TECHNICAL
REPORT

Analysis to support the Impact Assessment of the Commission's smoke-free initiatives

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Prepared for the Directorate General for Health and Consumer Protection (DG SANCO), European Commission

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Preface

This report supports the European Commission Directorate-General for Public Health and Consumer Protection (DG SANCO) in assessing the need for and potential impact of an EU initiative on smoke-free environments. The initiative would aim to assist Member States in implementing comprehensive smoke-free laws in line with their obligations under the World Health Organization (WHO) Framework Convention on Tobacco Control.

The report assesses the expected health, economic, social, and environmental impacts of five policy options that the Commission is considering for achieving smoke-free environments in the EU-27. These options are: continuing the current level of activity; an open method of coordination; a Commission recommendation; a Council recommendation; and binding EU legislation.

In order to examine the possible impacts of the policy options on smoke-free environments proposed by the Commission, available relevant evidence was collected from the peer-reviewed and grey literature. In addition the study was informed by two targeted stakeholder consultation meetings, and a wealth of related Commission-generated work, such as the Commission's consultation on the Green Paper *Towards a Europe Free From Tobacco Smoke: Policy Options at EU Level* (DG SANCO, 2007).

The report consists of two parts. Part A sets out a comprehensive description of the problem definition and context of the impact assessment of the Commission's smoke-free initiative. Part B, the impact assessment, provides a quantitative analysis and compares the expected impacts of the Commission's five policy options to help achieve smoke-free environments across the EU-27.

The report was prepared for and funded by DG SANCO and will serve as an input into their own regulatory impact assessment exercise. Since the time of writing in June 2008, smoke-free regulations in EU Member States may have changed. The analysis in this report was based on the best available facts at that time. This report will be of particular interest to DG SANCO and other European Commission Directorates-General, for which smoke-free environments are relevant. In addition, the study will be relevant to policymakers in EU Member States, and health promotion organisations, including non-governmental organisations, scientific institutions, and public administration bodies, and to organisations in the hospitality and tobacco industries concerned with smoke-free legislation.

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Introduction

This report aims to support the European Commission Directorate General for Public Health and Consumer Protection (DG SANCO) in assessing the need for and potential impact of an EU initiative on smoke-free environments. The initiative would aim to assist Member States in implementing comprehensive smoke-free laws in line with their obligations under the World Health Organization (WHO) Framework Convention on Tobacco Control—ratified so far by 26 Member States and the Community.

The report sets out a comprehensive description of the problem definition and context of the impact assessment of the Commission's smoke-free initiative. It then assesses the expected impacts of five policy options that are being considered by DG SANCO to achieve smoke-free environments across the EU-27 (Table 0.1).

Table 0.1: Description of policy options

Policy options	Characteristics
1. No change from status quo	Leave legislation to individual countries
2. Open method of coordination	Exchange information, experiences, best practices Develop common indicators Agree common targets
3. Commission recommendation	Provide guidance and encouragement to Member States in introducing smoke-free legislation
4. Council recommendation	As Commission recommendation, but originating from Member States
5. Binding legislation	EU-wide ban on smoking in the workplace including bars/restaurants (self-employed workers excluded)

By taking into account the health, economic, social, and environmental impacts, RAND Europe compares the strengths and weaknesses of the proposed policy options and supports the identification of a preferred policy option that will help achieve smoke-free environments. This report serves as an input into DG SANCO's own Impact Assessment exercise.

In this remainder of this executive summary we summarise the findings of our study. They are based on estimates from existing literature, data provided by the European Commission and our own calculations. In the executive summary, we do not provide detailed references for every single estimate or fact. Instead, we kindly refer the reader to the appropriate sections of the main text of the report, in which we elaborate in more detail on the literature, our data and calculations.

The problem of environmental tobacco smoke

Environmental tobacco smoke (ETS), also referred to as secondhand smoke or passive smoke, is a diluted mixture of side-stream smoke, which is released from a burning cigarette between puffs, and mainstream smoke, exhaled by the smoker. ETS contains over 4,000 gaseous and particulate compounds, including 69 known carcinogens (Surgeon General 2006).

In the EU-27 there are huge differences in the prevalence of ETS exposure within and between Member States, and by setting (i.e. the venue where exposure takes places, such as indoor workplaces, bars, government buildings). The most recent estimates (based on 2006 Eurobarometer data) suggest on average 19 percent of EU citizens are exposed to ETS daily in indoor workplaces—either as workers or customers of these venues, and 39 percent in bars, cafes, and restaurants. Across the EU-27, the percentage of the population who are exposed to ETS daily in indoor workplaces varies from 2 percent in Ireland to 38 percent in Greece, and in pubs from 1 percent in Ireland to 63 percent in Greece (Table 0.2)[1].

Table 0.2: Percentage of population in the EU exposed to ETS for at least 1 hour daily

Percentage of population	EU-27 average	Min.	Max.
Indoor workplaces/offices	19%	2% (Ireland)	38% (Greece)
Restaurants, pubs, and bars	39%	1% (Ireland)	63% (Greece)

Workers' exposure to ETS is of particular concern given its involuntary and unavoidable nature. In the EU, 32 percent of citizens declare being exposed to ETS in indoor workplaces or offices daily. The duration of ETS exposure varies within and across Member States. In eight Member States more than 20 percent of staff are exposed to ETS for more than 1 hour per day, and 10 percent of staff are exposed for more than 5 hours

[1] All figures reported in this paragraph are taken from the report "Attitudes of Europeans towards Tobacco" (European Commission, 2007). The EU-27 averages are a population-weighted average estimated by RAND Europe using the data underlying this report and made available to RAND Europe by the European Commission

per day. Greece had the highest percentage of staff at 61 percent being exposed to ETS more than 1 hour a day. In comparison countries such as Ireland, Malta, Sweden, and Finland had relatively low or zero proportion of staff being exposed to ETS in indoor workplaces or offices, which is not surprising given they had implemented smoking bans prior to 2006.

Hospitality workers face disproportionate burden of ETS exposure; 68 percent[2] of staff working in bars/restaurants declare being exposed to tobacco smoke daily, and the duration of exposure in this group appears to be significantly longer than in other workplaces. As shown in Table 0.3, 29 percent of staff in bars/restaurants is exposed to ETS for more than five hours per day compared with 10 percent of staff working in other indoor workplaces/offices. Staff exposures to ETS in bars/restaurants vary greatly across Member States.

Table 0.3: Percentage of staff exposed to ETS daily in the EU

	Indoor workplaces/offices	Bars/restaurants
More than 5 hours	10%	29%
1–5 hours	9%	18%
Less than 1 hour	13%	18%
Never	66%	34%

The WHO, International Agency for Research on Cancer (IARC), the US Surgeon General's, the US Environmental Protection Agency (EPA), and numerous scientific and medical bodies worldwide have documented the adverse effects of ETS on the respiratory and circulatory systems, its role as a carcinogen in adults, and its impact on children's health and development. ETS has been shown to cause lung cancer and coronary heart disease (CHD), and probably to cause chronic obstructive pulmonary disease, stroke, and asthma in adults. There is also evidence to suggest ETS may worsen pre-existing conditions such as asthma and chronic obstructive pulmonary disease (COPD). Moreover, ETS may be harmful to children, and the cause of asthma, pneumonia, bronchitis, respiratory symptoms, middle ear disease, and sudden infant death syndrome (Surgeon General 2006).

For most of these effects the level of individual risk from passive smoking is low when compared with active smoking, but the fact that large numbers of people are exposed results in a substantial burden of disease among the population.

The most recent estimate (prior to this report) in *Lifting the Smokescreen* (Smokefree Partnership, 2006) for how many deaths may be attributable to passive smoke among non-smokers in the EU-25 showed that passive smoking accounted for around 19,000 deaths in

[2] This estimate is a population-weighted average estimated by RAND Europe using the data underlying the report "Attitudes of Europeans towards Tobacco" (European Commission, 2007), made available to RAND Europe by the European Commission.

2002. Of these deaths, ETS exposure at home accounted for around 16,000 and ETS at work accounted for 3,000.

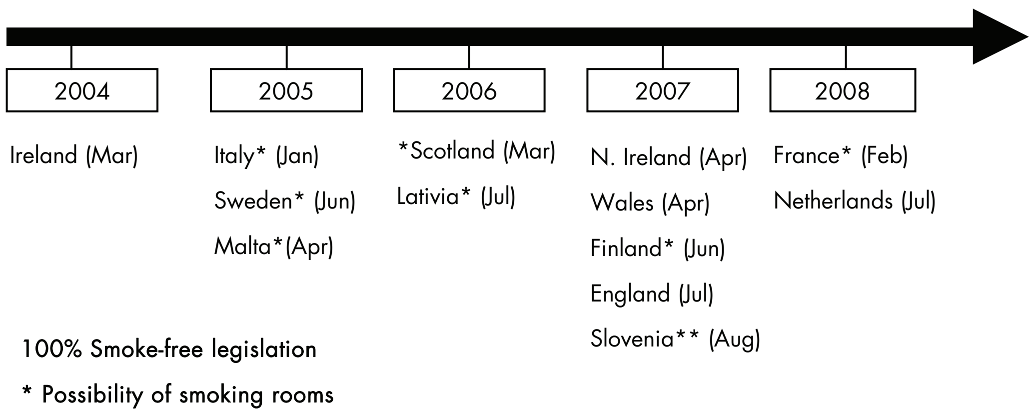
Few studies have attempted to estimate the costs of ETS in a systematic way, but in the single study that estimated the costs associated with premature mortality due to ETS, the cost was estimated at $7.1 billion (Aligne and Stoddard, 1997). The estimated cost of treating ETS-related diseases ranges from $700 million (Stoddard and Gray, 1997) to $2.1 billion (Adams, Solanki and Miller, 1997) depending on the study and population.

Evidence on the effects of smoke-free policies

Lower ETS prevalence

Many countries that have implemented smoke-free policies report lower ETS prevalence figures. In 2004, Ireland became the first country in the world to implement a comprehensive smoking ban in indoor workplaces, including restaurants and bars. Scotland, Wales, Northern Ireland, and England have also implemented comprehensive bans; and more and more countries, states, and cities in Europe and overseas are taking similar action (Figure 0.1).

Figure 0.1: Implementation of smoke-free laws in the EU[3]



Improved air quality and population health

Smoke-free legislation is also highly effective in improving air quality and population health, as measured through changes in coronary events (for example heart attacks) and respiratory symptoms. Smoking bans might have an indirect effect on ETS exposure, as well as a direct effect. The indirect effect of smoking bans is the result of their influence on smoking behaviour, including smoking prevalence, smoking cessation, smoking uptake,

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[3] This figure is accurate as of June 2008.

youth smoking behaviour, and smoking at home. Based on a comprehensive review[4] of the peer-reviewed and grey literature this report discusses the effects of smoke-free bans on these indirect aspects of smoking.

Reduced sales of cigarettes

Smoke-free legislation has also been shown to have economic effects on the tobacco and hospitality industries. Smoke-free bans may reduce the sale of cigarettes for the tobacco industry. The evidence on the effect on sales in the hospitality sector is more mixed. However, it is noteworthy that a 2008 update of the 2003 review by Scollo (2003) of the quality of the studies on the economic effects of smoke-free policies on the hospitality industry found that 47 of the 49 studies that are "best designed" report no negative impact on measures such as taxable sales (Scollo and Lal, 2008). Moreover, the US Surgeon General's (2006) report concludes that "evidence from peer-reviewed studies shows that smoke-free policies and regulations do not have an adverse economic impact on the hospitality industry".

Technological solutions for controlling ETS

In some countries indoor workplaces and bars/restaurants have employed technological strategies for controlling secondhand smoke, including designated smoking rooms equipped with ventilation systems, designated smoking areas with ventilation (not separated by walls), and smoking stations and cabins. The evidence is mixed as to the extent to which technological strategies are effective for controlling secondhand smoke. The US Surgeon General (2006) concluded that "establishing smoke free workplaces is the only effective way to ensure that secondhand smoke exposure does not occur in the workplace. Exposures of non-smokers to secondhand smoke cannot be controlled by air cleaning or mechanical air exchange." A similar position is held by the WHO. On the other hand, evidence reported by producers of smoking cabins and stations seems to suggest that such technological solutions can reduce the investigated tobacco smoking compounds close to 100 percent. However, the scientific quality of such evidence must be demonstrated (i.e. by publishing the study results in the peer-reviewed literature) before the effectiveness of technologies strategies for controlling secondhand smoke is proven.

Assessing the impact of policy options

To assess the five policy options, RAND Europe used a combination of methods and collected data from a variety of sources.

The starting point for the analysis of impacts was an extensive literature review. This review focused on uncovering literature that provided an understanding of the links between the proposed policy measures and health, economic, environmental, and social outcomes. The following is an overview of the types of data we collected:

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[4] We report the findings (including references) of this review in detail in Chapter 8.

- prevalence of ETS (the number of staff exposed to ETS in indoor workplaces/offices and bars/restaurants) across all 27 Member States from the Eurobarometer survey
- two stakeholder consultation meetings (one with business organisations, and the other with civil society and social partners) to seek expert opinion on the expected effect of each of the policy options on ETS exposure
- relative risk estimates from the literature for four diseases for which ETS is a known risk factor: lung cancer, cerebrovascular diseases (stroke), ischameic heart disease, and chronic lower respiratory diseases (including COPD and asthma)
- for each Member State, the annual number of deaths in the population of working age caused by each of the four diseases from Eurostat
- the medical and non-medical costs of the four diseases; where detailed Member State-specific cost estimates were not readily available we used indirect method of estimation
- tobacco and hospitality industry revenues and employment from Eurostat.

Using these data we carried out a quantitative analysis to estimate the effects of the policy option on various health, economic, environmental, and social impacts. Specifically, we estimated ETS prevalence in different settings for each of the 27 Member States and how it would change under each of the five policy options.

The rationale behind the assumptions for each of the policies are discussed in detail in the report. The smallest reduction in prevalence of ETS is expected for Policy 1 which takes into account the fact that several Member States are expected to implement smoke-free legislation over the next five years, even if the EC would take no further action. For policy 2 (Open Method of Coordination) and policy 3 (Commission recommendation), we assumed that the expected effects are likely to be similar and only slightly larger than Option 1 ("status quo"). The reasons for this are that: (1) implementation would be rather slow; (2) the OMC has never proved to be an effective policy measure in an evaluation; (3) the problem of ETS is mature and only real legislation is expected to have an effects; and (4) in an OMC the agreement is on objectives, but not on specific solutions. Policy 4 (Council recommendation) are expected to have a larger effect due to the ownership effect. Finally, the rationale for the expected reduction in ETS under Policy 5 is that a smoking ban has proven to be very effective in Member States where such regulation was implemented in the past. Therefore, Policy 5 can also be considered as the "maximum possible reduction" due to European legislation.

We then related ETS prevalence estimates (and changes therein) to mortality and costs using relative risk estimates from the literature for four diseases for which ETS is a known risk factor. Where quantitative impacts were difficult to calculate we provided a qualitative assessment of the expected impact based on the literature review. A summary of the expected impacts for each policy options is outlined below.

Comparing the policy options

Health impacts

The evidence relating the health impacts of ETS is fairly strong and precise. There is clear and mostly undisputed evidence that ETS exposure harms individual and public health. Table 0.4 shows the expected combined annual reduction in premature mortality from lung cancer, stroke, heart disease, and chronic lower respiratory disease under each of the five policy options. Binding legislation is expected to bring the largest reduction in annual deaths—up to 4,884 prevented deaths in office and hospitality workers, including 2,151 deaths among non-smoking employees[5]. This means around 80 percent of deaths due to ETS among employees would be prevented. The corresponding figures under Council recommendation (Policy 4) would be 1,550 and 646, respectively, which would prevent around 25 percent of staff deaths. The reduction in annual mortality under Policy 1 "no change from status quo" would bring the fewest reductions in ETS prevalence and related harm. The existing trend towards smoke-free environments could be expected to continue but at a slower pace.

Overall these estimates are probably conservative since they only include reduction of deaths associated with reduced ETS exposures among staff and exclude non-staff members, such as customers. In addition the estimates do not include settings other than bars/restaurants and indoor workplaces/offices where ETS exposures may occur, such as building sites.

It is important to note that the full effect of reduced exposure to ETS may take longer to be realised for some diseases (such as lung cancer) but may occur earlier for others (such as short term respiratory symptoms). Thus, the effects on mortality should be regarded as annual deaths prevented in the long run. Even though these expected effects will not fully materialise until a certain number of years have passed, the earlier the policy could be implemented, the larger the total benefits (over a series of years) will be. Other acute health benefits, such as reduction in respiratory symptoms and coronary events may accrue very rapidly.

[5] It is likely that such legislation could also prevent deaths due to ETS exposure in offices and the hospitality industry among visitors (i.e. non-workers). However, we did not have access to reliable data on ETS exposure among visitors of these places, and therefore excluded visitors from our analysis.

Table 0.4: Summary of estimated mortality in 2008 and reduction in annual mortality for each policy option due to ETS exposure among staff

	Non-smokers			Smokers			Smokers and non-smokers
	Indoor workplaces/offices	Bars/restaurants	Total	Indoor workplaces/offices	Bars/restaurants	Total	Total
Baseline 2008*	1,714 (25%)	786 (16%)	2,500 (41%)	2,694 (42%)	813 (17%)	3,507 (59%)	6,007
Reduction under Policy 1	−110	−51	−161	−173	−53	−225	−386
Reduction under Policy 2/3	−221	−101	−323	−346	−105	−451	−774
Reduction under Policy 4	−443	−203	−646	−693	−210	−904	−1,550
Reduction under Policy 5	−1,487	−664	−2,151	−2,046	−687	−2,733	−4,884

NOTE: * The percentage of total (smokers and non-smokers) is shown in brackets
Policy 1 = No change from status quo; Policy 2 = Open method of coordination; Policy 3 = Commission recommendation; Policy 4 = Council recommendation; Policy 5 = Binding legislation

In addition to the direct effect on exposure to tobacco smoke, the policies under consideration could also be expected to have an indirect effect on active smoking. Smoke-free policies have been reported to reduce tobacco consumption and encourage quit attempts among smokers, thus achieving a reduction in smoking prevalence[6]. These parallel impacts carry a substantial potential by contributing to the decrease in mortality and morbidity associated with smoking at the societal level. The largest reductions could be achieved with binding legislation and the smallest with the status quo options.

Economic impacts

Reduced medical costs

By reducing the prevalence of ETS exposure, an EU initiative can also be expected to reduce medical costs associated with major ETS-associated diseases (lung cancer, heart disease, stroke, and chronic lower respiratory diseases) and results in substantial cost savings. Medical costs include primary care, accident and emergency care, hospital inpatient care (including day cases and cardiac rehabilitation systems), outpatient care, and medications. Non-medical costs include informal care, productivity costs due to mortality and productivity costs due to morbidity (such as sickness absences).

[6] Please see section 8.1.4 for a more elaborate description of the evidence (including references)

As shown in Table 0.5, a binding legislation (Policy 5) could be expected to bring the largest expected reduction in medical costs, up to €1 billion annually among smoking and non-smoking staff in indoor workplaces/offices and bars/restaurants, followed by the Council recommendation, with a potential €344 million reduction and open method of coordination and Commission recommendation. The reduction under the status quo option would be only modest in comparison.

Table 0.5: Summary of estimated medical costs in 2008 and annual reduction in medical costs for each policy option due to ETS exposure among smoking and non-smoking staff in EU-27 countries, € million

	Non-smokers			Smokers			Smokers and non-smokers
	Indoor workplaces/offices	Bars/restaurants	Total	Indoor workplaces/offices	Bars/restaurants	Total	Total
Baseline 2008*	427 (27%)	139 (15%)	566 (41%)	636 (44%)	134 (15%)	770 (59%)	1,336
Reduction under Policy 1	–27	–9	–36	–41	–9	–49	–85
Reduction under Policy 2/3	–55	–18	–73	–81	–17	–99	–172
Reduction under Policy 4	–110	–36	–146	–163	–35	–198	–344
Reduction under Policy 5	–369	–118	–486	–473	–113	–587	–1,073

NOTE: * The percentage of total (smokers and non-smokers) is shown in brackets
Policy 1 = No change from status quo; Policy 2 = Open method of coordination; Policy 3 = Commission recommendation; Policy 4 = Council recommendation; Policy 5 = Binding legislation

Reduced non-medical costs

Non-medical costs include informal care, and productivity costs due to mortality and morbidity (such as sickness absences). As with the medical costs, a binding legislation (Policy 5) will have the largest expected reduction in non-medical costs, up to €893 million among smoking and non-smoking staff in indoor workplaces/offices and bars/restaurants, followed by a Council recommendation (Policy 4) with a potential of €290 million reduction and OMC/Commission recommendation (Table 0.6). In contrast, reduction under the status quo option would be only modest.

The estimated annual reductions in medical costs and non-medical costs are probably conservative since they exclude reduction of medical and non-medical costs associated with reduced ETS exposures among non-staff members and in settings other than offices and bars/restaurants.

Table 0.6: Summary of estimated non-medical costs in 2008 and annual reduction in non-medical costs for each policy option due to ETS exposure among smoking and non-smoking staff in EU-27, € million

	Non-smokers			Smokers			Smokers and non-smokers
	Indoor workplaces/offices	Bars/restaurants	Total	Indoor workplaces/offices	Bars/restaurants	Total	Total
Baseline 2008*	353 (27%)	124 (15%)	477 (42%)	529 (44%)	119 (15%)	647 (58%)	1,124
Reduction under Policy 1	–23	–8	–31	–34	–8	–42	–73
Reduction under Policy 2/3	–45	–16	–61	–68	–15	–83	–144
Reduction under Policy 4	–91	–32	–123	–136	–32	–167	–290
Reduction under Policy 5	–302	–105	–407	–385	–100	–486	–893

NOTE: * The percentage of total (smokers and non-smokers) is shown in brackets
Policy 1 = No change from status quo; Policy 2 = Open method of coordination; Policy 3 = Commission recommendation; Policy 4 = Council recommendation; Policy 5 = Binding legislation

Economic impacts for tobacco and hospitality industries[7]

The economic effects of smoking bans have been assessed for two different sectors: the tobacco industry and the hospitality industry.

The decrease in tobacco consumption as a result of comprehensive smoke-free legislation throughout the EU will have a direct effect on the size of the tobacco market. The revenue from tobacco sales across the EU-27 in 2007 is estimated at €67,089 million. For the entire EU-27, the expected loss in revenue under Policy 5 varies between €1,844 million and €4,696 million (Table 0.7). Assuming the ratio of employment/revenue to be constant in the longer run, binding legislation (Policy 5) would lead to a loss of at least 1,472 jobs in the tobacco industry in the longer run. This is a one-time overall shrinkage of the tobacco industry workforce and it is not the case the number of jobs decreases by 1,472 per year. The size of the tobacco industry workforce is expected to then stay at this reduced

[7] We refer the reader to sections 13.1.7 and 13.2.7 for a detailed overview of the estimates reported in this section and the calculations they are based on.

size. Considering that the current EU-27 labour force contains 218 million workers, even the upper bound estimate on jobs lost would not represent more than 0.001 percent of the entire EU-27 labour force.

Table 0.7: Estimated lost revenues in tobacco sales and jobs due to EU-wide smoking ban (Policy 5)

		Expected impacts	
	2007 estimate	Lower bound	Upper bound
Annual lost revenues	€67,089 M	€1,844 M	€4,696 M
Lost jobs	53,521	1,472	3,746

The revenue for bars/restaurants for EU countries with no smoking bans stands at €109 billion, and the number of staff employed in this sector is approximately 3 million. It is noteworthy that a 2008 update of the 2003 independent review by Scollo and Lal (2008) of the quality of studies on the economic effects of smoke-free policies on the hospitality industry found that 47 out of 49 studies that are best designed report no negative impacts on measures such as taxable sales[8]. Based on the comprehensive Scollo and Lal (2008) review it is expected that an EU initiative would have no major impact on the hospitality industry.

Other economic impacts for workplaces

Other potential economic impacts for workplaces include savings from a reduced number of smoking breaks, reduced cleaning maintenance and redecorating costs, and reduced costs in fire damage. It is anticipated that these savings will occur under each policy option, but binding legislation (Policy 5) would bring about the largest improvements since this would virtually eliminate ETS, followed by the Council recommendation and OMC/Commission recommendation while the status quo would bring only modest change.

There are various implementation and enforcement costs which may arise with an EU initiative, including the adoption, monitoring, and evaluation of smoke-free laws, smoking cessation support, public awareness measures, and so on. However these costs are likely to be minimal compared with the cost saving achieved through lives saved and morbidity savings[9]. The implementation and enforcement costs could be expected to be highest for binding legislation, which would impose binding minimum requirements throughout the EU, and continuous multi-tier cooperation under the open method of coordination.

Environmental impacts

The main environmental impact would be a significant improvement in indoor air quality (for example reductions in $PM_{2.5}$[10]). Based on the existing literature, it is anticipated that improvements in indoor quality will occur under each policy option, but binding

[8] We refer the reader to section 8.2 for a summary of the findings of the other two studies.

[9] We refer to section 14.3.5 for a more elaborate description.

[10] Particulate matter with a diameter less than or equal to 2.5 microns

legislation (Policy 5) would bring about the largest improvements, followed by the Council recommendation and OMC/Commission recommendation while the status quo would bring only modest change.

Social impacts

An EU initiative is expected to have social impacts such as a reduction in socio-economic inequalities, a reduction of ETS exposure at home, and impact on attitudes.

An EU smoke-free initiative would have social impacts on socio-economic inequalities, attitudes, and ETS exposure at home. Socio-economic inequalities exist within and between countries in terms of smoking prevalence, smoking cessation rates, and exposure to secondhand smoke. Evidence suggests that comprehensive smoke-free policies have the potential to reduce socio-economic-related disparities in tobacco consumption and ETS exposure; however, smoking bans need to be linked with broader measures such as awareness-raising campaigns targeting special settings like the home and private cars where particular vulnerable groups have the most exposure and which do not fall under the scope of current smoke-free legislation. An indirect consequence of an EU smoke-free initiative could be a reduction in the prevalence of smoking at home. Studies from Scotland, Ireland, New Zealand, and the US have reported reductions in the prevalence of smoking at home after the introduction of smoking bans.

An EU initiative could be expected to help create awareness about the dangers of passive smoking and increase support for smoke-free policies. Attitudes towards smoking bans are diverse and vary between Member States; however, surveys of people's attitudes have shown that in many countries public support for smoke-free laws increase after they are introduced, for example in Ireland from 59 percent to 93 percent.

It is anticipated that all of the social impacts described above will occur under each policy option, but binding legislation would bring about the strongest change, followed by the Council recommendation and OMC/Commission recommendation while the status quo would bring only modest change.

Study Limitations

It is important to note that our study results should be interpreted with caution and are subject to substantial limitations. In particular, lack of data on some important model parameters required us to make certain assumptions which affect the reliability of our estimates. As such, the estimates we report are useful to *understand* the mechanisms through which various policy alternatives affect outcomes of interest and for comparisons between the different policy options, but should not be used for the purpose of obtaining *precise predictions* on future prevalences, costs or mortality. We elaborate in greater detail on the study limitations in section 13.4.

Furthermore, it is important to note that we chose "breadth" over "depth". I.e., the specific purpose of this study was to support the Impact Assessment of the Commission smoke-free initiative. Following the Commission's request, we opted to explore the problem definition (of ETS) from many different perspectives and assess a broad range of impacts. This naturally limited the depth with which aspect of the problem definition and each of the impacts could be investigated. In this way, we believe our study adds value by providing:

- a comprehensive summary of the available evidence on ETS
- an exploratory quantitative analysis aimed to quantify the problem of ETS and the impacts of the proposed policy options as much as possible

Conclusions

In the previous sections we have provided detailed evidence based on the scientific literature, hard data, and subsequent exploratory analyses regarding the problem of ETS. We summarise our main conclusions as follows:

1. Environmental tobacco smoke (ETS) is a sizeable problem in Europe.
    a. ETS exposure has been shown to increase the chance of certain medical conditions, such as lung cancer, heart disease, stroke, and asthma.
    b. This leads to a substantial burden in terms of premature mortality and costs.
2. Exposure to ETS shows large variation depending on Member State and site.
3. A large part of the burden due to ETS is expected to be preventable.
    a. Various policies exist and have proven to be effective in decreasing exposure to ETS.
    b. Many countries still have no or only partial policies.
4. Europe-wide policies therefore have the potential to save many lives and costs.
5. Such policies are expected to potentially decrease revenue and employment in the tobacco industry.
6. It is expected that such policies on average have little or no effect on the hospitality industry.
7. How many lives and costs will be saved is expected to depend strongly on the type of action chosen.
8. Our research does not single out one policy option as superior to the others. The preferred option depends on how society is willing to trade off the principle of subsidiarity[11] and the preferences of citizens and governments of individual member states against the potential to save lives and cost, and other interests.

[11] The principle of subsidiarity is intended to ensure that decisions are taken as closely as possible to the citizen and that constant checks are made as to whether action at Community level is justified in the light of the possibilities available at national, regional or local level. Specifically, it is the principle whereby the Union does not take action (except in the areas which fall within its exclusive competence) unless it is more effective than action taken at national, regional or local level.

List of abbreviations

CHD	Coronary heart disease
COPD	Chronic obstructive pulmonary disease
DG SANCO	Directorate-General for Public Health and Consumer Protection
EATNP	European Alliance for Technical Non-smoker Protection
ENSP	European Network for Smoking Prevention
ETS	Environmental tobacco smoke
EU	European Union
FCTC	Framework Convention on Tobacco Control
GBP	Great British pound
GDP	Gross domestic product
IA	Impact assessment
IARC	International Agency for Research on Cancer
M	Million
MS	Member State
NICE	National Institute for Health and Clinical Excellence
NRT	Nicotine replacement therapy
PM	Particulate matter
QALY	Quality adjusted life year
R&D	Research and development
SES	Socioeconomic status
SHS	Secondhand smoke
UK	United Kingdom
US	United States of America
US EPA	US Environmental Protection Agency

VAT	Value added tax
VOC	Volatile organic compounds
WHO	World Health Organization

Glossary of terms

Incidence	The rate at which new cases of infection arise in a population.
Morbidity	Illness in a population.
Mortality	Death in population.
Odds ratio	A comparison of the presence of a risk factor for disease in a sample of diseased subjects and non-diseased controls. The number of people with disease who were exposed to a risk factor (Ie) over those with disease who were not exposed (Io) divided by those without disease who were exposed (Ne) over those who were not exposed (No). Thus OR = (Ie/Io)/(Ne/No) = Ie No/Io Ne.
Prevalence	The total number of cases of the disease in the population at a given time, or the total number of cases in the population, divided by the number of individuals in the population.
Relative risk	The proportion of diseased people among those exposed to the relevant risk factor divided by the proportion among those not exposed to the risk factor.
Secondhand smoke	Smoke that is breathed in from other people's tobacco smoke. This smoke is also referred to as environmental tobacco smoke (ETS). Secondhand smoke (SHS) is made up of sidestream and mainstream smoke. Sidestream smoke comes from the burning tip of the cigarette and is the major component of SHS. Mainstream smoke is the smoke that is exhaled by the smoker. Because SHS is inhaled by people who are not actively smoking, it is also commonly referred to as involuntary or passive smoking.

Acknowledgements

We wish to thank the participants of DG SANCO's two stakeholder consultation meetings (one with business organisations, the other with civil society and social partners) on 19 March 2008 who provided opinions on the likely effects of the proposed policies on various key inputs to the analysis and also provided our team with useful literature.

We would also like to thank colleagues at RAND Europe who have made contributions to this report. In particular, we wish to thank Sonja Marjanovic and Dimitris Potoglou for their useful and insightful comments during the quality assurance process.

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CHAPTER 1 Introduction

Exposure to environmental tobacco smoke (ETS)—a mixture of smoke from the burning end of a cigarette, pipe, or cigar and smoke exhaled by the smoker—is a source of widespread excess morbidity and mortality in the EU[12]. Evidence shows ETS contains over 4,000 gaseous and particulate compounds, including 69 known carcinogens (Surgeon General, 2006). Also referred to as secondhand smoke or passive smoking, it has been shown to have immediate adverse effects on the cardiovascular system and to cause coronary heart disease and lung cancer in adults. There is also suggestive evidence that ETS may cause chronic obstructive pulmonary disease (COPD), stroke, and asthma in adults and worsen pre-existing conditions such as asthma and COPD. ETS has also been shown to be harmful to children, causing acute respiratory infections, middle ear disease, sudden infant death syndrome, and more acute asthma.

The World Health Organization (WHO), International Agency for Research on Cancer (IARC), the US Surgeon General, the US Environmental Protection Agency (EPA), and numerous expert scientific and medical bodies worldwide have documented these adverse effects of secondhand smoke (SHS) on the respiratory and circulatory systems, its role as a carcinogen in adults, and its impact on children's health and development. For most of these effects the level of individual risk is low relative to active smoking, but the fact that large numbers of people are exposed results in a substantial burden of disease at the population level (Smoke Free Partnership, 2006).

The most recent estimate for the EU-25 in 2002 showed that passive smoking at work accounted for over 7,000 deaths, and passive smoking at home was estimated to cause a further 72,000 deaths. Among non-smokers, passive smoking accounted for about 19,000 deaths and 60,000 deaths among smokers (Smoke Free Partnership, 2006). This translates to a significant cost on the economy in terms of direct and indirect medical costs and productivity losses. A graphical overview of the problem in the EU is shown in Figure 1.1.

In recent years great progress towards smoke-free environments has been made. So far, comprehensive smoke-free laws have been adopted in over a third of EU Member States. However, in countries with no comprehensive restrictions the exposure to secondhand tobacco smoke remains high, particularly in the hospitality sector, and is a source of significant health inequity. In 2007 the Eurobarometer survey found the prevalence of ETS exposure was between 2 percent and 63 percent, varying across countries and settings.

[12] We will discuss this claim in detail in Chapter 3, 4 and 5.

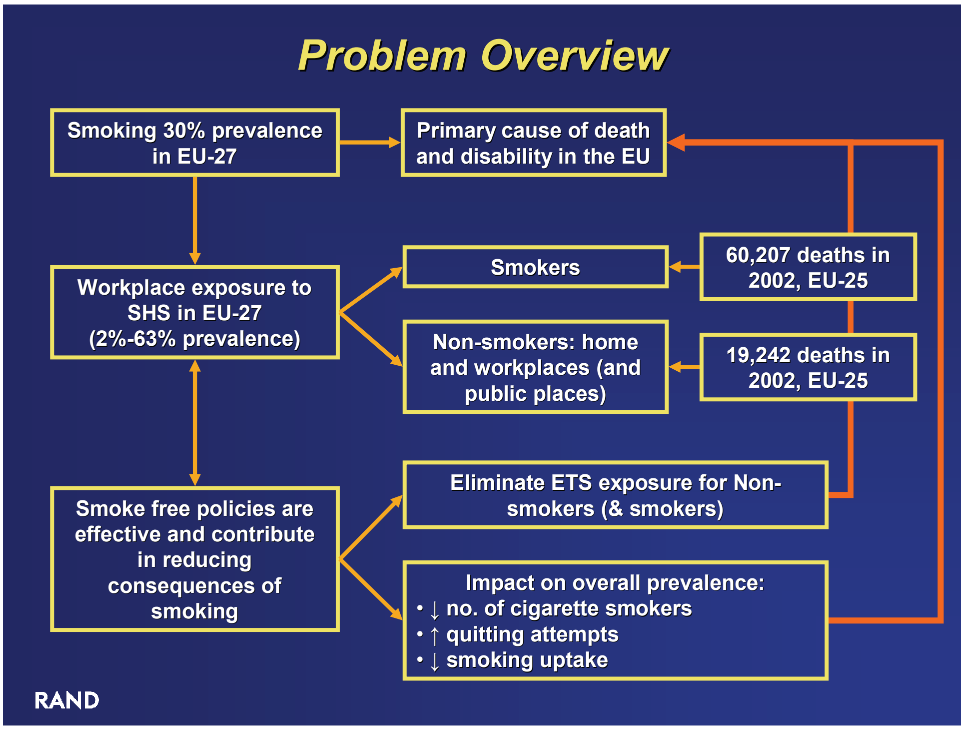
The largest numbers of people were exposed at restaurants, but smokers and non-smokers were also exposed to SHS at home, indoor workplaces, and offices and enclosed public places (European Commission, 2007).

At EU level, the issue of smoke-free environments has so far been addressed in non-binding resolutions and recommendations, which however did not provide detailed guidance on how to achieve fully smoke-free policies. In addition, a number of occupational health and safety directives address the issue, in some cases indirectly only, while in others the level of protection is not comprehensive.

At international level, the WHO Framework Convention on Tobacco Control (FCTC), ratified by 26 Member States and the Community, creates a legal obligation for all parties to ensure comprehensive protection from exposure to tobacco smoke. It also mandates governments to recognise that "scientific evidence has unequivocally established that exposure to tobacco smoke causes death, disease and disability". The guidelines adopted by the parties in July 2007 formulate a "golden standard" that every party should aim to achieve within five years of the Convention's entry into force for that party.

The Commission asked RAND Europe to conduct an impact assessment to support their smoke-free initiative, which aims to assist Member States in implementing comprehensive smoke-free laws in line with their obligations under the FCTC. The impact assessment considers five policy options: continuing the current level of activity, the open method of coordination, a Commission recommendation, a Council recommendation, and binding EU legislation. These policy options have resulted from the outcomes of the Commission's consultation on the Green Paper *Towards a Europe Free From Tobacco Smoke: Policy Options at EU Level* (DG SANCO, 2007). The next chapter presents the study's methodology and structure of the report.

Figure 1.1: Problem overview



CHAPTER 2 Report structure and methodology

This chapter provides an overview of the structure of the report, which is in two parts. We then summarise the study's methodology for each part.

2.1 Structure of the report

This report is in two parts. **Part A** sets out a comprehensive description of the problem definition and context of the impact assessment of the Commission's smoke-free initiative. **Part B**, the impact assessment, provides our quantitative analysis of the expected impacts of the five policy options the Commission is considering to help achieve smoke-free environments.

Part A consists of nine chapters. Chapter 1 and 2 provide the introductory material. Chapter 3 provides an overview of ETS prevalence in the EU-27. Chapters 4 to 6 discuss the health and financial burden of ETS and ETS and inequalities, respectively. In Chapter 7 an overview of smoke-free regulations is provided, and in Chapter 8 their effects on a range of non-economic and economic outcomes is described. Chapters 9 and 10 provide a discussion on the technological strategies for controlling ETS, and the cost-effectiveness of smoking cessation interventions, respectively. The conclusions for Part A are outlined in Chapter 11.

Part B consists of three chapters. Chapter 12 describes the five policy options that are under consideration by the Commission. Chapter 13 estimates the annual numbers of deaths and the medical and non-medical costs due to ETS exposure for smoking and non-smoking staff in indoor workplaces/offices and bars/restaurants across the EU-27 for 2008. The expected economic impacts on the hospitality and tobacco industry are estimated for each policy options, along with other health, environmental, and social impacts. Finally, in Chapter 14 the impacts are analysed and compared across the five policy options and the indicators that may be used to monitor the effects of the chosen policy options are described.

The report also includes seven appendices (A–G), which are referred to throughout the report.

2.2 Methodology—Part A

To provide a comprehensive problem definition of ETS and to examine the expected health, economic, social, and environmental impacts of passive smoking in the EU-27 we conducted a literature search. The detailed search strategy (including search terms) is presented in **Appendix A**. The search was performed on PubMed (National Library of Medicine) and EconLit electronic databases for a number of distinct areas of ETS, including prevalence, health and financial burden, inequalities, smoke-free policies and their effects, technological strategies for controlling ETS, and the cost-effectiveness of smoking cessation. For PubMed we used the MeSH database, which is the US National Library of Medicine's controlled vocabulary used for indexing articles. All searches were limited to articles with abstracts and published in English. In some cases our search was limited to articles published in the last five years if the initial search identified over 200–300 articles. We examined the title and abstract for each article to determine whether or not the article was relevant for the current assignment. We obtained the full article for all those abstracts deemed to be relevant. Given the extensive requirements of the study and a short timescale, the latest evidence and existing high quality reviews of evidence was sought first. Primary studies were only examined where reviews were lacking, or where they did not provide sufficient information for the nature and quality of primary evidence to be judged.

The grey literature (including reports of government agencies, international organisations, and other scientific associations) and conference proceedings (e.g. "Towards a Smokefree Society", September 2007, Edinburgh) were also searched for relevant ETS material accessible on the internet. A snowballing approach was taken to obtain further peer-reviewed and grey literature. We also examined several databases for additional relevant data on ETS and tobacco smoking, including OECD Health Data 2007, Eurostat, and the WHO's tobacco atlas. Moreover, England's National Health Service's quarterly reports on smoking cessation activities have been obtained. These were correlated to the introduction of the smoking ban in public places (in effect July 2007) to examine any differences or changes in the population's smoking cessation activities.

