Summary: Intervention & Options

Department /Agency: **Department of Health**	Title: **Impact Assessment of mandatory age restriction technology or prohibition for tobacco vending machines**	
Stage: Final	**Version:**	**Date: 11 November 2008**
Related Publications: Consultation on the Future of Tobacco Control (2008)		

Available to view or download at:

http://www.dh.gov.uk/tobacco

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What is the problem under consideration? Why is government intervention necessary?

Tobacco smoking is proven to cause serious harm to the health of the smoker. It also poses significant externalities to the rest of society.

Those under the age of 18 are uniquely vulnerable consumers in that they are not yet fully able to understand the risks of tobacco consumption. Government intervention is therefore justified to prevent people in this age group from purchasing tobacco products. However, the voluntary code of practice governing the siting of tobacco vending machines (the NACMO Guidance) does not sufficiently restrict young peoples' access to tobacco from this source.

What are the policy objectives and the intended effects?

The policy objective is to reduce smoking take-up, prevalence and/or the number of cigarettes smoked by under-18s, thus creating a future beneficial effect on public health.

Because 17% of regular smokers (or 14% of all smokers, including occasional smokers) aged 11 to 15 report that cigarette vending machines are their usual source of tobacco, further restricting access to these machines should contribute to the above objective.

What policy options have been considered? Please justify any preferred option.

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

2. Introduce age restriction mechanisms onto all tobacco vending machines.

3. Prohibit the sale of tobacco from vending machines.

NOTE: This IA sets out the costs and benefits if the relevant enabling legislation in the Bill were used; no implementation decision has yet been taken on these options.

When will the policy be reviewed to establish the actual costs and benefits and the achievement of the desired effects? Any future policy would be reviewed three years after the date of implementation of the policy.

Ministerial Sign-off For final proposal/implementation stage Impact Assessments:

I have read the Impact Assessment and I am satisfied that (a) it represents a fair and reasonable view of the expected costs, benefits and impact of the policy, and (b) the benefits justify the costs.

Signed by the responsible Minister:

.... Date:

Summary: Analysis & Evidence

Policy Option: 2	Description: Introduce age restriction mechanisms onto all tobacco vending machines

COSTS

ANNUAL COSTS		Description and scale of **key monetised costs** by 'main affected groups' One-off cost to vending machine operators of fitting a remote control system to 71,450 vending machines (over two years), including parts, labour and the cost of an exchange programme on site. Annual time cost (to staff and customers) of age checks. Lost reduction in duty revenue per annual cohort.
One-off (Transition)	**Yrs**	
£ 4,465,000	2	
Average Annual Cost (excluding one-off)		Total Cost (PV) £ 46m to £173m
£ 4.5m - £19.8m		

Other **key non-monetised costs** by 'main affected groups' Marginal increase in maintenance costs as a result of the installation of a remote control system to each machine. Marginal increase in enforcement costs (e.g. possible increased number of test purchases). Disposal cost of unmodifiable machines.

BENEFITS

ANNUAL BENEFITS		Description and scale of **key monetised benefits** by 'main affected groups' Life years gained by each annual cohort of underage smokers from smoking (on average) 0.45 fewer cigarettes per day per annual cohort; range is 10%-50% of the resulting figure due to uncertainty on how many underage smokers would successfully find an alternative source of tobacco.
One-off	**Yrs**	
£ 0		
Average Annual Benefit (excluding one-off)		Total Benefit (PV) £ 243m to £1.21bn
£ 29.2m to £146m		

Other **key non-monetised benefits** by 'main affected groups' Reduced morbidity arising from reduced cigarette consumption.

Key Assumptions/Sensitivities/Risks Enforcement is fully effective. Firms given two years to comply. Benefits range is due to uncertainty on exactly how many young smokers would be affected.

Price Base Year 2008	Time Period Years 10	Net Benefit Range (NPV) £ 165m to £882m	NET BENEFIT (NPV Best estimate) £ 281m

What is the geographic coverage of the policy/option?				UK (Excl. Scotland)	
On what date will the policy be implemented?				N/A	
Which organisation(s) will enforce the policy?				Trading Standards	
What is the total annual cost of enforcement for these organisations?				£ 0	
Does enforcement comply with Hampton principles?				Yes	
Will implementation go beyond minimum EU requirements?				Yes	
What is the value of the proposed offsetting measure per year?				£ 0	
What is the value of changes in greenhouse gas emissions?				£ 0	
Will the proposal have a significant impact on competition?				No	

Annual cost (£-£) per organisation (excluding one-off)	Micro 0	Small 0	Medium 0	Large No firms.
Are any of these organisations exempt?	No	No	N/A	N/A

Impact on Admin Burdens Baseline (2005 Prices)   (Increase - Decrease)

Increase of   £   Decrease of   £   Net Impact   £

Key:	Annual costs and benefits: Constant Prices	(Net) Present Value

Summary: Analysis & Evidence

Policy Option: 3	Description: Prohibit the sale of tobacco from vending machines

COSTS

ANNUAL COSTS		Description and scale of **key monetised costs** by 'main affected groups' Immediate one-off cost: the total value of UK cigarette vending machines (71,450 machines at £375 each). Annual costs: £40.9m annual cost to Exchequer of lost tobacco duty. £21.5m annual cost to legitimate smokers who no longer have the convenience of vending machines.
One-off (Transition)	**Yrs**	
£ 26.8m	0	
Average Annual Cost (excluding one-off)		
£ 62.4m		**Total Cost** (PV) £ 545m

Other **key non-monetised costs** by 'main affected groups' Costs arising from the bringing forward of disposal costs for existing cigarette vending machines. Marginal increase in enforcement costs.

