.

9 Foulds J, Ramström L, Burke M, Fagerström K. Effect of smokeless tobacco (snus) on smoking and public health in Sweden. Tob Control 2003; 12: 349–59.

10 Rodu B, Godshall WT. Tobacco harm reduction: an alternative cessation strategy for inveterate smokers. Harm Reduct J 2006; 3: 37.

11 Ramström LM, Foulds J. Role of snus in initiation and cessation of tobacco smoking in Sweden. Tob Control 2006; 15: 210–14.

12 Gray N, Henningfield J. Dissent over harm reduction for tobacco. Lancet 2006; 368: 899–901.

13 Kozlowski LT, Strasser AA, Giovino GA, Erickson PA, Terza JV. Applying the risk/use equilibrium: Use medicinal nicotine now for harm reduction. Tob Control 2001; 10: 201–03.

14 European Court of Justice. Press release no 99/04: judgments of the Court of Justice in cases C-210/03 and C-434/02 "The court declares the prohibition on tobacco products for oral use to be valid" 14 December 2004. Luxembourg: European Court of Justice. http://curia.europa.eu/en/actu/communiques/cp04/aff/cp040099en.pdf#search=%22european%20court%20of%20justice%20judgment%20of%20the%20court%20case%20c-210%2F03%20luxembourg%22 (accessed March 27, 2007).

15 Bertram MY, Lim SS, Wallace AL, Vos T. The costs and benefits of smoking cessation aids: Making a case for public reimbursement of nicotine replacement therapy in Australia. Tob Control (in press).

16 Trewin D. Year book Australia. ABS Catalogue No. 1301.0. Canberra: Australian Bureau of Statistics, 2003.

17 American Cancer Society. Cancer Prevention Study II (CPS-II). Atlanta: American Cancer Society, 1998.

18 Peto R, Lopez AD. The future worldwide health effects of current smoking patterns. In: Koop CE, Schwarz MR, eds. Critical issues in global health. New York: Jossey-Bass, 2000.

19 Hill DJ, White VM, Scollo MM. Smoking behaviours of Australian adults in 1995: Trends and concerns. Med J Aust 1998; 168: 209–13.

20 Ezzati M, Vander Hoorn S, Lopez AD, et al. Comparative quantification of mortality and burden of disease attributable to selected risk factors. In: Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJL, eds. Global burden of disease and risk factors. New York: The World Bank and Oxford University Press, 2006: 241–396.

21 Sullivan DA. A single index of mortality and morbidity. HSMHA Health Rep 1971; 86: 347–54.

22 Levy DT, Mumford EA, Cummings KM, et al. The relative risks of a low-nitrosamine smokeless tobacco product compared with smoking cigarettes: estimates of a panel of experts. Cancer Epidemiol Biomarkers Prev 2004; 13: 2035–42.

23 Thun MJ, Apicella LF, Henley SJ. Smoking vs other risk factors as the cause of smoking-attributable deaths: confounding in the courtroom. JAMA 2000; 284: 706–12.

24 Accortt NA, Waterbor JW, Beall C, Howard G. Chronic disease mortality in a cohort of smokeless tobacco users. Am J Epidemiol 2002; 156: 730–37.

25 Levy DT, Mumford EA, Cummings KM, et al. The potential impact of a low-nitrosamine smokeless tobacco product on cigarette smoking in the United States: estimates of a panel of experts. Addict Behav 2006; 31: 1190–200.

26 O'Connor RJ, Kozlowski LT, Flaherty BP, Edwards BQ. Most smokeless tobacco use does not cause cigarette smoking: results from the 2000 National Household Survey on Drug Abuse. Addict Behav 2005; 30: 325–36.

27 Kozlowski LT, Goldberg ME, Yost BA, White EL, Sweeney CT, Pillitteri JL. Smokers' misperceptions of light and ultra-light cigarettes may keep them smoking. Am J Prev Med 1998; 15: 9–16.

28 Chapman S. Chapter 4. Public health advocacy and tobacco control: making smoking history. Oxford: Blackwell Publishing, 2007.

29 Hall WD. The prospects for tobacco harm reduction. Int J Drug Policy 2005; 16: 139–42.

30 Jones J, Hunter D. Qualitative research: consensus methods for medical and health services research. BMJ 1995; 311: 376–80.

31 Jamrozik K. Estimate of deaths attributable to passive smoking among UK adults: database analysis. BMJ 2005; 330: 812–16.