2.3 Methodology—Part B

Our approach comprised five steps. First we obtained estimates for the prevalence of ETS (the number of people exposed to ETS in different venues) across all 27 Member States. Second, we obtained estimates on the expected effect of each of the five policies on ETS prevalence[13]. Third, we obtained relative risk estimates from the literature for four diseases for which ETS is a known risk factor, and transferred these into *ETS attributable fractions*. Fourth, we estimated the burden of the four diseases in terms of mortality and costs, across all 27 Member States. In the fifth and final step we calculated for each Member State the burden of ETS per disease–venue combination under each of the five policies. Each of these steps is described in detail at the beginning of Chapter 13.

[13] We elaborate on each of these steps and the exact method of data collection in section 13.1.

As part of the Impact Assessment exercise, DG SANCO organised two stakeholder consultation meetings (one with business organisations, the other with civil society and social partners) on 19 March 2008. The meeting was jointly facilitated by RAND Europe and DG SANCO. The purpose of the stakeholder meeting was to seek input from various stakeholders, in order to make the research process as transparent as possible and to obtain valuable information from stakeholders directly, information that is not always available through other data sources. During the meeting RAND presented interim study results in addition to the study's methodological approach. DG SANCO presented the five policy options under consideration in the Impact Assessment. Finally, RAND conducted an exercise to systematically collect expert knowledge and opinion on the likely effects of the proposed policies on various key inputs to the analysis.

PART A: PROBLEM DEFINITION

CHAPTER 3 ETS prevalence in the EU-27

3.1 Introduction

This chapter provides an overview of ETS prevalence across the EU-27 (the number of people exposed to ETS in different venues). The data on ETS prevalence has been obtained from the following sources:

- the 2007 European Commission's Eurobarometer survey: *Attitudes of Europeans towards Tobacco* (European Commission, 2007)
- the 2005 Fourth European Working Conditions Survey
- point estimates for numerous countries from the grey and peer-reviewed literature (presented in **Appendix B**).

The majority of prevalence estimates are self-reported (i.e. derived from questionnaires). Exposure categories used in various studies may vary (for example between the Eurobarometer and European Working Conditions surveys). To illustrate:

- The Eurobarometer survey classified ETS exposures by asking respondents "How long are you exposed to tobacco smoke daily?" [less than 1 hour per day; 1–5 hours per day; more than 5 hours per day; never or almost never; don't know].
- Alternatively, the 2005 Fourth European Working Conditions Survey asked respondents "Are you exposed at work to tobacco smoke from other people" [all of the time; around ¾ of time; around half the time; around ¼ of time; almost never; never; don't know].

In this chapter we provide an overview of ETS prevalence across the EU-27 using predominantly the Eurobarometer survey data (European Commission, 2007). There are two reasons for this. First, it is the most recent available data on ETS prevalence. Second, the data is suitable to make comparisons between countries, since the same data has been collected in a standardised way across the EU-27. The Eurobarometer survey was carried out in October and November 2006, and asked how long respondents were exposed to tobacco smoke in indoor workplaces or offices; restaurants, pubs, or bars; government facilities; health care facilities, and education facilities. We also overview some key findings of the Fourth European Working Conditions Survey. For the purposes of this Impact

Assessment, only ETS prevalence in indoor workplaces, or offices and restaurants, pubs, or bars are presented and discussed below. The Impact Assessment does not focus on exposure to ETS in government, healthcare, and education facilities since Member States already have smoking bans in place at these venues. Exposure to ETS may also occur at home and in outdoor public places; however, these were excluded from our analysis since it would be difficult to implement and regulate smoking bans in these venues.

3.2 ETS prevalence across the EU-27: Eurobarometer survey

The most recent estimates on ETS exposure (for 2006) suggest that on average 19 percent of EU citizens are exposed to ETS in indoor workplaces—either as workers or customers of these venues. Of these people, 10 percent are exposed to ETS for more than an hour a day. Figure 3.1 shows the proportion of people exposed to ETS in indoor workplaces or offices[14] in 2006, across the EU-27. ETS prevalence was defined as the percentage of respondents who self-reported they were exposed to ETS for more than 1 hour per day (black bars); and between zero and 1 hour per day (zero not included, textured bars).

The figure shows that ETS prevalence in **indoor workplaces or offices** varies across the EU from 2 percent in Ireland to 38 percent in Greece. It is not surprising that some countries such as Malta, Finland, and Ireland have relatively low ETS prevalence since they have implemented smoking bans in all enclosed public places prior to the survey.

Figure 3.1: Percentage of population exposed to ETS daily in indoor workplaces/offices, 2006

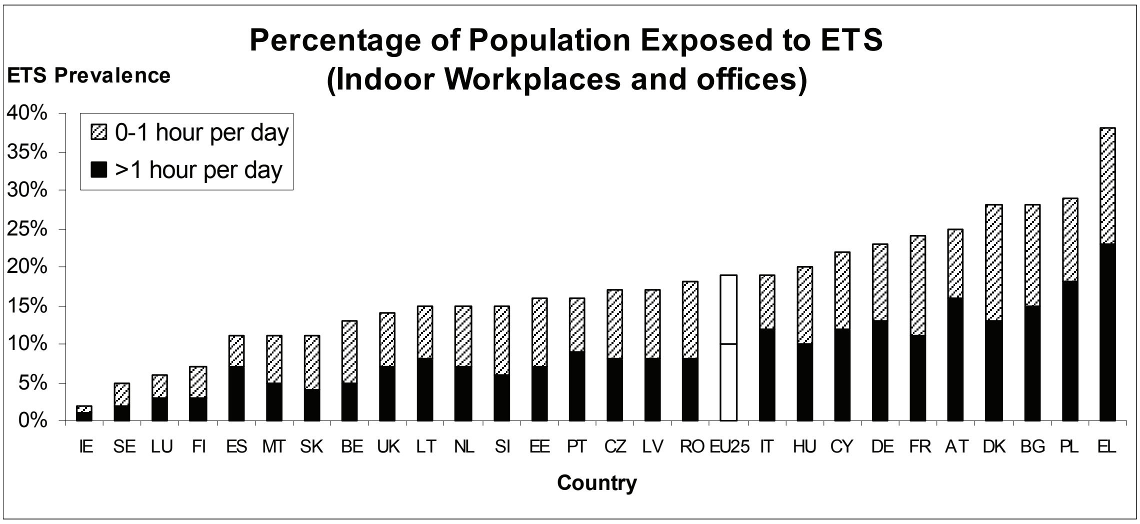


Figure 3.2 shows the proportion of people (workers and customers) exposed to ETS in **bars, pubs, and restaurants** in 2006 across the EU-27. ETS prevalence in pubs, bars, and restaurants varies across the EU from 1 percent in Ireland to 63 percent in Greece (any exposure). The EU-wide prevalence figure is 39 percent. Many countries that have implemented smoking bans since 2004 reported lower prevalence figures. In some cases,

[14] Including both workers and customers.

countries that reported higher ETS prevalence in indoor workplaces or offices also appeared to have higher ETS prevalence in bars/restaurants and pubs—for example Greece, Cyprus, Austria, and Hungary.

Figure 3.2: Percentage of population exposed to ETS daily in bars/restaurants and pubs, 2006

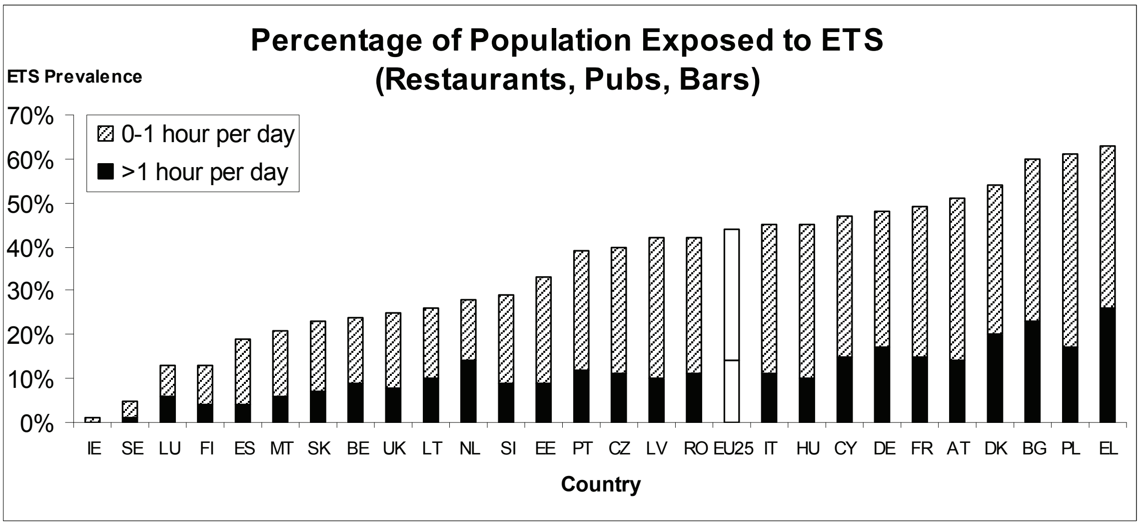


Figure 3.3 shows the percentage of **staff** exposed to ETS daily in indoor workplaces/offices in 2006 across the EU-27. Eight countries had more than 20 percent of staff being exposed to ETS for more than 1 hour per day, and 10 percent of staff being exposed to ETS for more than 5 hours per day.[15] Greece had the highest percentage of staff at 61 percent being exposed to ETS more than 1 hour per day. In comparison, countries such as Ireland, Malta, Sweden, and Finland have a relatively low or zero proportion of staff exposed to ETS in indoor workplaces/offices, which is not surprising as they have implemented smoking bans prior to the survey. The EU-27 population-weighted average for staff exposure in indoor workplaces/offices in 2006 (daily) is as follows: 10 percent more than 5 hours; 9 percent 1–5 hours; 13 percent less than 1 hour; and 66 percent never.

[15] The eight countries are Austria, Denmark, France, Germany, Greece, Hungary, Portugal, and Poland.

Figure 3.3: Percentage of staff exposed to ETS daily in indoor workplaces/offices, 2006

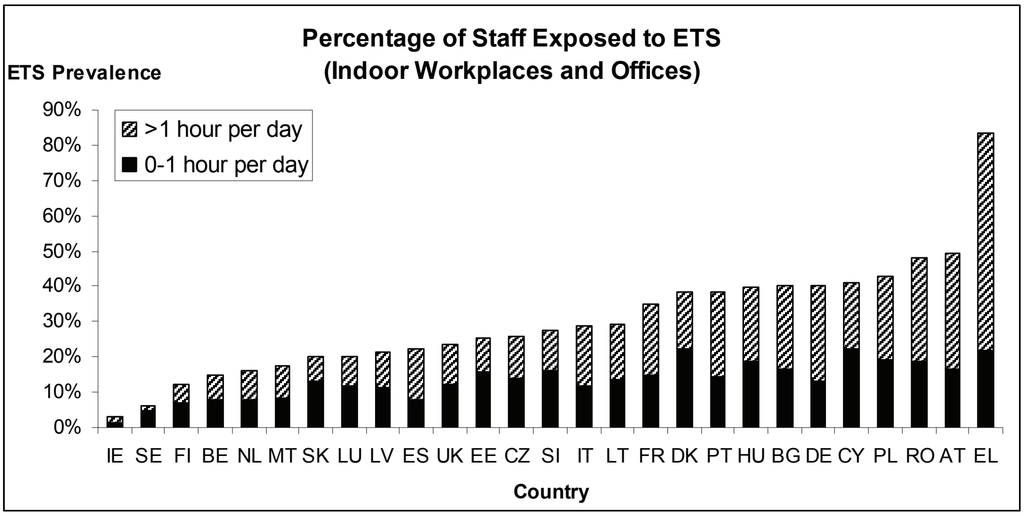
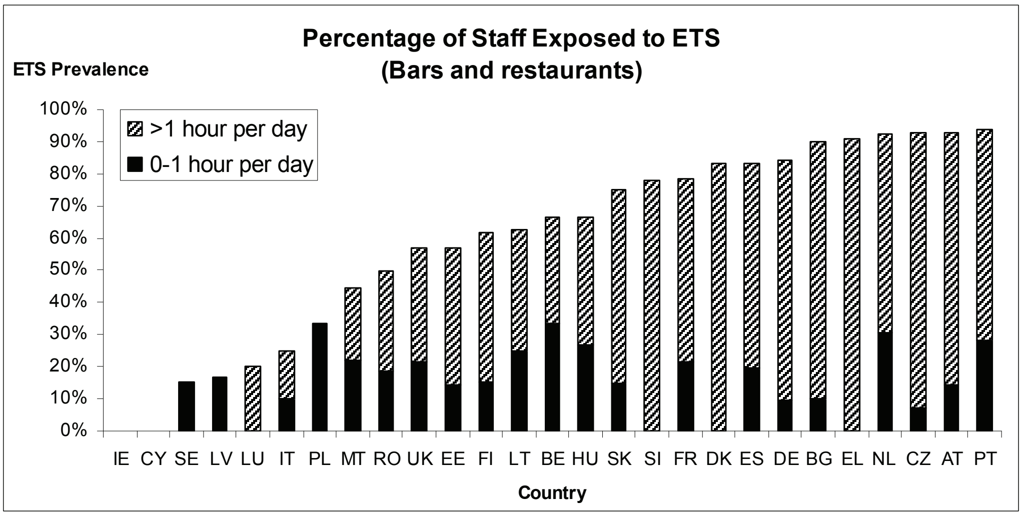


Figure 3.4 shows the percentage of staff exposed to ETS daily in bars/restaurants in 2006 across the EU-27. In Greece, Denmark, the Czech Republic, and Bulgaria over 80 percent of staff were exposed more than 1 hour per day. In contrast, countries such as Ireland that have smoking bans had zero staff exposed to ETS. The EU-27 population-weighed average for staff exposure in bars/restaurants and pubs in 2006 (daily) is as follows: 29 percent more than 5 hours; 18 percent 1–5 hours; 18 percent less than 1 hour and 34 percent never.

Figure 3.4: Percentage of staff exposed to ETS daily in bars/restaurants and pubs, 2006



3.3 ETS prevalence across EU-27: Fourth European Working Conditions survey

The Fourth European Working Conditions Survey also provides a breakdown of the number of people reporting exposure to ETS at work by occupation, size of employer's establishment, and activity of employer. The following are key findings:

- The three areas of employment that exposed the most people to ETS "around quarter of the time or more" were hotels and restaurants (50 percent), followed by construction (37.5 percent), and public administration and defence (22.7 percent).
- Hotels and restaurants exposed 21 percent of people to ETS "all the time", which was 3–20 times higher than any other sector (such as agriculture and manufacturing).
- People working in microenterprises (2–9 employees) had the highest exposure to ETS with 22.5 percent reporting exposure "around a quarter of the time or more". But overall there is limited variation in the number of people exposed to ETS at work by size of enterprise (number of employees in local establishment).
- The occupations exposing the most people to ETS at work "around quarter of the time or more" were the armed forces (39.4 percent), followed by skilled workers (31.4 percent), and machine operators (24 percent). In contrast, only 10.6 percent of professionals reported being exposed to ETS at work "around a quarter of the time or more".

3.4 ETS prevalence across EU-27: point estimates from literature

Point estimates of ETS prevalence by setting, age group, and gender obtained from the grey and peer-reviewed literature (excluding the two surveys described above) are shown in **Appendix B**. Based on this data it is difficult to make comparisons between the countries since the mechanism for and time period of data collection will vary between the studies.

CHAPTER 4 ETS health burden

There are no studies that examine and update the overall health burden of ETS either in terms of mortality or morbidity for the EU-27 Member States. Our analysis will estimate this burden using the methodology described in Part B. This chapter includes a summary of the analysis conducted by the Smokefree Partnership and presented in the report *Lifting the Smokescreen* (2006). In addition, we present an updated overview (as of early 2008) of the various estimates for the relative risks for ETS-associated diseases and conditions.

4.1 ETS mortality in the EU

ETS has been shown to have immediate adverse effects on the cardiovascular system and to cause coronary heart disease and lung cancer in adults. There is also suggestive evidence that ETS may cause chronic obstructive pulmonary disease (COPD), stroke, and asthma in adults (Surgeon General, 2006), and worsen pre-existing conditions such as asthma and COPD (Foreman et al., 2007; and Osman et al., 2007). ETS has also been shown to be harmful to children, causing acute respiratory infections, middle ear disease, sudden infant death syndrome, and more severe asthma (Surgeon General, 2006). For most of these effects the level of individual risk is low relative to active smoking, but the fact that large numbers of people are exposed results in a substantial burden of disease among the population. In many countries in Europe exposure to ETS continues to be ubiquitous in workplaces and enclosed public places. Furthermore, since non-smokers exposed to ETS inhale the same chemicals as active smokers, they probably also have an increased incidence of most other disorders linked to active smoking, though at a lower level of risk.

Lifting the Smokescreen (Smokefree Partnership, 2006), commissioned in 2004, provides the most recent estimate for how many deaths may be attributable to passive smoking in Europe. The report presents estimates for all adults across the EU-25 and, separately, for those who are non-smokers, of deaths for ischaemic heart disease, stroke, lung cancer, and chronic neoplastic pulmonary disease that are attributable to passive smoking.

Passive smoking at work accounted for over 7,000 deaths across the EU in 2002, and passive smoking at home was estimated to cause a further 72,000 deaths (Smokefree Partnership, 2006). Passive smoking at work accounted for about 2,800 deaths of non-smokers in the EU in 2002, while exposure at home caused a further 16,400 deaths of non-smokers. In the hospitality industry in the EU, one non-smoking employee was estimated to die every 3.5 working days from passive smoking.

Table 4.1 summarises the estimated number of deaths attributable to passive smoking in the 25 countries of the EU in 2002. Table 4.2 summarises the estimated number of deaths attributable to passive smoking among **non-smokers** in the 25 countries of the EU in 2002.

The authors note that the final figures for the harm attributable to passive smoking are conservative. For example the calculations omit deaths ascribed from pneumonia, where passive smoking can play a role in adults. Moreover, the authors did not estimate deaths in childhood that may be attributable to passive smoking. The report also omitted deaths in adults from other conditions known to be caused by active smoking, as well as morbidity (acute and chronic) caused by passive smoking.

Table 4.1: Estimated number of deaths attributable to passive smoking in the 25 countries of the EU in 2002

Condition	Exposure at home			Exposure at work		Total all home plus all workplaces
	Adults < 65 years	Adults 65 + years	All home	All workplaces	Hospitality industry	
Lung cancer	6,498	4,443	10,941	2,300	104	13,241
Ischaemic heart disease	10,025	19,873	29,898	2,444	119	32,342
Stroke	5,973	20,557	26,530	2,060	82	28,591
Chronic non-neoplasm respiratory disease	1,269	3,531	4,800	475	21	5,275
Total*	23,765	48,404	72,170	7,280	325	79,449

SOURCE: Smokefree Partnership (2006).

NOTE: *May be affected by rounding in component estimates.

Table 4.2: Estimated number of deaths attributable to passive smoking among non-smokers in the 25 countries of the EU in 2002

Condition	Exposure at home			Exposure at work		Total all home plus all workplaces
	Adults < 65 years	Adults 65 + years	All home	All workplaces	Hospitality industry	
Lung cancer	403	629	1,032	521	16	**1,553**
Ischaemic heart disease	1,781	6,977	8,758	1481	48	**10,239**
Stroke	729	4,954	5,683	596	19	**6,279**
Chronic non-neoplasm respiratory disease	155	815	970	201	6	**1,171**
Total*	**3,068**	**13,375**	**16,443**	**2,799**	**89**	**19,242**

SOURCE: Smokefree Partnership (2006).

NOTE: *May be affected by rounding in component estimates.

4.2 Relative risk estimates for ETS-associated diseases and conditions

This section examines relative risk estimates for mortality and morbidity associated with ETS for the following disease and conditions:

- lung cancer
- coronary heart disease
- stroke
- respiratory conditions in adults (e.g. asthma and COPD)
- respiratory conditions in children (e.g. asthma or wheezing).

We chose those diseases and conditions where the evidence is sufficient (or suggestive) to infer a causal relationship as defined by the Surgeon General (2006) report. The latest evidence and existing high-quality reviews of relative risks was sought first and primary studies were only examined where such reviews were either outdated, lacking, or where they did not provide sufficient information for the nature and quality of primary evidence to be judged.

The following reports were the basis for the ETS relative risks:

- *International Review of the Regulation of Smoking in Public Places* (NHS Health Scotland et al., 2005)
- *The Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General* (Surgeon General, 2006)

- *Going Smoke-free: The Medical Case for Clear Air in the Home, at Work and in Public Places* (Royal College of Physicians, 2005),

We also report relative risks associated with ETS based on meta-analysis presented in the peer-reviewed literature after the 2006 Surgeon General's report:

- "Meta-analysis of Studies of Passive Smoking and Lung Cancer: Effects of Study Type and Continent" (Taylor et al., 2007)
- "Lung Cancer Risk and Workplace Exposure to Environmental Tobacco Smoke" (Stayner et al., 2007).

The full range of relative risk estimates we found is included in **Appendix C**. We summarise this information in a convenient format in Table 4.3.

Table 4.3: Summary table of relative risk estimates associated with ETS and specific diseases

Condition	Work		Home	
	Lowest estimate	Highest estimate	Lowest estimate	Highest estimate
Lung cancer	1.03	2.01	1.16	1.29
CHD	1.11	1.21	1.25	1.42
Stroke	n/a	n/a	0.50	1.82
COPD/asthma	n/a	n/a	1.20	2.60
Childhood asthma	n/a	n/a	0.93	1.54

Table 4.3 shows that relative risk estimates reported in the literature exhibit wide ranges. Even though the large majority of studies report relative risks greater than 1 with 95 percent significance, a few studies report ratios smaller than 1. To illustrate, a relative risk estimate associated with ETS and lung cancer of 1.03 means among non-smokers exposed to ETS, there is an estimated 3% increase in the risk of death from lung cancer. The highest estimates are reported for lung cancer due to ETS exposure at work (2.01), stroke due to ETS exposure at home (1.82) and COPD/asthma due to ETS exposure at home (2.6). Separate relative risks for ETS exposure at work were not reported for three diseases (stroke, COPD/asthma, and childhood asthma).

CHAPTER 5 ETS financial burden

There are two pieces of work that attempted to estimate the costs of ETS in a systematic and comprehensive way (Behan et al., 2005, and Adam et al., n.d.). This section summarises their findings. The objective is to provide an overview and order of magnitude of the economic burden associated with ETS rather than precise estimates. There is uncertainty and variability across countries regarding different cost estimates, as well as the assumptions used to estimate the ETS financial burden. These factors limit data comparability.

The first report prepared by researchers from the US Centers for Disease Control and Prevention reviewed all studies, conducted up to the end of the 1990s, that provided estimates of the ETS costs for mothers, infants, and children. This review was part of the material presented at the 1999 WHO international consultation meeting on ETS and child health.

Overall, the studies provide a broad range of methods and cost-estimates. The studies reviewed varied significantly in the methods used, and differed in scope. Variety is reflected in the use of different kinds of cost data, the use of prevalence- or incidence-based approach, the use of attributable risk, and so on. Tables 5.1 and 5.2 summarise the findings for the US and non-US studies, respectively.

Table 5.1 shows the cost-estimates associated with morbidity range from US$210 million to US$2.1 billion depending on the study and the populations included. Moreover, the cost due to premature mortality, US$7.1 billion (in the single study that estimated it), is more than three times higher than the cost of ETS-related morbidity.

Table 5.2 shows the data in 1997 US dollars from countries other than the US. The variability on the estimates is more pronounced. For example morbidity costs range from US$50.5 million to US$267 million. This may be due to country-specific differences. In addition, the methodologies used were very dependent on the data that were available increasing the range of assumptions that had to be used to make estimations.

To aid interpretation, in Table 5.3 and 5.4 we present those estimated costs of ETS in the US and other countries expressed in 2007 euros.[16]

[16] We converted 1997 US dollars to 2007 euros by multiplying 1997 US dollars by annual average 2007 CPI (207.342) and dividing by annual average CPI for 1997 (160.5). We obtained annual average CPI from the US Department of Labour Statistics. We then converted 2007 US dollars to 2007 euros using FXHistory:

Table 5.1: Estimated costs of ETS in 1997 US dollars—US

Categories of costs	Adams, E. K., G. Solanki, and L. S. Miller, *Morbidity and Mortality Weekly Review*, Vol. 46, No. 44, 7 November 1997, pp. 1,048–1,050.	Aligne C. A., and J. J. Stoddard, *Archives of Pediatric Adolescent Medicine*, Vol. 151, July 1997, pp. 648–653.	Manning, W. G., E. B. Keeler, J. P. Newhouse, E.M. Sloss, and J. Wasserman, *Journal of American Medical Association*, Vol. 261, No. 11, 1989, pp. 1,604–1,609.	Markus, J. S., J. P. Koplan, C. J. R. Hugue, and M. E. Dalmat, *American Journal of Preventive Medicine*, Vol. 6, No. 5, 1990, pp. 282–289.	Stoddard J. J., and B. Gray, *American Journal of Public Health*, Vol. 87, No. 2, February 1997, pp. 205–209.
	1997 US dollars	1997 US dollars	1997 US dollars	1997 US dollars	1997 US dollars
Premature death					
Adults	–	–	–	–	–
Infants	–	$7.1 B	–	–	–
Children	–		–	–	–
Morbidity					
Mother	$1.5–2.1 B	–	–	–	–
Infant	(mother/infant)	$1.4 B	–	$998 M	–
Children	–	$897 M	–		$703 M(< 6yrs)
Asthma	–	$210 M		–	
Other conditions	–	$687 M			
Productivity					
Reduced work effort	–	–	–	–	–
Absenteeism	–	–	–	–	–
Other					
Fires	–	$23 M in morbidity and $366 M in premature death due to fires in above figures	$498 M in property losses due to fires at home	–	–
Nuisance	–			–	–
Bldg./maintenance	–			–	–
Special Services (LBW)	–			$985 M	–

SOURCE: Adams et al. (n.d..)

NOTES: The original source had notes associated with the estimated costs of ETS, but due to the quality of the PDF these could not be cited.

historical currency exchange (inter-bank rate) as at 14 March 2007: 0.75830 (http://www.oanda.com/convert/fxhistory).

Table 5.2: Estimated costs of ETS in 1997 US dollars—other countries

Categories of costs	Collins, D. J., and H. M. Lapsley, Commonwealth Department of Human Services and Health, 1996.	Doran, C. M., and R. W. Sanson-Fisher, *Australian and New Zealand Journal of Public Health*, Vol. 20, No. 6, 1996.	Forbes, W. F., and M. E.Thompson, *Canadian Journal of Public Health*, Vol. 74, 1983.	Godfrey, C., M. Raw, M. Sutton, and H. Edwards, *The Smoking Epidemic*, Health Education Authority, 1993.	Kaiserman, M. J., *Chronic Disease Canada*, Vol. 18, No. 1.
	Australian 1992 dollars converted and updated to 1997 US dollars (2007 euros)[17]	New South Wales 1989–1990 dollars converted and updated to 1997 US dollars	Canadian 1980 dollars converted and updated to 1997 dollars	Great Britain 1992 pounds converted and updated to 1997 dollars	Canadian dollars converted and updated 1997 US dollars
<u>Premature death</u>					
Adults	–	–	–	–	–
Infants	–	–	–	–	–
Children	–	–	–	–	–
<u>Morbidity</u>					
Mother	Estimated $135 M in health care costs due to passive smoke (10% of all smoking attributable health care costs)	$50.5 M due to passive smoke*	–	–	–
Infant			$8.4 M**	–	–
Children			$239.5 M**	$267 M**	–
Asthma				–	–
Other conditions				–	–
<u>Productivity</u>					
Reduced work effort	–	–	–	–	–
Absenteeism	–	–	–	–	–
<u>Other</u>					
Fires	–	–	–	–	$81.5 M
Nuisance	–	–	–	–	–
Bldg./maintenance	–	–	–	–	–
Special Services (LBW)	–	–	–	–	–

SOURCE: Adams et al. (n.d..)

NOTES: The original source had notes associated with the estimated costs of ETS, but due to the quality of the PDF these could not be cited.

[17] We converted 1997 US dollars to 2007 euros by multiplying 1997 US dollars by annual average 2007 CPI (207.342) and dividing by annual average CPI for 1997 (160.5). We obtained annual average CPI from the US Department of Labour Statistics. We then converted 2007 US dollars to 2007 euros using FXHistory: historical currency exchange (inter-bank rate) as at 14 March 2007: 0.75830 (http://www.oanda.com/convert/fxhistory).

Table 5.3: Estimated costs of ETS in 2007 euros[18]—US

Categories of costs	Adams, E. K., G. Solanki, and L. S. Miller, *Morbidity and Mortality Weekly Review*, Vol. 46, No. 44, 7 November 1997, pp. 1,048–1,050.	Aligne C. A., and J. J. Stoddard, *Archives of Pediatric Adolescent Medicine*, Vol. 151, July 1997, pp. 648–653.	Manning, W. G., E. B. Keeler, J. P. Newhouse, E.M. Sloss, and J. Wasserman, *Journal of American Medical Association*, Vol. 261, No. 11, 1989, pp. 1,604–1,609.	Markus, J. S., J. P. Koplan, C. J. R. Hugue, and M. E. Dalmat, *American Journal of Preventive Medicine*, Vol. 6, No. 5, 1990, pp. 282–289.	Stoddard J. J., and B. Gray, *American Journal of Public Health*, Vol. 87, No. 2, February 1997, pp. 205–209.
Premature death					
Infants		€7.0 B*			
Morbidity					
Mother	€1.5–2.1 B**	–	–	–	–
Infant	(mother/infant)	€1.4 B**	–	€978 M**	–
Children	–	€878 M**	–		€689 M** (< 6yrs)
Asthma	–	€206 M**		–	
Other conditions	–	€673 M**			
Other					
Fires	–	€23 M** in morbidity and €359 M* in premature death due to fires in above figures	€488 M**** in property losses due to fires at home	–	–
Nuisance	–			–	–
Bldg./maintenance	–			–	–
Special Services (LBW)	–			€965 M*****	–

SOURCE: Adams et al. (n.d..)

NOTES: The original source had notes associated with the estimated costs of ETS, but due to the quality of the PDF these could not be cited.

[18] We converted 1997 US dollars to 2007 euros by multiplying 1997 US dollars by annual average 2007 CPI (207.342) and dividing by annual average CPI for 1997 (160.5). We obtained annual average CPI from the US Department of Labour Statistics. We then converted 2007 US dollars to 2007 euros using FXHistory: historical currency exchange (inter-bank rate) as at 14 March 2007: 0.75830 (http://www.oanda.com/convert/fxhistory).

Table 5.4: Estimated costs of environmental tobacco smoke (ETS) in 2007 euros[19]—other countries

Categories of costs	Collins, D. J., and H. M. Lapsley, Commonwealth Department of Human Services and Health, 1996.	Doran, C. M., and R. W. Sanson-Fisher, *Australian and New Zealand Journal of Public Health*, Vol. 20, No. 6, 1996.	Forbes, W. F., and M. E.Thompson, *Canadian Journal of Public Health*, Vol. 74, 1983.	Godfrey, C., M. Raw, M. Sutton, and H. Edwards, *The Smoking Epidemic*, Health Education Authority, 1993.	Kaiserman, M. J., *Chronic Disease Canada*, Vol. 18, No. 1.
Morbidity					
Mother	Estimated €132 M in health care costs due to passive smoke (10% of all smoking attributable health care costs)	€49 M due to passive smoke*	–	–	–
Infant			€8.2 M**	–	–
Children			€234.6 M**	€261.6 M**	–
Asthma				–	–
Other conditions				–	–
Other					
Fires	–	–	–	–	€79.8 M

SOURCE: Adams et al. (n.d..)

NOTES: The original source had notes associated with the estimated costs of ETS, but due to the quality of the PDF these could not be cited.

The second analysis was made by the US Society of Actuaries in 2005 and examined the costs of ETS in a very systematic and comprehensive way (Behan et al., 2005). The analysis incorporates more recent estimates and evidence, of the costs resulting from ETS-related excess morbidity and the costs of excess mortality and disability. The latter includes lost wages, lost fringe benefits and lost services. Overall, the analysis indicates that the impact of ETS is in the order of several billion US dollars, with an annual price tag of roughly $10 billion (€8 billion). This corresponds to $33,000 (€27,467) for each US resident.

More specifically, the medical cost of ETS exposure per year for the US population is almost $5 billion (€4.1 billion) and the economic value of the ETS associated mortality and disability per year reaches $4.7 billion (€3.9 billion). Tables 5.5 and 5.6 show these results in a more detailed form for the morbidity and mortality estimates, respectively.

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[19] We converted 1997 US dollars to 2007 euros by multiplying 1997 US dollars by annual average 2007 CPI (207.342) and dividing by annual average CPI for 1997 (160.5). We obtained annual average CPI from the US Department of Labour Statistics. We then converted 2007 US dollars to 2007 euros using FXHistory: historical currency exchange (inter-bank rate) as at 14 March 2007: 0.75830 (http://www.oanda.com/convert/fxhistory).

Table 5.5: Estimated direct medical costs of exposure to ETS per year in the US population, based on present values (expressed in 2004 US dollars and 2007 euros)[20]

Category	Morbidity	Cost ($1 million)	Cost (€ million)
Cancer	Lung cancer	191	159
	Cervical cancer	14	12
Respiratory system	Asthma	773	643
	Otitis media	53	44
	Chronic pulmonary disease	1,215	1,011
Cardiovascular system	Coronary heart disease	2,452	2,040
Perinatal manifestations	Low birth weight	284	236
Total cost		**$4,982**	**€4,147**

SOURCE: Adjusted from Behan et al. (2005).

Table 5.6: Estimated economic value of lost wages, fringe benefits and services per year for the US population, based on present values (expressed in 2004 US dollars and 2007 euros)

Category	Morbidity	Cost ($1 millions)	Cost (€ millions)
Cancer	Lung cancer	469	390
	Cervical cancer	110	92
Respiratory system	Asthma (disability only)	161	134
	Chronic pulmonary disease	886	737
Cardiovascular system	Coronary heart disease	2,752	2,291
Perinatal manifestations	Low birth weight	174	145
Postnatal manifestations	Sudden infant death syndrome	131	109
Total		**4,683**	**3,898**

SOURCE: Adjusted from Behan et al. (2005)

[20] We converted 2004 US dollars to 2007 euros by multiplying 2004 US dollars by annual average 2007 CPI (207.342) and dividing by annual average CPI for 2004 (188.9). We obtained annual average CPI from the US Department of Labour Statistics. We then converted 2007 US dollars to 2007 euros using FXHistory: historical currency exchange (inter-bank rate) as at 14 March 2007: 0.75830 (http://www.oanda.com/convert/fxhistory).

We did not come across any cost of illness studies in Europe which have examined the economic burden of ETS. However, regulatory impacts assessments in Northern Ireland, England, Scotland, and Wales have estimated the expected health benefits and resource savings associated with comprehensive smoke-free legislation (see Tables 5.7, 5.8, 5.9, and 5.10) (NHS Health Scotland et al., 2005; Department of Health 2006; Department of Health 2007; Welsh Assembly Government, 2007). One could assume that these savings represent the current economic burden of ETS at workplaces and public places. The true economic burden of ETS is likely to be higher since comprehensive smoke-free legislation may not eliminate the economic burden of ETS in homes.

Based on this assumption the annual economic burden of ETS in Northern Ireland, Wales, England, and Scotland is £57.4 million, £120 million, £944–1,354 million, and £204 million, respectively. For comparison, note that this would equal to approximately £40 per capita for Wales' 3 million residents.

Table 5.7: Northern Ireland: annual benefits of comprehensive smoke-free legislation in 2006 prices based on 30-year appraisal, £ million

Health benefits	Three main smoking related diseases (lung cancer, stroke, and ischaemic heart disease)	All identified smoking related diseases
Economic value of lives saved	5.47	5.47
Morbidity savings (human cost of ill health)	14.42	14.42
Resource savings		
NHS treatment costs	3.20	4.10
Reduced sickness absence savings	0.60	0.60
Productivity gains as a result of reduced smoking breaks	28.20	28.20
Cost savings from reduced fire hazards and reduced cleaning and decoration costs	4.60	4.60
Total	**56.50**	**57.40**

SOURCE: Department of Health (2006)

Table 5.8: Wales: annual net present value of comprehensive smoke-free legislation in 2006 prices based on 30-year appraisal), £ million

Health benefits	
Economic value of lives saved	86.9
Morbidity savings (human cost of ill health)	12.6
Resource savings	
NHS treatment cost savings	2.9
Reduced sickness absence savings	4.0
Cost savings from reduced fire hazards	6.0
Cost savings from reduced cleaning and decoration costs	7.6
Total	120.0

SOURCE: Welsh Assembly Government (2007)

Table 5.9: England: annual benefits with full ban, £ million

Health benefits	
Averted deaths	21 (employees); 350 (customers); 371 (employees + customers)
Reduced sickness absence	70–140
Production gains (from reduced exposure to SHS)	340–680
Safety benefits (damage, fire, injuries, etc.)	63
Reduced cleaning and maintenance costs	100
Total	944–1,354

SOURCE: Department of Health (2007)

Table 5.10: Scotland: annual benefits relating to reduction in passive smoking with full ban, 2003 prices, £ million

Value of deaths avoided	91.4 (range: 16.8–176.7)
Morbidity savings (human cost of ill health)	12.8
Saving on NHS costs	5.3 (range: 4.5–11.5)
Saving on sickness absences	4.1–5.2
Fire damage	5.0 (range: 4.0–5.0)
Cleaning and redecoration	11.7
Smoking breaks	73.7
Total	**204 (range: 28.9–265.5)**

SOURCE: NHS Health Scotland et al. (2005)

CHAPTER 6 ETS and inequalities

Social and economic inequalities exist within and between different countries, and correlate with evidence on smoking prevalence and smoking cessation rates, as well as in terms of exposure to secondhand smoke. While comprehensive smoke-free policies have the potential to reduce socio-economic-related disparities in tobacco consumption and ETS exposure, the literature suggests that smoking bans need to be linked with broader measures such as awareness-raising campaigns targeting special settings like homes and private cars, where particular vulnerable groups have the most exposure and which do not fall under the scope of current smoke-free legislation.

6.1 Tobacco consumption and smoking cessation among different social groups

Over the past two decades, there has been an increasing association of smoking (and the corresponding tobacco-related illnesses) with markers of socio-economic inequalities (Kunst et al., 2004). Although smoking among adults is declining overall in the UK, key target groups, including pregnant women and disadvantaged groups, continue to present challenges in smoking cessation (MacAskill and Amos, 2007). In the UK, smoking has been identified as the single biggest cause of inequality in death rates between rich and poor and accounts for over half of the difference in risk of premature death between social classes. More specifically, death rates from tobacco are two to three times higher among disadvantaged social groups than among the better off (ASH, 2006). Recent estimates from England, Wales, Poland, Canada, and the US suggest that the excess mortality of poor men in these countries is largely explained by difference in smoking between the rich and the poor (Bobak et al., 2000).

Socioeconomic status is not the only social determinant of tobacco consumption. Smoking prevalence is known to vary also by gender and age (Greaves, 2007, and WHO, 2007). In Scotland, it has been estimated that over 75 percent of SHS-related deaths occur among women (Hole, 2005). In Estonia, a recent study found that a lower educational level was the strongest predictor of ever initiating regular smoking. In addition, smoking cessation among regular smokers was related more directly to aspects of social disadvantage originating in adult life, in particular among men who were unemployed, who had a lower occupational position or who had low income. Similarly, a gender difference was found to the degree that divorced women had both the highest initiation rates and the lowest cessation rates (Leinsalu et al., 2007). Finally, a UK study by Low et al. (2007)

demonstrated that while the expansion of smoking cessation services was successful in increasing the overall number of quitters, for Derwentside in the North East of England, the service "continued to exacerbate inequality in smoking prevalence between deprived and affluent wards".

6.2 Lower socio-economic groups are disproportionately burdened by ETS exposure

In 2000, Trinder et al. found that the severity of respiratory symptoms from cigarette smoke increased with increasing exposure and also that *the increase was greater among manual social classes*. In fact, British workers in routine and manual occupations are much more likely (2.25 times) to be breathing in other people's smoke than those in managerial and professional occupations (ASH, 2006). More specifically, according to 2004 data (before the ban on smoking in the workplace in Scotland), 900,000 people in routine and manual occupations (lower socio-economic groups) in Great Britain work in places where there are no restrictions on smoking at all compared with 400,000 managers and professional people (higher socio-economic groups. The figures were taken from the Labour Force Survey and Office of National Statistics Omnibus surveys 2004 and analysed for ASH by statisticians in the UK Department of Health. The Low et al. (2007) findings above are consistent with these two study results showing that social class is linked to increased exposure to cigarette smoke and to the severity of respiratory symptoms, independently of smoking.

In Sweden, the influence of socio-demographic factors on ETS exposure at work was investigated by multivariate regression analysis based on the Scania Public Health Survey 2000 (Moussa et al., 2004). The study found that male skilled manual workers and female unskilled manual workers had higher adjusted odds ratios (OR 4.0, 95 percent CI: 3.1–5.3 and OR 3.2, 95 percent CI: 2.2–4.7, respectively) of ETS exposure than non-manual high-level skilled employees. The authors concluded that "ETS should be recognised as a factor contributing to health inequalities" and "women of childbearing age need protective strategies".

In New Zealand, Whitlock et al. (1998) demonstrated that ETS exposure (using two different measures) was *steeply* and *inversely* associated with all three indicators of socioeconomic status (education level, occupational status and median neighbourhood household income). The authors concluded that greater ETS exposure might therefore contribute to the higher risks of disease and death among low socio-economic groups, providing a further rationale for targeting tobacco control measures to people in lower social classes.

Moreover, in 2005 the Fourth Working Conditions Survey showed 10.6 percent of professionals report exposure to ETS at work around a quarter of the time or more compared with 31.4 percent of skilled workers and 24 percent of machine operators.

There is evidence from New Zealand that significant ethnic and socio-economic disparities persist in a country with a national smoke-free law in the workplace and public places. In New Zealand, Ponniah (2007) found that the indigenous Maori population was more likely to report secondhand smoke in the home (OR = 2.45), in the car (OR = 2.80), and at work (OR=1.46) compared with non-Maori, and that the *likelihood of SHS exposure* at home and in the car *increases as the level of socio-economic deprivation increases*. In a European context, one could anticipate that the experience of the indigenous Maori in New Zealand might be shared by other similarly disadvantaged groups such as the Roma population.

Evidence also suggests that there is also a gender difference in SHS exposure in the work setting, with males being significantly more likely to report SHS exposure compared with females (Whitlock et al., 1998, and Ponniah, 2007). This finding is consistent with data from a variety of studies and initiatives in Europe showing that women who are of low socioeconomic status may be differently affected by and possibly less likely to benefit from smoke-free policies at work, but may benefit from smoke-free homes (Greaves, 2007). For example, a 2007 study in the UK revealed that UK prevalence of domestic ETS exposure—defined as occurring when a woman who does not smoke while pregnant has a partner who reported smoking during the pregnancy—remains high and ETS exposure lowers infants' birth weight (Ward et al., 2007). These gender-specific results suggest that any legislation introduced in the UK should be accompanied by educational programmes emphasising the fetal harm that can occur as a consequence of passive maternal smoking within pregnant women's homes. Moreover, gendered education and communication approaches should be used to increase public awareness and support for approval and enforcement of effective tobacco control policies (WHO, 2007).

In addition to gender in lower social groups, there is strong evidence since the mid-1990s that children in lower socioeconomic status environments are disproportionately affected by paediatric morbidity and mortality caused by ETS exposure (Charlton 1994; DiFranza and Lew, 1996; Pirkle et al., 1996; Weaver et al., 1996; Aligne and Stoddard, 1997; and Hopper and Craig, 2000). The results of the Swedish study mentioned above also demonstrated that individuals under 25 years old (across all occupational classes) were at highest risk of ETS exposure (Moussa et al., 2004). And in New Zealand, the socioeconomic gradients of ETS exposure have been shown to be steeper among participants aged less than 35 years than among participants aged over 50 years (Whitlock et al., 1998).

6.3 Effects of smoke-free policies across socio-economic group

There are four recent studies that suggest tobacco control policies, like smoke-free legislation, can be effective across socioeconomic groups (Edwards et al., 2007, and Hassan, 2007). For example, preliminary results from Hassan et al. (2007) found few socioeconomic differences in relation to the effectiveness of the smoke-free policy introduced in Scotland. In Scotland, for example, not only is smoking more prevalent in disadvantaged communities, but prior to the smoke-free legislation bars and pubs in the areas of socio-economic advantage were less likely to have smoking policies and more likely to permit smoking in all areas. Post legislation, a qualitative study in Scotland found a reduction in reported tobacco consumption (including quitting), particularly in disadvantaged communities. The study also found that smokers in both affluent and disadvantaged communities reported experiencing public disapproval associated with their smoking post legislation and this was an important factor that shaped their smoking behaviour. Moreover, the Scottish evaluation studies have found that there are similar levels of compliance to the legislation across all communities; there is no displacement of ETS into the home and the impact of reducing inequalities in health therefore may be significant (Martin et al., 2008).

But, given the short timeframe since its implementation, these preliminary results may not fully reflect the true consequences of a smoke-free policy for different social classes in Scotland. Similarly, a recent assessment of the NHS stop smoking services found a positive impact on reducing inequalities (Bauld, 2007). However, as Bauld (2007) suggests, if smoking cessation was the only policy instrument, it could take 50 years to achieve the UK's inequality targets. A third study in New Zealand showed the higher level of ETS exposure among Maori in households with one or more smokers present prior to implementation of the Smokefree Environments Amendment Act had disappeared by 2006 (Edwards et al., 2007). Although the authors concluded that comprehensive smoke-free environments legislation can have equitable effects for disadvantaged populations and may reduce health inequalities, they conclude that further research is required to test the longer term impact of the smoke-free legislation in reducing indigenous health inequalities in all indoor workplaces as well as *other settings* (emphasis added). Finally, a fourth study in Ontario, Canada, demonstrated that local smoking laws increased workplace smoking restrictions for blue collar workers and among this group the laws (including workplace smoking bans) reduced ETS exposure by 28–33 percent (Carpenter, 2007).

However, there are important reasons to support the argument that, while necessary, smoke-free legislation is insufficient to reduce social inequalities in ETS exposure, unless it is comprehensive and complemented by flanking measures such as awareness-raising campaigns to increase the support for smoking bans and maximise their impact in venues not covered by the legislation, such as private homes.

Smoke-free legislation impacts differently on smokers with high and low education and therefore needs to be accompanied by educational programmes targeted at less educated groups. In a study by Evans et al. (2007) it was found that, although the 2004 Irish smoking ban had a positive knock on effect on smoking in the home and on attitudes towards ETS, significantly more respondents from lower socio-economic groups allowed smoking in the home both before and after the ban. A Dutch study revealed that psychological resistance to smoke-free legislation is more pronounced among more disadvantaged groups, notably smokers with low socio-economic status (Willemsen, 2007), a finding that might explain the persisting disparity in smoking in the home in Ireland between socio-economic groups.

Furthermore, there is evidence that smoke-free policies—unless comprehensive—can actually reinforce existing disparities. A number of studies have demonstrated that the UK government's proposals for partial smoke-free legislation in England would offer the least protection to the most heavily exposed group—bar workers and customers in non-food-serving pubs in deprived areas. The results of a cross-sectional survey of the levels of secondhand smoke in pubs and bars by deprivation and food-serving status from North West England by Edwards et al. (2006) suggest that these proposals "would work against the UK government's stated aim to reduce health inequalities". Woodall et al. (2005) argue that a partial ban is likely to worsen socioeconomic inequalities in health and smoking prevalence, as most licensed establishments in the poorest areas would be exempt from the workplace ban on smoking (because they don't serve catered food), while most in the more affluent areas would be subject to the ban. The results of the study showed that people in deprived areas were more likely to live near licensed establishments exempt from the legislation to protect them against smoking, and also that the proportion of exempt pubs is higher than government estimates, at 43 percent rather than only 10–30 percent. Similar results and conclusions were provided by Tocque et al. (2005).

6.4 An equity-oriented tobacco control policy means linking up with broader social policies

In light of the available evidence and the policy need for developing equity-oriented tobacco control, it seems reasonable to support the conclusion of Leinsalu et al. (2007) that effective tobacco control policies should not only target lower educated individuals, but also those in material and gender disadvantage. Some action has been taken in the Netherlands to target lower socio-economic groups with a proven effective 24 hours no-smoking-campaign, developed by STIVORO. Preliminary results presented at a European conference in October 2007 revealed that, when implemented nationwide, the campaign reached the target group and also increased their intention to quit smoking. The latter is a particularly important finding since a significant higher percentage of smokers who want to quit in the Netherlands are not from lower socio-economic groups (Wiebing et al., 2007). In some areas in the UK, there is evidence of effective targeting of smoking cessation services (Bauld, 2007); for example, the targeted Partnership for Action on Tobacco and Health showed some positive impact on reducing the proportion of pregnant women and people faced with inequalities who smoke (MacAskill and Amos, 2007).

CHAPTER 7 Smoke-free regulations in EU Member States

7.1 Overview

There is no safe level of exposure to ETS (WHO, 2007). Therefore, the elimination of smoking from indoor environments is the only science-based measure that adequately protects a population's health from the dangerous effects of SHS. A study on the effects of smoking restrictions in the workplace highlights the following multiple reasons for restricting smoking in public places (Brownson et al., 2002):

- ETS causes acute and chronic diseases.
- The majority of persons experience annoyance and discomfort from ETS exposure and view ETS as a health hazard.
- Many non-smokers do not (or are not able to) take personal action to avoid exposure to ETS when smokers light up in their vicinity.
- Employers might realise lower maintenance and repair costs, insurance costs and high non-smokers' productivity when smoking is prohibited in the workplace.
- Restricting smoking in work settings might increase the likelihood that smokers in these settings smoke fewer cigarettes or quit smoking entirely.
- Employers might face liability for non-smokers' health.

In 2004, Ireland became the first country in the world to implement a comprehensive smoking ban in indoor workplaces, including restaurants and bars. More and more countries, states and cities in Europe and overseas are taking similar action (Figure 7.1).

Figure 7.1 Implementation of smoke-free laws in the EU[21]

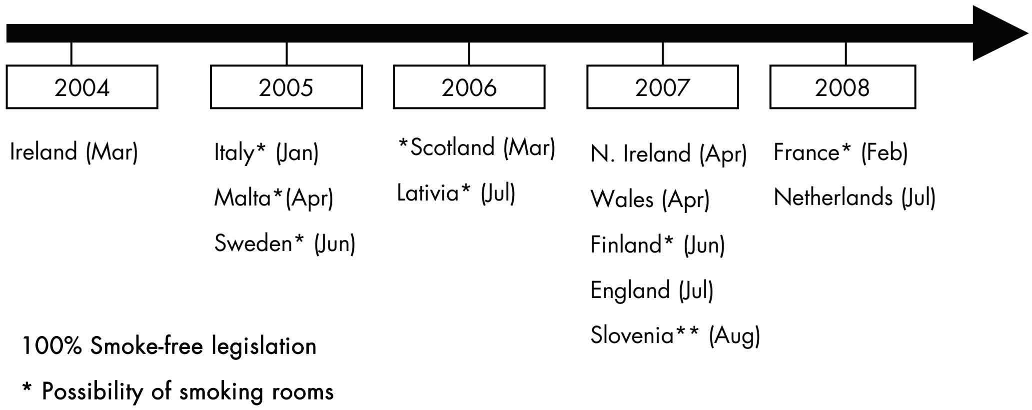

Table 7.1 provides an overview of the laws on smoke-free laws around the world obtained from Global Smokefree Partnerships (n.d.). Most smoke-free countries are in Europe (although a number of these countries allow for the possibility of designated, enclosed, ventilated smoking rooms) (Koh et al., 2007). In a number of other EU-27 countries smoking is banned in all enclosed workplaces and public places with the exception of the hospitality venues where partial restrictions apply. These include Belgium (exemption for snack and non-food establishments), Spain and Portugal (exemption for venues below 100 square metres).

[21] This figure is accurate as of June 2008.

Table 7.1: Smoke-free progress: an overview of smoke-free laws around the world

100% smoke-free	
Outside Europe	Europe
Argentina: 2 provinces and 1 city	England
Australia: 3 states and territories	Ireland
Bermuda	Northern Ireland
Canada: 7 provinces and territories (and more in future)	Scotland
New Zealand	Wales
Uruguay	
US: 11 states and territories (and more in future)	
Hong Kong (future)	
Smoke-free with exemptions (smoke-free but designated smoking rooms allowed (current legislation)	
Outside Europe	*Europe*
Canada—Quebec	Iceland
South Africa	Italy
Uganda	Malta
	Slovenia
	Norway
	Estonia
	Sweden
Smoke-free but designated smoking rooms allowed (future legislation)	
Europe	
Finland	
Smoke-free with other exemptions* (current legislation)	
Outside Europe	*Europe*
Australian states	Lithuania
Canadian provinces and territories	Spain
US states	France
Smoke-free with other exemptions (future legislation)	
Outside Europe	
Australian states	The Netherlands

* For example, smoking may be permitted in restaurants of less than a certain area, or in high-rolling rooms of casinos or on public transport.

SOURCE: Global Smokefree Partnerships (n.d.)

7.2 Country-specific smoke-free regulations in EU Member States

The European Network for Smoking Prevention (ENSP) provides a description of the smoke-free regulations across the EU-27 and trends towards smoke-free provisions as of January 2008 (European Network for Smoking Prevention, 2007). For each country a description is provided about when smoking bans were implemented in various settings, such as healthcare, government, and education facilities as well as public transport, indoor workplaces, and places of entertainment (bars/restaurants and so on). The ENSP descriptions also provide information on fines and penalties if people fail to comply.

There are other websites which also provide detailed information on country-specific regulations. Clearing the Air Scotland provides an interactive map of smoking legislation throughout the world.[22]

Furthermore, the Global Smokefree Partnership has published at least two reports which provide information on the extent to which countries in the EU (and beyond) have implemented smoke-free legislation (Global Smokefree Partnership, 2007, and n.d.).

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[22] Clearing the Air Scotland is a website resource provided by the Scottish government which gives information on the Scottish smoking ban. See: http://www.clearingtheairscotland.com/background/map.html.

CHAPTER 8 The effects of smoking bans

Over time, many countries have implemented policies that prohibit smoking in public places. The effects of such smoking bans have been evaluated by numerous researchers and published in the scientific literature. Typical outcome measures include: ETS exposure, air quality, population health, smoking behaviour, attitudes and compliance towards the bans, and economic effects on the industry sector. In this chapter we summarise this literature into a set of key findings on the effects of smoking bans. We distinguish between economic and non-economic effects. For a full overview of effects reported in the literature, we refer the reader to Appendix D.

8.1 The effects of smoking bans—non-economic

The evidence reported in the literature suggests that smoking bans have been highly effective in reducing ETS exposure and improving air quality. Smoking bans seem to have a positive effect on population health for specific conditions, such as coronary events and respiratory problems. In addition, the literature suggests that besides these direct effects, smoking bans have an indirect effect on smoking behaviour. We discuss these effects in more detail in the next paragraphs.

8.1.1 The effects of smoking bans on ETS exposure

The effect of smoking bans on ETS exposure has been measured through various outcomes, including self-reported exposure, cotinine levels (metabolised nicotine in blood), nicotine, and other more general outcome measures. Apparently, biological markers can give an objective measurement of ETS exposure. For each of these measures, the evidence reported in the literature points in the same direction: *smoking bans are effective in reducing ETS exposure*.

Based on self-reported exposure, smoking bans reduced ETS exposure at work from 20 percent to 8 percent in New Zealand, and from 30 hours of exposure to zero in Ireland (WHO, 2007, and Edwards et al., 2008). Among the 12 estimates we reviewed of cotinine-level changes due to smoking bans, all showed reductions, ranging from 12 percent (public places in Scotland) to 88 percent (among non-smoking volunteers in New Zealand bars) (Fernando et al., 2007; Semple et al., 2007). Similarly, nicotine levels (in the air) dropped dramatically in each of five studies that were reviewed, e.g. from 19.02 $\mu g/m^3$ to 0.25 $\mu g/m^3$ in a sample of 28 Italian bars (Gorinin et al., 2007).

A 100 percent effective smoking ban would reduce ETS exposure to zero by definition. In this light, the dramatic reductions do not come as a complete surprise, but rather suggest that in many cases smoking bans seem to be taken seriously and/or are well complied with and enforced.

8.1.2 The effects of smoking bans on air quality

The effect of smoking bans on air quality has been measured through changes in levels of particulate matter (PM). The main outcome measure, $PM_{2.5}$, refers to particulate matter that is 2.5 micrometres or smaller in size. Particulate matter is the term used for a mixture of solid particles and liquid droplets found in the air. Particle pollution is made up of a number of components, including acids (such as nitrates and sulphates), organic chemicals, metals, and soil or dust particles. Measuring airborne markers can indicate the average level of PM in an environment and is often easier to obtain than collecting biological samples.

For the eight studies that reported on the effects of smoking bans on air quality, all showed large reductions in PM, ranging from 83 percent (Irish bars) to 93 percent (US bars) (Goodman et al., 2005). Thus, the evidence reported in the literature suggests that *smoking bans lower particle pollution and thus improve air quality*.

8.1.3 The effects of smoking bans on population health

The effect of smoking bans on population health has been measured through changes in coronary events (for example heart attacks), and respiratory symptoms. Various studies have shown substantial reductions, including an 11.2 percent reduction in acute coronary events for residents 35–64 years old after implementation of a smoking ban policy in Italy (Cesaroni et al., 2008), and in Scotland a 17 percent reduction in heart attacks admission across nine hospitals one year after the smoke-free ban (NHS Health Scotland et al., 2005). Studies have also shown substantial reductions in respiratory symptoms as a result of smoke-free bans ranging from 13 percent to 40 percent in Irish, Spanish, and Scottish bar workers (Menzies et al., 2006; Ayres, 2007; and Fernandez, 2007). As we discussed above, the evidence suggests that smoking bans lower ETS exposure, which in turn has an effect on the risk of getting lung cancer, heart disease, strokes, and respiratory disease. This means it is likely that the effect of smoking bans on morbidity is wider than just the effects found above. However, proving these effects directly (finding evidence of a decrease in lung cancer incidence following smoke-free legislation) is difficult, because it can take many years before such effects will become observable. Still, the current evidence suggests that smoking bans have increased population health for at least coronary events and respiratory symptoms.

8.1.4 The effects of smoking bans on smoking behaviour

Perhaps one of the most interesting set of findings relates to the effect of smoking bans on smoking behaviour. Outcomes reported in the literature include: smoking prevalence, cigarette consumption, smoking cessation, smoking uptake, youth smoking behaviour, and smoking at home. See **Appendix D**, Tables D.9 to D.17 for a full overview.

Four peer-reviewed studies (Heloma et al., 2000; Fong et al., 2006; Gallus et al., 2006; Braverman et al., 2007), three reports or conference presentations (Gorini et al., 2007; Greiner et al., 2007; and Office of Tobacco Control, 2007), and two multi-country reviews—one in a peer-reviewed journal (Fichtenberg and Glantz, 2002) and the other a government body report (NHS Health Scotland et al., 2005) showed moderate reductions in **smoking prevalence** after the introduction of smoking bans, both inside and outside Europe. Estimates are typical in the range of about 2 to 6 percentage point reduction. Estimates from peer-reviewed studies on reductions in **cigarette consumption** due to smoking bans range from 1.2 to 3 cigarettes per day at the individual level (Heloma et al., 2000; Brownson et al., 2002; Fichtenberg and Glantz, 2002; Gallus et al., 2006; and Braverman et al., 2007). The grey literature also gives a similar amount of reduction in individual cigarette consumption as a result of smoking bans (NHS Health Scotland et al., 2005, and Office of Tobacco Control, 2007). At the population level, the reduction in cigarette consumption ranges from 4 percent to 29 percent, according to a number of peer-reviewed studies (Gallus et al., 2006; Cesaroni et al., 2008; and Chapman and Freeman, 2008) and other reports and conference presentations (Evans et al., 2007; Greiner et al., 2007; Salto et al., 2007; and WHO, 2007).

Various peer-reviewed studies reported on increases in **cessation attempts** (Brownson et al., 2002, and Fong et al., 2006) and in **people quitting smoking** (Brownson et al., 2002). Government reports, conference presentations, and even media releases confirm these findings (Greiner et al., 2007; BBC news, 22 March 2007; Salto et al., 2007; Directorate for Health and Social Affairs, 2005; Helakorpi et al., 2007; Surgeon General, 2006; Media release, 1 October 2004) and similar types of sources suggest a small increase in the **uptake of smoking** (Andreeva, 2007, and Spizzichino, 2007) after the introduction of smoking bans.

For example in Ireland, among smokers who quit following the smoking ban, 80 percent reported that the ban helped them quit, and 88 percent declared that the law had helped them not to start up smoking again (Fong et al., 2006). A review by Brownson et al. (2002) found the median change or difference in cessation attempts (measured and self-reported) in smokers exposed to workplace ban versus smokers exposed to lesser or no smoking bans to be 73 percent (−3.2 percent to 272 percent). Estimates from the various studies are difficult to summarise into a single range as different measures were used.

Two studies—one published in the prestigious *Journal of the American Medical Association* (*JAMA*)—reported substantial reductions in **smoking prevalence among teenagers** after introduction of community smoking bans or smoking restrictions in the home and workplace. The WHO (2007) reported a reduction in prevalence among teenagers living in communities with smoke-free laws compared with those that had no smoke-free laws of 17.2 percent. Another study reported teenagers who work in places that are smoke-free are nearly one-third less likely to have smoked than those with jobs where smoking is permitted (Farkas et al., 2000). Furthermore, an Australian peer-reviewed study in the journal *Health Promotion Practice* explored perceptions of how smoke-free policies might influence smoking behaviour through focus groups involving young social smokers and older regular smokers, and found pubs, bars, and nightclubs were perceived to provide encouragement for smoking more cigarettes by increasing smoking rate and facilitating smoking relapse. Smokers in the Australian study felt they would adapt to smoke-free policies and expected these policies to reduce their smoking or assist in their quitting (Wakefield et al., 2007).

Finally, four studies (Fong et al., 2006; Andreeva 2007; Evans et al., 2007; and Edwards et al., 2008), but only the latter one peer-reviewed, reported reductions in the **prevalence of smoking at home** after the introduction of smoking bans, ranging from 5 to 20 percentage point reductions. A qualitative study (Phillips et al., 2007), published in the *British Medical Journal*, on smoking in the home after the smoke-free legislation in Scotland found most adults had reported that they restricted smoking in the home, with a range of restrictions across social classes and home smoking profiles. Spatial, relational, health, and aesthetic factors influenced the development of restrictions. Children and grandchildren were important considerations in the development of restrictions, according to Philips et al. (2007). Currently, a peer-reviewed article by Godfrey (2007) explains that the Changes in Child Exposure to ETS (CHETS) study in Scotland is measuring changes in children's exposure to ETS and assessing whether displacement has taken place in the homes of smokers. The results of this ongoing work will be useful in contributing further knowledge and evidence about this area of impact of smoking bans.

In Australia, smoke-free workplaces were followed by a doubling of homes with smoking restrictions. In New Zealand, results from a population survey conducted by the Health Sponsorship Council between 2003 and 2006 indicate that reported exposures to smoking in the home have nearly halved over the three years, and in 2006 just over one in ten people reported exposure to SHS at home during the past seven days (Waa and McGough, 2006). Furthermore, results from the survey suggested that the number of care givers who allow smoking inside their home had decreased by one-third between 2003 and 2006 (HSC, 2006). Finally, another study cited in the peer-reviewed Chapman and Freeman (2008) article found that among factors that positively predicted having a smoke-free home was "believing smoke free was normative" (high acceptance of denormalising beliefs about smoking).

All the evidence cited above supports the hypothesis that *smoking bans have not only a direct effect on ETS exposure, but an indirect effect as well. This indirect effect is due to the effect on smoking behaviour.*

8.1.5 The effect of smoking bans on attitudes and compliance

Attitudes towards smoking bans are diverse and vary between countries. In many countries there is public support for smoke-free laws. Tables D.18 and D.19 in **Appendix D** show attitudes of citizens in European countries and non-European countries. In Ireland, for example the smoke-free law now has the support of 93 percent of the population compared with 59 percent prior to the law's introduction. Moreover, in Norway more than three-quarters of the public supported the smoke-free law by the end of the first year (Global Smokefree Partnership, 2007).

Compliance figures with smoking bans in eight countries is shown in Table D.20 **Appendix D**. For most countries, compliance rates are high, typically ranging in the upper 90th percentile. A study of the impact of smoke-free legislation on smoking behaviour and compliance in Scottish bars showed "fear of prosecution" was the main motive in enforcing the ban (Haw, 2007). Scottish studies have also shown that although there was a high degree of compliance, the nature and levels of compliance vary widely and suggest the need for more robust targeted surveillance methods, particularly supporting smokers in deprived areas (Martin et al., 2008).

8.2 The effects of smoking bans—economic

The economic effects of smoking bans have been assessed for two different sectors: the tobacco industry and the hospitality industry. We noted the studies on the economic effects on industry vary greatly in methodological quality. No studies were located that assessed the economic effects of smoking bans in other industries. Tables D.21 to D.23 in **Appendix D** presents a full overview.

Nine studies, three of which were peer-reviewed (Champman et al. cited in Royal College of Physicians, 2005; Gallus et al., 2006; and Cesaroni et al., 2008), reported the effects on the tobacco industry, with estimates on reductions in the sales of cigarettes ranging from 0.1 percent (Northern Ireland) to 14.1 percent (Norway). Most of the estimates on economic effects of smoking bans come from reports of the Global Smokefree Partnership, the 2006 Surgeon General report, and presentations of preliminary results at the 4th European Conference on Tobacco or Health in Basel in October 2007.

A total of 42 estimates were found on the effects of the hospitality industry, including eight estimates for bar and pub sales from two peer-reviewed studies (Lund cited in TSFS, and Thomson, 2006) and other respectable reports; one estimate for hotel room revenues from the NHS Health Scotland et al. (2005) report; five estimates for restaurant/cafés sales from three peer-reviewed studies (Bartosch and Pope cited in Royal College of Physicians, 2005; Lund and Helgason, 2005; Thomson, 2006) and other reports; 13 different estimates for patronage from at least five peer-reviewed studies (Kunzli et al., 2005; Adda et al., 2006; Fong et al., 2006; McCaffrey et al., 2006; Gallus et al., 2007); three estimates for overall hospitality sales with one provided in a peer-reviewed study (Alpert et al., 2007); one estimate for drink sales and one for food sales from the non-reviewed Federation of Licensed Victuallers' Association (2007); six estimates for employment from three peer-reviewed studies (McCaffrey et al., 2006; Thomson 2006; Alpert et al., 2007) and other reports; and, finally, one estimate for VAT from a peer-reviewed study by Lund cited in TSFS.

The evidence on the magnitude and direction of impact from smoking bans in the hospitality sector appears mixed. It ranges from reductions (a 4.4 percent decline in bar and pub sales in Ireland and New Zealand, and 10 percent reduction in overall hospitality sales in Scotland), to increases (a 6 percent increase in sales in restaurants and licensed cafés in Norway). These estimates, however, need to take into account the context within which these changes occur. For example, the effect of a 4 percent reduction in retail sales in bars and clubs in New Zealand was not sustained and subsequent figures were in line with pre-existing trends. Moreover, there may be a cultural and national effect as the US data is more consistent towards a positive effect. In sum, the evidence found suggests that *smoking bans reduced the sale of cigarettes. The effect on sales in the hospitality sector is, however, more mixed.*

It is noteworthy that a recently updated independent (not peer-reviewed) review by Scollo and Lal (2008) of the quality of the studies on the economic effects of smoke-free policies on the hospitality industry found that 47 of the 49 studies that are best designed report no negative impact on measures such as taxable sales. A summary of results of the 2008 update is provided in Box 8.1.

Moreover, the Surgeon General's (2006) report concluded that "evidence from peer-reviewed studies shows that smoke-free policies and regulations do not have an adverse economic impact on the hospitality industry".

Box 8.1: Summary of studies assessing the economic impact of smoke-free policies in the hospitality industry

- No negative economic impact from the introduction of smoke-free policies in restaurant and bars is indicated by 47 of the 49 studies where findings are based on an objective measure such as taxable sales receipts, where data points several years before and after the introduction of smoke-free policies were examined, where changes in economic conditions are appropriately controlled for, and where appropriate statistical tests are used to control for underlying trends and fluctuations in data.
- One of the two studies meeting all four of Siegel's criteria that did find a negative impact (Evans, 2005) was not peer-reviewed and was based on assessments from a highly selective sample of proprietors. The other (Lal and Siahpush, 2008) assessed the impact of smoke-free policies in gaming venues, a measure intended to reduce problem gambling in Victoria and introduced in parallel with a number of other measures aimed at reducing worrying levels of spending among low-income earners living in neighbourhoods with high numbers of poker machines in accessible venues such as corner pubs.
- Apart from the notable exception of Lal and Siahpush (2008), studies concluding a negative economic impact have predominantly based findings on outcomes predicted before introduction of policies, or on proprietors' subjective impressions or estimates of changes rather than actual, objective, verified, or audited data. These studies were funded predominantly by the tobacco industry or organisations allied with the tobacco industry.
- Almost none of the studies finding a negative impact are published in peer-reviewed journals.

SOURCE: Adapted from: Scollo and Lal (2008)

CHAPTER 9

Technological strategies for controlling secondhand smoke

This chapter provides an overview of technological strategies for controlling secondhand smoke, specifically the segregation of smokers and non-smokers. This may include designated smoking rooms equipped with ventilation systems, designated smoking areas with ventilation (not separated by walls), and smoking stations and cabins. The effectiveness and viability of these strategies is also discussed.

We draw on evidence from the peer-reviewed and grey literature (Table 9.1). A literature search was performed on PubMed using the terms "tobacco smoke pollution", "ventilation", and "designated smoking rooms".[23] The grey literature, including reports of government agencies, international organisations, and scientific associations, was searched for relevant material accessible on the internet. Several reports and peer-reviewed articles were also obtained through the stakeholder consultation on the Commission's smoke-free initiative on 19 March 2008. For example, material was obtained from the manufacturers of air treatment systems. A summary of the types of articles that were examined are presented in Table 9.1.

[23] A search was carried out using PubMed's MeSH database, which is the US National Library of Medicine's controlled vocabulary used for indexing articles. The search term used was "tobacco smoke pollution" + "ventilation". A total of 84 articles were identified. Another PubMed search was carried out using the search term "designated smoking rooms". Ten articles were identified. The title and abstract for each article was reviewed to determine whether or not the article was relevant for the current assignment. Full articles were obtained for all those abstracts we deemed to be relevant (articles focused on the effectiveness of designated smoking rooms, designated smoking areas with ventilation and/or smoking stations, and cabins).

Table 9.1: Summary of articles obtained from peer-reviewed and grey literature

Type of article	Number	Type of article	Number
Peer-reviewed journal article	11	Industry sponsored report	2
International agency	1	Charity	1
Professional associations	2	Independent	1
Scientific association	1	Non-profit association	1
Government/government agency	3	Partnership organisation	1
Government sponsored report	1	Conference proceeding	1
Industry	2	Foundation	1
		Professional society	1
		Total	29

Table E.1 in **Appendix E** lists and summarises the studies that have been incorporated into this chapter. Each study was summarised across the following dimensions: sample size, year of data collection, location, setting, study design, outcome measures, and technology considered to control secondhand smoke.

Most of the studies examining the effectiveness of technological strategies for controlling secondhand smoke have relied on observational designs, comparing concentrations of ETS in non-smoking and smoking sections of bars/restaurants or other venues (such as airports). Most of the studies also obtain concentrations at a control site, such as a non-smoking office building. The number of venues included in the studies varied from one to more than 50 over multiple cities. We did not come across any randomised control trial designs.

ETS concentrations (such as nicotine and particulate matter) are typically measured using personal air sampling equipment work by wait staff or volunteers, and/or by monitoring air quality. Furthermore, concentrations are typically measured over a specified time period (for example 4 hours or 1 day) and are taken from more than one sampling point in a venue. In several cases we could not summarise the study across the dimensions listed above since this information was not cited.

9.1 Types of air treatment systems

Ventilation and filtration are the two main methods of air treatment used to reduce indoor air pollution. Box 9.1 defines common terms cited in the literature (Smokefree Northern Ireland and Health Promotion Agency, n.d., and Surgeon General, 2006). Source control may also be used to eliminate or reduce individual sources of pollutants. The tobacco industry as well as other interest groups, such as manufacturers of air treatment systems, have promoted the installation and use of ventilation systems and equipment in an attempt to accommodate smokers and non-smokers in the same indoor enclosed spaces (Bialous and Glantz 2002; Drope et al., 2004; and Pilkington and Gilmore, 2004). The case is also made that if ventilation is complemented with improved filtration of the returned air, it may be possible to achieve greater reductions of some secondhand smoke constituents beyond what dilution alone can accomplish. This may help avoid the establishment of strict smoking bans (Surgeon General, 2006, and WHO, 2007).

Box 9.1: Description of different types of air treatment systems

Positive output ventilation systems exhaust air from an enclosed space at a rate that completely replaces the air in the room.

Dilution ventilation is the introduction and mixing of ventilation air with air already present in the space. For example, 80–90 percent of air may be re-circulated, 10–20 percent fresh air brought in from outside, and 10–20 percent of the stale air expelled.

Displacement ventilation involves the introduction of ventilated air generally at or near floor level in a directional pattern with little or no mixing to force air out from or near the ceiling. Displacement ventilation is often considered a design option for the separation strategy of smokers and non-smokers.

Filtration systems (sometimes called air cleaners) pump the air through very fine filters to remove particles of smoke and dust before the air is re-circulated.

Table 9.2 presents six technologies used in air cleaning systems. Air cleaners are typically classified by the method employed to remove particles of various sizes from the air. Neither air filtration (cleaning) or air conditioning is ventilation because neither process introduces air into or moves air through an enclosed space. The Environmental Protection Agency (2008) states there are three general types of air cleaners: mechanical filters, electronic air cleaners, and ion generators. Hybrid units, using two or more of these removal methods, are also available. Further, air cleaners may be in-duct units (installed in the central heating and/or air conditions systems) or stand-alone portable units. The effectiveness of these devices will be assessed by the volume of air processed and the removal efficiency of various constituents. The product of these two values is compared to the dilution rate achieved by the overall ventilation of the air delivered to the conditioned space. Field and laboratory investigations have evaluated the secondhand smoke controls strategies discussed above. In the next sections we review the effectiveness of various secondhand smoke control strategies.

Table 9.2. Comparison of air-cleaning systems

	Technology					
Characteristic	**Electrostatic precipitation**	**Solid media filtration**	**Gas-phase filtration**	**Ozone (O3) generation**	**Catalytic oxidation**	**Bipolar air ionization**
Function	Electronic	Physical	Physico-chemical	Electronic	Physico-chemical	Electronic
Principle	High-voltage wire and plate	Flat, pleated, or high efficiency particulate air media	Sorption and reaction	Sparking discharge	Solid catalyst with or without ultraviolet	Dielectric barrier discharge
Process	Charging of particulate matter	Collection of porous media	Sorption and reaction	O_3 generation	Catalytic oxidation	Positive and negative ion generation
Active species	Charged particles	High surface area	Sorption and reaction sites	O_3	Reactive oxygen species	Reactive oxygen and charged species
By-products	O_3 if not cleaned regularly	Spent filters; contaminants	Spent media with contaminants	Significant O_y, atmospheric reactants	Exhausted or fouled catalyst, some VOCs	Some O_3
VOCs	Sorption of VOCs on PM_x	NA	Adsorption/absorption	Chemical oxidation	Chemical oxidation	Chemical oxidation
PM_x	Collection on plates	Impact, settling, and diffusion	Collection on media	NA	NA	Agglomeration

NOTES:

VOCs = Volatile Organic Compounds
PM = particulate matter
NA = Not applicable

SOURCE: (Surgeon General, 2006)

9.2 Separating smokers and non-smokers

This section reviews studies in the peer-reviewed and grey literature which have examined whether secondhand smoking can be controlled by separating smokers from non-smokers, through means such as designated smoking rooms equipped with ventilation system (as allowed in Italy, France, and Sweden); designated smoking areas with ventilation (not separated by walls); and smoking stations or cabins.

9.2.1 Ventilation and designated smoking areas with ventilation systems

A number of studies examined whether secondhand smoking can be controlled by the use of ventilation or separating smokers from non-smokers with designated smoking areas (not separated by walls) with ventilation systems.

A panel of ventilation experts assembled by the Federal Occupational Safety and Health Administration (OSHA) and the American Conference of Governmental Industrial Hygienists (ACGIH) in June 2000 found that dilution ventilation used in virtually all mechanically ventilated buildings will not control secondhand smoke in the hospitality industry. Displacement ventilation was estimated to offer the potential for up to 90 percent reductions in ETS levels. However, this assertion was based on professional judgement rather than on measured data. Air cleaning was judged to be somewhere between dilution and displacement, depending on the level of maintenance. Panelists also observed that building ventilation codes are not routinely enforced. The panel concluded that dilution ventilation, air cleaning, or displacement ventilation technology (even under moderate smoking conditions) cannot control ETS risk to "acceptable"[24] levels for workers or patrons in hospitality venues without substantially impractical increases in ventilation. Moreover, smoking bans remained the only viable control measure to ensure workers and patrons of the hospitality industry are protected from exposure to toxic wastes from tobacco combustion (Repace, 2000).

The Dutch government commissioned a study from the Netherlands Organisation for Applied Scientific Research—TNO (Building and Construction) and the National Institute for Public Health and the Environment (RIVM) to review the literature on ventilation and air cleaning technologies that could be used in the hospitality industry, and ascertaining to what extent these technologies may help to limit exposure to ETS. The review found that the dilution application is the usual application in the hospitality industry. With this technique, several tens of percent of exposure reduction can be achieved. Possibilities to increase the air exchange rate are limited because of the comfort that would otherwise be lost at high air exchange rates. Ventilation systems based on replacement and not dilution may provide better results (about 90 percent reductions under the most favourable conditions) because much higher air exchange rates can be used without losing comfort. However, these estimates are based on measurements carried out under laboratory conditions. In practice, disturbances (objects and undesired air flows due to movements of persons, doors, and so on) may make the systems significantly less effective. In addition, installation and maintenance of these systems are much more expensive than for traditional dilution systems. The report estimated the cost of the purchasing and installation of full-displacement ventilation at around €1,000 per square metre (compared with the annual turnover of slightly less than €1,000 per square metre in cafés and bars, and approximately €2,700 in restaurants). This did not take into account the operating and maintenance costs (de Gids and Opperhuizen, 2004).

Several studies have found traditional systems based on dilution ventilation and air filtration to be ineffective at reducing levels of SHS. A study of secondhand smoke exposure in 60 randomly selected bars in Greater Manchester, UK, undertaken in 2003, found that complete separation of smokers from non-smokers reduced the concentrations of various SHS markers (for example respirable suspended particulate matter, ultraviolet light-absorbing particulate matter, and nicotine) by about 50 percent compared with smoking and non-smoking sections. However, compared with other settings (homes and other workplaces) with unrestricted smoking, mean ETS levels were high throughout all areas of the pubs regardless of ventilation systems in place, which included mechanical ventilation and extractor fans The authors note that better ventilation designs might have further reduced secondhand smoke (Carrington et al., 2003).

[24] The WHO state there is no "safe" level of ETS exposure. Hence the only "acceptable" level means zero.

In a study of 75 restaurants in 26 cities, Hammond (2002) also found no evidence that an increase in ventilation had any effect. Results indicated that, in spatially separated strategies where half or more of the seating area was non-smoking, SHS smoke levels in the non-smoking section were reduced, but levels remained high (Surgeon General, 2006).

The limited potential of traditional dilution ventilation has been confirmed by the results of two series of experiments that were carried out by the Institute for Health and Consumer Protection of the EC's Joint Research Centre ISPRA to test the impact of ventilation rates on ETS components. They indicate that chemicals such as volatile hydrocarbons, carbonyls, poly aromatic hydrocarbons, inorganic gases and particles, and so on cannot be rapidly and substantially eliminated from the indoor air atmosphere, even when high air exchange rates are applied. Further, diffusion of the emitted compounds and burning products is relatively slow, so dilution via mixing with new incoming fresh air is not very effective as a control measure. Only "wind tunnel" rates or other high rates of ventilation would be required to achieve pollutant levels close to ambient air limit values (Kotzias et al., 2006). These findings were comparable to results obtained from US studies carried out at different hospitality venues. In addition, the WHO (2007) argues that although increasing the ventilation rate reduces the concentration of indoor pollutants, including tobacco smoke, ventilation rates more than 100 times above common standards would be required just to control odour. Even higher ventilation rates would be required to eliminate toxins, which is the only safe option for health. Indeed, the WHO states that eliminating toxins in the air would require many air exchanges, which would be impractical, uncomfortable, and, most critically, unaffordable.

A report prepared by Theodor Sterling Associates (2007) assessed the indoor air quality and the performance of ventilation systems in three hospitality venues throughout the UK in December 2006. The study concluded that dilution ventilation when operated effectively can achieve levels of particles and gases in an indoor environment where smoking occurs that are comparable to levels of particles and gasses in the outdoor environment. In one hospitality venue $PM_{2.5}$ levels reached 27.6 $\mu g/m^3$ compared with 41.3 $\mu g/m^3$ outdoors. In the two other venues indoor measurements of the particles and gases were higher than outdoor measurements. Other studies measuring $PM_{2.5}$ levels after smoking bans have been enforced have shown that $PM_{2.5}$ levels can be reduced to, for example, 16 $\mu g/m^3$ in Scotland (Semple et al., 2007) and 5 $\mu g/m^3$ in Ireland (Office of Tobacco Control, 2005). This suggests that smoking bans are more effective at reducing levels of particles and gases than dilution ventilation (Theodor Sterling Associates, 2007). The study by Theodor Sterling Associates (2007) has been linked to the tobacco industry.

There have been a few published studies in the peer-reviewed and grey literature which have concluded that displacement ventilation technology for restaurants/pubs with separate smoking and non-smoking areas are capable of achieving non-smoking area or outside air ETS concentrations (Jenkins et al., 2001, and Theodor Sterling Associates, 2007). For example, a Canadian study by Jenkins et al. (2001) tested the concentration of ETS components in a small restaurant/pub with separate smoking and non-smoking areas (a facility outfitted with a heat-recovery ventilation system and directional airflow). The results indicated that ETS of the non-smoking section of the bars/restaurants were not statistically different ($P < 0.05$) from those measured in similar facilities where smoking is prohibited. This study only examined the issue of non-smoking patron exposure to ETS, and did not examine the issue of employees' exposure to ETS (Jenkins et al., 2001). This study has also been linked to the tobacco industry (Drope et al., 2004). Furthermore, this study has been criticised on methodological grounds (Surgeon General, 2006) and its results were undermined more recently by Repace and Johnson (2006) who examined whether displacement ventilation could control secondhand smoke. Results showed that displacement ventilation was not a viable substitute for smoking bans in controlling ETS exposure in contiguous designated non-smoking areas sharing the same space volume. Furthermore, a study in Ontario found leakage of ETS from a restaurant with a designated smoking area to other areas of the establishment. Again, these finding reinforces the EPA concept of atmospheric "spill-over" effect (Stantec Consulting, 2004)

Another study commissioned by the tobacco industry into the effectiveness of displacement ventilation in the day-to-day operations of three types of hospitality businesses indicated that exposure to ETS in the hospitality industry can be reduced significantly, up to 92–99 percent in the non-smoking areas (de Gids and Jacobs, 2006). However, the assessment of the study performed for the Dutch government by the National Institute of Public Health and Environment RIVM showed that the reported high levels of reduction were due to an incorrect calculation approach. Based on the same data, RIVM calculated that the reductions are lower (between 50 and 79 percent) for the three hospitality venues (National Institute for Public Health and the Environment, 2006)

Separate smoking and non-smoking areas may not protect employees from SHS. For example, a study by Stantec Consulting (2004) showed that based on data from personal air samplers work by staff, servers based in the non-smoking sections experienced higher levels of some ETS markers than were present in the non-smoking sections, which was probably because staff entered the smoking section to obtain drinks.

A recent review on ventilation performance for spaces where smoking is permitted also identified conflicting views. The authors acknowledge that where attention has been paid to ensuring that the ventilation system being tested is adequate and working correctly, significant improvements in indoor air quality can be made, but such solutions need to be scientifically and critically evaluated (Geens et al., 2006). Previously, pro-technological studies have been criticised for applying an incorrect method of calculation and as a result reporting excessively high reduction percentages in ETS (see for example National Institute for Public Health and the Environment (2006) and Piha (2006)).

Because some particulate matter in smoke is visible, ventilation and filtration systems can give the non-smoker the impression that they are safe from exposure to ETS by diluting the larger particles (ASH Scotland, 2004). However, the WHO (2007) argues that these systems cannot eliminate the carcinogens present in SHS, and cannot therefore be considered an adequate solution to eliminating the health risks associated with ETS. Further, many particles are inhaled or deposited on clothing, furniture, walls, and ceilings before they can be ventilated. As ventilation systems may increase comfort levels, many people under-estimate the extent to which they are exposed to ETS (not surprisingly given that carcinogens have no smell). In one US study, for example, 40 percent of people questioned reported exposure to ETS. However, the US Centre for Disease Control measured cotinine (a nicotine by-product in the body) in the blood of 88 percent of the non-smoking population (Pirkle et al., 1996). The twin criteria of health and comfort should not be confused.

Advanced technology solutions often require regular maintenance and ongoing monitoring to ensure effective operation (Broadbent, 2005). A commentary on ventilation by the New Zealand Health Select Committee reported that many proprietors leave their ventilation systems switched off, as they find the running costs too high.[25] The US Environmental Protection Agency has stated there are major costs for air cleaners including the initial purchase of the unit, maintenance costs (cleaning and/or replacement of filters and other parts), and operating costs (such as costs for electricity). Moreover, the most effective units are also the most costly. Other considerations (apart from cost, installation, use, and need for maintenance) include the noise of the unit, soiling of walls and other surfaces, and the air cleaners' ability to remove odours (Environmental Protection Agency, 2008).

9.2.2 Designated smoking rooms equipped with ventilation systems

Several researchers have investigated the use of designated smoking rooms to control secondhand smoke and whether they can protect non-smokers from exposure to secondhand smoke.

Studies evaluated for the Surgeon General's (2006) report showed that designated smoking rooms do not prevent persons **outside** these areas being exposed to secondhand smoke. There is usually a "spillover" effect into adjacent areas to the designated smoking room (Pion and Givel, 2004). The strategy may require complicated engineering and a careful assessment of relevant building characteristics. A study by Wagner et al. (2004), which examined ETS leakage from a simulated smoking room, found it essential to maintain the smoking room at a negative pressure with respect to adjacent areas to ensure that the tobacco smoke did not move out of the room into the surrounding air. They also found the amount of ETS pumped out by a smoking room door when it is open and closed can be reduced significantly by substituting a sliding door for the standard swing-type door. Another study in Ontario also found that designated smoking rooms prevented a substantial amount of ETS moving to adjacent smoking sections by physical separation and ventilation, and by maintaining the designated smoking rooms under negative pressure compared with the non-smoking section. There was a fifty-fold reduction in nicotine levels observed in non-smoking sections compared with the smoking sections in two restaurants (Stantec Consulting, 2004).

Moreover, a US study found levels of airborne ETS-related contaminants were significantly lower in the control environments (non-smoking buildings) than in the non-smoking dining rooms that were located within or adjacent to smoking dining rooms. Levels of ETS pollutants were also lower in the non-smoking dining rooms and smoking dining rooms (Akbar-Khanzadeh, 2003). The authors recommend that if non-smoking employees or patrons are to be fully protected, designated smoking dining rooms should be

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[25] Report of the New Zealand Health Select Committee Commentary on ventilation, 2003, cited in "Factsheet: Second-hand Smoke and Ventilation" (Smokefree Northern Ireland and Health Promotion Agency, n.d.).

completely separated from smoking dining rooms and both rooms should be equipped with separate ventilation systems.

Furthermore, designated smoking rooms may adversely affect the health of workers by exposing them to highly concentrated levels of secondhand smoke and would also subject any staff who enter these high concentration areas (Surgeon General, 2006, and German Cancer Research Center (DKFZ), 2007). For example one study showed smokers using the designated room were themselves subject to levels that were 1,800 times higher than typical office nicotine levels before the new smoking policy took effect (Vaughan and Hammond 1990). A more recent US study compared the mean levels of carbon dioxide and ultrafine particles in a smoke-free restaurant and a restaurant with a dedicated smoking room. The mean level in the smoking room was up to 43 times higher than at the smoke-free restaurant (Milz et al., 2007).

A Dutch study investigated the effectiveness and costs for a decentralised smoke extraction using recirculation and filtration in a designated smoke room. The concept was based on the extraction of air from a room by being blown in slowly, just above floor level. The cost of using the technology was estimated in the area of €5,000 to €10,000. Readings were taken in a smoking room with and without the air purifier, and in a smoke-free room. While the study found a potential exposure reduction for catering/hospitality staff of 40 percent for aldehydes, 69 percent for VOCs, 81 percent for fine particulate matter, and about 90 percent for nicotine in the smoking room, the absolute concentrations of the toxic substances were higher than in the smoke-free venue (Jacobs et al., 2006). Moreover, workplaces need to be completely smoke-free in order to protect employees from secondhand smoke. Employees may not have the same option as patrons to avoid SHS exposure if they have to enter designated smoking areas (German Cancer Research Center (DKFZ), 2007).

Regarding the costs of designated smoking rooms, laws that allow designated smoking rooms have been overturned in Ottawa, Canada, because they create unfair competition. Large businesses can afford to install them, but smaller businesses often cannot.[26]

9.2.3 **Smoking stations and cabins**

Manufacturers of smoking stations and cabins claim that these systems create an interior environment that is completely free of smoke and odour, in places where smoking is permitted through capturing the smoke before it spreads and purifying the smoke by filtration and releasing purified air. We were not able to identify evaluations in the peer-reviewed publications of such technology, but evidence has been reported by manufactures in reply to the Commission's stakeholder consultation on the Impact Assessment.

The manufacturers cite studies by public research institutes in a number of European countries. For instance, the SP Swedish National Testing Research Institute found that smoking cabins can reduce the investigated tobacco smoke compounds by close to 100 percent. The study was conducted in accordance with the EN ISO 16017-1 test method for "indoor, ambient and workplace air" and showed that 99.6 percent of pyridine and pyrrole gases were filtered away; 3-vinyl pyridine was filtered away in 99.7 percent of cases;

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[26] http://www.smokefreeottawa.com/english/article-e20.htm (accessed 29 May 2008)

and 99.9 percent of nicotine was filtered away. Another test showed that 99.99966 percent of particles, ranging from 0.10–0.45 µm, and 100 percent of larger particles, were filtered away.

There have also been evaluations to investigate whether smoking stations prevent smoking spreading to adjacent rooms (on the basis that they are used according to instructions). A study by the Labour Inspectorate in Finland found that nicotine and 3-ethyle pyridine were below the detection level (< 0.05 µ) in the surrounding room. Measurements were taken from three air samples on a normal working day from 8:45 a.m. to 4:10 p.m., and 43 cigarettes were smoked in the smoking station during the measurement period.

In 2007, the German BG-Institute for Occupational Health and Safety (BGIA), launched and published a standard procedure of certification for smoking cabins to be installed at workplaces (Institute for Occupational Health and Safety, 2007). This procedure, which in its test methodology makes use of numerous European norms (EN, CEN standards), was developed by an international group of health and safety experts, representatives of independent test laboratories and manufacturers of smoking cabins themselves. To pass a test procedure, it is required that a smoking cabin produces an air quality that contains no detectable levels of nicotine, TVOCs, carbon monoxide, formaldehyde, or acetaldehyde. The manufacturers are now working to prepare the ground for a European certification process for smoking cabins at the European Institute for Standardisation (CEN).

Manufactures emphasise a number of economic benefits of smoking stations or cabins in the workplace. First, they claim that smoking stations in the immediate workplace vicinity will keep smoking breaks short and reduce the likelihood of people leaving their work station to smoke outside. This helps avoid losses in productivity and also helps protect non-smokers from outdoor tobacco smoke. Another claim is that a total indoor smoking ban may create security problems. For example industrial companies might ban smoking outdoors because of the presence and/or proximity of explosive and inflammable materials. Moreover it is argued that if working people are not allowed to smoke in close proximity to their workstation they tend to lose concentration and become less motivated;[27] consequently, the social and working climate between smokers and non-smokers could suffer. Promoters also claim that smoking cabins ensure that neither ash nor cigarette ends are deposited in the front of office blocks. Evaluations of such claims in peer-reviewed publications were not identified. We came across limited information on the cost of purchasing a smoking station or cabins. A German website cites the commercial price of smoking stations as between €2,500 and €9,500, and smoking cabins for rent at a cost of €100–400 per month.

9.3 Conclusions

There are various studies which have examined the effectiveness of technological strategies for controlling secondhand smoke, including smoking stations and cabins, enclosed

[27] This argument could be undermined by confounding factors, such as nicotine withdrawal, which is known to have similar effects.

smoking rooms, designated smoking areas or floors, or by implementing both strategies, separating smokers from non-smokers and increasing ventilation. The WHO (2007) states that there is no evidence for a safe ETS exposure level and recommends that only 100 percent smoke-free environments protect the public from exposure to SHS and ventilation and smoking areas. It is argued that ventilation systems cannot remove all particulate matter produced by ETS and certainly not toxic gases (carcinogens) (WHO, 2007). Moreover, in 2006, the US Surgeon General's report concluded that "establishing smoke-free workplaces is the only effective way to ensure that secondhand smoke exposure does not occur in the workplace; and exposures of non-smokers to second-hand smoke cannot be controlled by air cleaning or mechanical air exchange" (Surgeon General, 2006). In 2005 the American Society of Heating, Refrigeration and Air Conditioning Engineers, the leading standard setting body in ventilation and air conditioning, also concluded that ventilation and other air filtration technologies cannot eliminate the health risks caused by SHS exposure, and that the most effective option is to make indoor place smoke-free (American Society of Heating and Air Conditioning Engineers, 2005).

There are considerable uncertainties surrounding current knowledge on technological solutions to control ETS. In particular, there are very few published peer-reviewed studies on the effectiveness of the new engineering approaches in real settings.

The studies reviewed in this chapter suggest that technological solutions based on mixed occupancy of smokers and non-smokers as well as designated smoking areas not physically isolated from non-smoking sections cannot adequately control non-smokers' exposure to ETS. The types of ventilation systems currently used in the hospitality sector and in workplaces (based on mixing and dilution) have been proved to have a limited impact on the levels of ETS pollutants. Of new technologies, displacement ventilation has been identified as potentially more effective. However, the figures for ETS reduction are never close to 100 percent, even with the most modern equipment.

Allowing smoking only in separate and isolated rooms can potentially control ETS exposure in non-smoking spaces in the same building. In order to prevent ETS leakage, it is essential that the smoking rooms be equipped with a separate ventilation system from non-smoking areas and maintained at a negative pressure with respect to adjacent areas. This approach, however, cannot control the adverse health effects for the occupants of the smoking rooms and the staff. Evidence reported by manufacturers of smoking cabins and stations seems to suggest that such technological solutions can reduce the investigated tobacco smoke compounds close to 100 percent, levels comparable to those of ambient air pollution. However, the scientific quality of such evidence must be demonstrated (i.e. by publishing the study results in the peer-reviewed literature) before the effectiveness of technologies strategies for controlling secondhand smoke is proven.

It should also be highlighted that modern ventilation systems are relatively expensive to install and maintain. This could create an uneven playing field. Large scale operators can afford to install sophisticated engineering systems, while smaller operators cannot. In addition, possible reductions in ETS exposure can only be achieved if equipment is properly used and maintained, which might require extensive inspection and monitoring infrastructure.

CHAPTER 10 Cost effectiveness of smoking cessation interventions

Table F.1 in **Appendix F** shows examples of country-level and meta-analysis-level economic evaluations we retrieved on the cost-effectiveness (or cost-consequences, or cost-savings) of different smoking cessation interventions (programmes or policies). Results are limited to evidence published since the turn of the millennium for European countries in the English language as well as for other countries such as Australia and the US.

The number of studies published on the economic impact of smoking cessation is substantial (n = 39 for Europe and meta-analyses; n = 50 for outside Europe), with the majority of studies including pharmacotherapies as one component of smoking cessation interventions such as booklets, courses, or counselling (n = 18 for European studies, n = 34 for non-European studies). Of these evaluations, specific comparison of the effectiveness of pharmacotherapies alone in stopping smoking occurred in eight of the European studies (20 percent of the total) and eight of the non-European studies (10 percent of the total).

We also found 13 European or meta-analysis studies (including European studies) and 13 non-European studies evaluating the cost-effectiveness of some form of counselling/advice or behavioural support alone in stopping smoking (33 percent of the total and 26 percent of the total, respectively). Finally, there were nine European and meta-analysis studies evaluating broader smoking cessation strategies such as nation- or community-wide smoking cessation programmes/policies (for example taxes and advertising bans in Estonia) or TV campaigns, and three studies evaluating only financial incentive-based smoking cessation (for example Quit and Win contests). A similar number of non-European studies were found: five investigated broader state- or community-wide smoking cessation programmes/policies (for example smoke-free workplaces versus free nicotine replacement therapy, or NRT) and four investigated incentive-based smoking cessation interventions such as Quit and Win contests or full insurance coverage of tobacco treatment. In addition, there were two US studies evaluating the cost-effectiveness of legal interventions: minimal legal purchase age (Ahmad, 2005) and enforcement to halt the sale of tobacco to youths (DiFranza et al., 2001).

10.1 Smoking cessation strategies: evidence of cost-effectiveness, especially when targeted to sub-groups

In general, smoking cessation interventions are highly cost-effective and compare favourably with other treatment modalities (Song et al., 2002; Ronckers et al., 2005; Cornuz et al., 2006; and Quist-Paulsen et al., 2006). For example, the cost-effectiveness of operating English smoking cessation services was well below the National Institute for Health and Clinical Excellence (NICE) benchmark of £20,000 per quality adjusted life year (QALY) (Godfrey et al., 2006).

The European Respiratory Society found smoking cessation treatment is cost-effective even when delivered through smoking cessation specialists; and the cost per year saved is four times greater than that of other well-established preventative interventions for hypertension, breast cancer, or hypercholesterolemia (Loddenkemper, 2003). Table 10.1 shows the cost-effectiveness of various smoking cessation programmes. A US study also found that an enforcement programme to halt the sale of tobacco to youths could save ten times as many lives as the same amount spent on mammography or screening for colorectal carcinoma (DiFranza et al., 2001).

Table 10.1: Cost-effectiveness of smoking cessation programmes

Intervention	Cost per life-year saved
Brief advice	€354
Brief advice with self-help	€426
Advice plus self-help plus advice to purchase NRT	€1,162
Advice with specialist services	€1,458

SOURCE: Loddenkemper (2003).

Some authors suggest that resources allocated to smoking cessation (for example physician advice) should be increased by 124 percent (Lofroth et al., 2006). However, different factors influence the economic impact of smoking cessation services on sub-populations and performance targets for smoking cessation services should reflect population differences (Godfrey et al., 2006). For example, Denmark's smoking cessation strategies were more cost-effective when offered to men, older persons, and light smokers than when offered to women, younger smokers, and heavy smokers (Olsen et al., 2006). Another European study showed that women have less success at quitting than men, regardless of whether they are treated with pharmacotherapy (bupropion) (Scharf and Shiffman, 2004). Nevertheless, analysis of gender-by-treatment interaction suggested that men and women benefited equally from slow-release bupropion (OR = 1.01) (Scharf and Shiffman, 2004). Finally, although there is limited cost-effectiveness evidence, a review of the literature shows that pregnancy-related smoking cessation and relapse prevention programmes yield favourable cost-benefit ratios, suggesting that the return on investment will far outweigh the costs for this critical population (Ruger et al., 2007).

10.2 Pharmacotherapies are the most cost-effective for individual smoking cessation

Pharmacotherapies for smoking cessation are considered favourable compared with other accepted public health interventions (Tran et al., 2002; Song et al., 2002; Curtiss and Crownover 2005; Cornuz et al., 2006). Studies in England and internationally have shown that using NRT/bupropion in smoking cessation interventions *significantly increases* the cost-effectiveness of smoking cessation services (Godfrey et al., 2006).

A US randomised controlled trial of mixed smoking cessation strategies indicated that the pharmacotherapy alone group consistently showed the lowest costs per participant and lowest costs for achieving each of the major study outcomes (Halpin et al., 2006). Moreover, compared with no intervention, programmes that offer free NRT are effective in the US, with a one-week supply of nicotine patches representing the most cost-effective strategy (Cummings et al., 2006).

Among the possible pharmacotherapies, earlier studies had given only some indication of the greater incremental cost-effectiveness of bupropion in comparison with NRT (NICE, 2002, and Song et al., 2002). But now there is strong evidence from more recent European data (Sweden, France, Spain, Switzerland, UK) and non-European data (Canada, Australia, US) that bupropion is the most cost-effective pharmacotherapy (Nielsen and Fiore, 2000; Antonanzas and Portillo, 2003; Scharf and Shiffman, 2004; Bolin et al., 2006; Cornuz et al., 2006; and Shearer and Shanahan, 2006). For pharmacological treatment, the marginal cost-effectiveness ratios are €1,768–5,879 for men and €2,146–8,799 for women, depending on age group. The average cost per life year saved is about £750 (£500–1,500), with £1,000–2,399 for NRT, £639–1,492 for bupropion slow-releasing, and £890–1,969 for NRT/bupropion. Finally, there is a wide range of incremental cost-effectiveness ratios for each type of pharmacotherapy (nicotine gum, patch, spray, inhaler, and bupropion) across a variety of European and non-European countries (Cornuz et al., 2006).

However, newer evidence suggests that a novel pharmacotherapy, varenicline, may be of more cost-benefit than the currently available pharmacologic alternatives (bupropion, nortiptyline, or NRT). A 2008 European study found that treatment with varenicline for smoking cessation is cost-effective compared with nortriptyline and unaided cessation, and even cost-saving compared with bupropion and NRT (Hoogendoorn et al., 2008). These findings confirm an earlier US study showing the cost benefit of varenicline to employers: savings for the employer, per non-smoking employee, were $540.60 for varenicline, $269.80 for bupropion SR generic, $150.80 for bupropion SR brand, and $81.80 for placebo (Jackson et al., 2007).

10.3 Financial incentives and support for smoking cessation: social prizes, full insurance coverage, and free vouchers

A number of studies have demonstrated how the use of financial incentives could increase the quit rate among smokers for a relatively modest investment of resources. Most notably, the Swedish Quit and Win contest was associated with cost-savings and health gains among women, amounting to €3,550 per female quitter (Johansson et al., 2005). An earlier study showed the contest cost US$188–1,222 per life-year gained. In New York, a Quit and Win contest, offering the chance to win a cash prize (usually $1,000) for successfully stopping smoking for at least one month, revealed the cost per attributable quit ranged was $301–954 (Tillgren et al., 1993). More recently, O'Connor et al. (2006) reveal that evidence from 11 Quit and Win contests shows that for a relatively modest investment of resources (median expenditures of $25,928 for promoting contests, ranging from $4,345 to $91,441), thousands of smokers can be recruited to make a serious quit attempt, with many remaining smoke-free months later.

Besides financial incentives, financial support can be provided to quit smoking, including the provision of partial or full financial benefit for smoking cessation treatment. A recent meta-analysis revealed that when full benefit was compared with a partial or no benefit, the costs per quitter varied between $260 and $2330 (Kaper et al., 2005). The authors also found that when smokers are offered full benefit, there is an increase in self-reported prolonged abstinence rates at relatively low costs compared with a partial or no benefit. This study reinforced the findings from a previous US study that full coverage of tobacco dependence treatment benefit with no patient cost-sharing is an effective strategy for increasing quit rates and quit attempts at low cost with employer-based insurance (Schauffler et al., 2001). When smoking cessation benefit is provided, cost of healthcare in the US decreased by $7.9 to $8.8 million (Barone-Adesi et al., 2006). In evaluating a number of different benefit strategies in New York, Bauer et al. (2006) found that offering a free two-week voucher for NRT was a cost-effective strategy for enhancing calls to quitlines in order to improve smoking quit rates in the US. Finally, Kaper et al. (2006) also assessed whether reimbursing the costs of smoking cessation treatment is a cost-effective intervention from the Dutch societal perspective; if Dutch society is willing to pay €10,000 for an additional quitter or €18,000 for a QALY, then reimbursement of smoking cessation treatment would be cost-effective.

However, the use of financial incentives and support for smoking cessation programmes should be carefully chosen when deciding public health priority in this area. Another US study found that a free NRT programme was 15 times more expensive than the smoke-free workplace programme, suggesting that smoke-free workplace programmes should be a public health priority. The average cost per QALY was $4,440 with the free NRT programme, whereas the average cost per QALY with the smoke-free workplace programme was $506 (Ong and Glantz, 2005). Other studies have shown smoke-free environments can be more cost-effective than programmes targeted at smoking cessation. One study showed that smoke-free environments are nine times more cost-effective per new non-smoker than providing smokers with nicotine replacement therapy (WHO, 2007). Hence, Ong and Glantz (2005) concluded that smoke-free workplace policies should be a public health funding priority, even when the primary goal is to promote individual smoking cessation.

Finally, financial support for pharmacotherapy alone may not always prove the most cost-effective. Indeed, among a mix of US tobacco control policies which included pharmacotherapy, flexible coverage was the most effective and, specifically, coverage of behavioural therapy alone was the most cost-effective (incremental cost per quitter was $2,500.94), compared with brief intervention alone ($3,381.03) and to prescription pharmacotherapy alone ($7,185.15) (Levy and Friend 2002).

10.4 "Behavioural support": health professional advice/counselling, quitlines, and intensive face-to-face interventions

There is a growing body of evidence showing the cost-effectiveness of supportive advice or counselling for smoking cessation. A number of different strategies include brief advice from physicians, nurses, or other healthcare professionals, delivery of booklets by specially trained healthcare professionals, quitlines or telecounselling, motivational interviewing, intensive interventions such as behavioural therapy, or nurse home visits, and so on. Notably, cost-effectiveness ratios range widely depending on the type of supportive intervention and the country of implementation (Silagy and Stead, 2004; Godfrey et al., 2006; Lofrothe et al., 2006; and NICE, 2006).

Some important conclusions from the various studies are as follows:

1. In Norway, a programme of delivering booklets by cardiac nurses with special training in smoking cessation remained highly cost-effective even if the cost of the programme increased (Quist-Paulsen et al., 2006).
2. The Dutch SmokeStop Therapy was found to be more cost-effective compared with minimal intervention, with a higher number of quitters (20 compared with 9) at lower total costs (Christenhusz et al., 2007). However, an earlier study showed that minimal counselling dominated all other interventions (such as physician or specialised counsellors) for every implementation period and, more importantly, minimal GP counselling was event cost saving (Feenstra et al., 2005).
3. A meta-analysis of brief physician advice concluded that costs of providing counselling are usually low if provided as a by-product of medical consultation (Silagy and Stead, 2004). Notably, in Switzerland, the training of primary care physicians in smoking cessation counselling is a very cost-effective intervention and may be more efficient than currently accepted tobacco control interventions (Pinget et al., 2007).
4. Quitlines were a cost-effective strategy for smoking cessation in Sweden and compared favourably with other smoking cessation policies. In Australia, telecounselling was shown to dominate brief GP advice and remained cost-effective across most scenarios after sensitivity analysis (Shearer and Shanahan, 2006). In the US, access to telephone counselling almost doubled the maintained quit rates over one year, with only $1,300 of direct costs for each case of one year's cessations attributable to counselling availability (McAlister et al., 2004).
5. Peer-delivered counselling compared with self-help doubled smoking cessation rates with incremental cost-effectiveness of $5,371 per additional quit at 12 months (Emmons et al., 2005).
6. The addition of supportive mailings of booklets and letters to prevent smoking relapse from typical smoking cessation therapies in the US were highly cost-effective because they reduced the incremental cost–utility ratio more than the prevention intervention cost (Chirikos et al., 2004).
7. The cost-effectiveness of community-based smoking cessation interventions compare favourably with other tobacco control interventions in the US. This is

true for the multi-faceted community intervention (Full Court Press project) designed to reduce youth tobacco use by changing the key environmental, personal, and behavioural factors (Ross et al., 2006), as well as for the Breathe Easy intervention to help women quit smoking in four US counties (Secker-Walker et al., 2005).

10.5 Some exceptions in the literature

There are four studies among the several dozen evaluating the economic impact of smoking cessation interventions that show either neutral or unclear results. First, Grenard et al. (2006) found in the US that motivational interviewing might be effective among adolescents and young adults with drug-related problems, including tobacco dependence, but the key components of a successful intervention have yet to be identified. However, according to the DARE Database, the study's methods were not sufficiently robust to confirm the reliability of the conclusion[28]. Yet, in a particular socio-economic group, another study found that motivational interviewing was cost-effective for preventing smoking relapse among low-income pregnant women and may be cost-saving when net medical cost savings are considered; whereas for smoking cessation, motivational interviewing cost more and provided no additional benefit compared to usual care, although it might offer benefits at costs comparable to other clinical preventive interventions if 8–10 percent of smokers are induced to quit (Ruger et al., 2007). Third, Hill (2006) examined four NRT and three antidepressants for smoking cessation in the US and concluded that the value for money of Zyban (antidepressant) was unclear due to the uncertain nature of the clinical data. The cost-effectiveness of the other two antidepressant drugs could not be fully assessed because they have significant side effects. Hill (2006) also found that nicotine gum appears to be the most cost-effective strategy for the general population (Hill, 2006), a conclusion that contradicts the findings from Cornuz et al. (2006), whose meta-analysis shows nicotine patches to be the second most cost-effective pharmacotherapy after bupropion. Fourth and finally, in a meta-analysis of opioid antagonists for pharmacotherapy of smoking cessation, David et al. (2006) could neither confirm nor refute whether naltrexone helps smokers quit; four trials failed to detect a significant difference in quit rates between naltrexone and placebo.

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[28] In particular, de DARE database notes that "The review question was described in broad terms. Elements of the question were not specified in the inclusion criteria and steps to minimise selection bias were not reported. The search was not extensive and the restriction to English language articles might have introduced language bias. The potential for publication bias was not explored. Methods to minimise errors and bias in the data extraction process were not reported. As the validity of the included studies was not assessed, the reliability of the findings from each study is uncertain. Apart from validity, adequate details of the characteristics of the included studies were presented in the tables. A narrative synthesis was appropriate in this review. However, the proportion of studies showing positive effects is not a reliable way to draw conclusions about effectiveness, especially when there are differences in study design and the study quality is unknown. Overall, the methods of the review were not sufficiently robust to support the authors' conclusion, albeit tentative, regarding the effectiveness of MI."

CHAPTER 11 Conclusions

The first part of this report sets out a comprehensive description of the problem definition and context of the impact assessment of the Commission's smoke-free initiative, addressing the roots of the problem, key stakeholders and affected populations; the prevalence of environmental tobacco smoke (ETS); analyses of the health and financial burden; discussions on how the burden related to socioeconomic inequalities; smoke-free regulations; the effect of smoking bans; technological strategies for controlling ETS; and the cost-effectiveness of smoking cessation. This section highlights some of the key findings:

- ETS or passive smoke is a diluted mixture of side-stream smoke, which is released from a burning cigarette between puffs, and mainstream smoke, exhaled by the smoker. ETS contains over 4000 gaseous and particulate compounds, including 69 known carcinogens.
- The adverse effects and risks associated with smoking have been well researched and established; during the past 20 years this has also been the case for adverse effects of smoking on people exposed to secondhand smoke. ETS has been shown to cause lung cancer and coronary heart disease, and there is suggestive evidence showing it may cause chronic obstructive pulmonary disease (COPD), stroke, and asthma in adults. There is also evidence to suggest ETS may worsen pre-existing conditions such as asthma and COPD. Moreover, ETS may be harmful to children causing asthma, pneumonia, bronchitis, respiratory symptoms, middle ear disease, and sudden infant death syndrome.
- In the EU-27 there are huge differences in the prevalence of ETS exposure within and between Member States and by setting. The most recent estimates (based on 2006 Eurobarometer data) suggest on average 19 percent of EU citizens are exposed to ETS daily in indoor workplaces—either as workers or customers of these venues, and 39 percent in bars/restaurants or bars. Across the EU-27, daily exposure to ETS in indoor workplaces varies from 2 percent in Ireland to 38 percent in Greece, and in pubs from 1 percent in Ireland to 63 percent in Greece. Many countries that have implemented comprehensive smoke-free policies bans since 2004 such as Ireland, Scotland, Wales, Northern Ireland, and England reported lower ETS prevalence figures. Compliance and attitudes towards the smoking bans in these countries has also been positive.

- Social and economic-related inequalities exist within and between different countries in terms of smoking prevalence and smoking cessation rates, and exposure to secondhand smoke. Lower socioeconomic groups bear the largest burden. Equity must be built into the design, implementation, and assessment of comprehensive smoking bans, specifically linking these measures with broader measures such as education programmes encouraging smoke-free homes and cars, and so on, where particular vulnerable groups have the highest exposure and which do not fall under the scope of regulation.

- Secondhand smoke exposure causes significant harm to health. The most recent estimate of how many deaths may be attributable to passive smoking among non-smokers in the EU-25 showed that passive smoking accounted for around 19,000 deaths. Of these deaths, ETS exposure at home accounted for around 16,000, and ETS exposure at work accounted for 3,000.

- Treating ETS-related diseases imposes a high economic burden on society. The cost of treating ETS-related diseases range from US$700 million to US$2.1 billion (1997) depending on the study and the population. Moreover, the costs associated with premature mortality due to ETS is estimated at $7.1 billion (in the single study that estimated it), and is more than three times higher than the cost of ETS-related morbidity.

- Smoke-free legislation is highly effective in reducing ETS exposure and improving air quality. Based on self-reported exposures, smoking bans reduced ETS at work from 20 percent to 8 percent in New Zealand and from 30 hours of exposure to zero in Ireland. Significant reductions have also been shown for biological markers of ETS exposure, such as cotinine (metabolised nicotine in blood) and nicotine levels in the air. Furthermore, all the studies we reviewed showed smoking bans result in large reductions in particulate pollution ranging from 83 percent in Irish bars to 93 percent in US bars.

- Smoke-free legislation result in increased population health, as measured through changes in coronary events (such as heart attacks) and respiratory symptoms. For example an Italian study showed an 11.2 percent reduction in acute coronary events for residents aged 35–64 years after implementation of a smoking ban policy, and a Scottish study found a 17 percent reduction in heart attacks admitted to nine Scottish hospitals one year after the smoke-free ban. Studies have shown reductions in respiratory symptoms ranging from 13 percent to 40 percent in Irish, Spanish, and Scottish bar workers.

- Smoking bans might not only have a direct effect on ETS exposure, but also an indirect effect. The indirect effect is due to the effect on smoking behaviour, including smoking prevalence, smoking cessation, smoking uptake, youth smoking behaviour, and smoking at home.

- The economic effects of smoking bans on the tobacco industry showed that smoking bans may reduce the sale of cigarettes. The effect on sales in the hospitality sector was more mixed. However it is noteworthy that a 2008 update of the 2003 review by Scollo et al. (2003) of the quality of the studies on the economic effects of smoke-free policies on the hospitality industry found that in 47 of the 49 studies that are "best designed" report no negative impact on measures such as taxable sales (Scollo and Lal, 2008). Moreover, the Surgeon General's (2006) report concludes that "evidence from peer reviewed studies shows that smoke-free policies and regulations do not have an adverse economic impact on the hospitality industry".

- There are various technological strategies for controlling secondhand smoke, specifically the segregation of smoking and non-smokers. These may include enclosed smoking rooms, designated smoking areas, smoking stations and cabins, and controlled and enhance ventilation and filtration systems. The evidence is mixed as to the extent to which technological strategies are effective for controlling secondhand smoke. The US Surgeon General (2006) conclude that "establishing smoke-free workplaces is the only effective way to ensure that secondhand smoke exposure does not occur in the workplace. Exposures of non-smokers to secondhand smoke cannot be controlled by air cleaning or mechanical air exchange." A similar position to this is held by the WHO. On the other hand, evidence reported by producers of smoking cabins and stations seems to suggest that such technological solutions can reduce the investigated tobacco smoke compounds close to 100 percent, which may be comparable to ambient air pollution levels. However, the ongoing development, and subsequent adoption, of appropriate European testing standards to confirm the effectiveness of a given manufacturer's solution will be key to delivering the promised technological returns.

- Smoking cessation interventions, especially pharmacotherapies such as NRT and bupropion, are highly cost-effective.

PART B: IMPACT ASSESSMENT

CHAPTER 12 Description of policy options

In this chapter the five policy options that the Commission may wish to introduce are described.

12.1 Description of policy options

Based on the outcome of the Green Paper consultation the five policy options listed in Table 12.1 are being considered by the Commission. They are discussed below.

Table 12.1: Policy options that the European Commission may wish to introduce

Policy option	Characteristics
1. No change from status quo	Leave legislation to individual countries
2. Open method of coordination	Exchange information, experiences, best-practices Develop common indicators Agree common targets
3. Commission recommendation	Provide guidance and encouragement to Member States in introducing smoke-free legislation
4. Council recommendation	As Commission recommendation, but originating from Member States
5. Binding legislation	EU-wide ban on smoking in the workplace including bars/restaurants (self-employed workers excluded)

1) No change from status quo

This option would mean no new activity on the part of the EU, while **continuing the current work** on secondhand smoke under the different Community programmes (Second Health Programme 2008–2013, Seventh Research Programme 2007–2013, Life+

programme 2007–2010, information and education campaigns, and networking initiatives).

Regulatory developments in this area would in this case be left to the Member States. Member States would retain the right to decide whether and how to introduce smoke-free measures depending on national circumstances and cultural differences.

2) Open method of coordination

This option would involve encouraging Member States' cooperation on smoke-free environments through the following:

- facilitating the exchange of experiences and best practices on how to develop, enforce, and monitor effective smoke-free policies at national, sub-national, and local level
- agreeing common targets and guidelines for Member States based on successful experiences
- developing a common set of indicators to monitor and evaluate progress
- periodic peer review, for example in the form of annual reports from the Member States.

A co-ordinating body (working group, task force, network of competent authorities) bringing together the representatives of the Member States and European Commission could be set up to facilitate the process by providing a forum for discussion, exchange of experience, and peer review for the Member States. This needs to be seen in the context of the envisaged establishment of an implementation mechanism for the EU Health Strategy.

Also existing structures, such as the Network of Competent Authorities on Heath Information and Knowledge and/or EU Working Party on Health Indicators could be used.

3) Commission recommendation

A recommendation from the Commission based on Article 152 TEC (Treaty of the European Community) would provide guidance and encouragement to Member States in introducing comprehensive smoke-free legislation. Such recommendation would take into account and possibly strengthen the guidelines on smoke-free environments adopted by the Second Conference of the Parties to the Framework Convention on Tobacco Control (FCTC) in July 2007. It could be accompanied by monitoring and reporting requirements (Commission to report periodically on the progress achieved based on Member States' reporting).

4) Council recommendation

A recommendation from the Council based on Article 152 TEC would provide guidance and encouragement to Member States in introducing comprehensive smoke-free legislation. Such recommendation would take into account and possibly strengthen the guidelines on smoke-free environments adopted by the Second Conference of the Parties to the FCTC in July 2007. It could be accompanied by monitoring and reporting requirements (Commission to report periodically on the progress achieved based on Member States' reporting). In addition, it could invite the Commission to take further measures (for example introduce binding minimum rules) in case of unsatisfactory progress.

5) Binding legislation

Workplace Legislation (Article 137)
Revision of the existing directives based on the Framework Directive on workplace safety and health 89/391/EEC. This option could include, in particular, extending the scope of the Carcinogens and Mutagens Directive 2004/37 to cover tobacco (smoke) and/or strengthening the requirements for the protection of workers from tobacco smoke in Directive 89/654/EEC on minimum health and safety requirements.

Enact a **separate directive on workplace smoking**.

Chemicals legislation (Article 95)
Although not directly related to the protection from secondhand smoke, a possible option to consider would be the **amendment of the Dangerous Substances Directive** (67/548/EEC) to classify tobacco smoke or tobacco as a carcinogen. This would automatically bring tobacco (smoke) under the scope of the Carcinogens and Mutagens Directive (2004/37/EC).

These five policy options are not mutually exclusive and might complement each other, either in parallel or over time.

CHAPTER 13 **Quantitative analysis**

This chapter estimates the annual numbers of deaths and the medical and non-medical costs due to ETS exposure for smoking and non-smoking staff in indoor workplaces/offices and bars/restaurants across the EU-27 in 2008; and the reduction in annual mortality for each policy option due to ETS is estimated. We also estimate the impacts on the hospitality and tobacco industry. In the first section, our approach is described followed by the results.

13.1 Data and methods

Our approach is based on similar approaches applied in the Impact Assessments regarding passive smoking in the UK ((NHS Health Scotland et al., 2005; Department of Health 2006; Department of Health 2007; Welsh Assembly Government, 2007) and *Lifting the Smokescreen* (Smokefree Partnership, 2006). It comprised five steps. First, we obtained estimates for the prevalence of ETS (the number of people exposed to ETS in different venues) across all 27 Member States. Second, we obtained estimates on the expected effect of each of the five policies on ETS prevalence. Third, we obtained relative risk estimates from the literature for four diseases for which ETS is a known risk factor, and transferred these into *ETS attributable fractions*. Fourth, we estimated the burden of the four diseases in terms of mortality and costs, across all 27 Member States. In the fifth and final step we calculated for each Member State the burden of ETS per disease-venue combination under each of the five policies. We will discuss each of the steps in detail below and use France as an example to further clarify our approach.

13.1.1 ETS prevalence—2006 estimate

We used the most recent data (field work Oct–Nov 2006) from the Eurobarometer survey to estimate the fraction of the population exposed to ETS. This survey covers the population aged 15+ years across all 27 Member States and is based on multi-stage random sampling, with about 1,000 responses in the majority of countries. The data allowed us to distinguish between location of exposure (home, indoor workplaces/offices, and bars/restaurants), and smoking behaviour (smoker and non-smoker). In addition, to be conservative, when the location of exposure was categorised as indoor workplace/office or bars/restaurants, we only included staff members and excluded non-staff members.

Table 13.1 shows how we identified different groups exposed to ETS, using specific questions and response options from the Eurobarometer questionnaire.

Table 13.1: Classification of different groups exposed to ETS

Category	Question	Qualifying answers
Exposed to ETS in indoor workplaces/offices	QB31b How long are you exposed to tobacco smoke on a daily basis—indoor workplaces and offices?	"1–5 hours a day" "More than 5 hours a day"
Exposed to ETS in bars/restaurants	QB31b How long are you exposed to tobacco smoke on a daily basis—restaurants, pubs or bars?	"1–5 hours a day" "More than 5 hours a day"
Smoker/tobacco user	QB19	Smoke packed cigarettes Smoke roll-up cigarettes Smoke cigars or a pipe Chew tobacco or take snuff
Non-smoker	QB19	Used to smoke but have stopped Never smoked
Staff (indoor workplaces/offices)	QB31a Where do you work?	"Indoor workplaces or offices"
Staff (pubs/restaurants, or bars)	QB31a Where do you work?	"Restaurants, pubs, or bars"

For example, respondents who chose any of the response categories "1–5 hours a day", or "More than 5 hours a day" to question QB31b ("How long are you exposed to tobacco smoke on a daily basis—indoor workplaces and offices?"), were categorised in our analysis as being "exposed to ETS in indoor workplaces/offices". It should be noted that respondents who chose "Never or almost never" were not classified as being exposed to ETS. In addition, those responding "Less than 1 hour a day" were also not classified as being exposed to ETS, in order to adopt a conservative approach and to avoid overstating the prevalence of ETS.

For example, according to the Eurobarometer data, in France at the end of 2006, 158 out of 1,022 respondents were non-smoking staff working in indoor workplaces/offices. Of these 158 respondents, 21 were exposed to ETS for at least 1 hour daily, leading to a prevalence fraction of ETS among non-smoking staff working in indoor workplaces/offices of 21/158 = 13.3%. In a similar way, we calculated prevalence estimates for ETS exposure among non-smoking staff working in bars/restaurants (55.6% in this example), smoking staff working in bars/restaurants (57.1% in this example), and smoking staff working in indoor workplaces/offices (31.4% in this example).

13.1.2 **ETS prevalence—2008 extrapolation**

The data discussed above relate to ETS prevalence at the end of 2006. Since then, various Member States have implemented either full or partial smoke-free legislation. As a result of this legislation, we would expect the 2008 ETS prevalence for indoor workplaces/offices and bars/restaurants and pubs in those Member States to be lower than the ETS prevalence reported in 2006. We think such an expectation is justified, given the effectiveness of smoke-free legislation in general, as reported in the literature (see Chapter 7). In order to avoid overstating the ETS prevalence in 2008, we assumed that for countries introducing full smoke-free legislation after 2006, prevalence rates in 2008 would fall to the average 2006 ETS prevalence of Ireland, Italy, and Sweden, countries that had already implemented smoke-free legislation prior to 2006[29].

Based on the literature, we assumed the countries show in Table 13.2 implemented full and partial smoking bans related to ETS exposure at indoor workplaces/offices and bars/restaurants between October and November 2006 and today. For all other countries we assumed 2008 ETS prevalence in indoor workplaces/offices and bars/restaurants and pubs to be equal to 2006 ETS prevalence.

Table 13.2: Smoke-free legislation (full and partial bans) implemented after 2006

	Indoor workplaces/offices	Bars/restaurants
Full ban	France United Kingdom	Estonia Finland France Lithuania The Netherlands Slovenia United Kingdom
Partial ban	Denmark Portugal	Belgium Denmark Germany Portugal

We continue our previous example, and note that France was one of the countries that implemented a smoking ban after 2006. We therefore assumed the 2008 prevalence of ETS among non-smoking staff working in indoor workplaces/offices (i.e. being exposed for at least 1 hour daily) would be equal to the 2006 average of Ireland, Italy, and Sweden,

[29] Smoke-free legislation was implemented in Ireland in March 2004, in Italy in January 2005 and in Sweden in June 2005. The levels of ETS exposure reported in these countries for 2006 therefore can be assumed to represent the effect of these policies within 1-2 years after implementation of the policy.

calculated as 3.72%. We then multiplied this fraction by the fraction of non-smoking staff working in indoor workplaces/offices in the total sample[30]: 3.72% * 158 / 1,022 = 0.57%. The latter estimate represents the fraction of the French (sample) population in 2008 who are non-smoking, working in indoor workplaces/offices and exposed to ETS for at least 1 hour daily.

13.1.3 The effects of the five policy options on ETS exposure

Based on discussions with legislators at the European Commission, we established a series of arguments supporting certain assumptions regarding the effect of the five policy options on ETS exposure. For Policy 1 ("status quo") this involved estimating ETS exposure under different scenarios of which member states would implement smoke-free legislation independently—even if no action would be taken by the Commission. These scenarios are based on evidence regarding proposed (but not yet adopted) legislation.

We then *independently* asked representatives from various stakeholder groups to give their (expert) opinion on the expected effect of each of the policy options on ETS exposure after explaining the problem of ETS and each of the proposed policy options in detail. The results from the latter exercise were used to validate our assumptions. The groups that participated in this exercise were as follows:

- Stockholm Centre of Public Health
- European Public Health Alliance (EPHA)
- International Network of Women Against Tobacco (INWAT)
- European Federation of Allergy and Airways Diseases Patients' Associations (EFA) and International Primary Care Respiratory Group (IPCRG)
- German Cancer Research Center (DKFZ)
- Pfizer
- Association of the European Self-medication Industry (AESGP)
- Veneto Health Department
- European Union of Non-smokers
- Flemish Institute for Health Promotion
- German Smoke Free Alliance
- Smokefree Partnership
- European Network for Smoking Prevention
- European Heart Network
- Association of European Cancer Leagues.

[30] We assumed that the fraction of non-smoking staff working in indoor workplaces/offices stayed constant between 2006 and 2008.

In the exercise, stakeholders were presented with tables showing the estimated 2008 ETS EU-average prevalence figure, in addition with estimates for the 25th and 75th percentiles of ETS prevalence across the EU-27. Separate estimates were provided for each of the different venues. Stakeholders were then asked to fill out a table with their estimates for 2013 average ETS prevalence and the 25th and 75th percentiles for each of the five policy options. During the exercise many stakeholders indicated they perceived the task as too difficult to complete immediately and requested more time to form their judgement. Stakeholders were then encouraged to submit their ratings, in addition to any qualitative assessments, by email. Of the 15 responses, all were obtained through email. The average[31] stakeholder ratings on the percentage reduction in ETS prevalence ratio compared with the baseline are shown in Table 13.13. Appendix G provides results of stakeholder consultation.

13.1.4 **Relative risk for selected diseases due to ETS**

We applied venue-specific estimates on the relative risk for lung cancer, cerebrovascular diseases (stroke), ischaemic heart disease, and chronic lower respiratory diseases (including COPD and asthma), identical to those reported by Jamrozik in "Lifting the smokescreen" (Smoke Free Partnership, 2006) and the Royal College of Physicians (2005) in the UK (Table 13.3). They are based on median figures obtained through meta-review of existing literature and are consistent with the ranges we report in Table 4.3.

Table 13.3: Relative risk estimates associated with ETS and specific diseases

Disease	ICD-10 Classification	Relative risk		
		Private home	Average workplace	Pub/bar/nightclub
Lung cancer	C3–C34	1.24	1.24	1.73
Stroke	I60–I69	1.45	1.45	2.52
Ischaemic heart disease	I20–I25	1.3	1.2	1.61
Chronic lower respiratory disease	J40–J47	1.25	1.25	1.76

In order to estimate the burden of ETS, we converted the eight relative risk ratios (for workplace and pub/bar/nightclub) to eight ETS attributed fractions. The ETS attributed fraction is defined as the part of a disease's burden that can be attributed to ETS:

$$ETS\ attributed\ fraction = \frac{ETS\,Prevalence * (Relative\,Risk - 1)}{(ETS\,Prevalence * (Relative\,Risk - 1) + 1)}$$

We obtained estimates for the burden of ETS in terms of mortality, medical and non-medical costs, by multiplying the number of deaths and costs due to each disease by the

[31] Because we only used these estimates for validation purposes, we did not consider additional statistics, such as the median, standard deviation or percentiles.

ETS attributed fractions. In the sections that follow we discuss how we obtained estimates for the number of deaths and costs due to each disease.

Because the ETS attributable fraction depends on the (Member State-specific) ETS prevalence, it varies by Member State, venue (indoor workplaces/offices and bars/pubs/restaurants), and smoking status (smoker/non-smoker). Continuing our example for France, the ETS attributable fraction for non-smoking staff in indoor workplaces/offices can be calculated as:

$$ETS\ attributed\ fraction = \frac{0.0057 * (1.24 - 1)}{(0.0057 * (1.24 - 1) + 1)} * 100\% = 0.138\%$$

Thus, 0.138 percent of the population-level burden of lung cancer in France can be attributed to ETS exposure among non-smoking staff in indoor workplaces/offices. By plugging in the relative risks for the other three diseases, it is possible to calculate the ETS attributed fractions in a similar way.

13.1.5 **Mortality**

For each Member State, we obtained data from Eurostat on the annual number of deaths in the population of working age (20–64 years) caused by each of the four diseases discussed above. For 16 countries, the most recent estimates were available for 2006 or later; for eight countries, the most recent estimates were available for 2005. For Italy and Denmark, the most recent estimates were available for 2003 and 2001, respectively. For Belgium, no estimates were available. To estimate mortality due to ETS, we applied the ETS attributable fraction to the number of deaths in the population of working age (20–64 years) for each of the four diseases.

For example, according to the Eurostat data, in France 12,034 people of working age died from lung cancer. Multiplying this by the ETS attributed fraction of 0.138% calculated above, leads to an estimated annual number of 17 deaths in France among non-smoking staff in indoor workplaces/offices from lung cancer caused by ETS.

13.1.6 **Costs**

For cerebrovascular disease and ischaemic heart disease, we obtained Member State-specific estimates for medical and non-medical cost for the year 2006 from the British Heart Foundation.[32] The method adopted by the British Heart Foundation relies on a top-down approach to calculate total annual expenditure for specific diseases, using aggregate data on morbidity, mortality, hospital admissions, disease-related costs, and other health-related indicators. The following services were included in the estimation of medical costs: primary care, accident and emergency care, hospital inpatient care (including day cases and cardiac rehabilitation services), outpatient care, and medications. Categories included in the estimation of non-medical costs included informal care, productivity costs due to mortality, and productivity costs due to morbidity.[33]

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[32] See www.heartstats.org (accessed 1/5/2008).

[33] For a detailed description of this approach, see www.heartstats.org/eucosts (accessed 1/5/2008).

Using OECD Health Data we estimated the average annual percentage increase in health care expenditure for each of the 19 OECD EU countries over the period 1996–2005, and imputed the average across these 19 countries (8.2 percent) for the remaining eight countries. To obtain estimates for the 2008 medical cost for cerebrovascular disease and ischaemic heart disease, we extrapolated the 2006 costs using this average annual percentage increase in health care expenditure for each of the Member States. We applied the same method for the extrapolation of the 2006 non-medical cost, but used the average annual percentage increase in GDP rather than health care expenditure[34].

In the case of France, the medical costs of treating stroke were €1,427,985,446 according to figures from the British Heart Foundation. Between 1996 and 2005, according to OECD Health Data, overall health care expenditure in France rose by 5.3 percent per year on average, leading to an estimated €1,582,299,557 in medical costs for treating stroke. Applying the ETS attributable fraction for stroke then leads to an annual medical cost among non-smoking staff in indoor workplaces/offices exposed to ETS of €4,080,415 in France. Similarly, the British Heart Foundation estimated the non-medical costs of stroke in France in 2006 as €1,742,987,431. Applying an average annual increase in GDP of 3.9 percent leads to an extrapolated 2008 estimate of €1,880,133,401. Finally, applying the ETS attributable fraction leads to an annual non-medical cost among non-smoking staff in indoor workplaces/offices exposed to ETS of €2,507,411 in France.

Unfortunately, detailed Member State-specific cost estimates were not readily available for lung cancer and chronic lower respiratory disease. We therefore used the following indirect method of estimation. For lung cancer, we obtained an estimate from the National Cancer Institute (part of the US National Institutes of Health) for total medical spending on lung cancer in the US in 2004. We then expressed medical spending on lung cancer as a percentage of health care expenditure in the US in 2004, and applied this percentage to the (estimated) 2008 health care expenditure in each of the 27 Member States. In other words, we assumed that the share of health care spending allocated to the treatment of lung cancer is relatively homogeneous across industrialised countries[35].

In order to carry out this estimation, we first had to estimate 2008 health care expenditure for each of the 27 Member States. For the 19 OECD EU countries, we used the most recent available data (2005 for the majority of countries) and extrapolated to 2008 using the average annual percentage increase in health care expenditure over the most recent ten-year period. For all other countries (except Latvia and Malta, for which no data were available) we extrapolated 2004 estimates on health care expenditure obtained from Eurostat, using the average (8.2 percent) annual increase in health care spending across the other countries. In case expenditure figures were not available in euros, we used the average exchange rate for the first half of 2008 to convert national currencies to euros.

[34] Here we use GDP, because these costs are not directly related to medical treatments. Therefore inflating these by an index specific to the costs of healthcare does not seem appropriate. Because non-medical costs include a broad range of costs, we think changes over time will likely track changes in GDP.

[35] Unfortunately, we were not able to evaluate this assumption due to a lack of data (in fact, if data were available to test this assumption, i.e. spending on lung cancer treatments across a wide range of countries, we likely could have obtained spending on lung cancer in the EU as well, in which case it would not be necessary to infer this spending from the US).

We applied a similar procedure to estimate the cost of lower respiratory disease, and obtained estimates on the medical cost of asthma for 1998 from Weiss et al. (2001), and on the medical cost of COPD for 2002 from the National Heart, Lung, and Blood Institute of the US National Institutes of Health. We also obtained estimates for non-medical cost for these diseases from the same sources, expressed these as a percentage of the US GDP (rather than health care expenditures) and applied this percentage to the 2008 GDP (obtained from Eurostat) for each of the 27 Member States in order to estimate the non-medical cost. Unfortunately we were not able to obtain estimates on the non-medical cost for lung cancer.

13.1.7 Methods to estimate effects of smoke-free legislation on revenues and employment to the tobacco industry

The decrease in tobacco consumption as a result of comprehensive smoke-free legislation throughout the EU will have a direct effect on the size of the tobacco market. Because of import and export of tobacco products between Member States and between the EU-27 and non-EU countries, it is not obvious how a decrease in the market size for tobacco products will affect revenues (turnover) and employment in the tobacco industry. For example, a smoking ban in a specific country might only partially affect the tobacco industry in that country in case this industry would generate a substantial amount of its revenues by exporting its products to countries not affected by the smoking ban.

According to Eurostat, in 2006, exports of tobacco products were valued at €1.8 billion and imports at €350 million. Comparing this to a total turnover across the EU-27 of €75 billion, shows that only 2.5 percent of the turnover is realised through export to non-EU countries, indicating a very direct relation, at least for the EU as a whole, between market size and industry revenues.

To estimate the effect of an EU-wide smoking ban on revenues and employment in the tobacco industry, we applied the estimates from the peer-reviewed literature (shown along with the non-peer-reviewed literature in Tables D.21 and D.22 in **Appendix D**) to the EU-wide estimated 2007 revenue and employment estimates for the tobacco and hospitality industry. However, applying the estimates from the literature directly, would assume that the entire EU would move from a scenario in which there is no smoking ban to a complete smoking ban. Because many countries already had smoking bans by 2008, we therefore had to apply a correction to the estimates from the literature. Because many of the larger Member States such as France, the UK, and Italy already had smoking bans, we estimated that only half of the entire EU-27 tobacco market would be affected by a new EU-wide smoking ban.

The most recent data on tobacco industry revenues across the EU-27 are available for the year 2006, which were extrapolated to 2007 by Eurostat using short-term indices.

We assumed that, holding everything else constant, any reductions in revenue would have a proportional effect on employment in the tobacco industry in the longer run. Since most of our estimated reductions in mortality and costs would only materialise in the longer run, we are mostly concerned with the longer run effects on employment as well, although we realise that the immediate (short-run) effect might be smaller in case firms incur disproportionally high cost when downsizing in the short run.

The most recent data on Member State-specific hospitality industry revenues (NACE categories 55.3 to 55.5—bars/restaurants, canteens and catering) across the EU-27 were available for the year 2006, which were extrapolated to 2007 by Eurostat using short-term indices.

At the EU-level, bars/restaurants, canteens and catering represent 69.9 percent (revenue) and 75.4 percent (employment) of the total, whereas hotels, camping sites and other provision of short-stay accommodation represent the remaining (much smaller) share. Unfortunately, no data were available to further distinguish between bars and restaurants. Because no country-specific estimates were available, we applied these average EU percentages to each country.

13.1.8 **Methods to estimate effects of smoke-free legislation on the cost of fires, cleaning, and redecoration costs**

To estimate the effect of an EU-wide smoking ban on the cost of fires, cleaning and decoration costs, we summed the estimates from the Health and Regulatory Impact Assessment on Smoking for Northern Ireland, reported as £4.6 million per annum; the English impact assessment, reported as £163 million; the Scottish impact assessment, reported as £16.6 million; and the Welsh impact assessment, reported as £13.5 million. To extrapolate this figure to an EU-wide estimate, we expressed this as a fraction of UK GDP and then applied this fraction to the GDP for Member States that did not have smoking bans as of 2008. Summing across these Member States resulted in the expected EU-wide reduction in the cost of fires, cleaning, and redecoration following a smoking ban.

13.1.9 **Methods to estimate effects of smoke-free legislation on mortality due to reduction in smoking**

The Health and Regulatory Impact Assessment on Smoking for Northern Ireland estimated 13 deaths due to ETS exposure in the workplace could be averted annually, while 27 deaths could be averted if there was a reduction in smoking prevalence across the entire population, both resulting from a smoking ban in the workplace. In other words, the estimated number of averted deaths from a reduction in smoking prevalence is estimated as more than twice the estimated number of deaths averted from a reduction in ETS exposure in the workplace. This figure assumes smoking prevalence would drop by 2 percent following a smoking ban, independent of existing downward trends in smoking prevalence rates. To extrapolate this to an EU-wide figure, we applied the ratio 27/13 to the number of averted deaths from ETS exposure.

It should be noted that the 27/13 ratio is far more conservative than the ratio that can be inferred from the English impact assessment, which estimates the monetary value of the number of averted deaths from ETS (after implementation of a full ban) as £21 million, whereas the monetary value of averted deaths from smokers giving up is estimated as £1,600 million—a ratio of 1,600/21. In addition, this study estimated the monetary value of averted deaths from reduced uptake of smoking as £550, leading to a combined ratio of (1600+550)/21, or 2150/21.

The Scottish impact assessment estimated 406 deaths from ETS exposure in public places (including workplaces, and the leisure and hospitality industry) could be averted annually if there was a smoking ban. The number of averted deaths from reduced active smoking is estimated as only 260, leading to a ratio of 260/406, which is much smaller than the two previous ratios discussed above. A fairly similar ratio was found in the Welsh impact assessment, which estimated the number of averted deaths from ETS exposure as 253 per year and the number of averted deaths due to reductions in active smoking as 120 per year, leading to a ratio of 120/253. The latter ratio is based on deaths resulting from lung cancer and coronary heart disease (CHD) only.

13.2 **Results**

Table 13.4 provides a summary of our baseline estimates for 2008. In this section we will discuss these estimates in further detail, in addition to the way they are expected to change under each of the policies considered.

Table 13.4: Summary of baseline estimates

	Indoor workplaces/offices	Bars/restaurants
	Staff	Staff
ETS exposure of over 1 hour in 2008 (per 1,000)		
—non-smokers	18.62	2.58
—smokers	28.66	2.47
Total number of deaths		
—non-smokers	1,714	786
—smokers	2,694	813
Total medical cost (€ million)		
—non-smokers	427	139
—smokers	636	134
Total non-medical cost (€ million)		
—non-smokers	353	124
—smokers	529	119

Throughout this chapter we distinguish between exposure among staff in indoor workplaces/offices and bars/restaurants. We do not consider exposure among staff in healthcare and educational facilities, as well as government buildings. The reason to exclude these latter categories is that the Eurobarometer survey shows very small numbers of staff exposed (about 55 for each of these three venues across the entire EU-27, in a sample of 28,532 individuals), which prohibits effective use of these data in our country-level analysis. If the data would have allowed us to include the effects of ETS exposure among staff in healthcare and educational facilities, and government buildings, we would not expect our findings and conclusions to change drastically, because this population is only about 13 percent of the size of staff exposed in indoor workplaces/offices.

13.2.1 **ETS exposure—2006**

Table 13.5 shows the fraction of smoking and non-smoking staff (per 1,000) exposed to ETS for at least 1 hour daily, for each of the combinations of categories[36].

Table 13.5: Number of staff per 1,000 EU citizens exposed to ETS in 2006 for at least 1 hour daily

	Non-smokers		Smokers	
	Indoor workplace/office staff	Bar/restaurant staff	Indoor workplace/office staff	Bar/restaurant staff
Average	21.27	4.04	31.95	4.12
Minimum	0.99	–	2.98	–
Maximum	51.00	12.67	99.00	9.87

The first row of Table 13.5 shows the population-weighted average for the EU-27. The largest category of staff exposed to ETS is smoking staff in indoor workplaces/offices (32 exposed per 1,000 population). The number of staff exposed in bars/restaurants is relatively small. The minimum and maximum across the EU-27 (second and third row) show that these figures can vary considerably across Member States.

Note, however, that these proportions take the entire population as denominator. An alternative measure is to estimate the proportion of people exposed to ETS within each of the subgroup populations, for example the number of non-smoking staff in indoor workplaces/offices exposed to ETS divided by the number of all non-smoking staff in indoor workplaces/offices. These estimates are shown in Table 13.6 and Table 13.7.

Table 13.6: Percentage of staff exposed to ETS for at least 1 hour daily in 2006 within each subpopulation

	Non-smokers		Smokers	
	Indoor workplace/office staff	Bar/restaurant staff	Indoor workplace/office staff	Bar/restaurant staff
Average	13%	46%	31%	48%

Table 13.7: Percentage of staff exposed to ETS for at least 1 hour daily in 2006 within each subpopulation (smokers and non-smokers combined)

	Indoor workplace/office staff	Bar/restaurant staff
Average	20%	47%

[36] All estimates in the remainder of this chapter are shown as point estimates. Assessing the uncertainty around these estimates (e.g. standard errors or confidence intervals) was outside the scope of this study. We discuss the limitations of this in section 13.4.

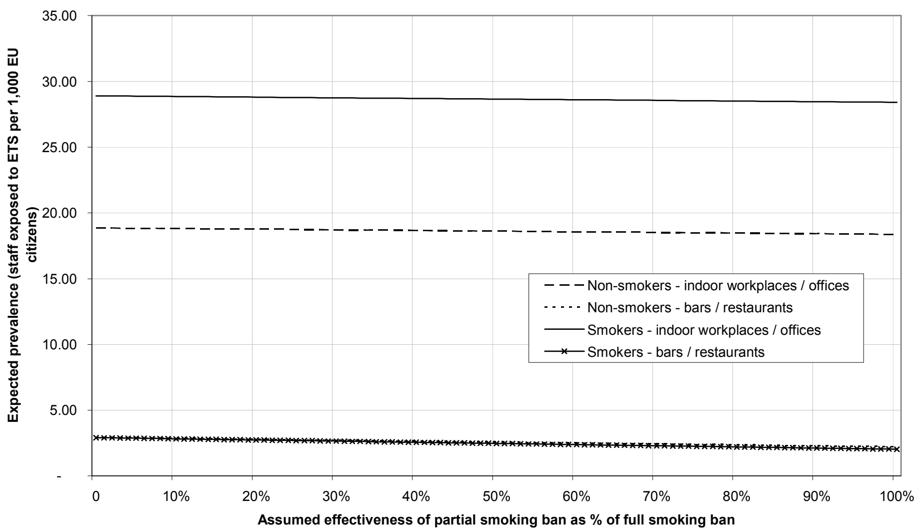
13.2.2 **ETS exposure—2008**

Using the approach outlined in section 13.1.2, we updated the 2006 ETS prevalence estimates for 2008, taking into account that various Member States have implemented smoke-free legislation since 2006. For each quantity of interest, we show a high and low estimate, depending on the assumed effect of partial bans implemented between 2006 and 2008. The high estimate assumes the effect of a partial ban is equal to the effect of no ban while the low estimate assumes the effect equals the effect of a full ban. Table 13.8 updates the 2006 estimates shown in Table 13.5 to 2008, and Figure 13.1 shows the entire range of ETS prevalence estimates under different assumptions regarding the effectiveness of partial bans. Note that the high and low estimates in Table 13.8 correspond to the 0 percent and 100 percent estimates in Figure 13.1 (extreme left and right ends of the lines).

Table 13.8: Estimated number of staff per 1,000 EU citizens exposed to ETS in 2008 for at least 1 hour daily

Estimate	Non-smokers		Smokers	
	Indoor workplace/office staff	Bar/restaurant staff	Indoor workplace/office staff	Bar/restaurant staff
High	18.86	2.93	28.90	2.91
Low	18.37	2.22	28.41	2.03

Figure 13.1: Expected 2008 ETS prevalence (for at least 1 hour daily per1,000) as a function of the assumed effectiveness of partial smoking bans implemented after 2006

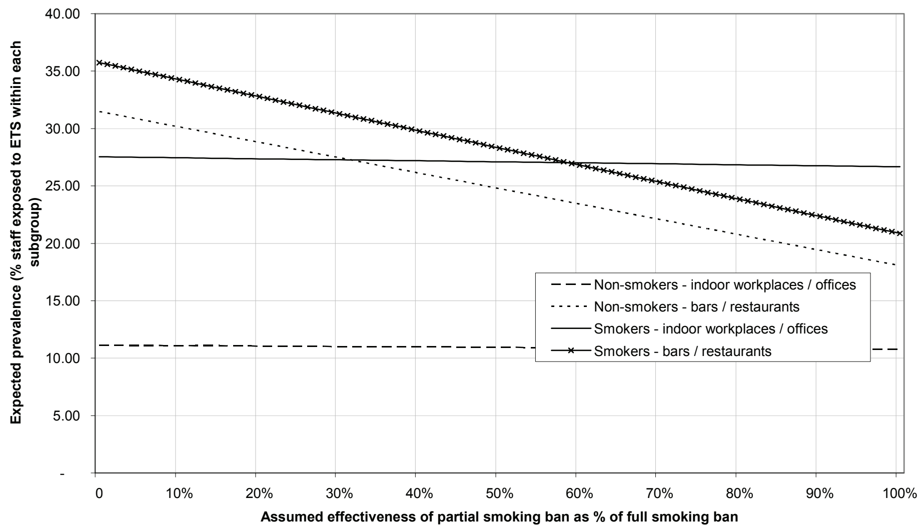


Similarly, Table 13.9 updates Table 13.6 to 2008, with the full range of ETS estimates under different assumptions of the effect of partial bans shown in Figure 13.2. Comparing Figure 13.1 to Figure 13.2 provides more insight into the impact of the uncertainty around the effect of partial bans: While the effect of partial bans can have a large impact on the average ETS prevalence *within staff in bars/restaurants*, the eventual impact of ETS exposure *across the entire population* is much smaller. The reason for this is that only a small fraction of the population is employed as staff in bars/restaurants.

Table 13.9: Estimated percentage of staff exposed to ETS for at least 1 hour daily in 2008 within each subpopulation

Estimate	Non-smokers		Smokers	
	Indoor workplace/office staff	Bar/restaurant staff	Indoor workplace/office staff	Bar/restaurant staff
High	11.13	31.47	27.53	35.73
Low	10.76	18.05	26.66	20.86

Figure 13.2: Expected 2008 ETS prevalence (for at least 1 hour daily within subgroups per 1,000 staff) as a function of the assumed effectiveness of partial smoking bans implemented after 2006



Finally, Table 13.10 updates Table 13.7 to 2008, showing expected ETS prevalence within indoor workplace/office staff and staff in bars/restaurants (with smokers and non-smokers combined).

Table 13.10: Percentage of staff exposed to ETS for at least 1 hour daily in 2008 within each subpopulation (smokers and non-smokers combined)

	Indoor workplace/office staff	Bar/restaurant staff
High	17.26	33.96
Low	16.75	19.32

In the remainder of this report, we will assume partial bans have half the effect of a full ban, and hence our baseline estimates for 2008 fall in the middle of the high and low estimates shown above.

13.2.3 **ETS exposure under five alternative policies—2013**

After showing 2006 and 2008 baseline estimates in the previous two sections, we now consider ETS prevalence in 2013, under each of the five policies. Each of these policies is assumed to lead to a different ETS prevalence estimate for 2013. Based on discussions with legislators at the European Commission, we applied the following proportional reductions to the prevalence *ratios*:

- Policy 1: 6 percent reduction
- Policies 2, 3 and 4: between 13 percent and up to 26 percent reduction, with Policies 2 and 3 being closer to the lower bound and policy 4 closer to the upper bound.
- Policy 5: prevalence rates for all Member States become equal to Ireland (a 100 percent reduction for bars/restaurants and 87–89 percent reduction in indoor workplaces/offices), corrected for the fact that Policy 5 is somewhat narrower in scope than the Irish ban (see below for a further explanation). As a result, after this correction, the reduction in prevalence under Policy 5 is equal to an 85 percent reduction in ETS prevalence among staff in bars/restaurants and 76–78 percent reduction in indoor workplaces/offices.

We will now discuss the rationale behind these assumptions for each of the policies in detail.

The assumed 6 percent reduction in prevalence ratios for Policy 1 takes into account the fact that several Member States are expected to implement smoke-free legislation over the next five years, even if the EC would take no further action. It is therefore useful to examine *proposed* legislation across the EU-27, and simulate how implementation of this legislation would affect the 2013 ETS prevalence under Policy 1. We therefore categorised Member States with smoke-free legislation proposals into three categories, where category 3 represents legislation that is most likely to be implemented and category 1 represents legislation that is least likely to be implemented.

Category 1

Category 1 assumes that by 2013 Greece, Poland, Slovakia, and Hungary will have banned smoking in indoor workplaces/offices and bars/restaurants. Greece currently has a draft bill to ban smoking in all public places as of 2010. Because of the drastic change this would imply, Greece is categorised in category 1, even though this is a draft law to be presented for parliament's approval. In Poland, a parliamentary initiative to ban smoking in all public places passed the health committee of the parliament in March 2008. It needs two more readings in the lower chamber and one in the senate. In Hungary, the health ministry drafted a proposal for a comprehensive smoking ban covering all indoor workplaces, including bars/restaurants. However, there was a change at the post of the health minister and it is not sure that the new minister will take up the initiative. In Slovakia, the health ministry drafted a proposal for a partial ban in the hospitality sector (with an exemption for venues below 200 square metres). Still, it has to be approved by the cabinet, before it is sent to the parliament.

Category 2

Category 2 assumes that by 2013 Austria will have a partial ban for bars/restaurants and the Czech Republic will have banned smoking in indoor workplaces/offices and bars/restaurants. In Austria, a partial ban in hospitality venues (below 80 square metres) can be expected as of January 2009, agreed on by the government in April 2008. However, the draft law now has to be approved by the parliament. Because there is a coalition government in Austria and there have been long negotiations on the proposed changes, chances have increased that the amendment will be accepted in the parliament. In the Czech Republic a parliamentary initiative to ban smoking in all public places passed the health committee of the parliament but was watered down in the second reading with partial ban alternatives. However, it needs one more reading in the lower chamber and one in the senate. A number of similar initiatives failed in the past though.

Category 3

Category 3 assumes that by 2013 Romania will have a full ban in indoor workplaces/offices and a partial ban in bars/restaurants. In January 2008, the government adopted an emergency ordinance setting out a full ban in workplaces and a partial ban in hospitality sector (exemption for venues smaller than 100 square metres as of January 2009). The ordinance has already been approved by one chamber of the parliament (senate) but still has to be approved by the other chamber (deputies).

In addition to Romania, in April 2008 the Latvian parliament adopted a bill introducing a total ban smoking in all enclosed public places including hospitality venues as of April 2010. Because ETS prevalence among staff in bars/restaurants is already zero according to the most recent Eurobarometer survey (and smoking is already now allowed only in separate smoking rooms), the adoption of this law is unlikely to significantly change ETS exposure among staff in bars/restaurants in 2013.

Table 13.11 shows the estimated ETS prevalence under the assumptions made for each of the three categories, and Table 13.12 shows the resulting percentage reduction compared with the 2008 baseline. Partial bans are assumed to have half the effect of full bans. The latter table reveals that the assumption of a 6 percent reduction for Policy 1 is not unreasonable and would be consistent with a situation in which most of the countries in category 2 and 3 would have implemented their proposed smoke-free policies by 2013. The table also shows that ETS prevalence in the EU would have reduced substantially by 2013 if all category 1 countries would also become successful in implementing the proposed legislation. As we have argued above, there are many uncertainties around these policies, and one cannot simply assume that they will all be implemented.

Table 13.11: Estimated number of staff per 1,000 EU citizens exposed to ETS in 2013 for at least 1 hour daily

	Non-smokers		Smokers	
	Indoor workplace/office staff	Bar/restaurant staff	Indoor workplace/office staff	Bar/restaurant staff
Baseline 2008	18.62	2.58	28.66	2.47
Policy 1, Cat 3, 2013	17.95	2.56	27.53	2.39
Policy 1, Cat 3 + 2, 2013	17.83	2.36	27.16	2.20
Policy 1, Cat 3 + 2 + 1, 2013	15.33	2.20	23.45	1.94

Table 13.12: Percentage reduction compared to baseline

	Non-smokers		Smokers	
	Indoor workplace/office staff	Bar/restaurant staff	Indoor workplace/office staff	Bar/restaurant staff
Policy 1, Cat 3, 2013	−4%	0%	−4%	−3%
Policy 1, Cat 3 + 2, 2013	−4%	−8%	−5%	−11%
Policy 1, Cat 3 + 2 + 1, 2013	−18%	−15%	−18%	−21%

For policy option 2 (Open Method of Coordination) and policy option 3 (Commission recommendation), we assumed that the expected effects are likely to be similar and only slightly larger than Option 1 ("status quo"). The reasons for this are that: (1) implementation would be rather slow; (2) the OMC has never proved to be an effective policy measure in an evaluation; (3) the problem of ETS is mature and only real legislation is expected to have an effects; and (4) in an OMC the agreement is on objectives, but not on specific solutions.

Option 4 (Council recommendation) are expected to have a larger effect due to the ownership effect.

Finally, the rationale for the expected reduction in ETS under Policy 5 is that a smoking ban has proven to be very effective in Member States where such regulation was implemented in the past. By assuming ETS prevalence for Member States to be equal to Ireland (where this policy has lowered ETS most dramatically), Policy 5 can also be considered as the "maximum possible reduction" due to European legislation.

There is however a subtle difference between Policy 5 and the Irish ban. Whereas the Irish ban applied to both places with employees and places with only self-employed (or family workers), Policy 5 will not affect businesses that are entirely run by self-employed or family workers. For the hospitality industry, on average 15.4 percent of the workforce is self-employed or a family worker (based on Eurostat data from the labour force survey), and in the general workforce it is 12.3 percent. Hence, we reduced all effects of Policy 5 by 15.4 percent (hospitality industry) and 12.3 percent (indoor workplaces/offices).

To give an idea about the size of the assumed reductions, it is useful to express them as a (hypothetical) equivalent of Member States going entirely smoke-free. For example, a 6 percent reduction in EU-wide ETS prevalence (Policy 1) among non-smoking staff in indoor workplaces/offices would be equal to Spain reducing ETS exposure in this category to zero. Or, for another example, a 26 percent reduction EU-wide (Policy 4) among non-smoking staff in bars/restaurants would be equal to Belgium, Denmark, Greece, Luxembourg, Austria, Portugal, Bulgaria, and Hungary reducing ETS exposure in this category to zero.

As we explained in the methods section, we validated these estimates against the expert opinion of members of 15 stakeholder organisations. Their average ratings are shown in Table 13.13.

Table 13.13: Percentage stakeholder ratings on percentage reduction in ETS prevalence ratio compared with baseline

Venue	Stakeholders ratings on percent reduction in ETS prevalence ratio compared with baseline				
	Policy 1 No change status quo	Policy 2 Open method of coordination	Policy 3 Commission recommendation	Policy 4 Council recommendation	Policy 5 Binding legislation
Overall exposure—indoor workplaces/offices	0%	–1%	–2%	–66%	–81%
Overall exposure—bars/restaurants	–1%	–2%	–5%	–70%	–89%
Workers' exposure—indoor workplaces/offices	0%	–1%	–1%	–66%	–89%
Workers' exposure—bars/restaurants	0%	–1%	–2%	–75%	–94%
Exposure at home	0%	–1%	–3%	–12%	–20%

These ratings reveal that the estimates we applied are slightly larger for policy 1–3, and substantially more conservative for Policy 4.

Table 13.14 shows the estimated number of staff exposed to ETS for at least 1 hour a day per 1,000 EU citizens under each of the five policies in 2013. For the remainder of this chapter we will assume Policy 1 (status quo) will lead to a 6 percent reduction in ETS prevalence ratios and partial bans will have half the effect of a full ban.

Table 13.14: Estimated number of people per 1,000 EU citizens exposed to ETS for at least 1 hour daily

	Non-smokers		Smokers	
	Indoor workplace/office staff	Bar/restaurant staff	Indoor workplace/office staff	Bar/restaurant staff
Baseline 2008	18.62	2.58	28.66	2.47
Policy1 No change from status quo	17.41	2.41	26.80	2.31
Policy 2–3 Open method of coordination	16.20	2.24	24.94	2.15
Policy 4 Council recommendation	13.78	1.91	21.21	1.83
Policy 5 Binding legislation	2.53	0.40	7.28	0.38

13.2.4 **Estimated reductions in ETS-related mortality under each of the policies**

In this section we show—separately for non-smokers and smokers—the EU-27-wide mortality and cost estimates for the 2008 baseline and each of the five policy alternatives. We obtained these estimates following the approach described in the previous chapter. A summary of the estimated mortality due to ETS exposure among smoking and non-smoking staff in the EU-27 is shown at the end of this section (Table 13.19).

In all tables that follow we show figures for the different venues (indoor workplaces/offices and bars/restaurants) separately, in addition to the total. In some cases, the total shown differs slightly from the sum of the separate estimates due to rounding of the separate estimates (while the totals have been calculated using the un-rounded estimates).

Non-smokers

Table 13.15 shows an estimate for the total number of annual deaths to ETS in 2008 among non-smoking staff as 2,500. Note that this is a very conservative estimate, as it does not include non-staff members visiting bars, restaurants and pubs.

Table 13.15: Estimated EU-wide mortality due to ETS exposure among non-smokers in 2008

Baseline 2008	Non-smokers		
	Indoor workplace/office staff	Bar/restaurant staff	Total
Lung cancer	387	156	542
Stroke	378	160	538
Heart disease	384	138	522
Chronic lower respiratory disease	565	332	897
Total	1,714	786	2,500

Table 13.16 shows the expected *reduction* in annual deaths in 2013 under each of the five policies. Whereas reductions for the first four policies are only modest, a large reduction of up to 1,487 deaths among non-smoking staff in indoor workplaces/offices, and 664 deaths among non-smoking staff in bars/restaurants is expected under Policy 5.

Table 13.16: Estimated annual reductions in mortality due to ETS exposure among non-smokers for each of the policies

		Non-smokers		
		Indoor workplaces/office staff	Bar/restaurant staff	Total
Policy 1	Lung cancer	25	10	35
	Stroke	24	10	35
	Heart disease	25	9	34
	Chronic lower respiratory disease	36	21	58
	Total	110	51	161
Policy 2/3	Lung cancer	50	20	70
	Stroke	49	21	69
	Heart disease	50	18	67
	Chronic lower respiratory disease	73	43	116
	Total	221	101	323
Policy 4	Lung cancer	100	40	140
	Stroke	97	41	139
	Heart disease	99	36	135
	Chronic lower respiratory disease	146	86	232
	Total	443	203	646
Policy5	Lung cancer	335	132	466
	Stroke	327	135	463
	Heart disease	333	116	449
	Chronic lower respiratory disease	492	280	773
	Total	1,487	664	2,151

Policy 1 = No change from status quo; Policy 2 = Open method of coordination; Policy 3 = Commission recommendation; Policy 4 = Council recommendation; Policy 5 = Binding legislation

Smokers

We now show a separate set of estimates for the annual number of deaths due to ETS among smokers. I.e. we assume that regular ETS exposure adds to the risk from smoking itself. A noticeable difference between Table 13.15 and Table 13.17 is that mortality from ETS exposure in indoor workplaces/offices is much higher among smokers compared to non-smokers. This reflects the baseline prevalence numbers (i.e. the number of smokers exposed to ETS at indoor workplaces/offices is much larger than the number of non-smokers exposed to ETS at indoor workplaces/offices).

Table 13.17: Estimated EU-wide mortality due to ETS exposure among smokers in 2008

	Indoor workplaces /offices	Bars/restaurants	Total
Disease	Staff	Staff	
Lung cancer	600	161	761
Stroke	601	197	798
Heart disease	612	159	771
Chronic lower respiratory disease	881	296	1,176
Total	2,694	813	3,507

Table 13.18 shows estimated reductions in mortality under each of the policies.

Table 13.18: Estimated annual reductions in mortality due to ETS exposure among smokers for each of the policies

		Indoor workplaces/offices	Bars/restaurants	Total
	Disease	Staff	Staff	
Policy 1	Lung cancer	39	10	49
	Stroke	38	13	51
	Heart disease	39	10	50
	Chronic lower respiratory disease	57	19	76
	Total	173	53	225
Policy 2/3	Lung cancer	77	21	98
	Stroke	77	25	102
	Heart disease	79	21	100
	Chronic lower respiratory disease	113	38	151
	Total	346	105	451
Policy 4	Lung cancer	155	42	196
	Stroke	154	51	205
	Heart disease	158	41	199
	Chronic lower respiratory disease	227	76	303
	Total	693	210	904
Policy 5	Lung cancer	449	136	586
	Stroke	456	166	622
	Heart disease	464	135	598
	Chronic lower respiratory disease	677	250	927
	Total	2,046	687	2,733

Policy 1 = No change from status quo; **Policy 2** = Open method of coordination; **Policy 3** = Commission recommendation; **Policy 4** = Council recommendation; **Policy 5** = Binding legislation

It should be noted that these impacts might not materialize immediately. For example, for the current cohort of people that would not be exposed to ETS due to any of the proposed policies, a reduction in lung cancer mortality would only become apparent after several years. For other diseases, such as heart disease the effect might be more immediate though. Thus, the effects on mortality should be regarded as annual deaths prevented in the longer run[37].

Even though these effects will not fully materialise until a certain number of years has passed, the earlier a policy could be implemented, the larger the total benefits (i.e. over a series of years) will be. It is expected that full implementation of Policy 5 would take about 3 years longer compared to the other policies. For example, in a cohort of non-smoking staff in indoor workplaces/offices encompassing 10 years, the expected number of averted deaths due to heart disease would be 990 (99 x 10) under policy option 4, whereas it would be 2,331 (333 x 7) rather than 3,330 (333 x 10) under policy option 5.

Summary

Table 13.19 shows a summary of the estimated mortality in 2008 and reduction in mortality for each policy option due to ETS exposure among smoking and non-smoking staff in the EU-27.

Table 13.19: Summary of estimated mortality in 2008 and annual reduction in mortality for each policy option due to ETS exposure among smoking and non-smoking staff in EU-27

	Non-smokers			Smokers			Smokers and non-smokers
	Indoor workplaces/offices	Bars/restaurants	Total	Indoor workplaces/offices	Bars/restaurants	Total	Total
Baseline 2008*	1,714 (25%)	786 (16%)	2,500 (41%)	2,694 (42%)	813 (17%)	3,507 (59%)	6,007
Policy 1	−110	−51	−161	−173	−53	−225	−386
Policy 2/3	−221	−101	−323	−346	−105	−451	−774
Policy 4	−443	−203	−646	−693	−210	−904	−1,550
Policy 5	−1,487	−664	−2,151	−2,046	−687	−2,733	−4,884

* The percentage of total (smokers and non-smokers) is shown in brackets
Policy 1 = No change from status quo; Policy 2 = Open method of coordination; Policy 3 = Commission recommendation; Policy 4 = Council recommendation; Policy 5 = Binding legislation

13.2.5 Medical cost

In this section we show—separately for non-smokers and smokers—the EU-27 wide annual medical cost estimates for the 2008 baseline and each of the five policy alternatives. A summary of the estimated annual medical cost due to ETS exposure among smoking and non-smoking staff in the EU-27 is shown at the end of this section (Table 13.24).

[37] It was outside of the scope of this study to estimate exactly how long it will take for these effects to materialise

Non-smokers

In this section we show the estimated annual medical cost due to ETS exposure across the EU-27, which total to €566 million and are highest for the treatment of stroke (€242 million) and heart disease (€149 million).

Table 13.20: Estimated EU-wide medical cost due to ETS exposure among non-smokers in 2008, € millions

	Indoor workplace/office staff	Bar/restaurant staff	Total
Lung cancer	29	11	41
Stroke	185	58	242
Heart disease	116	34	149
Chronic lower respiratory disease	97	37	134
Total	427	139	566

Table 13.21 shows that large reductions in medical cost are possible, up to 85 percent among staff in bars/restaurants under Policy 5. Although policies 3 and 4 are assumed to have lower effectiveness than Policy 5, they could still save between 73 million euro (Policy 2/3) and 146 million euro (Policy 4) annually.

Table 13.21: Estimated annual reductions in medical cost due to ETS exposure among non-smokers for each of the policies, € million

		Indoor workplaces/offices	Bars/restaurants	Total
	Disease	Staff	Staff	
Policy 1	Lung cancer	2	1	3
	Stroke	12	4	16
	Heart disease	7	2	10
	Chronic lower respiratory disease	6	2	9
	Total	27	9	36
Policy2/3	Lung cancer	4	1	5
	Stroke	24	7	31
	Heart disease	15	4	19
	Chronic lower respiratory disease	13	5	17
	Total	55	18	73
Policy 4	Lung cancer	8	3	11
	Stroke	47	15	62
	Heart disease	30	9	39
	Chronic lower respiratory disease	25	10	35
	Total	110	36	146
Policy5	Lung cancer	25	9	35
	Stroke	159	49	208
	Heart disease	100	28	129
	Chronic lower respiratory disease	84	31	115
	Total	369	118	486

Policy 1 = No change from status quo; **Policy 2** = Open method of coordination; **Policy 3** = Commission recommendation; **Policy 4** = Council recommendation; **Policy 5** = Binding legislation

Smokers

Tables 13.22 and 13.23 show similar results for the medical cost due to ETS among smokers.

Table 13.22: Estimated EU-wide medical cost due to ETS exposure among smokers in 2008, € million

	Indoor workplaces/offices	Bars/restaura nts	Total
Disease	Staff	staff	
Lung cancer	45	10	55
Stroke	274	56	330
Heart disease	170	33	203
Chronic lower respiratory disease	147	34	181
Total	636	134	770

Table 13.23: Estimated annual reductions in medical cost due to ETS exposure among smokers for each of the policies, € million

		Indoor workplaces/offices	Bars/restaurants	Total
	Disease	Staff	Staff	
Policy 1	Lung cancer	3	1	4
	Stroke	17	4	21
	Heart disease	11	2	13
	Chronic lower respiratory disease	9	2	12
	Total	41	9	49
Policy 2/3	Lung cancer	6	1	7
	Stroke	35	7	42
	Heart disease	22	4	26
	Chronic lower respiratory disease	19	4	23
	Total	81	17	99
Policy 4	Lung cancer	11	3	14
	Stroke	70	15	85
	Heart disease	44	9	52
	Chronic lower respiratory disease	38	9	47
	Total	163	35	198
Policy 5	Lung cancer	33	9	42
	Stroke	203	48	251
	Heart disease	129	28	156
	Chronic lower respiratory disease	108	29	138
	Total	473	113	587

Policy 1 = No change from status quo; **Policy 2** = Open method of coordination; **Policy 3** = Commission recommendation; **Policy 4** = Council recommendation; **Policy 5** = Binding legislation

Summary

Table 13.24 shows a summary of the estimated medical costs in 2008 and annual reduction in medical costs for each policy option due to ETS exposure among smoking and non-smoking staff in the EU-27, € millions.

Table 13.24: Summary of estimated medical costs in 2008 and annual reduction in medical costs for each policy option due to ETS exposure among smoking and non-smoking staff in EU-27, € million

	Non-smokers			Smokers			Smokers and non-smokers
	Indoor workplaces /offices	Bars/restaurants	Total	Indoor workplaces /offices	Bars/restaurants	Total	Total
Baseline 2008*	427 (27%)	139 (15%)	566 (41%)	636 (44%)	134 (15%)	770 (59%)	1,336
Policy 1	–27	–9	–36	–41	–9	–49	–85
Policy 2/3	–55	–18	–73	–81	–17	–99	–172
Policy 4	–110	–36	–146	–163	–35	–198	–344
Policy 5	–369	–118	–486	–473	–113	–587	–1,073

* The percentage of total (smokers and non-smokers) is shown in brackets

Policy 1 = No change from status quo; Policy 2 = Open method of coordination; Policy 3 = Commission recommendation; Policy 4 = Council recommendation; Policy 5 = Binding legislation

13.2.6 Non-medical cost

In this section we show—separately for non-smokers and smokers—the EU-27 wide annual non-medical cost estimates for the 2008 baseline and each of the five policy alternatives. A summary of the estimated annual non-medical costs due to ETS exposure among smoking and non-smoking staff in the EU-27 is shown at the end of this section (Table 13.29).

Non-smokers

In this section we show the non-medical cost due to ETS, including productivity losses due to premature death and morbidity. Excluding the cost of lung cancer (for which we could not find recent and reliable estimates), the non-medical cost due to ETS for non-smoking staff are slightly less than the medical costs, totalling an estimated €477 million in 2008. Potential savings are estimated at €61 million, €123 million and €407 million for Policy 2/3, 4 and 5 respectively.

Table 13.25: Estimated EU-wide non-medical cost due to ETS exposure among non-smokers in 2008, € million

	Indoor workplaces / offices	Bars/restaurants	Total
Disease	Staff	Staff	
Lung cancer	n/a	n/a	n/a
Stroke	154	54	208
Heart disease	102	31	134
Chronic lower respiratory disease	96	38	135
Total	353	124	477

Table 13.26: Estimated annual reductions in non-medical cost due to ETS exposure among non-smokers for each of the policies, € million

		Indoor workplaces/offices	Bars/restaurants	Total
	Disease	Staff	Staff	
Policy 1	Lung cancer	n/a	n/a	–
	Stroke	10	3	13
	Heart disease	7	2	9
	Chronic lower respiratory disease	6	2	9
	Total	23	8	31
Policy2/3	Lung cancer	–	–	–
	Stroke	20	7	27
	Heart disease	13	4	17
	Chronic lower respiratory disease	12	5	17
	Total	45	16	61
Policy 4	Lung cancer	–	–	–
	Stroke	40	14	54
	Heart disease	26	8	35
	Chronic lower respiratory disease	25	10	35
	Total	91	32	123
Policy5	Lung cancer	–	–	–
	Stroke	131	46	177
	Heart disease	88	27	115
	Chronic lower respiratory disease	83	33	115
	Total	302	105	407

Policy 1 = No change from status quo; **Policy 2** = Open method of coordination; **Policy 3** = Commission recommendation; **Policy 4** = Council recommendation; **Policy 5** = Binding legislation

Smokers

Finally, we show estimates for the non-medical cost due to ETS among smokers in Tables 13.27 and 13.28.

Table 13.27: Estimated EU-wide non-medical cost due to ETS exposure among smokers in 2008, € millions

	Indoor workplaces/offices	Bars/restaurants	Total
Disease	Staff	Staff	
Lung cancer	n/a	n/a	n/a
Stroke	231	52	284
Heart disease	152	31	183
Chronic lower respiratory disease	145	35	180
Total	529	119	647

Table 13.28: Estimated annual reductions in non-medical cost due to ETS exposure among smokers for each of the policies, € million

		Indoor workplaces/offices	Bars/restaurants	Total
	Disease	Staff	Staff	
Policy 1	Lung cancer	n/a	n/a	–
	Stroke	15	3	18
	Heart disease	10	2	12
	Chronic lower respiratory disease	9	2	12
	Total	34	8	42
Policy 2/3	Lung cancer	–	–	–
	Stroke	30	7	36
	Heart disease	20	4	24
	Chronic lower respiratory disease	19	5	23
	Total	68	15	83
Policy 4	Lung cancer	–	–	–
	Stroke	59	14	73
	Heart disease	39	8	47
	Chronic lower respiratory disease	37	9	47
	Total	136	31	167
Policy 5	Lung cancer	–	–	–
	Stroke	166	44	211
	Heart disease	112	26	139
	Chronic lower respiratory disease	107	30	137
	Total	385	100	486

Policy 1 = No change from status quo; **Policy 2** = Open method of coordination; **Policy 3** = Commission recommendation; **Policy 4** = Council recommendation; **Policy 5** = Binding legislation

Summary

Table 13.29 shows a summary of the estimated non-medical costs in 2008 and annual reduction in non-medical costs for each policy option due to ETS exposure among smoking and non-smoking staff in the EU-27.

Table 13.29: Summary of estimated non-medical costs in 2008 and annual reduction in non-medical costs for each policy option due to ETS exposure among smoking and non-smoking staff in EU-27, € million

	Non-smokers			Smokers			Smokers and non-smokers
	Indoor workplaces/offices	Bars/restaurants	Total	Indoor workplaces/offices	Bars/restaurants	Total	Total
Baseline 2008*	353 (27%)	124 (15%)	477 (42%)	529 (44%)	119 (15%)	647 (58%)	1,124
Policy 1	23	8	31	34	8	42	73
Policy 2/3	45	16	61	68	15	83	144
Policy 4	91	32	123	136	32	167	290
Policy 5	302	105	407	385	100	486	893

* The percentage of total (smokers and non-smokers) is shown in brackets

Policy 1 = No change from status quo; **Policy 2** = Open method of coordination; **Policy 3** = Commission recommendation; **Policy 4** = Council recommendation; **Policy 5** = Binding legislation

13.2.7 **Results industry revenues and employment**

Tobacco industry revenues

We estimated 2007 revenues across the entire EU-27 tobacco industry from Eurostat data as €67,089 million. According to the peer-reviewed literature (shown along with the non-peer-reviewed literature in Table D.21, **Appendix D**) the effect of a smoking ban on tobacco revenues ranges from a reduction of 5.5 percent (Cesaroni et al., 2008) to 14 percent (Directorate for Health and Social Affairs, 2005). As discussed in the methods section, we would expect to see about half of this effect if an EU-wide smoking ban would be implemented, because various countries already have smoking bans in place. For the entire EU-27, the expected loss in revenue is within a range from €1,844 million to €4,696 million.

Table 13.30: Estimated lost revenues in tobacco sales and jobs due to EU-wide smoking ban, € million

	2007 estimate	Lost revenues and jobs due to smoking ban	
		Lower bound	Upper bound
		2.75%	7%
EU-27 revenues	67,089	1,844	4,696
EU-27 jobs	53,521	1,472	3,746

Tobacco industry employment

Table 13.30 shows the estimated number of people employed in the tobacco industry (NACE code 160) across the entire EU in 2007. Assuming the ratio of employment/revenue to be constant in the longer run, an EU-wide smoking ban would lead to a loss within a range from 1,472 to 3,746 jobs in the tobacco industry in the longer run. Note that this is not an annual loss (as the other figures are), but rather an overall shrinkage of the tobacco industry workforce. Considering that the current EU-27 labour force contains 218 million workers, even the upper bound estimate on jobs lost would represent less than 0.002 percent of the entire EU-27 labour force.

Hospitality industry revenues

Although the comprehensive Scollo and Lal (2008) review concluded that smoking bans did not have a negative effect on the hospitality industry, we still think it is informative to extrapolate the range of effects reported in the literature to an EU-wide estimate. Table 13.31 shows for countries with no smoking ban for bars/pubs and restaurants the 2008 estimated revenues and expected change in revenues due to an EU-wide smoking ban. The upper and lower bound in the table reflect the large range of effect estimates reported in the literature, varying from a reduction in revenues of 10 percent (Adda et al., 2006) to an increase in revenues by 9 percent (Thomson and Wilson, 2006). As a result, the estimated change in revenues varies between −€11 billion and +€10 billion annually.

Table 13.31: Estimated annual changes in revenues in bar/restaurant and pub sales due to EU-wide smoking ban, € million

Country	Comprehensive smoke-free legislation present	2007 revenues	Change in revenue due to smoking ban	
			Lower bound	Upper bound
			–10%	**9.3%**
Belgium		8,557	–855.7	795.8
Denmark		4,042	–404.2	375.9
Greece				
Spain		42,110	–4,211.0	3,916.3
Finland	Yes			
France	Yes			
Ireland	Yes			
Italy	Yes			
Luxembourg		790	–79.0	73.5
Netherlands	Yes			
Austria		6,944	–694.4	645.8
Portugal		6,936	–693.6	645.1
Sweden	Yes			
Germany West		27,000	–2,700.0	2,511.0
United Kingdom	Yes			
Bulgaria		726	–72.6	67.5
Cyprus		980	–98.0	91.2
Czech Republic		2,783	–278.3	258.8
Estonia	Yes	305		
Hungary		1,909	–190.9	177.5
Latvia	Yes	447		
Lithuania	Yes			
Malta	Yes			
Poland		3,461	–346.1	321.9
Romania		1,345	–134.5	125.0
Slovakia		860	–86.0	80.0
Slovenia	Yes			
			–10,758.2	**10,005.1**

The expected effect on hotel revenues (−0.054 percent, as reported by NHS Health Scotland et al., 2005) is much smaller compared with the effect on bars/restaurants and pubs. Given that hotel revenues represent 30 percent of total revenues in the hospitality sector, the expected loss from an EU-wide smoking ban is estimated at €17.6 million annually.

Hospitality industry employment

Table 13.32 shows the expected change in employment (in 1,000 workers) due to an EU-wide smoking ban. Following the range of effect estimates reported in the literature, McCaffrey et al. (2006) reported an 8.82 percent reduction while Thomson and Wilson (2006) reported a 9 percent increase, the resulting (one-time) change is in the range of 265,000 jobs lost to 271,000 jobs gained.

Table 13.32: Estimated changes in employment (1,000 workers) in bar/restaurant and pub sales due to EU-wide smoking ban

Country	Comprehensive smoke-free legislation present	2007 employment	Change in employment due to smoking ban	
			Lower bound	Upper bound
			−8.82%	+9%
Belgium		140	−12.4	12.6
Denmark		81	−7.1	7.3
Greece				
Spain		981	−86.6	88.3
Finland	Yes			
France	Yes			
Ireland	Yes			
Italy	Yes			
Luxembourg		12	−1.1	1.1
Netherlands	Yes			
Austria		144	−12.7	12.9
Portugal		235	−20.7	21.1
Sweden	Yes			
Germany West		809	−71.4	72.8
United Kingdom	Yes			
Bulgaria		87	−7.6	7.8
Cyprus		19	−1.7	1.7
Czech Republic		122	−10.7	11.0
Estonia	Yes	14		
Hungary		105	−9.3	9.5
Latvia	Yes	27		
Lithuania	Yes			
Malta	Yes			
Poland		177	−15.6	15.9
Romania		99	−8.7	8.9
Slovakia		22	−1.9	2.0
Slovenia	Yes			
			−265.4	270.9

13.2.8 Estimated effects of smoke-free legislation on the cost of fires, cleaning, and redecoration costs

The total savings related to the cost of fires, cleaning and redecoration resulting from a smoking ban estimated in the four impact assessments for the UK added up to £197 million, or 0.015 percent of the 2006 UK GDP. Applying this fraction to the GDP of member states that did not have a full smoking ban by 2008, led to an extrapolated figure for annual EU-wide savings from a smoking ban (Policy 5) of €965 million.

13.2.9 **Estimated effects of smoke-free legislation on mortality due to reduction in smoking**

As discussed in the methods chapter, the four UK impact assessments found different ratios between the number of deaths averted due to ETS exposure and reduction in active smoking. By applying the three most reasonable ratios (27/13, 260/406, and 120/253) to our estimated number of 2,151 averted deaths from ETS under Policy 5, we found that an EU-wide smoking ban would lead to 4,467, 1,377, or 1,020 averted deaths from reductions in active smoking, depending on the ratio chosen.

13.3 Discussion and conclusion

Our analysis has shown that the current burden of ETS is substantial. Even under conservative assumptions (the requirement of being exposed for at least an hour daily), 2,500 non-smoking EU citizens of working age die each year due to ETS exposure at the place where they work. More than 1,700 of these are due to exposure in indoor workplaces/offices, equal to an average of more than seven deaths per regular business day (Table 13.33). The total annual costs among non-smoking and smoking staff combined, estimated at almost €2.5 billion, are substantial. To provide a comparison, they almost equal the worldwide WHO proposed 2006–07 budget. At the same time, we know from countries (for example Ireland) with smoke-free legislation that exposure levels can drop considerably and approach zero if a ban on smoking at specific venues is implemented and enforced. It is reasonable to expect a similar reduction would be possible in other countries as well, in case EU-wide smoke-free legislation (policy option 5) would be implemented. As our analysis shows, up to 85 percent of deaths due to ETS among employees in the workplace could be prevented. Given that not only staff but also non-staff members are being exposed to ETS in workplaces and bars/restaurants, the number of (preventable) deaths due to ETS in the entire population is likely even larger.

In case the EU would choose to adopt less stringent smoke-free policies compared with option 5, for example a Commission or Council recommendation, the number of prevented deaths and savings from non-medical costs is still considerable, but substantially less than under option 5.

It is interesting to compare our results with the most recent reported estimates in the literature, in particular those by Jamrozik (Smokefree Partnership, 2006). Jamrozik estimated 2,799 non-smokers across the EU-25 died in 2002 due to ETS exposure at workplaces (including the hospitality industry). This estimate is remarkably close to our estimate of 2,500 deaths due to ETS (combined for non-smoking staff in indoor workplaces/offices and bars/restaurants). However, our estimates for the number of deaths among non-smoking staff in bars/restaurants (786) is much higher than what Jamrozik reports for the hospitality industry (89). As far as we know no recent comprehensive direct estimates have been reported for the medical and non-medical cost of ETS, which makes it difficult to compare our findings in this area to existing work.

The method underlying our analysis is similar in many respects to various country-specific impact assessments on smoke-free legislation. For example, the impact assessments for Northern Ireland and Scotland applied a population attributable risk factor to the incidence of lung cancer, ischaemic heart disease and stroke to estimate the annual number of deaths caused by ETS, in addition to the costs resulting from morbidity due to these diseases and attributable to ETS.

It should be noted that our estimates only consider (changes in) exposure to ETS among staff members in indoor workplaces/offices, bars/restaurants, and pubs. However, visitors of these places will likely be exposed to ETS as well, in case staff members report to be exposed. It is expected that the policies considered examined in this report would not only affect exposure among staff but also among these visitors. It is difficult to estimate the effect on non-staff members, because reliable data on ETS prevalence in this group is not currently available. All we can say is that most likely the population of non-staff members in bars/restaurants and pubs is substantially larger than the population of staff members (for example a restaurant with ten staff will likely serve many more than ten guests during one evening), and hence the absolute number exposed to ETS is much larger for non-staff members. At the same time, the time of exposure (in hours per day) is likely lower for non-staff compared with staff, making it difficult to compare the risk of exposure and resulting burden.

Likewise, a (relatively small) number of people are exposed to ETS in other work places and (fairly substantial) number at home. For the latter category, reliable prevalence estimates were not available from the Eurobarometer dataset, and hence we were not able to estimate the burden due to ETS exposure at home. However, we should also note that the policies considered in this report do not directly aim to reduce ETS exposure at home.

As we discussed in the methods chapter, we were not able to obtain reliable and recent estimates on the costs of lung cancer, asthma, and COPD, neither for individual member states, nor for the EU as a whole. Although the European Lung White Book contains estimates on the costs of these diseases, they are of limited value as they are not very recent (estimates for the year 2000) and apply to the EU-15, in addition to Norway and Switzerland, rather than the EU-27. Because of our preference to use estimates published in the peer-reviewed literature[38], we instead opted for a different method based on US cost figures published in the peer-reviewed literature, and expressed these as a ratio of total US health care costs. It is useful to compare our estimates to those reported in the European Lung White Book.

For lung cancer (the total cost of lung cancer, both resulting from ETS and from other causes), the direct medical costs we estimated were €9.6 billion, whereas the European Lung White Book estimated these as €2 billion in 2000, which would be €3.8 billion in 2008 (assuming an average 8 percent annual increase in health care expenditures, based on calculations we made using OECD Health Data). Given that the latter estimate applies to only 15 member states, our estimate does not diverge by an order of magnitude from the European Lung Whitebook. Performing the same exercise for COPD, our estimate was €18 billion, whereas the 2008 extrapolated European Lung Whitebook estimate would be

[38] We preferred to use estimates from the peer-reviewed literature, specifically due to the peer-review process.

€18.9 billion. Finally, for asthma these figures would compare as €6.1 billion (ours) and €14.6 billion (European Respiratory Society, 2003).

It might be useful to compare our medical cost estimates to (extrapolated) estimates from the UK impact assessments (NHS Health Scotland et al., 2005; Department of Health 2006; Department of Health 2007; Welsh Assembly Government, 2007). Potential savings in treatment costs under a complete smoking ban were estimated at £110.818 million at 2003 prices (Northern Ireland £2.6 million; England £100 million; Scotland £5.318 million; and Wales £2.9 million), or 0.13 percent of the UK's 2003 expenditure on health care (£86,529 million in 2003 according to OECD Health Data). We applied this percentage to the predicted 2008 expenditure on health care in all EU-27 countries that did not have a smoking ban in 2008, and half the percentage to all EU-27 countries that had a partial smoking ban. The resulting savings from a total smoking ban based on this extrapolation are €682 million. This is somewhat higher than our estimated savings under policy option 5 for non-smoking staff (€486 million) and considerably lower than our estimated savings under that same policy option for non-smoking and smoking staff combined (€1,073 million).

Table 13.33: Estimated number of deaths attributable to passive smoking among non-smoking staff in the EU-25 in 2002 and EU-27 in 2008

	Non-smokers			
	Indoor workplaces/offices		Bars/restaurants	
Disease	EU-25 2002	EU-27 2008	EU-25 2002	EU-27 2008
Lung cancer	521	387	16	156
Ischaemic heart disease	1,481	384	48	160
Stroke	596	378	19	138
Chronic lower respiratory disease	201	565	6	332
Total	**2,799**	**1,714**	**89**	**786**

Based on the analysis presented in this chapter, we can conclude that the burden of ETS is (still) substantial. Under the assumption that individual Member States will take limited action in further adopting smoke-free legislation, EU-level legislation has the potential of averting at least 2,150 annual deaths among non-smoking workers in indoor workplaces/offices and bars/restaurants, and saving over €1 billion annually in combined medical and non-medical cost for non-smokers. The exact policy instrument chosen can have an important effect on the expected savings, and requires careful consideration in the political debate.

We know from the literature that smoke-free policies can have substantial effects on industry revenues, in particular those of the tobacco and hospitality sector[39]. The extrapolations we made based on an EU-wide smoking ban show that such losses can amount to €1.9 billion annually for the tobacco industry. However, this estimate is very sensitive to the exact effect assumed, making it difficult to provide an exact quantification across the policy options. This is even more the case for the effects on the hospitality industry, where the literature reports contradictory evidence—both positive and negative effects on revenue, leading to extrapolated increases and reduction in revenues due to EU-wide smoke-free legislation in the order of €10 billion annually. Further research would be necessary to obtain a more conclusive estimate than is currently available from the literature.

13.4 Study limitations

It is important to note that our study results should be interpreted with caution and are subject to substantial limitations. In this section we will discuss the most important limitations.

First, we should stress that all cost and outcome figures reported as part of the quantitative analysis should be treated as estimates—approximations of the true values. This is because these estimates typically relate to future situations under different scenarios, and are affected by many factors subject to considerable uncertainty itself. In addition, the data feeding into our calculations is likely subject to measurement error, of which the magnitude in most cases is undocumented. It was outside of the scope of this study to provide statements on the degree of uncertainty around these estimates (e.g. standard errors, or confidence bounds), or to test whether differences in estimates across the policy options were statistically significant.

A second major limitation of this study is that we were confronted with some instances where we were not able to find valid and reliable estimates of costs and outcomes. In particular, this was the case for the costs of lung cancer, respiratory diseases and reductions in the number of deaths among smokers as a direct result of reductions in the number of smokers due to smoke-free legislation (either due to people quitting smoking, smoking less, or not starting smoking). In these cases we had to infer these estimates by extrapolating estimates from either the US or the UK to (the rest of) Europe. Obviously, such out-of-sample extrapolations are not without controversy, and limit the reliability of our estimates. During the research process we made every effort to collect accurate European data on the costs of lung cancer and respiratory diseases, but had to conclude such data simply do not exist[40].

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[39] See section 8.2 for an extensive overview of the effect of smoke-free policies on industry revenues.

[40] This lack of data was further confirmed when the European Commission contacted their network of public health staekholders, asking for these estimates. The sources suggested by these stakeholders (such as the European Lung Whitebook) did not yield the required data to complete the analysis using European cost data on lung cancer and respiratory diseases.

A third important limitation is that the exact effect of each of the five policy options on ETS exposure cannot easily be predicted. There is considerable uncertainty how these policy options will interact with national policies, and the speed at which individual Member States would adopt national policies in the absence of EU-level regulation. Using expert opinion to predict the effect of the five policies has inherent limitations as well, notably due to its subjective nature.

As we explained in section 13.1.3, we based our predictions regarding the effects of the five policy options on discussions with legislators from the European Commission, and verified these predictions using the informed opinions from stakeholders that participated in a public stakeholder meeting organised by the European Commission. We collected these opinions in a structured way (delphi method). Any imbalance in the sample of 15 respondents is a result of non-response or the fact that certain stakeholder groups could have been under-represented at the stakeholder meeting, and not from any selection on our side. Still, we should note that the sample was a purposive sample of all major EU-level stakeholders and not randomly drawn from all possible stakeholders.

Fourth, the estimates we used for the relative risk associated with ETS and specific diseases do not differentiate between exposure time and severity. By excluding exposure under 1 hour from our estimates, we have tried to be conservative in our baseline estimates.

Fifth, the Eurobarometer data we used for estimates of the prevalence of ETS are based on a sample drawn from the populations of each of the 27 Member States. The size of these samples is about 1,000 respondents for the majority of the countries and is based on multi-stage random sampling. Because we did not have data on the number of non-respondents, the potential bias due to non-response is unknown. E.g., if people exposed to ETS would somehow be less (more) likely to respond to the eurobarometer survey, the prevalence in the sample would be lower (higher) than the prevalence in the underlying population. Although a sample of 1,000 people seems quite substantial, we should note that sample sizes for the different subpopulations in our study (e.g. non-smoking staff working in bars/restaurants) are much smaller. As a result, the uncertainty around these prevalence estimates, and all subsequent estimates that are based on these prevalence estimates, is likely high.

Finally, there is considerable uncertainty regarding the effect of smoke-free policies on industry revenues and employment. In particular, we were not able to locate much evidence about the degree of proportionality for effect between revenues and employment in the tobacco industry. Our assumption of a fully proportional relationship between revenues and employment might overstate the loss of jobs due to smoke-free legislation if the true relationship would be Cobb-Douglas shaped.

CHAPTER 14 Analysis of impacts and comparison of policy options

14.1 Introduction

The purpose of this chapter is twofold. First, it analyses the impacts that can be expected to occur as a consequence of implementing each policy that the Commission may wish to introduce. Second, it compares them so as to allow consideration of the strengths and weaknesses of the policy options.

We identify the health, economic, environmental, and social impacts of each policy, why they occur and who is affected. This involved identifying those impacts that are expected to occur, but also possible unintended impacts. In this chapter the relevant evidence from previous chapters has been brought forward and applied to the EU-27.

14.2 Health impacts

14.2.1 Effects on population health

As demonstrated in the previous chapters the evidence relating the health impacts of ETS is strong and fairly precise. There is clear and undisputed evidence that ETS exposure harms individual and public health. This section summarises the expected impacts of the proposed policy options on population health.

The effects on premature mortality

By reducing the prevalence of ETS exposure, an EU initiative could be expected to reduce mortality from major ETS-associated diseases (lung cancer, stroke, heart disease, and chronic lower respiratory disease) and increase healthy life years. For each policy option, the estimated reduction in premature mortality across these diseases due to reduced ETS exposure in bars/restaurants and indoor workplaces/offices has been quantified for two groups: smoking and non-smoking staff. The expected reduction in annual deaths under each policy is summarised in Table 14.2.

As shown in the table, a binding legislation (Policy 5) will have the largest expected reduction in annual deaths, up to 1,487 deaths among non-smoking staff in indoor workplaces/offices, and 664 deaths among non-smoking staff in bars/restaurants. The expected reduction in annual deaths among smoking staff in both settings is even greater.

In comparison, the reductions in pre-mature deaths for the first four policies are only modest. Overall these estimates are probably conservative since they only include reduction of deaths associated with reduced ETS exposures among staff and exclude non-staff members, such as customers. In addition, the estimates do not include settings other than bars/restaurants and indoor workplaces/offices where ETS exposures may occur, such as outdoor workplaces (such as building sites), and government, education, transport, and healthcare facilities. Nevertheless, in most Member States we expect ETS exposures to be relatively low or eliminated in these settings because of existing smoking bans.

It is important to note that the full effect of reduced exposure to ETS may take longer to be realised for some diseases (such as lung cancer) but may occur earlier for others (such as short term respiratory symptoms). Thus, the effects on mortality should be regarded as annual deaths prevented in the longer run. Even though these expected effects will not fully materialise until a certain number of years has passed, the earlier a policy could be implemented, the larger the total benefits (over a series of years) will be. Other acute health benefits, such as improved respiratory symptoms in bar workers, which are described below, may accrue very rapidly.

The most recent estimates of the number of deaths attributable to ETS reported in the literature are those by Jamrozik (Smoke Free Partnership, 2006). Jamrozik estimated 2,799 non-smokers across the EU-25 died in 2002 due to ETS exposure at workplaces (including the hospitality industry). This estimate is remarkably close to our estimate of 2,500 deaths due to ETS (combined for non-smoking staff in indoor workplaces/offices and bars/restaurants). However, our estimates for the number of deaths among non-smoking staff in bars/restaurants (786) are much higher than what Jamrozik reports for the hospitality industry (89).

It is possible to compare the number of deaths from ETS exposure relative to other involuntary risks, such as air pollution, unintentional injuries, and alcohol-related deaths (Table 14.1). The number of premature deaths among smoking and non-smoking staff attributable to SHS (6,007) is a lot smaller than other involuntary causes such as traffic air pollution (over 21,000); however, it is reasonably close to the number of people experiencing occupationally acquired noise induced hearing loss (6,374) and the number of road accident fatalities for children (6,389). It should be noted that our estimate of the number of deaths attributable to ETS is conservative since it only includes smoking and non-smoking staff and excludes non-staff members, and it does not account for ETS exposures that may occur in other venues, such as home.

Table 14.1: Benchmarking deaths attributable to ETS against other involuntary risks

Attributable cause	Estimated annual deaths in Europe
ETS exposure (among **non-smoking** indoor workplace/office and bar/restaurant staff)	2,011
ETS smoke (among **smoking** indoor workplace/office and bar/restaurant staff)	2,896
Asbestos-induced lung cancer (UK only)[1]	5,000
ETS smoke (among **non-smoking and smoking** indoor workplace/office and bar/restaurant staff)	**6,007**
Road traffic accidents (< 15 years old)[2]	**6,389**
Occupationally acquired noise induced hearing loss[3]	6,734
Poisonings[2]	14,516
Alcohol-related deaths from traffic accidents[4]	17,000
Mortality due to traffic air pollution (France, Austria, Switzerland only)[5]	21,802
Falls[2]	23,853
Drownings[2]	27,705
Fires[2]	31,971
Road traffic accidents (15–59 years old)[2]	93,502
Total Road traffic accidents[2]	132,832

SOURCE:

[1] UK estimate only http://www.tuc.org.uk/h_and_s/index.cfm?mins=262
[2] Estimated number of deaths in EURO WHO Region for 2002, see: http://www.who.int/healthinfo/bodgbd2002revised/en/index.html
[3] EU-15 http://riskobservatory.osha.europa.eu/hearingloss/summary_html
[4] Anderson, P. The impact of alcohol in Europe
[5] Kunzli et al. (2000) Public-health impact of outdoor and traffic-related air pollution: a European assessment

The effects on respiratory symptoms among bar workers

By reducing the prevalence of ETS, an EU initiative could be expected to substantially reduce the effects on respiratory symptoms among bar workers. Studies have shown substantial reductions in respiratory symptoms as a result of smoke-free legislation. In Scottish bar workers a 32 percent reduction in respiratory and sensory symptoms was found two months post the smoke-free ban. One year post the smoke-free ban in Scotland, self-reported respiratory symptoms among Scottish bar workers had reduced by 16 percent. This is similar to the reported reductions in respiratory symptoms among Irish bar workers one year post implementation of the smoking ban in Ireland. Other studies in Spain and the US have reported reductions in respiratory symptoms after smoking bans among hospitality workers between 20 and 50 percent.

As we discussed above, the evidence suggests that smoking bans lower ETS exposure, which in turn has an effect on the risk of getting lung cancer, heart disease, stroke, and respiratory disease. This means it is likely that the effect of smoking bans on morbidity is wider than just the effects found above. However, proving these effects directly (finding evidence of a decrease in lung cancer incidence following smoke-free legislation) is difficult, because it can take many years before such effects will become observable.

While it was not possible to quantify the expected reduction in respiratory symptoms associated with each policy option for the EU-27, based on the existing literature we can expect the highest reductions in respiratory symptoms to be associated with binding legislation (policy option 5) (++++). As shown in summary Table 14.2, the lowest reductions (+) in respiratory symptoms are likely to be associated with "no change from status quo" (policy option 1).

The effects on coronary events

By reducing the prevalence of ETS, a, EU initiative could also be expected to substantially reduce the effects on coronary events (e.g. heart attacks). As discussed in Chapter 8, various studies have shown substantial reductions, including an 11.2 percent reduction in acute coronary events for residents 35–64 years old after implementation of a smoking ban in Italy, and in Scotland a 17 percent reduction in heart attack admissions across nine hospitals one year after the smoke-free ban.

While it was not possible to quantify the expected reduction in coronary events associated with each policy option for the EU-27, based on the existing literature we can expect the highest reductions in coronary events to be associated with binding legislation (policy option 5) (++++). As shown in Table 14.2, the lowest reductions (+) in coronary events are likely to be associated with "no change from status quo" (policy option 1).

Additional health effects

It is important to note that the policies under consideration are expected to contribute to additional health benefits such as smokers reducing their consumption and deciding to quit; and thus achieving a reduction in smoking prevalence. These parallel impacts carry a substantial potential by contributing to the decrease of the burden that is associated with smoking at the societal level. These expected impacts across the five policy options are summarised in Table 14.2. While it was not possible to quantify the additional health benefits associated with each policy option for the EU-27, based on the existing literature we can expect the largest health benefits (++++) to be associated with binding legislation (policy option 5) and the smallest health benefits (+) associated with "no change from status quo" (policy option 1).

Reduced smoking consumption and deciding to quit

Estimates on reductions in cigarette consumption due to smoking bans range from 1.2 to 3 cigarettes per day at the individual level (Gallus et al., 2006; Cesaroni et al., 2008; and Chapman and Freeman, 2008), and 4 percent to 29 percent at the population level (Gallus et al., 2006; Cesaroni et al., 2008; and Chapman and Freeman, 2008). Various studies have reported people quitting smoking after the implementation of smoking bans. Estimates from studies in Italy, Ireland, and Spain suggest 9 percent to 15 percent people quit smoking after implementation of smoking bans (Directorate for Health and Social

Affairs 2005; Gorini et al., 2007; Salto et al., 2007). Moreover, in Ireland, among smokers who quit following the smoking ban, 80 percent reported that the ban helped them quit, and 88 percent declared the law had helped them not to start smoking again (Fong et al., 2006).

Reduced smoking prevalence

Eight studies and two reviews showed moderate reductions in smoking prevalence after the introduction of smoking bans, both inside and outside Europe (Heloma et al., 2000; Fong et al., 2006; Gallus et al., 2006; Braverman et al., 2007; Gorini et al., 2007; Greiner et al., 2007; and Office of Tobacco Control, 2007; Fichtenberg and Glantz, 2002; NHS Health Scotland et al., 2005). Estimates are typical in the range of about 2 to 6 percentage point reduction and this is likely to bring about additional reductions in ETS-related harm.

Previous UK impact assessments have estimated the number of deaths averted due to ETS exposure and reduction in active smoking. For example the Northern Ireland health and regulatory impact assessment estimated 13 deaths in the workplace could be averted annually, while 27 deaths could be averted if there was a reduction in smoking prevalence across the entire population. In other words, the estimated number of averted deaths from a reduction in smoking prevalence is estimated at more than twice the estimated number of deaths from a reduction in ETS exposure in the workplace. Based on applying the most reasonable ratios from the Northern Ireland, Scottish, and Wales assessment, under Policy 5, an EU-wide smoking ban would lead to 1,020, 1,377, or 4,467 averted deaths from reductions in active smoking (depending on the ratio applied).

Workplace smoking bans have also been shown to reduce smoking prevalence among particular groups, such as teenagers, and in a particular setting such as at home. These impacts may be somewhat unintended but contribute to reducing ETS-related harm.

Two studies reported substantial reductions in smoking prevalence among teenagers after introduction of community smoking bans or smoking restrictions in the home and workplace. The WHO (2007) reported a reduction in prevalence among teenagers living in communities with smoke-free laws versus none of 17.2 percent. Another study reported teenagers who work in places that are smoke-free are nearly one-third less likely to have smoked than those with jobs where smoking is permitted (Farkas et al., 2000).

Finally, four studies reported reductions in the prevalence of smoking at home after the introduction of smoking bans, ranging from 5 to 20 percentage point reductions. A qualitative study of smoking in the home after the smoke-free legislation in Scotland found most adults had reported that they restricted smoking in the home, with a range of restrictions across social classes and home smoking profiles. Spatial, relational, health, and aesthetic factors influenced the development of restrictions. Children and grandchildren were important considerations in the development of restrictions (Phillips et al., 2007). Currently, the CHETS (Changes in Child Exposure to ETS) study in Scotland is measuring changes in children's exposure to ETS and assessing whether displacement has taken place in the homes of smokers (Godfrey, 2007). In Australia, smoke-free workplaces were followed by a doubling of home with smoking restrictions. In New Zealand reported exposures to smoking in the home has nearly halved over three years from 2003 to 2006 and one in 2006, just over one in ten people reported exposure to SHS at home during the past seven days (Waa and McGough, 2006). Furthermore, results from a survey carried out in New Zealand suggested that the number of care givers who allow smoking inside their home had decreased by one-third between 2003 and 2006 (HSC, 2006). A study cited in Chapman and Freeman (2008) found that among factors that positively predicted having a smoke-free home was "believing smoke free was normative."

Summary

In summary, due to its binding nature, Policy 5 would bring the maximum possible reductions in ETS-related harm since ETS exposure is virtually eliminated in indoor workplaces. However, the implementation would take longer than would be the case with policy option 4 (Council recommendation). The health benefits of Policy 1 ("no change from status quo") would bring the least reductions in ETS prevalence and related harm. The existing trend towards smoke-free could be expected to continue but at a slower pace. The effects of Policy 2 and Policy 3 would be similar and they would bring only modest reductions in ETS compared with option 1. The implementation of "open method of coordination" may be slow and not well suited to tackling a problem like ETS. The impact of a Commission recommendation would be limited by the fact that it may not create a sense of commitment among Member States. Policy Option 4 is expected to have a larger health benefits due to the ownership effect. The impact could be expected to materialise relatively quickly.

Table 14.2: Expected health impacts of different policy options

	Setting	Policy 1 Status quo	Policy 2/3 OMC/Commission Recommend	Policy 4 Council Recommend	Policy 5 Binding legislation
Reduction in **pre mortality** among **non-smokers**	Indoor workplace/office staff (A)	110	221	443	1,487
	Bar/restaurant staff (B)	51	101	203	664
Reduction in **pre mortality** among **smokers**	Indoor workplace/office staff (C)	173	346	693	2,046
	Bar/restaurant staff (D)	53	105	210	687
Reduction in **pre mortality** among **smokers and non-smokers**	Indoor workplace/office staff (A+C)	283	567	1,136	3,533
	Bar/restaurant staff (B+D)	104	206	413	1,351
	Both setting (A+B+C+D)	386	774	1,550	4,884
Reduction in respiratory symptoms	Bar/restaurant staff	+	++	+++	++++
Reduction in coronary events	Both settings	+	++	+++	++++
Reduction in mortality from reduced active smoking	Indoor workplace/office staff and bar/restaurant staff	+	++	+++	++++
Reduced cigarette consumption		+	++	+++	++++
Quitting smoking		+	++	+++	++++
Reduced smoking prevalence		+	++	+++	++++
Key: Benefits (+): minimal (+); moderately-small (++); moderately-large (+++); large (++++) Costs (-): minimal (-); moderately-small (--); moderately-large (---); large (----)					

14.3 Economic impacts

This section summarises the expected economic impacts of the proposed policy options in four areas: medical and non-medical costs, the tobacco industry, the hospitality industry, the pharmaceutical industry, and for workplaces in general.

14.3.1 Economic impacts for medical and non-medical costs

By reducing the prevalence of ETS exposure, an EU initiative can also be expected to reduce medical and non-medical costs associated with major ETS-associated diseases (lung cancer, stroke, heart disease, and chronic lower respiratory disease) and result in substantial cost savings.

For each policy option, the estimated annual reduction in medical and non-medical costs across these diseases due to reduced ETS exposure in bars/restaurants and indoor workplaces/offices has been quantified for two groups: smoking and non-smoking staff. The expected annual reduction in medical and non-medical costs under each policy is summarised in Table 14.3.

Medical costs include primary care, accident and emergency care, hospital inpatient care (including day cases and cardiac rehabilitation systems), outpatient care, and medications. As shown in the table, a binding legislation (Policy 5) will have the largest expected annual reduction in medical costs, up to €369 million among non-smoking staff in indoor workplaces/offices, and €118 million among non-smoking staff in bars/restaurants. The expected reduction in medical costs among smoking staff in both settings is even greater. In comparison, the reductions in medical costs for the first four policies are only modest.

Non-medical costs include informal care, productivity costs due to mortality and productivity costs due to morbidity (such as sickness absences). As shown in the table, a binding legislation (Policy 5) will have the largest expected annual reduction in non-medical costs, up to €302 million among non-smoking staff in indoor workplaces/offices, and €105 million among non-smoking staff in bars/restaurants. The expected reduction in non-medical costs among smoking staff in both settings is even greater. In comparison, the reductions in non-medical costs for the first four policies are only modest.

Similarly to the previous health benefit estimates; these estimates are probably conservative since they only include reduction of medical and non-medical costs associated with reduced ETS exposures among staff and exclude non-staff members, such as customers. In addition, the estimates do not include settings other than bars/restaurants and indoor workplaces/offices where ETS exposures may occur, such as outdoor workplaces (for example building sites), and government, education, transport, and healthcare facilities. Nevertheless, in most Member States we expect ETS exposures to be relatively low or eliminated in these settings because of existing smoking bans.

Regulatory impacts assessments in the UK have also shown the monetary health benefits as a result of comprehensive smoke-free legislation to be substantial. The annual monetary health benefits due to reductions in active and passive smoking were estimated at £3,211–3,621 million in England, £155.9 million in Wales, £221.5 million (range: £44.4–399.3 million) in Scotland, and £55.1 million in Northern Ireland (Table 14.4).

Table 14.3: Expected economic impacts on health care costs due to reduced ETS across the five policy options, € million

	Setting	Policy 1 Status quo	Policy 2/3 OMC/Commission Recommend	Policy 4 Council Recommend	Policy 5 Binding legislation
Reduction in medical cost among non-smokers	Indoor workplace/office staff (A)	27	55	110	369
	Bar/restaurant staff (B)	9	18	36	118
Reduction in medical cost among smokers	Indoor workplace/office staff (C)	41	81	163	473
	Bar/restaurant staff (D)	9	17	35	113
Reduction in medical cost among smokers and non-smokers	Indoor workplace/office staff (A+C)	68	136	273	842
	Bar/restaurant staff (B+D)	18	35	71	231
	Both settings (A+B+C+D)	85	172	344	1,073
Reduction in non-medical cost among non-smokers	Indoor workplace/office staff (E)	23	45	91	302
	Bar/restaurant staff (F)	8	16	32	105
Reduction in non-medical cost among smokers	Indoor workplace/office staff (G)	34	68	136	385
	Bar/restaurant staff (H)	8	15	32	100
Reduction in non-medical cost among smokers and non-smokers	Indoor workplace/office staff (E +G)	57	113	227	687
	Bar/restaurant staff (F+H)	16	31	64	205
	Both settings (E+F+G+H)	73	144	290	893

Table 14.4: Expected health benefits and resources savings from comprehensive smoke-free legislation in UK impact assessments

		England*	Northern Ireland**	Scotland*	Wales***
Health benefits					
Economic value of lives saved	Reduced exposure to ETS	371 (21 employees + 350 customers)	5.47	91.4 (range: 16.8–176.7)	86.9
	Reduced active smoking	1,780 (1,600 employees + 180 customers)	19.35	108.5 (range: 11.7–169.7)	46.8
	Reduced uptake of smoking	550	–	-	–
Morbidity savings (human cost of ill health)	Reduced exposure to ETS	–	14.42	12.8 (range: 10.8–36)	12.6
	Reduced active smoking	–	11.14	–	–
Resource savings					
NHS treatment costs	Reduced exposure to ETS		4.10	5.3 (range: 4.5–11.5)	2.9
	Reduced active smoking	100		2.8 (range: 1.2–4.2)	2.2
Reduced sickness absence	Reduced exposure to ETS	70–140	0.6	4.1–5.2	4
	Reduced active smoking			0.8 (range: 0.34–1.2)	0.47
Production gains (from reduced exposure to ETS)		340–680	–	–	–
Total (£ million)		**3,211–3,621**	**55.08**	**221.5** (range: 44.4–399.3)	**155.87**

NOTES:

* Annual benefits

** Annual benefits based on 30 years' appraisal

*** Annual net present value based on 30 years' # appraisal

14.3.2 Economic impacts for tobacco industry

Tobacco industry revenues

The revenue from tobacco sales across the EU-27 is estimated at €67,089 million. According to the peer-reviewed literature the effect of a smoking ban on tobacco revenue ranges from a reduction of 5.5 percent to 14 percent. One could expect to see about half of this effect if an EU-wide smoking ban would be implemented, because various countries already have smoking bans in place. For the entire EU-27, the expected loss in revenue under Policy 5 varies between €1,844 and €4,696 million.

It is interesting to note that the regulatory impact assessment for England estimated the annual loss of profit to the tobacco industry and tobacco retailers to be slight over two times greater at £97 million with a full ban, compared with voluntary action (equivalent to "no change from status quo") at £43 million.

Tobacco industry employment

The number of staff employed in the tobacco industry across the entire EU in 2008 is estimated at 53,521 million. Assuming the ratio of employment/revenue to be constant in the longer run, an EU-wide smoking ban (policy option 5) would lead to a loss of at least 1,472 jobs (lower estimate) in the tobacco industry in the longer run (Table 14.5). Note that this is not an annual loss, but rather an overall shrinkage of the tobacco industry workforce. Considering that the current EU-27 labour force contains 218 million workers, even the upper bound estimate on jobs lost would not represent more than 0.001 percent of the entire EU-27 labour force. The magnitude of impacts would be somehow smaller under policy options 4 and 2/3 and significantly smaller under options 1–3.

Table 14.5: Estimated lost revenues in tobacco sales and jobs due to EU-wide smoking ban (Policy 5)

Costs	2007 estimate	Lower bound	Upper bound
		2.75%	7%
EU-27 revenues	€67,089 M	€1,844 M	€4,696 M
EU-27 jobs	53,521	1,472	1,579

14.3.3 **Economic impacts for the hospitality industry**

Hospitality industry revenues

The revenue for bars/restaurants for EU countries with no smoking bans stands at €109 billion, and the number of staff employed in this sector is approximately 3 million. Based on the comprehensive Scollo and Lal (2008) review it is expected that an EU initiative would have no major impact on the hospitality industry. A summary of Scollo and Lal (2008) findings are shown in Box 14.1.

However, it is still informative to extrapolate the range of effects reported in the literature to an EU-wide estimate. It is expected changes in revenues in bar/restaurant and pub sales due to an EU-wide smoking ban (Policy 5) will vary from a reduction in revenues of 10 percent to an increase in revenues by 9 percent. As a result, the estimated change in revenues varies between −€11 and +€10 billion annually.

Box 14.1: Summary of studies assessing the economic impact of smoke-free policies in the hospitality industry

- No negative economic impact from the introduction of smoke-free policies in restaurant and bars is indicated by 47 of the 49 studies where findings are based on an objective measure such as taxable sales receipts, where data points several years before and after the introduction of smoke-free policies were examined, where changes in economic conditions are appropriately controlled for, and where appropriate statistical tests are used to control for underlying trends and fluctuations in data.
- One of the two studies meeting all four of Siegel's criteria that did find a negative impact (Evans, 2005), was not peer-reviewed and was based on assessments from a highly selective sample of proprietors. The other (Lal and Siahpush, 2008) assessed the impact of smoke-free policies in gaming venues, a measure intended to reduce problem gambling in Victoria and introduced in parallel with a number of other measures aimed at reducing worrying levels of spending among low-income earners living in neighbourhoods with high numbers of poker machines in accessible venues such as corner pubs.
- Apart from the notable exception of Lal and Siahpush (2008), studies concluding a negative economic impact have predominantly based findings on outcomes predicted before introduction of policies, or on proprietors' subjective impressions or estimates of changes rather than actual, objective, verified, or audited data. These studies were funded predominantly by the tobacco industry or organisations allied with the tobacco industry.
- Almost none of the studies finding a negative impact are published in peer-reviewed journals.

SOURCE: Adapted from: Scollo and Lal (2008)

Previous regulatory impact assessments which have estimated the economic impacts for the hospitality sector have reported a range of estimates. Overall there appears to be a largely neutral effect.

In Scotland the annual effect of a smoking ban on the hospitality sector (including hotels and bars/restaurants) has been estimated. The final regulatory impact assessment revised the NHS Health Scotland et al. (2005) estimates and predicted a slight negative impact. In Wales and Northern Ireland the effect of a full ban on the hospitality sector, based on 30-year appraisal, was estimated at +£42 million and +£46 million, respectively.

The estimated effects for changes in employment in bars/restaurants and pubs also vary. It is estimated an EU-wide smoking ban (Policy 5) would result in annual changes in the range of 265,100 jobs lost to 271,000 jobs gained (Table 14.6).

Table 14.6: Estimated loss in revenues in hospitality industry and jobs due to EU-wide smoking ban

Costs	2007 estimate	Lower bound	Upper bound
		−10%	9.3%
Annual change in revenues*	Hospitality industry (restaurants/pubs/bars)	−€11 B	+€10 B
Annual change in employment	Hospitality industry (restaurants/pubs/bars)	−265,000	+271,000

* For example, due to an increase/decrease in customer sales

14.3.4 Economic impacts for the pharmaceutical industry

There is little evidence available on the impact of smoke-free legislation on revenues and employment for the pharmaceutical industry. Whereas the hospitality and tobacco industry have been quite vocal about the potential impacts of such policies on their revenues and employment, this is not so much the case for the pharmaceutical industry. In fact, during the stakeholder consultation (attended by representatives of pharmaceutical firms) the issue did not come up, nor was it addressed in written contributions received from the pharmaceutical industry. Moreover, in its written contribution to the stakeholder consultation, one of the pharmaceutical firms urged the European Commission to implement total smoking bans by the end of 2008.

Impacts on the pharmaceutical industry are not explicitly addressed in *Lifting the Smokescreen* (Smokefree Partnership, 2006), and the various British impact assessments. In addition, our own comprehensive review of the literature did not pick up any articles that quantified potential impacts to the pharmaceutical industry.

14.3.5 Other economic impacts for workplaces

Other potential economic impacts for workplaces include savings from a reduced number of smoking breaks, reduced cleaning maintenance and redecorating costs, reduced costs in fire damage, and implementation and enforcement costs. These are briefly described below in reference to the policy options under consideration by the Commission.

Reduced number of smoking breaks

Potential productivity gains could be expected from a reduced number of smoking breaks resulting from an EU-smoke-free initiative. It is unclear, however, to what extent these savings could be fully realised in practice, as workers might choose to take smoking breaks outside buildings. It is interesting to note that while the impact assessments carried out in Scotland and Northern Ireland predicted a positive impact on workers' productivity as a result of reduced smoking breaks, in England and Wales production losses were expected from smokers who were previously allowed to smoke at work and would continue to smoke outside the building.

Reduced cleaning, maintenance and redecorating costs

There is little information on the estimated effects of workplace smoking restrictions on cleaning and redecoration costs, although it is recognised that there will be an effect. The reduction in cleaning and maintenance costs is likely to be the highest with binding legislation (policy option 5) since this should virtually eliminate SHS. The other four policy options will also help reduce cleaning and maintenance costs but to a lesser degree, as shown in Table 14.7.

Previous impacts assessments that have estimated the reduction in cleaning and maintenance costs and have found modest savings to be made with smoke-free bans. A Scottish impact assessment estimated the number of Scottish smokers in workplaces with no restrictions gave a cost estimate of £11.7 million. The calculation was based on a US survey which found the extra costs were £300 per smoker per year where unrestricted smoking was allowed. The Wales regulatory appraisal on smoke-free premises (based on 30 years) estimated the reduced cleaning and decoration costs with a comprehensive smoking ban to be £7.6 million (based on a 30-year appraisal), and only 0.76 million with a voluntary approach (equivalent to "no changes to the status quo"). In England the regulatory impact assessment estimated the reduced cleaning and maintenance costs at £100 million with a full ban and £20 million with voluntary approach towards introducing smoke-free legislation.

Reduced costs in fire damage

There is little information on the estimated effects of workplace smoking restrictions on cost savings from reduced fire hazards. Table 14.7 summarises the expected impact of reduced costs in fire damage. As expected, the largest reductions in cost savings are expected with a binding legislation (Policy 5). Moreover, the savings with the four other policy options would be smaller compared to a full smoking ban.

For comprehensive smoking bans previous regulatory impacts assessments in England, Wales, and Scotland have estimated the costs saving from reduced fire hazards at £63 million,[41] £7.6 million and at least £4 million, respectively. In contrast, a voluntary approach to reduce SHS (or "no change in status quo") resulted in much smaller cost savings from reduced fire hazards, £13 million in England and £0.6 million in Wales.

The total annual savings related to the cost of fires, cleaning, and redecoration from a smoking ban across the EU-27 (Policy 5) is estimated at €965 million.

Implementation and enforcement costs

There are various implementation and enforcement costs which may arise with an EU initiative, but these are likely to be minimal. The extent of these costs is likely to depend on the content of each policy. The expected impact on implementation and enforcement costs across the five options the Commission may wish to introduce is discussed below.

Comprehensive smoke-free legislation is likely to have low costs (for example costs of displaying no smoking signage), while a smoke-free legislation allowing exemptions (such as designated smoking rooms with ventilation) is likely to have higher implementation costs. We might expect the two policies to have similar enforcement costs.

In some cases government departments (such as departments of health) might provide signage that meets requirements to businesses free of charge in the lead-up to

[41] This figure is for safety benefits (damage, fire, injuries, and so on).

implementation. This would mean the costs would be imposed on governments rather than hospitality owners.

The English, Welsh, and Northern Irish regulatory impact assessments estimated implementation and enforcements costs. The costs are minimal compared with the costs saving achieved through lives saved, morbidity savings, and NHS treatment costs and productivity gains.

The implementation and enforcement costs (including smoking cessation, public awareness, signage, and monitoring and evaluation) for the Welsh Assembly government were estimated at £35.9 million with a comprehensive smoking-free legislation (based on a 30-year appraisal). The costs to local authorities (for example recruitment and training of enforcement officers and activities to raise awareness of the proposed legislation among businesses) were estimated at 36.9 million. In comparison, the implementation and enforcement costs associated with a voluntary approach is only expected to fall on the Welsh Assembly government, £34.3 million (based on a 30-year appraisal).

The Northern Ireland impact assessment estimated the costs to the Northern Ireland administration to be £47 million, and to local authorities £6 million.

The English impact appraisal estimated the annual costs of implementation of regulatory requirements and enforcement with a full ban at £30–35 million, of which the implementation of regulatory requirements made up £0–5 million. No costs were associated with voluntary action.

Table 14.7: Expected economic impacts of the policy options

	Setting	Policy 1 Status quo	Policy 2/3 OMC/Commission recommendation		Policy 4 Council recommendatio n	Policy 5 Binding legislation
Workers productivity' related to smoking breaks		+/–	++/––		+++/–––	++++/––––
Reduced costs of fires, cleaning and redecoration	All workplac es	+	++		+++	++++ €965 million
Implementation and enforcement costs	All workplac es	–	–––	––	––	–––
Key: Benefits (+): minimal (+); moderately-small (++); moderately-large (+++); large (++++) Costs (-): minimal (-); moderately-small (--); moderately-large (---); large (----)						

14.4 **Environmental impacts**

14.4.1 **Environmental benefits**

Improved air quality

The main environmental impact would be a significant improvement in indoor air quality. It expected the largest improvements in air quality will arise with a binding legislation. However, the other four policy options will also bring about improvements in air quality, but to a lesser degree as shown in Table 14.8. For the eights studies that reported on the effects of smoking bans on air quality, all showed large reductions in $PM_{2.5,}$ ranging from 83 percent (Irish bars) to 93 percent (US bars). Thus, the evidence reported in the literature suggests that comprehensive smoking bans lower particulate pollution and thus improve air quality.

Table 14.8: Expected environmental impacts of the policy options

	Setting	Policy 1 Status quo	Policy 2/3 OMC/Commissio n recommendation	Policy 4 Council recommendatio n	Policy 5 Binding legislation
Reduction in indoor air pollution	Bars	+	++	+++	++++
Key: Benefits (+): minimal (+); moderately-small (++); moderately-large (+++); large (++++) Costs (-): minimal (-); moderately-small (--); moderately-large (---); large (----)					

14.5 **Social impacts**

14.5.1 **Social effects**

Reduction in socio-economic inequalities

As discussed in Chapter 6, socio-economic inequalities exist within and between countries in terms of smoking prevalence, smoking cessation rates, and exposure to secondhand smoke. For example in 2000 Trinder et al. found British workers in routine and manual occupations were 2.25 times likely to be breathing in SHS than those in managerial and professional occupations. Furthermore, in New Zealand Whitlock et al. (1998) demonstrated that ETS exposure was steeply and inversely associated with all three indicators of socioeconomic stauts (education level, occupational status, and household income).

A number of studies have shown that smoke-free legislation, can be effective across socio-economic groups (Carpenter, 2007; Edwards et al., 2007; Hassan et al, 2007; and Martin et al., 2008). For example Martin et al. (2008) found the Scottish smoke-free legislation resulted in reductions in tobacco consumption (including quitting), particularly in disadvantaged communities. Moreover, there was no displacement of ETS in the home. Hence an EU initiative might be expected to bring disproportionate benefits to the lower SES groups, and the impacts of reducing inequalities in health may be significant (Martin et al., 2008). Furthermore, a binding legislation is most likely to bring about reduced inequalities, as shown in Table 14.9.

Another study by Evans et al. (2007) found significantly more respondents from lower-SES groups allowed smoking in the home both before and after the Irish smoking ban in 2004. Therefore there is evidence to suggest that although smoke-free legislation has the potential to reduce inequalities, it should be linked with broader measures such as awareness-raising campaigns targeting special setting like the homes and private cars where particular vulnerable groups may have the most exposure and which do not fall under the scope of smoke-free legislation.

The effect on attitudes

Attitudes towards smoking bans are diverse and vary between EU Member States. An EU initiative may help create awareness among the dangers of passive smoking and increase support for smoke-free measures. Surveys of people's attitudes have shown that in many countries public support for smoke-free laws increases after they are introduced. In Ireland, for example, the smoke-free law now has the support of 93 percent of the population compared with 59 percent prior to the law's introduction. Moreover, in Norway more than three-quarters of the public supported the law by the end of the first year it was introduced (Global Smokefree Partnership, 2007). Therefore it is anticipated that support for smoke-free laws will increase under each policy option, but comprehensive smoke-free legislation will bring about the strongest (positive) shift in people's attitudes.

An unintended consequence for smokers could be the felt stigma or sense of alienation associated with being a more visible smoker (Martin et al., 2008). Chapman and Freeman (2008) found in countries with histories of comprehensive tobacco smoking polices and declining smoking prevalence, there has been a widespread erosion of the social tolerance and acceptability of smoking.

Reduction of ETS exposure at home

An unintended consequence of an EU smoke-free initiative could be a reduction in the prevalence of smoking at home. The extent to which this occurs may vary among socio-economic groups. The expected reduction of ETS exposure at home across the five policy options is shown in Table 14.9.

Four studies reported reductions in the prevalence of smoking in the home after the introduction of smoking bans ranging from 5 to 20 percentage point reductions (Fong et al., 2006; Andreeva 2007; Evans et al., 2007; and Edwards et al., 2008). In New Zealand exposures to smoking in the home nearly halved over three years from 2003 to 2006, and in 2006 just over one in ten people reported exposure to SHS at home during the past seven days (Waa and McGough, 2006). Furthermore, in Australia smoke-free workplaces were followed by a doubling of homes with smoking restrictions.

Table 14.9: Expected social economic impacts of the policy options

	Policy 1 Status quo	Policy 2/3 OMC/Commission recommendation	Policy 4 Council recommendation	Policy 5 Binding legislation
Reduction of ETS at home	+	+	+	++
Reduction in socio-economic inequalities	+	++	+++	++++
Increased support for smoke-free policies	+	++	+++	++++
Key: Benefits (+): minimal (+); moderately-small (++); moderately-large (+++); large (++++) Costs (-): minimal (-); moderately-small (--); moderately-large (---); large (----)				

14.6 Monitoring and evaluation

Policymakers need systems in order to verify whether implementation is on track and to what extent the policy is achieving its set objective. If a policy is not achieving its objective policymakers need to understand whether this is because of a flawed policy design or poor implementation. Monitoring and evaluation arrangements, including generating data on the basis of carefully designed indicators, provide valuable information in this regard and help in defining how to optimise the policy intervention and measure its effectiveness.

Ideally baseline data collection is carried out prior to policy implementation. The timetable for follow-up data collection will be linked to the introduction of the policy and data should be collected over time.

The indicators that could be used to monitor the effects of the chosen policy options should cover the data shown in Table 14.10.

Table 14.10: Indicators to monitor the effects of smoke-free policy options

Main indicator	Sub-indicator	Source of information
Prevalence and effectiveness of smoke-free policies in Member States and elsewhere	Indicators to be explored	Studies published in the peer-reviewed (and grey) literature
Changes in exposure to SHS in different settings:	At workplaces At public places At private homes	• *European Household Survey* (5 yearly) • *European Working Conditions Survey* (annual basis from 2010) • Eurobarometer surveys (annual)
Changes in exposure to SHS for particular groups:	Children Lower socio-economic groups Hospitality workers	• *European Household Survey* (5 yearly) • *European Working Conditions Survey* (annual basis from 2010) • Eurobarometer surveys (annual)
Changes in tobacco use:	Smoking prevalence Smoking consumption Cessation attempts	• *European Health Interview Survey* (5 yearly) • Eurobarometer surveys (annual)
Access to and use of cessation service	Indicators to be explored	Surveys
Changes in public attitudes towards smoke-free policies	Indicators to be explored	Eurobarometer surveys
Measurement of impact that ban has on drinking behaviour (frequency and location)	Indicators to be explored	Surveys
Monitoring of changes in incidence and prevalence of smoking-related diseases	Indicators to be explored	Hospital admission and mortality data
Monitoring of economic impacts of ban on licensed trade	Indicators to be explored	Surveys and audit of accounts

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APPENDICES

Appendix A: Literature review

This Appendix outlines our literature review methodology. We conducted a literature review to examine the health, social, economic, and environmental impacts of passive smoking in the EU-27.

The literature review covered a number of distinct areas, including:

- evidence relating to prevalence of ETS (by country, age, gender, and setting)
- relative risks related to the health effects of exposure to ETS
- direct and indirect costs of ETS
- impact of restrictions on exposure levels and on tobacco use behaviours
- economic impacts of restrictions on workplaces, in general, and on the hospitality sector in particular
- Member State policies on ETS
- evidence of transnational impacts
- evidence of technological solutions
- equity issues.

We searched PubMed (National Library of Medicine) and EconLit electronic databases. For PubMed we used the MeSH database, which is the US National Library of Medicine's controlled vocabulary used for indexing articles. Table A.1 presents our search strategy. All searches were limited to articles with abstracts and published in English. In some cases our search was limited to articles published in the last five or ten years if the initial search identified over 200–300 articles. We examined the title and abstract for each article to determine whether or not the article was relevant for the current assignment. We obtained the full article for all those abstracts we deemed to be relevant. Table A.1 also shows the number of articles that were available for each (MeSH) search term and the number of articles we retrieved.

Table A.1: Search strategy

PubMed MeSH search terms	Limits	Total number of articles (no. reviews) available	Number of articles retrieved
"Tobacco Smoke Pollution" [MeSH] AND "Prevalence " [MeSH]	All dates, abstract, English	314 (25 reviews)	25
"Tobacco Smoke Pollution" [MeSH]AND "Mortality" [MeSH]	All dates, abstract, English	56 (9 reviews)	9
"Tobacco Smoke Pollution" [MeSH] AND "Morbidity" [MeSH]	Published in the last 5 years, abstract, English	183 (19)	31
"Tobacco Smoke Pollution" [MeSH] AND "Risk Factors" [MeSH]	Published in the last 5 years, abstract, English	298 (50)	27
"Tobacco Smoke Pollution" [MeSH] AND "Health Care Costs" [MeSH]	All dates, abstract, English	15 (0)	5
"Tobacco Smoke Pollution" [MeSH] AND "Cost-Benefit Analysis" [MeSH]	All dates, abstract, English	10 (1)	3
"Tobacco Smoke Pollution" [MeSH] AND "Smoking cessation" [MeSH]	Published in the last 10 years, abstract, English	185 (39)	40
PubMed Non-MeSH search terms			
"Smoking and equity"	All dates, abstract, English	59 (13)	7
EconLit search terms			
"Passive smoking"	No limits	6	6
"Secondhand smoke"	No limits	2	2
"Environmental tobacco smoke"	No limits	7	7
"Smoking and costs"	No limits	75	6
"Smoking cessation"	No limits	58	25

Given the extensive requirements of the review and a short timescale, the latest evidence and existing high-quality reviews of evidence was sought first and primary studies were only examined where such reviews were lacking or where they did not provide sufficient information for the nature and quality of primary evidence to be judged.

The grey literature (including reports of government agencies), international organisations, and other scientific associations), and conference proceedings (for example Towards a

Smokefree Society, September 2007, Edinburgh) was also searched for relevant ETS material accessible on the internet. A snowballing approach was taken to obtain further peer-reviewed and grey literature. This is whereby an existing report's bibliography (for example the Green Paper: *Towards a Europe Free from Tobacco Smoke: Policy Options at EU Level* (DG SANCO, 2007) is used to identify further articles of relevance. These articles obtained through snowballing and contacts are not included in Table A.1.

We also examined several databases for additional relevant data on environmental tobacco smoke and tobacco smoking, including OECD Health Data 2007; Eurostat; and the WHO's tobacco atlas. Moreover, England's National Health Service quarterly reports on smoking cessation activities have been obtained and will be correlated to the introduction of the smoking ban in public places (in effect July 2007) to examine any differences/changes in the population's smoking cessation activities.[42]

[42] Statistics on NHS Stop Smoking Services in England April to June and April to September 2007, The Information Centre, 28 January 2008.

Appendix B: ETS prevalence

This section provides an overview of ETS prevalence across the EU-27. The section is divided into four parts. The first part describes ETS prevalence. The second part describes ETS prevalence across the EU-27 by the setting in which the exposure occurs. The third and fourth parts describe ETS prevalence across the EU-27 by gender, and age group, respectively.

ETS prevalence

Table B.1 shows point estimates for ETS prevalence obtained from the peer reviewed literature. Overall the point estimates for ETS prevalence were obtained from five studies. Prevalence estimates ranged from 22.5 percent in Greece to 81.8 percent in Denmark. In some cases, a point estimate in one country has been adopted in another country for impact assessment purposes. In several cases the point estimate may be for one location within a country (for example Twose et al., 2007) and/or not include the total population (for example Vineis et al., 2007) prevalence estimates only include people aged 35–74 years.

There were 20 countries for which we did not obtain point estimates—Austria, Belgium, Cyprus, Czech Republic, England, Estonia, Finland, Hungry, Ireland, Latvia, Lithuania, Luxembourg, Malta, Northern Ireland, Poland, Portugal, Romania, Scotland, Slovakia, and Slovenia.

Table B.1: ETS prevalence in the EU-27

Country	ETS prevalence (%)	Study (Author, year)
Denmark	81.8%	(Vineis et al., 2007)
France	59.8%	(Vineis et al., 2007)
Germany	50.8%	(Heidrich et al., 2007)
Germany	22.5%	(Vineis et al., 2007)
Greece	46%	(Panagiotakos et al., 2007)
Italy	66.5%	(Vineis et al., 2007)
Netherlands	63.2%	(Vineis et al., 2007)
Spain	Available[43]	(Twose et al., 2007)
Sweden	69.8%	(Vineis et al., 2007)

ETS prevalence by setting

Table B.2 shows ETS prevalence by setting. The three main settings in which we found ETS prevalence estimates were the workplace, leisure/public places and home. ETS prevalence in the workplace ranged from 5 percent to 11 percent in England to 85 percent in Denmark. In the home ETS prevalence ranged from 16 percent in Finland to 55 percent in Sweden. In total prevalence estimates were obtained from 13 studies. In several countries more than one estimate was obtained. In some countries such as England ETS prevalence has been estimated for combinations of locations (see Box B.1).

[43] The data in the study can be used to calculate an age-standardised rate, which is a summary measure of a rate that a population would have if it had a standard age structure.

Box B.1: Estimated exposure of non-smokers to ETS for all possible locations—England

None: 58%

Home only: 14%

Workplace only: 3%

Public places only: 19%

Home and workplace: 1%

Home and public places: 5%

Workplace and public places: 1%

Home, workplace, and public planes: n/a

We did not come across ETS prevalence data by setting for ten countries—Bulgaria, Cyprus, Czech Republic, Hungry, Latvia, Malta, Poland, Romania, Slovakia, and Slovenia. Some studies have assumed that a country's ETS prevalence can be based on another country's estimates. For example, the report *Lifting the Smokescreen* (Smokefree Partnership, 2006) used Austria's ETS prevalence estimate at work for the remainder of Western Europe and Denmark's for the remainder of Eastern Europe.

Table B.2: ETS prevalence by setting

EU-27	ETS prevalence			Study (Author, year)	Grey/Peer
	Work	Leisure	Home		
Austria	34%			(Smokefree Partnership, 2006)	Grey
	180,000 workers exposed at least 75% of working time			(Kauppinen et al., 1998)	Grey
Belgium	190,000 workers exposed at least 75% of working time			(Kauppinen et al., 1998)	Grey
Denmark	85%			(Smokefree Partnership, 2006)	Grey
	100,000 workers exposed at least 75% of working time			(Kauppinen et al., 1998)	Grey
Estonia	35%		48%	(Helasoja et al., 2001)	Peer
Finland	24%		16%	(Helasoja et al., 2001)	Peer
	10%			(Nurminen and Jaakkola, 2001)	Peer
	53%			(Heloma et al., 2000)	Peer
	110,000 workers exposed at least 75% of working time			(Kauppinen et al., 1998)	Grey
France	3.2 million			(Alipour et al., 2006)	Peer

	1.2 million workers exposed at least 75% of working time			(Kauppinen, Toikkanen et al., 1998)	Grey
Germany	20%			(Smokefree Partnership, 2006)	Grey
	14%		12%	(Heidrich et al., 2007)	Peer
	2.4 million workers exposed at least 75% of working time			(Kauppinen et al., 1998)	Grey
Greece	170,000 workers exposed at least 75% of working time			(Kauppinen et al., 1998)	Grey
Ireland	58,000 workers exposed at least 75% of working time			(Kauppinenet al., 1998)	Grey
Italy	15.3%		36.8%	(Simoni et al., 2007)	Peer
	800,000 million workers exposed at least 75% of working time			(Kauppinen et al., 1998)	Grey
Lithuania	27%		44%	(Helasoja et al., 2001)	Peer
Luxembourg	11,000 workers exposed at least 75% of working time			(Kauppinen et al., 1998)	Grey
Netherlands	350,000 workers exposed at least 75% of working time			(Kauppinen et al., 1998)	Grey
Portugal	210,000 workers exposed at least 75% of working time			(Kauppinen et al., 1998)	Grey
Spain	Need to weight	Need to weight	Need to weight	(Twose et al., 2007)	Peer
	700,000 workers exposed at least 75% of working time			(Kauppinenn et al., 1998)	Grey
Sweden	210,000 workers exposed at least 75% of working time			(Kauppinen et al., 1998)	Grey
			54.5%	(Larsson et al., 2001)	Peer
England	5%	25%	27%	(Department of Health, 2003)	Grey
	11%		37%	(Jamrozik, 2005)	Peer
UK	8%			(Smokefree Partnership, 2006)	Grey
	1.3 million workers exposed at least 75% of working time			(Kauppinen et al., 1998)	Grey
Scotland		15.6%		Patton (2006)	Grey

ETS prevalence by gender

Table B.3 shows ETS prevalence by gender. In total the point estimates for ETS prevalence were obtained from five studies. For those countries where we found estimates, ETS prevalence was only slightly higher for males. Some of the figures reported in Table B.3 are for only a sub-set of the population.

There were 20 countries for which we did not obtain ETS prevalence data by gender—Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, France, Germany, Greece, Hungary, Ireland, Latvia, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, and the United Kingdom.

Table B.3: ETS prevalence by gender

EU 27	ETS prevalence (%)		Study (Author, year)	Grey/Peer
	Male	Female		
Estonia	52%	45%	(Helasoja et al., 2001)	Peer
Finland	27%	20%	(Helasoja et al., 2001)	Peer
	12%	8%	(Nurminen and Jaakkola, 2001)	Peer
Italy		21.3%	(Simoni et al., 2006)	Peer
Lithuania	46%	42%	(Helasoja et al., 2001)	Peer
Spain	Available	Available[44]	(Twose et al., 2007)	Peer
Sweden	54%	55%	(Larsson et al., 2001)	Peer

ETS prevalence by age group

Table B.4 shows ETS prevalence by age group. In total the point estimates for ETS prevalence were obtained from eight studies. The majority of studies we found (except two) reported prevalence's of ETS for younger people. The estimates for people aged less than 15 years ranged from 27.4 percent in Scotland to 62.3–88.6 percent in Poland. Most studies reported these exposures coming from parental smoking.

There were ten countries for which we did not obtain ETS prevalence data by age group—Belgium, Cyprus, Denmark, Finland, France, Ireland, Luxembourg, Malta, Portugal, and Sweden.

Table B.4: ETS prevalence by age group

EU 27	ETS prevalence (%)			Study (Author, year)	Grey/peer
	< 15 yrs	15–64 yrs	65+ yrs		
Austria	63.4%			(Moshammer et al., 2006)	Peer
Bulgaria	71.7%			(GTSS Collaborative Group, 2006)	Peer
	70.9%			(Pattenden et al., 2006)	Peer
Czech Republic	60.1%			(Moshammer et al., 2006)	Peer
	57.8%			(GTSS Collaborative Group, 2006)	Peer
	57.4%			(Pattenden et al., 2006)	Peer
Estonia	85.7%			(GTSS Collaborative Group, 2006)	Peer
Germany	46.6%			(Moshammer et al., 2006)	Peer
	45.8%			(Pattenden et al., 2006)	Peer

[44] The data in the study can be used to calculate an age-standardised rate, which is a summary measure of a rate that a population would have if it had a standard age structure.

Greece	92.7%			(Moshammer et al., 2006)	Peer
Hungary	59.0% 88.4% 55.9%			(Moshammer et al., 2006) (GTSS Collaborative Group, 2006) (Pattenden et al., 2006)	Peer Peer Peer
Italy	58.2%			(Pattenden et al., 2006)	Peer
Latvia	65.20%			(GTSS Collaborative Group, 2006)	Peer
Lithuania	53.90%			(GTSS Collaborative Group, 2006)	Peer
Netherlands	57.5% 58.1%			(Moshammer et al., 2006) (Pattenden et al., 2006)	Peer Peer
Poland	68.2% 88.6% 64.9% 62.3% 72.1%			(Moshammer et al., 2006) (GTSS Collaborative Group, 2006) (Pattenden et al., 2006) (Warren et al., 2000) (Warren et al., 2000)	Peer Peer Peer Peer Peer
Romania	86.0%			(GTSS Collaborative Group, 2006)	Peer
Slovakia	54.0% 82.6% 48.4%			(Moshammer et al., 2006) (GTSS Collaborative Group, 2006) (Pattenden et al., 2006)	Peer Peer Peer
Slovenia	77.5%			(GTSS Collaborative Group, 2006)	Peer
Spain		Available	Available[45]	(Twose et al., 2007)	Peer
United Kingdom	 50%		13%	(Jamrozik, 2005) Rushton L et al. (2003)	Peer Peer
Scotland	27.4%			(Akhtar et al., 2007)	Peer

[45] The data in the study can be used to calculate an age-standardised rate which is a summary measure of a rate that a population would have if it had a standard age structure.

Appendix C: Relative risks

This section examines the relative risks for mortality and morbidity associated with ETS for: lung cancer, coronary heart disease, stroke, respiratory conditions in adults (for example asthma and COPD); and respiratory conditions in children (for example asthma or wheezing).

Lung cancer

Table C.1: Relative risk of lung cancer for non-smokers exposed to workplace ETS

Reference	Location	No studies in meta-analysis	RR (95% CI)
(Stayner et al., 2007)	Multiple	22	1.24 (1.18–1.29)
(Stayner et al., 2007) High exposure	Multiple	22	2.01 (1.33–2.60)
(Royal College of Physicians, 2005) Male and female	Multiple	7 (1,582 lung cancer cases)	1.03 (0.86–1.23)
(Surgeon General, 2006) Non-smokers vs. none	Multiple	25	1.22 (1.13–1.33)
(Surgeon General, 2006) Non-smoker vs. none	Europe	7	1.13 (0.96–1.34)

Table C.2: Relative risk of lung cancer for non-smoking men exposed to workplace ETS

Reference	Location	No studies in meta-analysis	RR (95% CI)
(Royal College of Physicians, 2005) Men	Multiple	6 (246 lung cancer cases)	1.12 (0.80–1.56)
(Surgeon General, 2006) Men vs. none	Multiple	25	1.12 (0.86–1.50)

Table C.3: Relative risk of lung cancer for non-smoking women exposed to workplace ETS

Reference	Location	No studies in meta-analysis	RR (95% CI)
(Royal College of Physicians, 2005) Women	Multiple	19 (3,588 lung cancer cases)	1.19 (1.09–1.30)
(Surgeon General, 2006) Women versus none	Multiple	25	1.22 (1.10–1.35)

Table C.4: Relative risk of lung cancer for non-smokers exposed to home ETS from spousal smoking

Reference	Location	No studies in meta-analysis	RR (95% CI)
(Surgeon General, 2006) Spousal smoking: smoking versus non-smoking spouse	Multiple	44 case control	1.21 (1.13–1.30)
(Surgeon General, 2006) Spousal smoking: Smoking versus non-smoking spouse	Multiple	8 cohort	1.29 (1.125–1.49)
(Surgeon General, 2006) Spousal smoking: smoking versus non-smoking spouse	Europe	52	1.16 (1.03–1.30)

Table C.5: Relative risk for lung cancer for never smoking women exposed to home ETS from spousal smoking

Reference	Location	No studies in meta-analysis	RR (95% CI)
(Taylor et al., 2007)	Multiple	55	1.27 (1.17–1.37)
(Taylor et al., 2007)	Europe	11	1.31 (1.24–1.52)
(Surgeon General, 2006)	Multiple	52	1.37 (1.05–1.79)
(Taylor et al., 2001, cited in NHS Health Scotland et al., 2005)*	Multiple	43	1.29 (1.17–1.43)
(Royal College of Physicians, 2005)	Multiple	46 (6,257 lung cancer cases)	1.24 (1.14–1.34)

Table C.6: Relative risk of lung cancer for never smoking men exposed to home ETS from spousal smoking

Reference	Location	No studies in meta-analysis	RR (95% CI)
(Royal College of Physicians, 2005)	Multiple	11 (442 lung cancer cases)	1.37 (1.02–1.83)
(Surgeon General, 2006)	Multiple	8 Cohort	1.29 (1.125–1.49)
(Surgeon General, 2006)	Multiple	52 spousal studies included in meta-analysis for SG report	1.22 (1.13–1.31)

Coronary heart disease

Table C.7: Relative risk of CHD for non-smokers exposed to home/work ETS

Reference	Location	No. studies in meta-analysis	RR (95% CI)
(Surgeon General, 2006)	Multiple	16 (9 cohort and 7 case-control)	1.27 (1.19–1.36)
(Surgeon General, 2006) Non-smokers exposed to low to moderate (1–14 or 1–19 cigarettes/day) SHS	Multiple	8	1.16 (1.03–1.32)
(Surgeon General, 2006) Non-smokers exposed to moderate to high (≥ 15 or ≥ 20 cigarettes/day) SHS	Multiple	8	1.44 (1.13–1.82)

Table C.8: Relative risk of CHD for non-smokers ever-exposed to workplace ETS

Reference	Location	No. studies in meta-analysis	RR (95% CI)
(Wells, 1998a, cited in NHS Health Scotland et al., 2005)* Ever-exposure to ETS in the workplace	Multiple	8	1.18 (1.04–1.34) for mortality only (n = 8) 1.32 (1.01–1.72) for morbidity only (n = 6)
(He et al., 1999, cited in NHS Health Scotland et al., 2005)*	Multiple	8	1.11 (1.00–1.23)
(Steenland, 1999, cited in NHS Health Scotland et al., 2005)*	Multiple		1.21 (1.04–1.41)

Table C.9: Relative risk of CHD for non-smokers ever-exposed to home ETS from spousal smoking

Reference	Location	Number of studies in meta-analysis	RR (95% CI)
(Glantz and Parmley, 1991, cited in NHS Health Scotland et al., 2005)	Multiple	10	1.3 (1.2–1.4)
(Wells, 1994, cited in NHS Health Scotland et al., 2005)*	Multiple	10	1.42 (1.15–1.75)
(Law et al., 1997, cited in NHS Health Scotland et al., 2005)*	Multiple	19	1.30 (1.22–1.38)
(Thun et al., 1999, cited in NHS Health Scotland et al., 2005)	US	17	1.25 (1.17–1.33) 1.25 (1.17–1.33) for fatal CHD 1.25 (1.17–1.33) for no fatal myocardial infarction
(Thun et al., 1999, cited in NHS Health Scotland et al., 2005)*	Multiple	8	1.22 (1.13–1.32)

(Wells, 1998a, cited in NHS Health Scotland et al., 2005)*	Multiple	18	1.49 (1.29–1.78) for all home (n = 18) 1.28 (1.02–1.61) for morbidity only (n = 6) 1.21 (1.09–1.35) for mortality (n = 6)
(He et al., 1999, cited in NHS Health Scotland et al., 2005)*	Multiple	18	1.25 (1.17–1.32) 1.24 (1.17–1.32) for mortality only (n = 14)
(He et al., 1999, cited in NHS Health Scotland et al., 2005)* Never-smokers exposed to ETS by spouses who smoke more than 20 cigarettes/day	Multiple	7	1.31 (1.21–1.42)

Stroke

Table C.10: Relative risk of stroke for non-smokers exposed to home ETS from spousal smoking—meta analysis

Reference	Location	No. studies in meta analysis	RR (95% CI)
(Royal College of Physicians, 2005)	Multiple	3 cohort	1.27 (1.10–1.46)

Table C.11: Relative risk of stroke for never smokers exposed to home ETS from spousal smoking—individual studies

Reference	Location	Type of study and number of individuals (no. of stroke cases)	RR (95% CI)
(Bonita et al., 1999, cited in Royal College of Physicians, 2005) Never smokers and former smokers who quit > 10 years ago exposed to ETS from spouse. Men and women	New Zealand	Case-control. 215 cases and 1,366 controls	1.82 (1.34–2.49)
(You et al., 1999, cited in Royal College of Physicians, 2005) Men and women	Australia	Case-control. 149 cases and 210 controls. Lifetime non-smoking men and women	1.70 (0.98–2.92)
(Anderson et al., 2004, cited in Royal College of Physicians, 2005)		Case-control	0.5 (0.2–1.3)
(Anderson et al., 2004, cited in Royal College of Physicians, 2005)		Case-control	1.3 (0.7–2.3)

Table C.12: Relative risk of stroke for never smokers exposed to home ETS from spousal smoking—individual studies (men only)

Reference	Location	Type of study and number of individuals (no. of stroke cases)	RR (95% CI)
(Iribarren et al., 2001, cited in Royal College of Physicians, 2005)		Cross-sectional 16,524 (42)	0.25 (0.04–0.82)
(Lee et al., 1986, cited in Royal College of Physicians, 2005)		Case-control	0.78 (0.23–2.24)
(Bonita et al., 1999, cited in Royal College of Physicians, 2005) Never smokers and former smokers who quit > 10 years ago exposed to ETS from spouse.	New Zealand	Case-control. 215 cases and 1,366 controls	2.10 (1.33–3.32)
(Sandler et al., 1989, cited in Surgeon General, 2006) ETS exposure in the home (self-reported)	Washington country, Maryland US	Cohort	0.97 (0.65–1.46)

Table C.13: Relative risk of stroke for never smokers exposed to home ETS from spousal smoking—individual studies (women only)

Reference	Location	Type of study and number of individuals (no. of stroke cases)	RR (95% CI)
(Iribarren et al., 2001, cited in Royal College of Physicians, 2005)		Cross-sectional 26,197 (95)	1.23 (0.75–1.96)
(Lee et al., 1986, cited in Royal College of Physicians, 2005)		Case-control	1.00 (0.54–1.91)
(Bonita et al., 1999, cited in Royal College of Physicians, 2005) Never smokers and former smokers who quit > 10 years ago exposed to ETS from spouse.	New Zealand	Case-control. 215 cases and 1,366 controls	1.66 (1.07–2.57)
(Sandler et al., 1989, cited in Surgeon General, 2006) ETS exposure in the home (self-reported)	Washington country, Maryland US	Cohort	1.24 (1.03–1.49)

Respiratory effects in adults from exposure to SHS (e.g. asthma and COPD)

Table C.14: Relative risk of adult onset asthma for non-smokers exposed to home and/or work ETS

Reference	Location	Type of study (Number of participants)	RR (95% CI)
(Robbins et al., 1993, cited in NHS Health Scotland et al., 2005) Self-reported asthma Home and work	California, US	Cohort (3,917)	1.57 (0.81–2.97)
(Leuenberger et al., 1994, cited in NHS Health Scotland et al., 2005) Self-reported asthma Home and/or work SHS in the past 12 months among lifetime non-smoking Swiss adults	Switzerland	Cross sectional (4,197)	1.39 (1.04–1.86)
(Jaakola et al., 2003, cited in NHS Health Scotland et al., 2005) Home and work ETS exposure in the previous 12 months	Finland	Case control (521)	1.66 (0.99–2.78)
(Surgeon General, 2006) ETS exposure (versus none) at home or work		Review	40–60%

Table C.15: Relative risk of adult onset asthma for non-smokers exposed to home ETS (women only)

Reference	Location	Type of study (Number of participants)	RR (95% CI)
(Ng et al., 1993, cited in (NHS Health Scotland et al., 2005) Self-reported adult onset asthma Home (live with heavy smoker—more then 20 cigarettes/day)	Singapore	Cross sectional (1,438)	1.6 (0.69–3.70)

Table C.16: Relative risk of adult onset asthma for non-smokers exposed to work ETS

Reference	Location	Type of study (number of participants)	RR (95% CI)
(Greer et al., 1993, cited in Surgeon General, 2006) Self-reported asthma Among population of 3,577 Seventh Day Adventists between 1977 and 1987	California, US	Cohort (3,577)	1.5 (1.2–1.8)
(McDonnell et al., 1999, cited in NHS Health Scotland et al., 2005)	California, US	Case control (521)	1.21 (1.04–1.39) for 7 year increments-women
(Flodin et al., 1995, cited in Surgeon General, 2006)	Sweden	Case control (79 cases)	1.5 (0.8–2.5)

Table C.17: Relative risk of COPD for non-smokers exposed to home and work ETS

Reference	Type of study (Number of participants)	RR (95% CI)
(Robbins et al., 1993, cited in Surgeon General, 2006) Airways obstructive disease (self-reported symptoms and physician diagnoses—asthma, chronic bronchitis, and emphysema) ETS exposure at home and work during childhood and adulthood	Cohort study 1977–1987 of 3,914 adults aged 25 years and older	1.7 (1.3–2.2)
(Leunberger et al., 1994, cited in Surgeon General, 2006) Self-reported chronic bronchitis ETS exposure at home and work during previous 12 months	Cross-sectional survey of 4,197 Swiss adults 18–60 years old	1.7 (1.3–2.2) (odds ratio)
(Dayal et al., 1994, cited in (Surgeon General, 2006) Exposed to less than one pack of cigarettes per day (low) Obstructive respiratory disease (self-reported physician-diagnosed asthma, chronic bronchitis, or emphysema)	Case control (219 lifetime non-smokers versus 657 controls)	1.2 (0.8–1.7)
(Dayal et al., 1994, cited in (Surgeon General, 2006) Exposed to one or more pack of cigarettes per day (high) Obstructive respiratory disease (self-reported physician-diagnosed asthma, chronic bronchitis, or emphysema)	Case control (219 lifetime non-smokers versus 657 controls)	1.9 (1.2–2.9)
(Forastiere et al., 2000, cited in Surgeon General, 2006) Self-reported COPD in 4 areas of Italy	Cross sectional survey of 1,983 non-smoking women	1.75 (0.88–3.47)
(Surgeon General, 2006) COPD	Qualitative evidence synthesis	1.2–2.0

Table C.18: Relative risk of COPD for non-smokers exposed to home ETS from spouse

Reference	Condition	Exposure	Location	Type of study (number of participants)	RR (95% CI)
(Royal College of Physicians, 2005)	COPD	Never smokers exposed to ETS from spouse		8	25% (10–43%)
(Forastiere et al., 2000, cited in Surgeon General, 2006)	Self-reported COPD		4 areas of Italy	Cross sectional survey of 1,983 non-smoking women	1.75 (0.88–3.47)
(Kalandidi et al., 1987)	Hospital admissions for COPD (chronic obstructive lung disease)	Women's whose husbands smoked one pack per day or less (low) Women's whose husbands smoked more than one pack per day (low)		Hospital based case-control study (cases: 103 ever-married women aged 40–73 non-smokers; controls: 179 ever-married non-smoking women)	2.6 (90% CI 1.3–5.0) low 1.5 (0.8–2.7) high
(Hirayama, 1981)	COPD (mortality from emphysema and asthma)	Spousal smoking (husband former smokers or smokes 19 cigarettes or less per day) (low) Spousal smoking (husbands smoked 20 or more cigarettes per day) (high)		Population-based cohort study of 91,540 non-smoking Japanese housewives aged 40 years and older	29% (low) 49% (high) Results not statistically significant
(Sandler et al., 1989)	COPD mortality (from emphysema and bronchitis)	Household smoking exposure	Washington country, Maryland, US	Cohort study among 10,799 residents (life time non-smokers)	5.7 (1.2–26.8) women (n = 13) 0.9 (0.2–5.3) men (n = 6)

Respiratory effects in children from exposure to SHS

Table C.19: Respiratory effects in children from exposure to SHS

Reference	Condition	Exposure	Number of studies in meta-analysis	RR (95% CI)
(Royal College of Physicians, 2005)	Early lower respiratory illnesses (similar for wheezing and non-wheezing illnesses)	Children exposed when one or both parents smoke	Summary estimates	60% (47–74%)
(Royal College of Physicians, 2005)	Asthma at school age	Children exposed when one or both parents smoke	Summary estimates	23% (14–33%)
(Royal College of Physicians, 2005)	"Clinically defined Asthma" in case control studies	Children exposed when one or both parents smoke	Summary estimates	39% (19–64%)
(Surgeon General, 2006)	Asthma prevalence	Children exposed to smoking by either parent, 1976–1999	12 studies that did not adjust for potential confounders (unadjusted pooled odds ratio)	1.26 (1.15–1.38) odds ratio
(Surgeon General, 2006)	Asthma prevalence	Children exposed to smoking by either parent, 1986–2000	18 studies that adjusted for a variety of potential confounders (adjusted pooled OR)	1.22 (1.12–1.32) odds ratio
(Surgeon General, 2006)	Asthma prevalence	Children exposed to smoking by either parent	29 studies. Overall pooled; odds ratio from all the studies, using adjusted values if available	1.23 (1.14–1.33) odds ratio
(Surgeon General, 2006)	Childhood asthma and wheeze illness onset	Maternal smoking	Meta-analyses 4 cohort studies for the first 5 to 7 years of life	1.31 (1.22–1.41)
(Surgeon General, 2006)	Childhood asthma and wheeze illness onset	Maternal smoking	Meta-analyses 4 cohort studies for school years or throughout childhood,	1.13 (1.04–1.22)

			excluding infancy	
(Surgeon General, 2006)	Childhood asthma or wheeze prevalence	Smoking by either parent, 1974–2000	15 case control studies (pooled OR)	1.39 (1.19–1.64)
(Surgeon General, 2006)	Childhood asthma or wheeze prevalence	Maternal smoking, 1974–2000	15 case control studies (pooled OR)	1.54 (1.31–1.81)
(Surgeon General, 2006)	Childhood asthma or wheeze prevalence	Paternal smoking, 1974–2000	15 case control studies (pooled OR)	0.93 (0.81–1.07)

Appendix D: Effects of smoking bans

In this appendix we provide summary tables for the non-economic and economic effects of smoking bans. The non-economic effects comprise ETS exposure among non-smokers, air quality, population health, smoking behaviour, and attitudes and compliance. The economic effects of smoking bans relate to the tobacco industry, hospitality sector, and other industries.

ETS exposure among non-smokers

Tables D.1–D.4 summarise the effects of ETS exposure among non-smokers using various measures including by self-report, by cotinine, by nicotine, and general (non-specific).

Table D.1: ETS exposure among non-smokers by self-report

Study	Country	Setting	Before	After	Reduction
(Edwards et al., 2008) Previous week in 2003 compared to previous week in 2006	New Zealand	Work	20%	8%	12%
(WHO, 2007)	Ireland	Work	30 hrs	0 hrs	100%
BBC News 42 Dublin pubs in 73 bar workers	Ireland	Pubs	40 hrs	25 mins	99%
(Abrams et al., 2006)	US (New York)	Hospitality	20 hrs	6 hrs	70%
(Eisner et al., 1998) Reduction over the previous 7 days	US (San Francisco)		28 hrs	2 hrs	93%
Weekly, 20 July 2007	US (New York)	Restaurant patrons	19.8%	3.1%	16.7%
New York Adult Tobacco Survey (n~2000 residents		Bar patrons	52.4%	13.4%	39%

aged ≥ 18 years). Pre: 26 June to 23 July 2003 vs. post: 1 April to 30 June 2004					
(Farrelly et al., 2005) From baseline to 12 months follow-up	US (New York)	Hospitality workers ($n = 30$, $p < 0.01$)	12.1 hrs (95%CI 8.1 to 16.3 hrs)	0.2 hrs (95%CI −0.1 to 0.5 hrs)	98%
(Eisner et al., 1998) Median self-reported ETS per week ($p < .001$)	US (California)	Bartenders	29 hrs	2 hrs	93%

Table D.2: ETS exposure among non-smokers by cotinine (a principal nicotine metabolite and highly specific biomarker in saliva, urine, or blood)

Study	Country	Setting	Before	After	Reduction
(WHO, 2007) Post implementation	Ireland	Hospitality			69%
(Akhtar et al., 2007)	Scotland	(in children)			39%
(Goodman et al., 2005) Before and 1 year post ban.	Ireland	Dublin bar men ($n = 81$)			81%
(Semple et al., 2007)Pre and 1 year post ban	Scotland		2.94 ng/ml^{-1}	0.41 ng/ml^{-1}	12%
(Clancy et al., 2007) 42 pubs. Pre and post ban.	Ireland	Work			81%
(Fernandez et al., 2007)	Spain	Work: Total ban			53.1%
		Work: Designated areas			21.4%
		Work: No restrictions			14.8%
(Haw, 2007) Adult, non-smokers, aged 18–74 years old	Scotland	Public and private places	0.57 ng/ml	0.38 ng/ml	33%
(Haw, 2007) Adult, non-smokers, aged 18–74 years old	Scotland	Public and private places			49%

in non- smoking households					
(Haw, 2007) Adult, non-smokers, aged 18–74 years old in smoking households	Scotland	Public and private places	0.92 ng/ml	0.81 ng/ml	12%
(Mulcahy et al., 2005) Median cotinine concentration	Ireland	Hotel employees	1.6 ng/mL	0.5 ng/mL	69%
(Mulcahy et al., 2005)	Ireland	Bars	35.5 $\mu g/m^3$	6.0 $\mu g/m^3$	83%
(Mulcahy et al., 2005) Sample from 20 Galway city centre bars among 35 hospitality workers at 15 hotels	Ireland	Bars			69%
(Allwright, 2004) Control: 22.5% reduction in Northern Irish staff	Northern Ireland	Bars			80%
(Semple et al., 2007) Feb 2006 to Feb 2007	Scotland	Bar	3.25 ng/ml	0.55 ng/ml	83%
Weekly, 20 July, 2007 New York Adult Tobacco Survey (n = 1,594 saliva samples among non-smoking residents aged ≥ 18 years). Pre: 26 June to 23 July 2003 vs. post: 1 April to 30 June 2004; geometric mean levels.	New York		0.078 ng/mL	0.041 ng/mL	47.4%
(Menzies et al., 2006) Serum cotinine levels (1 month after ban) P < .001	Scotland	Bar workers	5.15 ng/mL	3.22 ng/mL	(−1.93 ng/mL 95% CI −2.83 to −1.03 ng/mL)

(Menzies et al., 2006) Serum cotinine levels (2 months after ban) P < .001	Scotland	Bar workers	5.15 ng/mL	2.93 ng/mL	(−2.22 ng/mL 95% CI −3.10 to −1.34 ng/mL)
(Fernando et al., 2007) Average increase in cotinine before and after a 3hr visit to 30 bars in 3 cities. Pre: winter and spring 2004 Post: winter and spring 2005	New Zealand	Non-smoking volunteers in bars	0.66 ng/ml	0.08 ng/ml	88%
(NHS Health Scotland et al., 2005) SHS exposure in non-smoking adults and children (cotinine)	Scotland				39%
(Farrelly et al., 2005) From baseline to 12 months follow-up	US (New York)	Hospitality workers (n = 24, p < 0.01)	3.6 ng/ml (95%CI 2.6 to 4.7 ng/ml)	0.8 ng/ml (95%CI 0.4 to 1.2 ng/ml)	78%
(Haw, 2007) Mean salivary cotinine 1-year post implementation	Scotland				89%

Table D.3: ETS exposure among non-smokers by nicotine

Study	Country	Setting	Before	After	Reduction
(WHO, 2007)	Ireland	Bars			83%
(Lopez et al., 2007) Pre and post after 1 year	Spain	Hospitality	88%	60%	28%
		Public administration			50%
		Universities			65%
		Private sector			100%
(Gorini et al., 2007) In Austria: before 24.53 μg/m³ and after 24.14	Italy (vs. Austria)	Hospitality	44.07 μg/m³	1.34 μg/m³	97%
		Discos	86.63	1.94	98%

µg/m^3[g]			µg/m^3	µg/m^3	
(Gorini et al., 2007) Study locations: Florence and Belluno. Pre and 2 years post ban in sample of 28 bars.	Italy	Bars	19.02 µg/m^3	0.25 µg/m^3	99%
		Restaurants	2.03 µg/m^3	0.10 µg/m^3	95%
		Discos/pubs	35.16 µg/m^3	0.01 µg/m^3	99%
(Ellingsen et al., 2006) 13 study sites		Bars/restaurants	28 µg/m^3	0.6 µg/m^3	99%
(Johnsson et al., 2006) Enforcement Finnish Tobacco Act (1 July 2003). Smoking allowed in 50% of service area (if service area > 50m^2 provided smoke does not spread in area where smoke prohibited. N = 16 establishments across 3 Finnish cities. Nicotine: geometric mean in establishments.	Finland	In food and dining restaurants	0.7 µg/m^3	0.6 µg/m^3	14%
		Bars and taverns	10.6 µg/m^3	12.7 µg/m^3	+20%
		Discos and nightclubs	15.2 µg/m^3	8.1 µg/m^3	47%
		All establishments	7.1 µg/m^3	7.3 µg/m^3	+0.1%

Table D.4: General ETS exposure among non-smokers (non-specific ETS exposure)

Study	Country	Setting	Before	After	Reduction
(Brownson et al., 2002)	Multiple	Work			–60% (+4––97%)
(Hopkins et al., 2001)	Multiple				60.5%
(Andreeva, 2007)	Ukraine	Work: complete ban			OR 0.504 (95%CI 0.335–0.758)
	Ukraine	Work: restricted to isolated premises			OR 0.622 (95% CI 0.442–0.873)
	Ukraine	Work: non-isolated premises			OR 0.806 (95% CI 0.544–1,195)
(Skeer et al., 2005) n = 3650 adults vs. employees complete smoke-free ban	Massachusetts US	Designated smoking areas at work			2.9 times the odds of being exposed 1.74 times the duration of exposure
(Skeer et al., 2005)	Massachusetts	No restrictions			10.27 times the odds of being

n = 3650 adults (survey) vs. employees complete smoke-free ban	US	at work			exposed 6.34 times the duration of exposure

Table D.5: Impact on air quality ($PM_{2.5}$)

Study	Country	Setting	Before	After	Reduction
(Goodman et al., 2005) 42 Dublin pubs; pre and post ban.	Ireland	Bars			83%
(Semple et al., 2007) Baseline and 2 months after ban in 41 pubs in 5 locations.	Scotland	Bars			86%
(Office of Tobacco Control, 2005) Dublin pubs; pre and 1 year after ban	Ireland	Pubs	40.2 µg/m³	5.0 µg/m³	88%
(Semple et al., 2007)	Scotland		167 g/m³	16 g/m³	91%
(Travers et al. 2004) 14 bars where smoking been allowed pre-ban	US (New York)		412 µg/m³	27 µg/m³	93%
Reaney (Reuters) Pre and after 1 year of ban.	Ireland	Bar workers in pubs			53% 87.6% (PM_{10})
(Office of Tobacco Control, 2005) US and international smoking pubs (n = 87) (in pre column) versus smoke-free Irish pubs (n = 41)	Ireland	Irish pubs	340 µg/m³	23 µg/m³	93%
(Alpert et al., 2007) N = 27 hospitality venues	Massachusetts (US)	Hospitality venues			93%
(Lee et al., 2007) N = 9 hospitality venues and one bingo hall Average indoor concentrations, pre and 1 week after 100% smoke-free workplace law Lower level was sustained.	Georgetown, Kentucky, US	Hospitality venues and one bingo hall	84 µg/m³	18 µg/m³	79%

Study	Setting	No. times PM2.5 higher in places with smoking vs. no smoking
(Hyland et al., 2008) $PM_{2.5}$ in 1,822 bars, restaurants, retail outlets, airports, and other workplaces in 32 geographically dispersed countries. *NB: A summary of smoke-free versus smoking places by country is available.*	Overall places	8.9 (95% CI 8 to 10)
	Bars	15.4 (95% CI 12.5 to 34.5)
	Restaurants	6.2 (95% CI 5.3 to 7.2)
	Transportation places	8.8 (95% CI 5.4 to 14.2)
	Other places	7.0 (95%CI 5.4 to 9.0)
	Smoking and smoke-free venues in 29 countries *without* comprehensive clean indoor air policies compared to Ireland, New Zealand and Uruguay.	7.5 (85%CI 5.9 to 9.7)

Health effects

Table D.6: Coronary events (hospital admissions)

Study	Country	Before	After	Reduction
(Cesaroni et al., 2008) Acute coronary event (out of hospital deaths and hospital admissions) for residents *aged 35–64 years old* Time period: 2000 and 2004–05 and after smoking ban in Jan 2005.	Italy			11.2% (95%CI 6.9–15.3%)
(Cesaroni et al., 2008) Acute coronary events (out of hospital deaths and hospital admissions) for residents *aged 65–74 years old*. Time period: 2000 and 2004–05 and after smoking ban in Jan 2005.	Italy			7.9% (95%CI 3.4–12.2%)
(Barone-Adesi et al., 2006) Acute myocardial infarction in six months after ban	Italy			0.7%
(NHS Health Scotland et al., 2005) Heart attacks admitted to 9 major Scottish hospitals 1 year post ban (average reduction of 3% per annum in the 10 years leading up to ban)	Scotland			17%
(Howell et al, 2007) AI coronary events (hospital admissions per week)	Ireland	0.10	1.03	
(Redpath, 2007) Average annual change in incidence MI	Scotland	−4.7% (95%CI −4.9 to −4.5)	−25.1% (95%CI −38.7 to −8.4)	20.4%
(Redpath, 2007) Average annual change in MI (admissions)	Scotland	−3.4% (95%CI −3.6 to −3.2)	−24.9% (95%CI −41.3 to −3.8)	21.5%
(Redpath, 2007) Average annual change in MI (deaths)	Scotland	−6.67% (95%CI −6.94% to −6.39%	−17.7% (95%CI −39.4 to −11.8)	11%
(Spizzichino, 2007) AMI in 2005. AMI absolute numbers increased overtime 2001–04	Italy			7%

(Cited in WHO, 2007) Heart attack—Piedmont region	Italy			20%
(Le Figaro, 2008) Admissions to emergency wards for myocardial infarction since 1 Jan 2008 (compared to Jan and Feb 2006 and 2007)—equivalent to reduction of 10,000 heart attacks in 2008.	France			15%
(Lemstra et al., 2008) Age standardised incidence (hospital discharges) rate for acute MI from 1 July 2000 to 30 June 2004 and 1 July 2004 to 30 June 2005.	Canada	176.1 cases per 100,000 pop (95% CI 165.3 – 186.8)	152.4 cases per 100,000 pop (95% CI 135.3 – 169.3)	13%
(Bartecchi et al., 2006) AMI hospitalisations among residents in Pueblo, 18 months pre and post ban in licensed venues.	US (Colorado)			27%
(Samet, 2006) Admissions for AMI during 6 months of ban. Admission rose after public smoking ban lifted.	Helena, Montana US			40%
(Dong-Chul and Torabi, 2007) Hospital admissions for AMI among non-smoking patients in Monroe County [pre public smoking ban: August 2001 to May 2003 versus post: August 2003 to May 2005). No significance difference (17 vs. 18) pre implementation of smoking ban between Monroe Country and Delaware County. Delaware County (control): pre: 18 versus post: 16.	Monroe Country (US)	17	5	–12 (–21.19 to –2.81) or 71%
(Sargent et al., 2004) Hospital discharge rates for AMI (304 cases in study)	Helena, Montana			RR 0.60 (95%CI 0.21 – 0.99)
(Bartecchi et al., 2006) Hospital discharge rates for AMI (2794 cases in study)	Pueblo, Colorado			RR 0.73 (95%CI 0.63–0.85)
(Barone-Adesi et al., 2006) Hospital discharge rates for AMI in person under 60 (4213 cases in	Piedmont, Italy			RR 0.89 (95%CI 0.81–0.98)

study)				
(Khuder et al., 2007) Hospital discharge rates for ischaemic heart disease and heart failure (1109 cases in study)	Bowling Green, Ohio			RR 0.61 (95%CI 0.55–0.67)
(Dinno and Glantz, in press) Pooled estimate (random effects model) for above 4 studies.	Meta			RR 0.73 (95%CI 0.56–0.89)
(Irish Independent, 5 Sept 2007) Heart attack hospital admissions in the South-West Public hospitals, after year of ban	Ireland			11%
NYS Dept of Health, 28 Sept 2007) Hospital admissions for AMI in NY State in 2004 (smoking ban took effect July 2003)	New York, US			8%

Table D.7: Respiratory symptoms

Study	Country	Setting	Before	After	Reduction
(Allwright, 2004)	Ireland	Bar workers			16.7%
(Fernandez, E., TSFS, 2007)	Spain	Work			39.2%
(Ayres, TSFS, 2007) N = 371 bar workers: baseline and 1 year after ban.	Scotland	Bar workers	67%	54%	13%
(Semple et al., 2007) pre (Feb 2006) and 1 year after ban (Feb 2007)	Scotland		73%	57%	16%
(Menzies et al., 2006) Respiratory and sensory symptoms (1 month after ban) P < .001	Scotland	Bar workers	79.2%	53.2%	26% (95%CI 13.8–38.1%)
(Menzies et al., 2006) Respiratory and sensory symptoms (2 months after ban) P < .001	Scotland	Bar workers	79.2%	46.8	32.5 (95%CI 19.8–45.2%)
Reaney (Reuters) Decrease in symptoms both respiratory and irritant. Pre and after 1 year of ban.	Ireland	Bar workers in pubs			30–40%

(Farrelly et al., 2005) From baseline to 12 months follow-up. Sensory symptoms (n = 24, p < 0.01). No change in overall prevalence of upper respiratory symptoms, p < 0.16)	US (New York)	Hospitality workers	88% (95% CI 66–95%)	38% (95%CI 20–59%)	50%
(Eisner et al., 1998) Respiratory symptoms p < 0.001	US (California)	Bartenders (n = 39)			41%
(Eisner et al., 1998) Sensory irritation symptoms p < 0.001	US (California)	Bartenders (n = 41)			22%

Table D.8: Other diseases

Study	Country	Disease	Before	After	Reduction
(Cited in European Respiratory Society, 2008)	14 countries in Europe	Incidence lung cancer			30%
(Cited in European Respiratory Society, 2008)		Incidence asthma			8%
(Menzies et al., 2006) Airway inflammation in Asthmatic bar workers exhaled nitric oxide (1 month after ban) P < .04	Scotland	Bar workers	34.3 ppb	27.4 ppb	0.8 fold change (95%CI 0.67 to 0.96 ppb)

Effects on smoking behaviour

Table D.9: Smoking prevalence in Europe

Study	Country	Setting	Before	After	Reduction
(Fong et al., 2006)	Ireland	Work	62%	14%	48%
		Restaurants	85%	3%	82%
		Bars/pubs	98%	5%	93%
		Shopping malls	40%	3%	37%
(Heloma et al., 2000) Among workers	Finland				5%
Gorini et al. (2007) Daily smokers aged 16–74 years in 2003 vs. 2006	Norway		27.3%	24.5%	2.8%
Braverman et al. (2007) Daily smoking. Baseline and 4 months post implementation. No significant change in these variables between 4 and 11 months post implementation.	Norway	Any			3.6%
		Work			6.2%
(Greiner et al., 2007) Switzerland, 11–13 Oct 2007 Pre ban and post ban after 3 months	Ireland		24.7%	22.9%	1.8%
(Gallus et al., 2006) March–April 2004 versus same period in 2005 and 2006. In 2005 prevalence 25.6%.	Italy		26.2% (2004)	24.3% (2006)	1.9%
Deputy Chief Medical Officer, Department of Health, England (Presentation) Adult smokers (no dates specified)	England		24%	22%	2%
Office of Tobacco Control Annual report (2007)	Ireland		26.4	25.7	1.4%

In March 2004 vs March 2006					

Table D.10: Smoking prevalence outside Europe

Study	Country	Setting	Before	After	Reduction
(Gorini et al., 2007) 1992–3 vs. 2001–02. In the rest of US reduction was 14%.	California		18.8%	14.7%	4.1%
(Lemstra et al., 2008) Saskatoon. Time period: 2003 (pre-ban) to 2005 (post ban). Smoking prevalence in Saskatchewan remained unchanged at 23.8%.	Canada		24.1%	18.2%	5.9%
(Fichtenberg and Glantz, 2002) Meta analysis of 26 studies		Workplaces (among employees)			3.8%
(Brownson et al., 2002) Workers employed in smoke-free workplaces vs. no smoking restrictions			16%	26.4%	
(NHS Health Scotland et al., 2005) Review	Multiple				3.8–20%
(Fichtenberg and Glantz, 2002) Review. Among employees Effect sizes were about half this size in workplaces where partial restrictions were already present.	Multiple				3.8% (2.8–4.7%
(Levy et al., 2007) Review of literature to determine inputs and effect sizes for the SimSmoke model.	Thailand	Workplace total ban			3% (with variation by age and gender)
		Workplace partial ban, requiring			2% (with variation

		ventilation (smoking restricted to ventilated areas in all indoor workplace)			by age and gender)
		Workplace partial ban limited to common areas (smoking limited to non-ventilated common area)			1% (with variation by age and gender)
		Restaurant total ban			1%
		Restaurant partial ban (ban in all restaurants except in designated areas)			0.5%
		Other place bans (ban in three of four locations—malls, retails stores, public transportation, and elevators)			1%
US study cited in (Smokefree Partnership, 2006) Versus 2.6% reduction in smoking prevalence if partial ban.	US				5.7%

Consumption

Table D.11: Individual consumption

Study	Country	Setting	Before	After	Reduction in number of cigarettes smoked
(Brownson et al., 2002) Follow up periods of up to 2 years. Review	Multiple	Work place bans			1.2 (0 to –4.3) per day
(Fichtenberg and Glantz, 2002) Meta analysis of 26 studies. For Active smokers.	Multiple	Workplace bans			3.1 per day
(NHS Health Scotland et al., 2005) Review		Workplace			1.2–3.1 per day
(Heloma et al., 2000)	Finland		19	16	3
(Gallus et al., 2006) In 2005 smokers consumed 14.6 cigarettes per day.	Italy		15.4 (2004)	13.9 (2006)	9.7% per day
(Braverman et al., 2007) Continuing smokers. Baseline and 4 months after ban.	Norway	Any			1.55
		At work			1.63
(Andreeva, 2007)	Ukraine	Work (complete ban)			3.08
		Work (isolated premises)			2.39
(Office of Tobacco Control Annual report, 2006) 2005 and 2006	Ireland	Occasional (1–5 per day)			+2.2%
		Light (6–10 per day)			–1.2%
		Regular (11–20 per day)			–0.3%

		Heavy (21+ per day)			–0.7%

Table D.12: Total consumption

Study	Country	Before	After	Reduction in tobacco consumption
(Cesaroni et al., 2008) Rome. Frequency of cigarette smoking. Time period: 2000–04 and after smoking ban Jan 2005.	Italy	34.9%	30.5%	4.4%
		20.6%	20.4%	0.2%
(Fichtenberg and Glantz, 2002) Meta analysis of 26 studies. For Active smokers.				29%
(World Bank cited in WHO, 2007)				4–10%
(WHO, 2007) Review	Multiple			29%
(Champman, et al.) Review. Time period: 1988–1994	US			12.7%
(Pisano, 2008)	Italy			8%
(Salto et al., 2007) Daily consumption	Spain			28.4%
(Greiner et al., 2007) Pre and 3 months after ban.	Ireland	65%	46%	19%
(Evans et al., 2007)	US			10%
(Gallus et al., 2006) March–April 2004 versus same period in 2005. Survey in March April 2004 vs. comparison survey in 2005	Italy			7.6%
				23% (15–24 year olds)
				10.5% (women)

Cessation

Table D.13: Cessation attempts

Study	Country	Increase in cessation attempts
(Brownson et al., 2002) Review. Median change or difference in cessation attempts (measured and self-reported) in smokers exposed to workplace ban vs. lesser or no ban.	Multiple	73% (–3.2% to 272%)
National Cancer Institute (Brownson et al., 2002) Review	Multiple	OR: 1.09 (95%CI 1.00–1.18)
(Fong et al., 2006) Survey of 640 smokers. Other findings: Among smokers who quit since ban, 80% reported ban helped them quit, 88% said helped stay quit, and 34% are more likely to use NRT.	Ireland	46%
(Greiner et al., 2007) Switzerland, 11–13 Oct 2007 Proportion of heavy smokers: Pre ban and post ban after 3 months.		11.6% (pre) to 9.9% (post)
(Greiner et al., 2007) Switzerland, 11–13 Oct 2007 Proportion of light smokers: Pre ban and post ban after 1 year.	Ireland	25% (pre) to 28.3% (post)
Media release, 1 August 2005, Quit Organisation Increase in calls to quit line in first month following smoking ban July 1, 2007.	Australia (VIC)	27%
BBC News, 22 March 2007 Increase in number of people contacting smoking cessation services in the 3 months prior to the ban	Scotland	40%

Table D.14: Actually quit smoking

Study	Country	Quitting
(Gorini et al., 2007) Survey Jan–April 2005 among owners of 1,641 bars/restaurants, pizzerias, and pubs in N. Italy. Smoking owners who quit after the ban.	Italy	15%
National Cancer Institute (Brownson et al., 2002) OR of being former smoker of 3 months or more. Review		OR: 1.34 (95%CI 1.10 to 1.63)
(Directorate for Health and Social Affairs, 2005) Employees (1 out of 10 employees quit smoking)		10%
(Salto et al., 2007), Switzerland, 11–13 Oct 2007	Spain	9.1%

(Information Centre for Health and Social Care, Department of Health, 2008) 165,000 smokers quit April–Sept 2007	England and Wales	28%
Media release, Quit 1 October 2004 The percent of smokers who are "somewhat or very likely to quit smoking" with smoke-free ban in pubs, clubs, and gambling venues.	Australia (VIC)	28%
(Helakorpi et al., 2007) OR for daily smoking after 1995 for Employed men.	Finland	OR: 0.83 (95% CI 0.73–0.94)
(Helakorpi et al., 2007) OR for daily smoking after 1995 for employed women	Finland	OR: 0.78 (95% CI 0.68–0.91)
(Surgeon General, 2006) If US workplaces implemented 100% smoke-free policy	US	1.3 million smokers quitting

Table D.15: Uptake/initiation of smoking

Study	Country	Setting	Before	After	Uptake
(Spizzichino et al., 2007) 2003–2005. Males aged (18–19 years old)	Italy		26.5%	27.7%	1.2%
(Spizzichino et al., 2007) 2003–2005. