Explanatory Memorandum to the Protection from Tobacco (Sales from Vending Machines) (Wales) Regulations 2011

This Explanatory Memorandum has been prepared by the Department of Health, Social Services and Children and is laid before the National Assembly for Wales in conjunction with the above subordinate legislation and in accordance with Standing Order 27.1.

Minister's Declaration

In my view, this Explanatory Memorandum gives a fair and reasonable view of the expected impact of the Protection from Tobacco (Sales from Vending Machines) (Wales) Regulations 2011. I am satisfied that the benefits outweigh any costs.

Lesley Griffiths AM
Minister for Health and Social Services

26 September 2011

1. Description

The Protection from Tobacco (Sales from Vending Machines) (Wales) Regulations 2011 ("the Regulations") prohibit the sale of tobacco from vending machines in Wales. The primary focus of the Regulations is protecting children and young people by reducing their access to tobacco.

2. Matters of special interest to the Constitutional and Legislative Affairs Committee

None.

3. Legislative background

Section 22 of the Health Act 2009, inserts a new section 3A into the Children and Young Persons (Protection from Tobacco) Act 1991. Section 3A provides powers for the Welsh Ministers to make regulations that prohibit the sale of tobacco from vending machines.

The Health Bill as introduced into Parliament contained a version of section 3A of the Children and Young Persons (Protection from Tobacco) Act 1991 which provided for regulations to impose restrictions on the sale of tobacco from vending machines or to prohibit the sale of tobacco from vending machines. During Report Stage in the House of Commons, an amendment was passed which narrowed the power so that the only possible exercise of the power is to prohibit the sale of tobacco from vending machines. The debate relating to the amendment can be found in Hansard at: http://www.publications.parliament.uk/pa/cm200809/cmhansrd/cm091012/debtext/91012-0016.htm

This instrument is subject to the affirmative procedure.

4. Purpose & intended effect of the legislation

The Regulations will ban the sale of tobacco from vending machines in Wales from 1 February 2012. Section 3A(8) of the Children and Young Persons (Protection from Tobacco) Act 1991 provides that the definition of tobacco is the same as that contained in section 7 of the Children and Young Persons Act 1933. Section 7 of that Act provides that "tobacco" includes cigarettes, any product containing tobacco and intended for oral or nasal use and smoking mixtures intended as a substitute for tobacco.

Regulation 2(2) of the Regulations provides that "the person who controls, or is concerned with the management of, the premises where the automatic machine is located" will be guilty of an offence if tobacco products are sold from vending machines in Wales in contravention of the ban. Section 3A(4) of the Children and Young Persons (Protection from Tobacco) Act 1991 provides that such a person is liable on summary conviction to a fine not exceeding level four on the standard scale.

Premises is given a wide definition in regulation 2(3) of the Regulations to include “any place and any vehicle, vessel, hovercraft, stall or moveable structure”.

Smoking is the leading cause of premature death and illness in Wales, accounting for one in five deaths (around 5,650 people each year). It is also contributes to the gap in life expectancy between rich and poor.

Although only one per cent of the total tobacco market is accounted for by vending machine sales, 10 per cent of regular smokers aged 11 to 15 report that cigarette vending machines are a usual source of tobacco. Research has found that the National Association of Cigarette Vending Machine Operators voluntary code has not been effective in sufficiently restricting young people’s access to tobacco products from this source. In November 2009, the Welsh Heads of Trading Standards published findings from a test purchasing survey in which enforcement officers were assisted by young volunteers who attempted to purchase cigarettes from vending machines in a variety of types of premises. Of the 145 attempted purchases, 86 (59%) resulted in a sale.

Given these concerns, the Welsh Government considers that the current situation with regard to cigarette vending machines presents a risk to public health, and it therefore considers it important to prohibit sales from such machines.

A detailed explanation of the effect of the Regulations is at Annex 1. This Regulatory Impact Assessment was included as part of the consultation on the draft Tobacco Control Regulations in April 2010. No further impact assessment has been prepared since and there are no material changes since the consultation paper was published.

5. Consultation

A formal consultation on the draft Tobacco Control Regulations, together with the draft Regulatory Impact Assessment, was undertaken between 12 April 2010 and 6 July 2010. This consultation included a draft version of the Protection from Tobacco (Sales from Vending Machines) (Wales) Regulations. Consultees included retail and business representative organisations, local authorities, Wales Heads of Trading Standards, Public Health Wales, NHS organisations, the Chartered Institute of Environmental Health, Professional organisations, the Welsh Local Government Association, Wales Tobacco Control Alliance and voluntary sector organisations. The consultation document is available at:
http://wales.gov.uk/consultations/healthsocialcare/tobacco/?lang=en&status=closed

244 responses to the consultation were received from a wide variety of stakeholders. A detailed analysis of the consultation responses is available on the Welsh Government website at:
http://wales.gov.uk/consultations/healthsocialcare/tobacco/?lang=en&status=closed

No substantial changes have been made to the Protection from Tobacco (Sales from Vending Machines) (Wales) Regulations as a result of the consultation. The only change that has been made is to include “stall” in the definition of premises in regulation 2(3) of the Regulations. The Welsh Government believes that prohibition of tobacco sales from vending machines remains an appropriate response.