BENEFITS

ANNUAL BENEFITS		Description and scale of **key monetised benefits** by 'main affected groups' Life years gained by each annual cohort of underage smokers from smoking (on average) 0.45 fewer cigarettes per day; range is 10%-50% of the resulting figure due to uncertainty on how many underage smokers would successfully find an alternative source of tobacco.
One-off	**Yrs**	
£ 0		
Average Annual Benefit (excluding one-off)		
£ 32.4m to £162m		**Total Benefit** (PV) £ 270m to £1.35bn

Other **key non-monetised benefits** by 'main affected groups' Reduced morbidity arising from reduced cigarette consumption. Possible gain in quality and length of adult smokers' lives if cigarettes become less readily accessible.

Key Assumptions/Sensitivities/Risks Enforcement is fully effective. Benefits range is due to uncertainty on exactly how many young smokers would be affected.

Price Base Year 2008	Time Period Years 10	**Net Benefit Range** (NPV) £ -616m to £463m	**NET BENEFIT** (NPV Best estimate) £ -346m

What is the geographic coverage of the policy/option?			UK (Excl. Scotland)	
On what date will the policy be implemented?			N/A	
Which organisation(s) will enforce the policy?			Trading Standards	
What is the total annual cost of enforcement for these organisations?			£ 0	
Does enforcement comply with Hampton principles?			Yes	
Will implementation go beyond minimum EU requirements?			Yes	
What is the value of the proposed offsetting measure per year?			£ 0	
What is the value of changes in greenhouse gas emissions?			£ 0	
Will the proposal have a significant impact on competition?			No	

Annual cost (£-£) per organisation (excluding one-off)	Micro £85k	Small £85k	Medium £9m	Large No firms.
Are any of these organisations exempt?	No	No	N/A	N/A

Impact on Admin Burdens Baseline (2005 Prices)   (Increase - Decrease)

Increase of £   Decrease of £   **Net Impact** £

Key: **Annual costs and benefits: Constant Prices**   **(Net) Present Value**

[Use this space (with a recommended maximum of 30 pages) to set out the evidence, analysis and detailed narrative from which you have generated your policy options or proposal. Ensure that the information is organised in such a way as to explain clearly the summary information on the preceding pages of this form.]

Introductory Notice: The Bill contains enabling legislation concerning the sale of tobacco from vending machines. This Impact Assessment illustrates how the legislation might be used, and calculates the associated costs and benefits. A decision has yet to be taken on the implementation method, but this IA shows the substantial benefits (both quantifiable and unquantifiable) that could be realised from the exercise of secondary legislation using the power proposed. A further Impact Assessment will be published alongside any proposed secondary legislation, detailing the reasoning behind the preferred option. Note that this Impact Assessment illustrates the costs and benefits if the legislation on tobacco vending machines were used in all UK countries minus Scotland. Further country-specific Impact Assessments may follow for Wales and Northern Ireland if those countries decide to go ahead. Cost and benefit calculations in those Impact Assessments may differ due to the use of data that is specific to the country in question.

Background

1. 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 nature, vending machines present a possible means for under-18s to purchase tobacco products.

2. Consequently, voluntary guidance has been issued by the National Association of Cigarette Machine Operators (NACMO) concerning the siting of vending machines. The guidance suggests that vending machines should be sited in supervised, monitored areas so that under-18s are unable to use the machines undetected.

3. Information from NACMO suggests that 78% of machines are located in public houses, with 10% being located in clubs, 7% in hotels or restaurants, 3% in shops, 1% in bingo halls and 1% elsewhere.

4. Nonetheless, survey evidence, as published in '*Smoking, drinking and drug use among young people in 2006*' – The Information Centre, suggests that vending machines remain a source of tobacco for those aged 11-15 despite their relative expense. Nonetheless, their importance has significantly 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 of age of sale has now risen to 18, this is unlikely to impact on the ease of accessing tobacco from vending machines.