ANNEX 1: REGULATORY IMPACT ASSESSMENT: PROHIBITION OF TOBACCO SALES FROM VENDING MACHINES

Purpose and intended effect of the legislation

1. Tobacco smoking is proven to cause serious harm to the health of smokers and to non-smokers who are exposed to second-hand smoke. It is the major preventable cause of illness and premature death in Wales, accounting for one in five deaths each year. Smoking is also a leading cause of health inequalities, having been identified by the National Institute for Health and Clinical Excellence (NICE) as the main cause for the gap in life expectancy between rich and poor. Smoking-related illness has been estimated to cost the NHS in Wales an estimated £386 million in 2007/08, equivalent to £129 per head and 7% of total healthcare expenditure in Wales[1].

2. Most smokers start smoking during adolescence. Two thirds of adults who have ever smoked in the UK say that they started before they were 18. Those under the age of 18 are particularly vulnerable consumers in that they do not always have the capacity to understand the risks of tobacco consumption and to make informed decisions. In addition, existing young smokers may be unable to reduce their risks due to addiction. Young people can quickly develop a dependence on nicotine[2].

3. The Welsh Government is already investing in programmes to discourage young people from starting smoking: these include the SmokeBugs! Club for 9-11 year olds; the Smokefree Class Competition for 11-13 years olds; and the ASSIST peer support programme for 12-13 year olds. Young people are also a priority group for Stop Smoking Wales, the service which is funded by the Welsh Government and run by Public Health Wales to help people to stop smoking.

4. To complement these educational and support programmes, Government intervention is justified to prevent young people from accessing tobacco products. It is illegal to sell tobacco products to those under the age of 18; the age of sale for tobacco products was increased from 16 to 18 on 1 October 2007. However, because of their automated and often unsupervised nature, cigarette vending machines continue to present a means for under-18s to purchase tobacco products.

5. In reflection of this problem, the UK Government worked with the National Association of Cigarette Machine Operators (NACMO) to develop a code of practice defining the siting arrangements for vending machines (the NACMO code of practice). This advises that vending machines should be sited in supervised, monitored areas so that under-18s are unable to use the machines undetected. The NACMO code of practice was set out in the 1998 *Smoking Kills* White Paper which said:

> The new code provides clear guidance to machine operators on the siting arrangements expected. A machine should be sited in a monitored, supervised area

> so that staff can be sure of preventing its use by young people... There is now no excuse for machine operators or pub, club and restaurant managers to site machines inappropriately.[3]

6. Information provided by NACMO to the UK Department of Health suggests that the great majority of tobacco vending machines (78%) are located in public houses. Other locations include clubs (10%), hotels and restaurants (7%), shops (3%), bingo halls (1%) and other unspecified venues (1%).

7. Nonetheless, survey evidence from England[4] suggests that vending machines remain a source of tobacco for those aged 11-15 despite being comparatively more expensive than cigarettes from retail outlets. The importance of vending machines as a source of cigarettes for young people has decreased in recent years, and they are less commonly cited than other sources of tobacco (such as purchases from shops and being given cigarettes by friends). Although the minimum age of sale has now risen to 18, this is unlikely to impact on the ease of accessing tobacco from vending machines.

8. Reducing access to the other common sources of tobacco for young people is already being addressed by other UK measures such as raising the age of sale, strengthening sanctions against retailers who sell to people under the legal age, increased activity to reduce the availability of illicit tobacco and enforcement activity by local authorities.

9. As tobacco vending machines account for only 1 per cent of the UK market in tobacco sales, it appears that a disproportionate number of young people under the minimum legal age for sale of tobacco purchase their cigarettes from vending machines. Ten per cent of regular smokers aged 11 to 15 report that cigarette vending machines are a usual source of tobacco.

10. Research has found that the current voluntary code on the siting of vending machines has proved to be insufficiently effective in restricting young people's access to tobacco products from this source. In November 2009, the Welsh Heads of Trading Standards (WHOTS) published findings from a survey[5] of tobacco vending machines carried out by Trading Standards Officers in mid and west Wales. Of the 176 machines inspected, 32 (18%) were deemed to be in an unsuitable location within the premises in terms of ease of staff supervision.

11. Also in 2009, WHOTS invited local authorities across Wales to take part in a test purchasing survey[5] in which officers were assisted by young volunteers who attempted to purchase cigarettes from vending machines in a variety of types of premises. Of the 145 attempted purchases, 86 (59%) resulted in a sale. Of the 86 sales, 71 (83%) involved vending machines sited in areas of the premises which were judged by local authority officers to be capable of supervision by staff. In many instances, staff awareness of the law prohibiting underage sales appeared to be low.

12. The UK is a party to the WHO Framework Convention on Tobacco Control (FCTC), the world's first public health treaty.[6] The treaty includes the following obligations under Article 16 (sales to and by minors):

> Each Party shall adopt and implement effective legislative, executive, administrative or other measures at the appropriate government level to prohibit the sales of tobacco products under the age set by domestic law, national law or eighteen. These measures may include… ensuring that tobacco vending machines under its jurisdiction are not accessible to minors and do not promote the sale of tobacco products to minors.
>
> When signing, ratifying, accepting, approving or acceding to the Convention or at any time thereafter, a Party may, by means of a binding written declaration, indicate its commitment to prohibit the introduction of tobacco vending machines within its jurisdiction or, as appropriate, to a total ban on tobacco vending machines.

13. The FCTC is elaborated through guidelines for parties. Under Article 13 (tobacco advertising, promotion and sponsorship), guidelines have been agreed and provided to parties which suggest that "vending machines should be banned because they constitute by their very presence a means of advertising or promotion under the Convention".

14. The World Health Organisation's *European Strategy for Tobacco Control*[7] recommends that strategic national action should include "banning sales [of tobacco] through vending machines". According to the World Health Organisation, 22 countries in the WHO EURO region have banned the sale of tobacco through vending machines (10 since 2002). Of these 22 countries, 12 are European Union Member States.

Policy options

15. Section 22 of the Health Act 2009 inserts a new section 3A into the Children and Young Persons (Protection from Tobacco) Act 1991 which contains regulation making powers that enable the Welsh Ministers to prohibit the sale of tobacco from vending machines in Wales. The following policy options are therefore considered:

• Option 1: Retain the status quo, including the voluntary NACMO guidance on the siting of vending machines.

• Option 2: Prohibit the sale of tobacco from vending machines in Wales.

Option 2: Prohibit the sale of tobacco from vending machines.

16. NACMO has stated that the tobacco vending machine industry currently has an annual gross margin of £102 million, and that it consists of 200 private businesses and one large business with a total of around 550 employees. These figures are for the whole of the UK, so a population-based scaling factor of 0.05 for Wales derived from ONS mid-08 estimates would be appropriate.

17. The following points relate to recurring annual costs:

a. The economic cost of a ban on tobacco vending machines is calculated as the total value of the machines currently used in Wales. According to NACMO data, there are around 57,934 tobacco vending machines in England, Wales and Northern Ireland. Using a pro rata scaling factor of 0.053, this gives an estimate of 3,070 cigarette vending machines in Wales. The estimated worth of each vending machine (bearing in mind that the average machine is not new) is £375. This gives a **one-off cost of £1.15 million**. It is likely that the one-off cost would be incurred very soon after the policy announcement, as this would make it difficult for cigarette vending machine companies to borrow money.

b. Although purchases from cigarette vending machines represent only a small proportion of tobacco sales, if such purchases are not fully offset by an increase in cigarette sales elsewhere, this will result in a loss of utility to the consumer, as a result of lower consumption. It becomes very difficult to apply standard economic theory to predict utility losses in consumption of addictive substances. Tax revenue is a transfer of benefit from tobacco consumers to the community (the Exchequer). To the extent that smokers may no longer buy as much tobacco, part of this transfer ceases – for the purposes of this document, the reduction in tax revenue is taken as an estimate of the loss of utility. It should be noted, however, that this is likely to be a significant overestimate.

c. To quantify the possible impact on tax revenues, consider that HMRC forecast £8279 million tobacco duty revenues in 2009/10 for the UK as a whole[8]. When downscaled to Wales (using a population-based scaling factor of 0.05), the estimate becomes £414 million. Using the NACMO estimate that 1% of cigarette sales are from vending machines, and keeping the calculations in the same terms as above, forecast vending machine-associated tax revenue from sales in Wales must be around £4.14 million for 2009/10. Assuming that 25% to 75% of vending machine cigarette sales are not offset by increased sales elsewhere, the reduction in tax revenue, and hence the estimate of loss of utility as a result of this policy option, is **£1.04 million** to **£3.1 million** per annum.

d. This policy option will result in lost utility to legitimate cigarette machine users; cigarette vending machines are clearly a convenience for which some consumers are willing to pay. The Tobacco Manufacturers Association state[9] that in 2007, 47 billion duty-paid cigarettes were consumed in the UK. Scaling this down to Wales only (using a scaling factor of 0.05) yields 2.35 billion cigarettes. As 1% of these (i.e. 23.5 million cigarettes) would have been sold in vending machines, vending machine sales would have been equivalent to 1.18 million packs of 20 cigarettes. Using a mark-up of circa £1 per packet for vending machine cigarettes, and using this as an indication of the consumer surplus lost because of the non-availability of vending

machines, the annual cost of lost convenience to legitimate cigarette machine users would be **£1.18 million per annum**.

18. The following costs are not quantified, as they are most unlikely to be significant enough to shift the judgements that this Impact Assessment is designed to inform.

a. The bringing forward of the cost of disposal for cigarette vending machines. All machines will need to be disposed of at some point, but (due to the policy) this would occur sooner than would otherwise have been the case. Because costs incurred closer to the present are discounted less heavily, bringing forward the disposal would involve some economic cost.

b. A marginal increase in the cost of current enforcement visits; such visits would now take note if a vending machine were still in operation.

c. Lost manufacturers' profit from reduced tobacco sales. In the main this is not an economic cost, as it would be likely be offset by increased expenditure (and profit) elsewhere in the economy. There would be some cost inherent in the retraining/reconfiguration of labour and capital currently used by the tobacco industry (so that it can be used elsewhere). Additionally, some resources may be less productive in their new alternative use (or they may not have an alternative use) due to their specificity to the tobacco context. These costs are not quantified due to lack of data, though it is noted (through stock market data) that the tobacco industry return on capital employed (ROCE) may be higher than average.

d. The cost to the Welsh Government of informing businesses about the changes in legislation. This is anticipated to be small in the context of the other costs presented in this Impact Assessment.

19. Overall, the costs of option 2 include a one-off cost of £1.15 million plus annual costs of £2.22 million to £4.28 million. **Discounted over ten years, the total cost ranges from £20 million to £37 million**.

Benefits

20. The following sections identify the monetised benefit of smoking one fewer cigarette per day, then illustrate the associated benefits of each policy option.

Quantifying the monetised benefit of smoking one fewer cigarette per day

21. The benefits analysis in the Technical Appendix identifies (i) the discounted number of life-years saved from each young person who does not start smoking, and (ii) the number of life-years saved for a randomly chosen adult smoker who quits smoking. The estimates are adjusted for the fact that smokers may quit their habit in future.

22. It is suggested that the mortality impact of smoking increases linearly (from zero) with each cigarette smoked per day. The ONS publication *Smoking and drinking among adults, 2006* [10] finds that the average number of cigarettes smoked per day equals 15 per day for men and 13 per day for women. It is possible to calculate the number of life-years saved by smoking one fewer cigarette per day from a young age, given that the individual may quit in the future. For men, it is simply one fifteenth of the male value calculated in (i) above. For women, it is one thirteenth of the female value calculated in (i) above.

23. The number of life-years saved by a random adult smoking one fewer cigarette per day, given that they may quit in future, is equal to one fifteenth of the male value calculated in (ii) above (for men). For women, it equals one thirteenth of the female value calculated in (ii) above.

24. The male and female results are averaged to give an overall value.

25. The results are as follows:

i. Smoking one fewer cigarette per day from a young age: 0.11 life years gained (£5,550)
ii. Smoking one fewer cigarette per day (random adult): 0.09 life years gained (£4,400)

26. The following paragraphs explain the derivation of the estimates for (i) and (ii) above. A detailed description of the calculations is provided in the Annex, including references for all sources of data. The values are discounted in line with Green Book principles and a standard £50,000 value per life year is applied to each.

27. The calculations begin with data from the General Household Survey (2006) on smokers' ages, smoking prevalence and smoking status (i.e. whether the respondents are current smokers, former smokers or those who have never smoked). The proportion of smokers who have quit as they get older is found to increase at a fairly steady and constant rate (with roughly an extra 1% of smokers quitting at every year of age; 18% of those who have ever smoked by age 16 have already stopped at that age).

28. The seminal 50-year study of smoking mortality in British doctors (by Doll et al., 2004) is used to obtain mortality rates for the following categories of smoker:
• (a) those who have quit between ages 35-44,
• (b) those who have quit between ages 45-54,
• (c) those who have quit between ages 55-64, and
• (d) those who continue to smoke beyond age 65

29. Non-smokers' mortality rates are also obtained from this study. The results are combined with smoking prevalence data for the above age groups and the latest Office for National Statistics population mortality data to produce eight sets of two life tables: one life table for nonsmokers, and one

for the category of smoker under consideration ((i) to (iv) above, for both males and females). The differences between each pair of life tables indicate how the smokers' life expectancy loss is distributed between different years of age. The figures are discounted appropriately to take account of the fact that benefits accrued in the future are worth less than benefits accrued today.

30. The results of these calculations are presented in the table below, and are used to calculate the final estimates:

Quit age band	**Percentage of smokers in this band**	**Change in life years lived for this band (discounted, male)**	**Change in life years lived for this band (discounted, female)**
Under 35	38.2%	0.00	0.00
35 to 44	10.5%	-0.85	-0.66
45 to 54	10.5%	-2.75	-2.34
55 to 64	10.5%	-3.48	-3.03
65 or over	30.2%	-4.49	-4.15

31. For each sex, the number of life years saved for each young smoker (given that they may have quit anyway in future) is calculated by weighting the number of life years lost in each quit age band by the percentage of smokers who quit in that age band.

32. For each sex, the estimated monetary benefit for each adult who is induced to quit smoking (as opposed to each child who does not start smoking) is derived by a similar calculation to above. Calculations are made for each age band, and the results are then weighted by the percentage of smokers in each age band in order to give a final figure.

33. The calculations described in the two paragraphs above deliver two results: one for men, and one for women. Each result is adjusted downwards to take account of the fact that the doctors in the 2004 study by Doll[11] consumed a median of 18 cigarettes per day; current average consumption is less than this, at 15 per day for men and 13 per day for women.

34. A full discussion is presented in the Technical Appendix, but the above calculations are argued to be conservative. For example, improvements in the quality of life from quitting smoking (or never starting to smoke) – such as avoiding the morbidity associated with various smoking-related diseases – are not taken account of in the above calculations. Other limitations of the analysis are also discussed in the Technical Appendix.

35. The data presented above state that for 10% of regular smokers aged 11-15, a vending machine is a usual source of tobacco products. However, respondents were allowed to specify more than one 'usual source', meaning that the responses sum to 227% (instead of 100%). It seems unreasonable to state that 10% of the respondents' cigarettes came from vending machines; the 10% estimate is therefore adjusted downwards to 4.4%. (4.4% has been chosen because if all the other responses were adjusted downwards by the same factor, they would then sum to 100%).

36. It is therefore instructive to consider the health implications of a 4.4% average reduction in under-18s' cigarette consumption. The Health and Social Care Information Centre publication cited above[4] finds that 11-15 year olds smoke an average of 6 cigarettes per day. A 4.4% reduction in this figure would yield, on average, 0.26 fewer cigarettes per day. Note that this figure is an average; some children may completely stop smoking, whereas others may not reduce their smoking at all.

37. Consider the scenario in which this average reduction in daily cigarette consumption persists throughout the cohort's life. Using the estimates provided in the previous section, and taking averages across the male and female results:
• 0.03 life years saved per person (monetised as £1,500).

38. Using a birth cohort size of 35,000 per annum and a smoking prevalence of 20% for 16-19 year olds from Welsh Health Survey data for 2008[12], 7,000 smokers per year would be affected by the proposed policy. 210 life years would be saved per annum (i.e. per cohort), monetised at a total of £11 million per annum.

39. The reduction needs to persist throughout the cohort's lifetime. It is likely that this will be the case for some individuals, especially those who do not start smoking because of the difficulty of buying from vending machines, but it may not be the case for all individuals. There is also the possibility that young people will be very effective at finding alternative sources of cigarettes (thus blunting the policy benefits), although recent changes (such as the new minimum age of sale) imply that they may not be entirely successful. The benefits are therefore presented as a range, equal to 10% – 50% of the values calculated above.

40. Overall, the estimated (health) benefits therefore range between £1.1 million to £5.5 million per annum. This is **£9 million to £46 million** when discounted over ten years.

Non-monetarised benefits of policy option 2

41. No assessment has been made of any potential savings that might accrue outside of the ten year impact assessment period due to reductions in smoking-related illness by implementing option 2, either to the NHS or wider society. Because this policy option involves a full prohibition of tobacco sales from vending machines, it may also reduce adult cigarette consumption (in that it makes cigarettes slightly more difficult to acquire). As stated above, one fewer cigarette smoked per day is estimated to result (for a randomly chosen adult smoker) in a gain of 0.09 life years (or £4,400). It might be argued that any life years saved here are not a legitimate benefit, as adults are entitled to smoke if they wish, but issues such as addiction may also be taken into account.

Implications of the cost-benefit analysis

42. The present value of the net benefit ranges from -**£11 million to £9 million** for this option. To calculate the low end of the net benefit range (-£11 million) the low end of the cost range is subtracted from the low end of the benefit range; this is because the costs and benefits move together due to the varying assumptions about the proportion of cigarettes purchased from vending machines which are no longer consumed. The same approach is applied to the upper end of the range. There is uncertainty over the magnitude of the effects of the policy so the midpoint of this range is taken as **the best estimate: -£1 million**. The result of this analysis therefore shows that implementing the policy may impose a cost upon society. Therefore, from an economic perspective, the quantitative analysis, taken by itself, suggests that the policy may not be cost-beneficial.

43. The quantitative analysis presented above is based on a number of assumptions, about which there is debate and much uncertainty. For example, the process for estimating the loss of utility due to lower convenience and consumption for smokers is not straightforward, and the use of the standard theory of economics may be undermined in this area. It is therefore likely that the costs have been overstated to some extent. Similarly, the standard approach of discounting future benefits, including life-years saved, is subject to debate, and the approach taken in this analysis may result in an underestimate of the total benefits realised. Furthermore, given the focus in this policy on reducing young people's access to cigarettes, it is likely that additional weight would be given to the benefits to this particular target group. However, there is no agreed mechanism by which this can be easily done and incorporated in the analysis presented here, and it has therefore not been incorporated into the analysis above. It is important to recognise, therefore, that whilst the analysis undertaken here suggests that the costs may outweigh the benefits, the reality may be that the benefits of this policy exceed the costs once these other factors, which are difficult to quantify reliably, are taken into account.

Competition Assessment

44. No significant competition issues have been identified with either of the options. The legislative options apply equally to all retail outlets and are therefore unlikely to have any significant competition implications.

References

1. Phillips C J & Bloodworth A, 2009: Cost of smoking to the NHS in Wales. Swansea University, Swansea.

2. Di Franza J et al, 2007: Symptoms of tobacco dependence after brief intermittent use: the development and assessment of nicotine dependence in youth, *Archives of Pediatrics and Adolescent Medicine* 162 (7): 704-710

3. HM Government (1998). *Smoking Kills: A White paper on Tobacco.* TSO, London

4. Health and Social Care Information Centre, 2009: *Smoking, drinking and drug use among young people in 2008.*

5. Welsh Heads of Trading Standards, 2009: Report on Tobacco Vending Machine Enforcement Projects.

6. Available at: www.who.int/fctc

7. The European Strategy for Tobacco Control (ESTC) was adopted by the WHO Regional Committee for Europe at its fifty-second session in September 2002 and provides an evidence-based framework and guidance for effective national action and international cooperation. The ESTC sets out strategic directions for action in the Region, to be carried out through national policies, legislation and action plans.

8. See http://www.hmrc.gov.uk/stats/tax_receipts/table1-2.pdf

9. See http://www.the-tma.org.uk/uk-cigarette-consumption.aspx

10. Goddard, E (2008). Smoking and drinking among adults, 2006. Office of National Statistics, Newport.

11. Doll R., Peto R., Boreham J. and Sutherland I. (2004). 'Mortality in relation to smoking: 50 years' observations on male British doctors', British Medical Journal, 328, p 1519.

12. Welsh Assembly Government (2009). Welsh Health Survey 2008: analysis of unpublished data. Statistical Directorate, Welsh Assembly Government, Cardiff

TECHNICAL APPENDIX

1. This technical appendix was prepared by the UK Department of Health[1]. It describes the method and data sources behind the estimation of:

> i. the discounted number of life years saved for each young person who does not take up smoking;
>
> ii. the discounted number of life years saved for a randomly chosen adult who quits smoking today. This figure is lower, as some harm may already have been done by past smoking.

2. To convert the above figures into a monetary value, a standard value of £50,000 per life year is applied. Both estimates take account of the fact that many smokers quit during their lifetime, thus reducing the expected number of

life years lost from starting to smoke in the first place, and reducing the expected number of life years gained by quitting today.

3. The following main sources of data are used:

iii. General Household Survey (2006) source data. Used to identify the age distribution of smokers and the relationship between age and the percentage of smokers who have quit.

iv. Doll et al, 2004[2]. Reports the impact of smoking on mortality, split by age of quitting smoking (if applicable).

v. Office for National Statistics (ONS) period life tables, United Kingdom, 2004–06[3]. Reports population mortality estimates. Used to transform the outputs of the doctors' study into life years saved.

4. The steps common to both estimates are listed below:

vi. **Identify an estimate of the percentage of smokers who have quit by each year of age.** Data from GHS (2006)[4] are used here. The percentage who have quit increases at a fairly steady and constant rate as age increases. A linear relationship was therefore identified between age and the percentage who have quit; the results imply that 18.2% of 'ever smokers' have already quit by age 16, with 1.05% quitting in each year thereafter up to age 94.

vii. **Identify an estimate of the prevalence of smoking at each year of age.** Data from GHS (2006)[5] are used here.

viii. **Identify an age distribution for the smoking population.** Again, data from GHS (2006)[6] are used here.

ix. **Identify mortality data (by year of age) for non-smokers and for four categories of smoker (as defined by quit age).** Mortality data are taken from Doll et al. (2004, Table 5), which lists number of deaths per 1,000 people at ages 34–44, 45–54, 55–64, 65–74 and 75–84. (These are referred to below as the five age bands.) This information is presented at each age band for lifelong non-smokers, as well as:
• those who have quit at age 35–44;
• those who have quit at age 45–54;
• those who have quit at age 55–64; and
• those who continue to smoke beyond age 65.

These four categories of smoker are used throughout the calculations, and are referred to as 'quit age bands'. The data are converted into relative risks by dividing the number of deaths per 1,000 in each of these four categories by the equivalent number of deaths (i.e. the number of deaths in the same age band) for the lifelong non-smokers. The following formulae are then applied, which calculate mortality rates at each year of age (from 0 to 100) for smokers and non-smokers respectively:

• Smokers' mortality at age x = M * (r / (pr + 1 – p)).
• Non-smokers' mortality at age x = M * (1 / (pr + 1 – p)).
• Where M is the mortality estimate from the ONS life tables for age x, r is the relative risk at age x, and p is the prevalence (expressed as a proportion) at age x.
• The above formulae are calculated for each year of age, for each sex and for each of the four categories of smoker, as the relative risks differ between quit age categories and population mortality differs between the sexes.

x. **Identify the number of life years lost (by year of age) for each combination of sex and the four categories of smoker.** For each combination of quit age band and sex[7], two life tables are calculated, following the method of Chiang (1984)[8]. One of the two life tables starts with the smokers' mortality figures and the other starts with the nonsmokers' mortality figures (both for each year of age, and as calculated above). Each life table models a birth cohort of 100,000 children; one column in particular measures the total number of life years lived by the cohort for each year of age. For each year of age, the difference in this column between the two life tables is calculated and divided by 100,000 to convert the value into the expected number of life years lost per capita (for that age). The sum of these values across all years of age (from 0 to 100) equals the number of life years lost by the specified combination of quit age band and sex.

xi. **Discount the numbers of life years lost, as calculated in the previous step.** As the life years lost occur in future years of the cohort's life, they should be discounted appropriately. The discount rates used are equal to Green Book rates minus 2%. The 'minus 2%' takes account of the fact that the monetary value per life year (which is applied later on) can be expected to grow at the same rate as real economic growth. The 2% figure for this is taken from the Social Rate of Time Preference assumptions underlying the Green Book discount rates. The sum of the discounted numbers of life years lost at each year of age equals the discounted number of life years lost by the specified combination of quit age band and sex.

5. The end results of these calculations are presented in the following table. The identified relationship between age and the percentage of smokers who have quit is used to calculate the percentages in the second column.

Quit age band	Percentage of smokers in this band	Change in life years lived for this band (discounted, male)	Change in life years lived for this band (discounted, female)
Under 35	38.2%	0.00	0.00
35 to 44	10.5%	-0.85	-0.66
45 to 54	10.5%	-2.75	-2.34
55 to 64	10.5%	-3.48	-3.03
66 or over	30.2%	-4.49	-4.15

6. The benefit (in discounted life years) for each child who does not take up smoking is estimated as follows:

xii. A weighted average of the number of life years saved for male children is calculated, with the percentage of smokers who quit in each quit age band being used to weight the life expectancy penalties for those bands.

xiii. A similar weighted average is calculated for female children.

xiv. The resulting male and female estimates are then downscaled to 83% and 72% of their calculated value, respectively. This reflects the fact that the median doctor from the doctors' study smoked 18 cigarettes per day, whereas current averages for men and women are lower: 15 and 13 respectively (GHS 2006 [9]). Current smokers can therefore be expected to experience less harm.

xv. The resulting downscaled estimates are then monetised with a value of £50,000 per life year.

7. Therefore, **the benefit for each child who does not take up smoking:**
xv.i Males: 1.75 life years, i.e. £87,559.
xvii. Females: 1.57 life years, i.e. £78,703.

8. The benefit (in discounted life years) for a randomly chosen adult who quits smoking is estimated as follows:

xviii. The aforementioned five age bands for adult smokers are also used here: those aged (i) under 35, (ii) 35–44, (iii) 45–54, (iv) 55–64, and (v) over 65. The percentage of smokers that quit in each quit age band is then considered, given that the smoker has already reached one of age categories (i) to (v) above. For example, 10.5% of smokers quit in the 55–64 age band, whereas 30.2% go on to become lifetime smokers. For an individual who is already aged 55–64, it must be that 10.5% / (10.5% + 30.2%) = 25.9% will quit in the 55–64 age band, whereas the remaining 74.1% continue to smoke over the age of 65.
xix. For each category of smoker age, the percentage of smokers who quit in each quit age band (as adjusted above) is multiplied by the life year penalty associated with each quit age band. Obviously, as we move towards the older age bands, fewer and fewer quit age bands enter into the calculation (as it is not possible, say, to quit smoking at 35–44 if you are already aged 45–54). This calculation gives the expected number of life years lost given that the smoker may quit at some point in the future. The calculated values for the older age groups are larger, as they are more likely to become lifelong smokers.

xx. For each age band, the previous table indicates the number of life years that would be lost anyway if the smoker were to quit at their current age. This number is higher for the older age groups, as more harm has already been done. For each age band, these values are

subtracted from the numbers calculated in the previous bullet. This gives the number of life years that could be reclaimed if the smoker were to stop smoking at their current age.

xxi. GHS (2006) data on the age distribution of smokers are used to weight the number of life years that could be saved in each age band. This yields a final estimate of the number of life years that could be saved if a random smoker were to quit today.

9. Therefore, **the benefit for each adult who decides to quit smoking:**

xxii. Males: 1.18 life years, i.e. £58,884.

xxiii. Females: 1.12 life years, i.e. £55,755.

10. For the following reasons, the benefit estimates described above are conservative:

xxiv. They do not take account of the improved quality of life that results from quitting smoking. For example, a quitter may escape diseases that reduce their quality of life as well as reduce their life expectancy (such as chronic obstructive pulmonary disease).

xxv. It is assumed that no harm is incurred by smoking over the age of 84. There is likely to be some harm here (which would increase the measured benefits if counted), but there is a lack of precise data. In any case, as the cohort is fairly small by this age, the results are not particularly sensitive to this assumption. Even assuming that the relative risk for those aged 84 also holds for those who are aged 84 and over, the discounted 'child who does not start smoking' benefits only increase by less than 5%.

xxvi. It is assumed in this assessment that no harm is incurred by smoking under the age of 35. Again, there is likely to be a benefit from not smoking at this age, but there is a lack of precise data.

xxvii. It is assumed that quitting after the age of 65 yields no health benefit. There is also likely to be a small benefit here, but again, there is a lack of precise data.

xxviii. The estimates do not take account of the fact that the resulting reduced smoking prevalence would reduce demand for stop smoking goods and services. The economic resources saved could be used for other purposes.

11. Other limitations of the estimate include:

xxix. It is assumed that the same smoking mortality impacts hold for both men and women. The Doll et al. (2004) study only covers male doctors.

xxx. It is assumed that the average daily number of cigarettes smoked throughout life is linearly related to the number of life years lost. The relationship is unlikely to be perfectly linear in practice.

xxxi. The Doll et al. (2004) study does not explicitly adjust for confounding factors (although it does control for social class, given that its sample consists only of doctors). For example, if smokers are also more likely to drink heavily, this may exaggerate the mortality impact of smoking. However, a similar cohort study[10] (based in The Netherlands) does adjust for a long list of confounding factors, including socioeconomic status, alcohol use and body mass index. The authors conclude that adjusting for confounding factors reduces the estimated number of (undiscounted) life years lost due to smoking by half a year. This is a fairly small effect given that the estimated life expectancy loss to smokers (including the adjustment for potential confounders) is still equal to seven years. Given that the estimates presented in this annex are discounted and take account of future quit propensities, any reduction to take account of confounding factors would be considerably less than half a life year.

Technical Report References

1. UK Department of Health, 2008: Consultation on the future of tobacco control. Department of Health, London: pp 105-109

2. Doll R., Peto R., Boreham J. and Sutherland I. (2004). 'Mortality in relation to smoking: 50 years' observations on male British doctors', British Medical Journal, v 328, p 1519.

3. Available at: http://www.statistics.gov.uk/StatBase/Product.asp?vlnk=14459&Pos=&ColRank

4. Variables 'age' and 'cigsmk1' were used – the latter identifies 'ex-smokers', 'current smokers' and 'never smokers'. For each year of age, the percentage of smokers who have quit equals the number of 'ex-smokers' divided by the sum of 'ex-smokers' and 'current smokers'.

5. Prevalence at each year of age was defined as the number of current smokers (as indicated by the variable 'cigsmk1') at each age, divided by the total number of individuals of that age in the sample.

6. The variable 'age' was used on the subset of respondents who are current smokers (as indicated by the variable 'cigsmk1').

7. For example, one combination considers male smokers who quit at age 35–44.

8. Chiang C. (1984). The Life Table and its Applications. Krieger, Malabar, Florida.

9. Goddard E. (2008). General Household Survey 2006: Smoking and drinking among adults, 2006. Office for National Statistics, Newport.

10. Streppel M., Boshuizen H., Ocke M., Kok F. and Kromhout D. (2007). 'Mortality and life expectancy in relation to long-term cigarette, cigar and pipe smoking: the Zutphen Study', Tobacco Control, 16, pp. 107–113. The Zutphen Study, based in Zutphen, The Netherlands, covers 1,373 men born between 1900 and 1920 and studied between 1960 and 2000.