Usual source of cigarettes for regular smokers aged 11-15, 2006
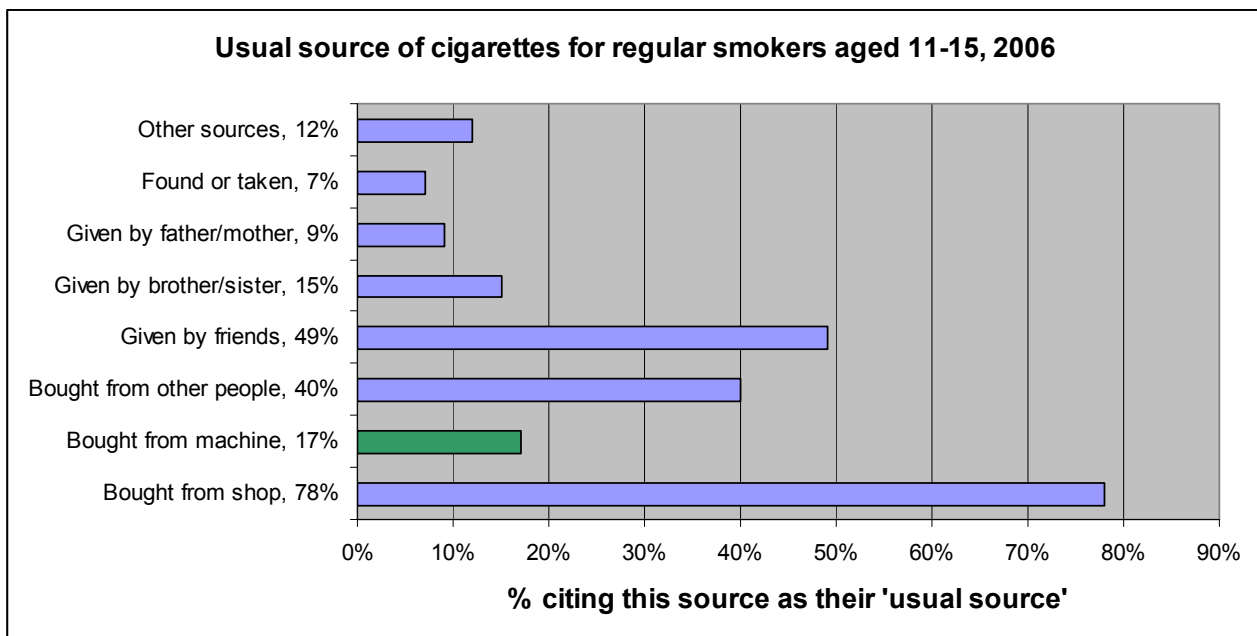
Usual source of cigarettes for regular smokers aged 11-15, 2006

Year	1982	1986	1990	1994	1996	1998	2000	2002	2004	2006
% responding 'bought from machine'	13%	19%	37%	31%	32%	30%	22%	22%	24%	17%

Source: *'Smoking, drinking and drug use among young people in 2006' – The Information Centre. Percentages total more than 100% because pupils could give more than one answer.*

5. However, the other common sources of tobacco for young people are already being addressed by other measures such as raising the age of sale, strengthening sanctions against retailers who sell to people under the legal age, enforcement action against smuggling and through effective media communications campaigns.

6. Because tobacco vending machines account for only 1% 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.

Rationale for further control on tobacco vending machines

7. Tobacco smoking is proven to cause serious harm to the health of the smoker. It also poses significant externalities to the rest of society and is a leading cause of health inequalities; prevalence is higher among routine and manual groups.

8. Those under the age of 18 are uniquely vulnerable consumers in that they are not yet fully able to understand the risks of tobacco consumption, so appropriate interventions may be justified.

9. Additionally, existing smokers may be unable to reduce their risks due to addiction or lack of information.

Policy options

10. The following policy options are considered:

  ■ (Option 1) Retain the status quo, including the voluntary NACMO guidance on the siting of vending machines.

  ■ (Option 2) Introduce age restriction mechanisms onto all tobacco vending machines.

  ■ (Option 3) Prohibit the sale of tobacco from vending machines.

Types of age restriction mechanisms and action taken in other countries

11. The following types of age restriction mechanism may be suitable:

  a. Electronic age verification: Tobacco companies provide an electronic ID card (after proof of age has been provided) that allows customers to activate tobacco vending machines. Alternatively, an electronic chip or code is inserted into the tobacco purchaser's ATM card (on proof that the cardholder is 18 years or over). A customer is only able to buy tobacco from the vending machine if they insert the card, which electronically "awakens" the machine. Such electronic card systems are used in Germany and the Netherlands, and are soon to be introduced in Japan.

  b. ID Coin mechanism: Potential purchasers are required to obtain an ID coin from a member of staff, which is then inserted into the tobacco vending machine before purchase. The vending machine cannot be activated without the insertion of an ID coin. This system enables staff to monitor who is purchasing tobacco from the vending machine and ask for proof of age where necessary. This system is used on a proportion of vending machines in the Republic of Ireland.

  c. Remote control: The vending machine can only be activated by means of a remote control held by a staff member. Potential purchasers need to approach a staff member in order for the machine to be activated, which enables the staff member to ask for proof of age where necessary. Such a system is used in New Zealand.

12. The World Health Organisation's (WHO) Framework Convention on Tobacco Control, which was ratified by the UK in 2004, encourages measures that ensure that tobacco vending machines are not accessible to minors. A 2003 European Council Recommendation[1] suggests member states restrict access to tobacco vending machines to locations accessible to persons over the age set for purchase of tobacco products in national law or otherwise regulate the access to the products sold through such machines in an equally effective way. The WHO European Strategy for Tobacco Control[2] goes further, stating that strategic national actions to restrict availability of tobacco to young people should include banning sale through vending machines.

Costs

Option 2: Introduce age restriction mechanisms on to all tobacco vending machines.

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[1] Council Recommendation on the prevention of smoking and on initiatives to improve tobacco control (2003/54/EC)

[2] WHO European Strategy for Tobacco Control 2002

13. According to National Association of Cigarette Machine Operators (NACMO) data, there are circa 78,000 cigarette vending machines in the UK. This Impact Assessment covers only the UK minus Scotland, so a population-based scaling factor (derived from ONS mid-2006 estimates) of 0.916 is applied. This yields an estimate of 71,448 cigarette vending machines in the UK minus Scotland.

14. Profit-maximising firms would of course opt for the cheapest possible age verification system that satisfies regulatory requirements.

15. NACMO have suggested that the following costs might be incurred for each vending machine modified.

    a. ID Card system: £300 per machine (excluding labour costs), possibly with an extra cost for telephone line rental. 30% of the machine estate could not be converted to use this system. Significant extra costs would be incurred by the provision of personal activation cards; obtaining such cards would also impose an inconvenience (with associated time cost) on customers. If age verification data were instead included on new bank cards, this would require the agreement (and likely compensation) of UK banks.

    b. ID Coin system: £125 per machine, plus £0.10 per token (excluding labour costs). Assuming 100 tokens per site, the total cost would be £135 per machine.

    c. Infra-red remote control system: £60 per machine (excluding labour costs).

    d. £50 in labour costs should be added to all of the above costs, to reflect the cost of fitting the appropriate modification.

    e. The cost of the cheapest possible conversion (the infra-red system), including labour, would therefore be (£60 + £50) = £110 per machine.

16. Sinclair Collis, a large cigarette machine operator, have suggested slightly different costs:

    a. ID Card system: £300 per machine (presumably excluding labour costs). The extra costs stated above would still apply on top of this.

    b. ID Coin system: £125 per machine, plus £0.10 per token. The company state that *'this takes into account the cost of coin mechanism upgrade (£25-£30) plus labour and fitting, and the required exchange programme on site, although there would also be ongoing operational costs'.*

    c. Radio frequency remote control system: £70 plus labour costs per machine. This is Sinclair Collis' preferred age verification system.

    d. The overall cost of the radio frequency control system must be less than £125 per machine, given that it is Sinclair Collis' preferred mechanism. For conservativeness, it is assumed that the overall cost is £125 per machine.

17. An overall cost of £125 per machine is therefore used in this Impact Assessment.

18. Using the figure of 71,448 cigarette vending machines in the UK minus Scotland, this would yield a **one-off cost of £8.93 million**. The estimate does also not take account of economies of scale in modifying the machines. In order to reduce compliance costs, firms would be given two years to comply.

19. The radio frequency control system will impose a time cost on staff, who will now have to check identification for younger customers who wish to use the vending machine. It will also impose a time cost on the customers themselves. Consider a time cost of 10 seconds per transaction to both the staff member and the consumer. The Tobacco Manufacturers Association[3] state that (in 2007) 47 billion duty-paid cigarettes were consumed in the UK. Scaling this down into UK-minus-Scotland terms (using a scaling factor of 0.916) yields 43.1 billion cigarettes. As 1% of these (i.e. 431 million cigarettes) would have been sold in vending machines, vending machine sales would have been equivalent to 21.5 million

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[3] See http://www.the-tma.org.uk/uk-cigarette-consumption.aspx

packs of 20 cigarettes. These sales are equivalent to 59,794 hours per annum for staff, and 59,794 hours per annum for customers. The Department for Transport 'Value of travel time savings' gives an indication of the value of leisure time: £3.54 per hour at end-1997 prices, or £4.53 per hour in 2007/8 prices[4]. The Annual Survey of Hours and Earnings (ASHE) states that in 2007, the mean wage of bar staff was £6.01[5], or £7.81 when uplifted by 30% to include other costs of employment. These rates value the time cost calculated above at a combined value of **£738,000 per annum**.

20. There is some lost tax revenue associated with the reduced consumption set out in the Benefits section. 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 – there is no offsetting gain to the consumer themselves or to the Exchequer, so the lost duty represents an economic cost.

21. The tax loss calculation is consistent with the benefits calculation, which adjusts for the fact that some smokers quit during their lifetime, thus reducing the estimated tax loss associated with having fewer new smokers. An average price of £5 per 20-pack is used alongside the current specific duty rate of £112.07 per 1,000 cigarettes, and the current ad valorem rate of 22%. This gives a figure of £3.34 per 20-pack sold. Lost VAT revenue is not considered, as this will likely be offset by increased expenditure on other VAT-eligible products. As in the Benefits section, the calculation is based on average consumption of 15 cigarettes per day for men, and 13 per day for women. The same quit age bands are used, including the band of 'under 35'. In each quit age band, smokers are modelled to quit in the middle of the age band (for example, those quitting between ages 35 and 44 are modelled to no longer smoke when they reach age 40). Those quitting in the 'under 35' band are modelled to no longer smoke when they reach age 26 (a middle figure that is based on starting at age 16), and those in the 'over 65' quit age band are modelled to smoke until death. Tax revenues for each quit age band are discounted at Green Book rates. Discounted tax revenue losses for each quit age band are then weighted by the estimated percentage that quits in that age band (see Technical Appendix). The result is a loss of £9,100 per smoker who does not start, averaged across the sexes. Given an average consumption of 14 cigarettes per day across men and women, this is equivalent to £650 per daily cigarette not smoked by a new smoker. The Benefits section is based on a reduction of 0.045-0.225 (10-50% of 0.45) cigarettes per day amongst 130,000 young smokers. This is equivalent to a tax shortfall of **£3.8 million - £19 million per annual cohort**.

22. Any losses resulting from lost sales to under-18s are excluded.

23. The following costs are not quantified; they are most unlikely to be significant enough to shift the judgements that this IA is designed to inform.

    a. Any increased maintenance cost arising from the fact that extra equipment has been added to the vending machine.

    b. The cost of disposal for any (likely older) machines that could not be fitted with the extra equipment. There is no estimate of the number of such machines, but it should be noted that this cost relates to the bringing forward of disposal; all machines have a limited service life.

    c. Any increase in the cost of enforcement visits. It may be that test purchasing, for example, needs to be expanded to include establishments with vending machines. The number of test purchases would need to be increased in order to maintain the probability that a given establishment is subjected to a test purchase.

    d. Lost manufacturers' profit from reduced tobacco sales. This is largely not an economic cost, as it would likely be offset by increased expenditure (and profit) elsewhere in the

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[4] Using the HM Treasury GDP Deflator from 1997/98 to 2007/08. See http://www.hm-treasury.gov.uk/economic_data_and_tools/gdp_deflators/data_gdp_fig.cfm
[5] Gross hourly pay, Table 14.5a, Annual Survey of Hours and Earnings (2007). See http://www.statistics.gov.uk/downloads/theme_labour/ASHE_2007/2007_occ4.pdf

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 alterative 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.

24. Overall, option 2 results in a one off-cost of £8.93 million (spread over two years), and an annual cost of £4.5 million - £19.8 million. Summed over ten years and discounted appropriately, these costs equal **£46 million - £173 million**.

Option 3: Prohibit the sale of tobacco from vending machines.

25. NACMO have stated that the tobacco vending machine industry currently:

    a. Has an annual gross margin of £102 million.

    b. Consists of 200 private businesses with a total of circa 1,000 employees, and one large business with circa 200 employees. This gives a total of 1,200 employees.

    c. Note that these figures are for the whole of the UK, so will be higher than if they only covered the UK minus Scotland (the countries covered by this Impact Assessment). As above, a population-based scaling factor of 0.916 would be appropriate.

26. The economic cost of a ban on tobacco vending machines is calculated as the total value of the machines currently used in the UK minus Scotland. Given the estimate of 71,448 machines in the UK minus Scotland, and an estimate that each vending machine is worth £375 (bearing in mind that the average machine is not new), a **one-off cost of £26.8 million** is obtained.

27. Although they only represent a small proportion of tobacco sales, if purchases from cigarette vending machines are not fully offset by an increase in cigarette sales elsewhere, this will result in a revenue loss to the Exchequer. 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 – there is no offsetting gain to the consumer themselves or to the Exchequer. Lost tax revenue is therefore an economic cost.

    a. To quantify the possible impact on tax revenues, consider that HMRC forecast £7.602 billion tobacco duty revenues in 2008/9 for the UK as a whole.[6] VAT is levied on top of tobacco duty, yielding a total UK revenue of £8.932 billion. When downscaled to UK-minus-Scotland terms (using a population-based scaling factor of 0.916), the estimate becomes £8.182 billion. 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 must equal £81.8 million for 2008/9. Assuming that 50% of vending machine cigarette sales are not offset by increased sales elsewhere, the impact on the Exchequer as a result of this policy option is **£40.9 million per annum**.

28. 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[7] state that (in 2007) 47 billion duty-paid cigarettes were consumed in the UK. Scaling this down into UK-minus-Scotland terms (using a scaling factor of 0.916) yields 43.1 billion cigarettes. As 1% of these (i.e. 431 million cigarettes) would have been sold in vending machines, vending machine sales would have been

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[6] See http://www.hmrc.gov.uk/stats/tax_receipts/table1-2.pdf
[7] See http://www.the-tma.org.uk/uk-cigarette-consumption.aspx

equivalent to 21.5 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 vending machines being unavailable, the annual cost of lost convenience to legitimate cigarette machine users would be **£21.5 million per annum**.

29. The following costs are not quantified; they are most unlikely to be significant enough to shift the judgements that this IA 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. This is largely not an economic cost, as it would 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 alterative 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.

30. Overall, the costs of option 3 include a one-off cost of £26.8 million plus annual costs of £62.4 million. Discounted over ten years, the total cost is **£545 million**.

Benefits

Quantifying the monetised benefit of smoking one fewer cigarette per day

31. The benefits analysis in the Annex 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.

32. 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' 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.

33. 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.

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

35. The results are as follows:

    a. Smoking one fewer cigarette per day from a young age: 0.11 life years gained

£5,550

b. Smoking one fewer cigarette per day (random adult): 0.09 life years gained

£4,400

36. 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.

37. 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).

38. 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

39. 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 non-smokers, 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.

40. 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

41. 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.

42. 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.

43. 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 study by Doll et al. (2004) 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.

44. A full discussion is presented in the 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 Appendix.

Quantifying the benefits of policy option 2

45. The data presented above state that for 17% 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 17% of the respondents' cigarettes came from vending machines; the 17% estimate is therefore adjusted downwards to 7.5%. (7.5% has been chosen because if all the other responses were adjusted downwards by the same factor, they would then sum to 100%).

46. It is therefore instructive to consider the health implications of a 7.5% average reduction in under-18s' cigarette consumption. The publication 'Smoking, drinking and drug use among young people in England in 2006' (*The Information Centre*) finds that 11-15 year olds smoke an average of 6 cigarettes per day. A 7.5% reduction in this figure would yield, on average, 0.45 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.

47. 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:

■ 0.05 life years saved per person (monetised as £2,500).

48. Using a birth cohort size of 650,000 per annum and a smoking prevalence of 20% for 16-19 year olds (as taken from 'Smoking and drinking among adults, 2006' – *Office for National Statistics*), 130,000 smokers per year would be affected by the proposed policy. 6,500 life years would be saved per annum (i.e. per cohort), monetised at a total of £324 million per annum.

49. 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.

50. Overall, the estimated (health) benefits therefore range between £32.4 million to £162 million per annum. However, enforcement is unlikely to be 100% effective, leaving some children able to use tobacco vending machines. Evidence from the USA[8] on locking mechanisms suggests that they are not necessarily fully effective, although the systems discussed above do not require the operator to remember to enable the lock. Because of this, the above benefits are downscaled by 10%, yielding estimated annual benefits of £29.2

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[8] Forester, J, Hourigan, M & Kelder, S. (1992, September). Locking Devices on Cigarette Vending Machines: Evaluation of a City Ordinance. American Journal of Public Health, 82(9): 1217-19

million to £146 million. This is equivalent to **£243 million to £1.21 billion** when discounted over ten years.

Quantifying the benefits of policy option 3

51. The health benefit should be calculated on the same basis as for option 2, with the same caveats. This yields a range of £32.4 million to £162 million per annum, or **£270 million to £1.35 billion** when discounted over ten years. Full compliance is assumed, so no adjustment is made for children circumventing the ban.

52. Because this policy option involves a full ban on 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

53. When calculating net benefits, it is noted that whilst the NICE budget threshold is £20,000 to £30,000, recent literature suggests a value per life year of £50,000. At the margin, one pound of extra Government health expenditure therefore gives two pounds of benefit. Reductions in tax revenue are therefore doubled in the net benefit calculation, to take account of the monetised gains that could have been achieved with that revenue.

54. Option 2 (age restriction mechanisms) therefore has a net benefit of **£165 million to £882 million** compared to **£-616 million to £463 million** for option 3.

55. Central net benefit figures of **£281 million (option 2)** and **£-346 million (option 3)** are calculated using a reduction in consumption of 0.09 cigarettes per day (i.e. 20% of the 0.45 cigarettes-per-day reduction discussed initially in the benefits section; the net benefit range is instead driven by 10-50% of the 0.45 figure). This reduction is associated with 10-year discounted benefits of £538.9 million. The central net benefit estimate for option 3 is equal to this £538.9 million estimate minus the stated £885 million 10-year discounted costs (including the aforementioned tax revenue adjustment). The central net benefit estimate for option 2 is equal to the £538.9 million benefit (scaled down by 10% due to non-compliance to give a £485 million benefit) minus £204 million 10-year discounted costs (including the aforementioned tax revenue adjustment). The £204 million cost is consistent with the costs set out in option 2, but uses the 0.09-cigarettes-per-day consumption reduction figure in the tax loss calculation in order to ensure consistency with the benefit calculation.

Specific Impact Tests: Checklist

Use the table below to demonstrate how broadly you have considered the potential impacts of your policy options.

Ensure that the results of any tests that impact on the cost-benefit analysis are contained within the main evidence base; other results may be annexed.

Type of testing undertaken	Results in Evidence Base?	Results annexed?
Competition Assessment	No	Yes
Small Firms Impact Test	No	Yes
Legal Aid	No	No
Sustainable Development	No	No
Carbon Assessment	No	No
Other Environment	No	No
Health Impact Assessment	Yes	Yes
Race Equality	No	Yes
Disability Equality	No	Yes
Gender Equality	No	Yes
Human Rights	No	Yes
Rural Proofing	No	No

Specific Impact Tests

Competition assessment for option 2 (age verification systems):

1. Option 2 would not directly limit the number or range of suppliers.

2. It is possible that option 2 may indirectly limit the number or range of suppliers. Because the regulations would apply to all vending machine operators, the proposal does not significantly raise the cost of some existing operators relative to others (other than through the number of machines owned). However, the proposal will increase the cost of entering the market, due to the need to purchase age restriction hardware for each vending machine that the proposed entrant plans to operate.

3. Option 2 does not limit the ability of suppliers to compete.

4. Option 2 does not limit the incentive for suppliers to compete vigorously.

Competition assessment for option 3 (prohibition of cigarette vending machines):

5. Option 3 would limit the range of suppliers, in that cigarettes could now only be purchased from suppliers who do not use vending machines. It should nonetheless be noted that only 1% of UK cigarettes are purchased from vending machines.

6. Aside from the obvious implication that vending machine operators will no longer be able to compete, option 3 is unlikely to further limit the ability of suppliers to compete.

7. Option 3 is unlikely to limit the incentive for suppliers to compete vigorously.

8. Option 3 will have a greater impact on competition than option 2.

Small firms impact test

Consultation

9. The proposed options are likely to impact upon small businesses as there would be costs in complying with the options. The Government has engaged with, and received cost estimates from, representatives of small businesses (such as the National Association of Cigarette Machine Operators, which represents small vending machine operators) prior to the publication of the consultation. It has also received a consultation submission from them and from a small number of individual vending machine operators.

Option two vs. option three

10. While the National Association of Cigarette Machine Operators (NACMO) would prefer option one, maintaining the status quo, they would prefer option two to option three, arguing that option three removes any ability of their industry to function. Similarly, the British Institute of Innkeeping provided results of a survey of their membership, showing most supported applying age-restrictions devices over an outright ban.

11. Therefore the Department of Health has committed to introducing regulations to impose age restricting devices on cigarette vending machines. This will give the industry an opportunity to prevent underage sales while continuing to operate their business lawfully. Moreover,

regulations to apply age restricting devices will not come into effect before April 2011, in order to avoid adding any further burden to business during difficult economic times.

12. Should age restricting devices prove unsuccessful in preventing underage sales, however, the Department of Health will seek to ban the sale of cigarettes from vending machines altogether from 2013.

<u>Timing</u>

13. While implementation of either option will require further consultation to determine the final regulations applied, in both cases it will be important to ensure a sufficient lead-in time until October 2011. Any regulations should come into effect on a common commencement date (6th April or 1st October) and guidance would be made available well in advance. This would follow the example set by smokefree legislation, where we provided an online repository for all guidance and advice as well as sending packs of information to all relevant businesses and providing a telephone helpline.

14. It will be important to provide transitional support through Trading Standards, in terms of training and resources to support compliance, particularly for smaller businesses. As with smokefree legislation, we would look to fund this centrally during transition to enable all businesses to implement any new obligations while minimising any associated burdens. Restrictions on vending machines will support businesses to avoid selling cigarettes illegally to people under 18.

Health

15. The proposed policy may result in a reduction in the number of cigarettes smoked by under-18s. As stated (and quantified) in the cost-benefit analysis above, this reduction would have a beneficial impact on the health of the population by reducing the incidence of smoking related morbidity and mortality. It may also have a wider impact on the general well being of the population by children taking less time off school and adults taking less time of work due to smoking related illness.

Age

16. The proposed policy is likely to impact differently on people on grounds of their age.

17. Age restriction mechanisms should prevent children and young people under the legal age of sale of tobacco (i.e. under 18 years old) from accessing tobacco from vending machines. This age restriction will not affect adult smokers who will still be able to access tobacco from this source.

18. A prohibition on the sale of tobacco from vending machines would prevent all smokers from purchasing their tobacco from vending machines. Whereas adult smokers would be able to purchase tobacco from other sources, such as supermarkets and newsagents, children and young people under the age of 18 years would not be able to purchase tobacco from these alternative sources.

19. The differential impact of the proposal policy on young people under the age of 18 years would be a positive impact because it would help to reduce smoking levels amongst this age group.

Race and ethnicity

20. The proposed policy is not likely to impact differently on people on grounds of their race or ethnicity. The proposed policy is population-wide and will affect all adult smokers equally; it does not differentiate on the grounds of race or ethnicity.

21. Some ethnic and racial groups have higher smoking rates than the general adult population, for example Bangladeshi men[9]. However, there is no evidence of certain ethnic or racial groups purchasing their tobacco from vending machines more frequently than the population as a whole.

22. A policy that prohibits the sale of tobacco from one particular source could, in theory, have more impact on ethnic or racial groups with higher smoking rates than the general population as a whole. However, adult smokers in these ethnic and racial groups could purchase their tobacco from other sources, such as supermarkets and newsagents and it therefore should not have a differential impact.

23. An age restriction mechanism on tobacco vending machines would not have a differential impact on people aged 18 and over on the grounds of their race or ethnicity because adults would still be able to purchase tobacco from vending machines.

24. The survey used for establishing the smoking prevalence of young people aged between 11 and 15 years (the 'Smoking, drinking and drug use in England' survey – *The Information Centre*) does not collect data on the smoking rates of various ethnic and racial groups. It is therefore not possible to assess whether the proposed policy of either prohibiting or restricting the sale of tobacco from vending machines will impact differently on people under the age of 18 years on grounds of race or ethnicity. There is also no evidence available on whether smokers in certain ethnic or racial groups under the age of 18 years access vending machines more frequently than other ethnic or racial groups. In any event, any impact will be a beneficial impact by reducing the rates of smoking and the uptake of smoking within that racial or ethnic group.

Gender

25. The proposed policy is not likely to impact differently on people over the age of 18 years on grounds of their gender for the same reasons set out in more detail above in relation to age, ethnicity and race. Briefly, the reasons are that there is no evidence of one gender purchasing tobacco from vending machines more frequently than the other gender. Age restriction mechanisms on tobacco vending machines would not affect adult smokers. If there were a prohibition on the sale of tobacco from vending machines, adult smokers could purchase their tobacco from alternative sources. The proposed policy would affect all adult smokers equally and does not differentiate on grounds of gender.

26. However, the proposed policy is likely to impact differently on people under the age of 18 years on grounds of their gender. Girls aged 11 to 15 years are more likely to be regular smokers than boys in the same age group. Therefore, a proposed policy that restricts access to tobacco for people under the age of 18 may affect more girls than boys. However, this differential impact will be a beneficial one in helping to reduce smoking levels amongst young people, in particular young females.

Disability, transgender, religion or belief and sexual orientation

27. The proposed policy is not likely to impact differently on people on grounds of their disability, transgender, religion or belief, or sexual orientation. The proposed policy is a population

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[9] Health Survey for England 2004, Volume 1, The Health of Minority Ethnic Groups, The Information Centre, published 2006

wide policy that affects all adult smokers equally and does not differentiate on grounds of disability, transgender, religion or belief, or sexual orientation.

Human Rights

28. The proposed policy is to prohibit or restrict access to tobacco from vending machines. We do not expect there to be any significant human rights impacts.

Measuring the impact of the policy

29. The annual 'Smoking, drinking and drug use among young people in England' survey (*The Information Centre*) measures smoking prevalence of boys and girls aged 11 to 15. The General Household Survey measures the smoking prevalence of men and women aged between 16 and 19 years. Both surveys also measure the number of cigarettes smoked per day.

30. It may be possible to measure the impact of the policy by comparing the results of these two surveys over time.

31. However, a multi-faceted response is necessary to effectively tackle tobacco use and a number of policies and initiatives to help reduce smoking prevalence will be will be active at any one time. Therefore, trends in smoking rates amongst young people and changes in smoking rates between genders cannot solely be attributed to any one policy.

Technical Appendix

32. This Technical Appendix describes the method and data sources behind the estimation of:

   a. The discounted number of life years saved for each young person who does not take up smoking.

   b. 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.

33. 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.

34. The following main sources of data are used:

   a. 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.

   b. Doll, Peto, Boreham and Sutherland (2004), 'Mortality in relation to smoking: 50 years' observations on male British doctors' (*BMJ* 2004;328;1519). Reports the impact of smoking on mortality, split by age of quitting smoking (if applicable).

c. Office for National Statistics (ONS) period life tables, United Kingdom, 2004-06[10]. Reports population mortality estimates. Used to transform the outputs of the doctors' study into life years saved.

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

   a. **Identify an estimate of the percentage of smokers who have quit by each year of age.** Data from GHS (2006)[11] is 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.

   b. **Identify an estimate of the prevalence of smoking at each year of age.** Data from GHS (2006) is used here[12].

   c. **Identify an age distribution for the smoking population.** Again, data from GHS (2006) is used here[13].

   d. **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, Peto, Boreham and Sutherland (Table 5, 2004), 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

      ▪ (i) those who have quit between age 35-44,

      ▪ (ii) those who have quit between age 45-54,

      ▪ (iii) those who have quit between age 55-64, and

      ▪ (iv) those who continue to smoke beyond age 65

   These categories of smoker are used throughout the calculations, and are referred to as quit age bands (alongside an 'age under 35' band). 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.

   e. **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[14],

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[10] Available at http://www.statistics.gov.uk/StatBase/Product.asp?vlnk=14459&Pos=&ColRank
[11] 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'.
[12] 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.
[13] The variable 'age' was used on the subset of respondents who are current smokers (as indicated by the variable 'cigsmk1').

two life tables are calculated following the method of Chiang (1984)[15]. One of the two life tables starts with the smokers' mortality figures and the other starts with the non-smokers' 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.

    f. **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.

36. 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
65 or over	30.2%	-4.49	-4.15

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

    a. 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.

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

    c. 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[16]). Current smokers can therefore be expected to experience less harm.

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

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[14] For example, one combination considers male smokers who quit between the ages of 35-44.
[15] Chiang CL (1984), "The Life Table and its Applications", .Malabar (FL): Robert E Krieger Publ Co
[16] ONS (2006), "Smoking and drinking amongst adults, 2006", Page 9. Available at
http://www.statistics.gov.uk/downloads/theme_compendia/GHS06/Smokinganddrinkingamongadults2006.pdf

38. **Therefore: Benefit for each child who does not take up smoking:**
    a. Males: 1.75 life years, i.e. £87,559
    b. Females: 1.36 life years, i.e. £68,210

39. The benefit (in discounted life-years) for a randomly chosen adult who quits smoking is estimated as follows:
    a. 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 to 64, it must be that (10.5% / (10.5% + 30.2%) = 25.9% will quit in the 55 to 64 age band, whereas the remaining 74.1% continue to smoke over the age of 65.
    b. 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.
    c. 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.
    d. GHS (2006) data on the age distribution of smokers is 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.

40. **Therefore: Benefit for each adult who decides to quit smoking:**
    a. Males: 1.36 life years, i.e. £67,943
    b. Females: 1.12 life years, i.e. £55,755

41. For the following reasons, the benefit estimates described above are conservative:
    a. 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).
    b. 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%.
    c. It is assumed 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.

d. 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.

e. 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.

42. Other limitations of the estimate include:

a. It is assumed that the same smoking mortality impacts hold for both men and women. The Doll, Peto, Boreham and Sutherland (2004) study only covers male doctors.

b. 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.

c. The Doll, Peto, Boreham and Sutherland (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 (based in The Netherlands)[17] 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.

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[17] Streppel, Boshuizen, Ocke, Kok and Kromhout (2007), "Mortality and life expectancy in relation to long-term cigarette, cigar and pipe smoking: the Zutphen Study", Tobacco Control 2007;16;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.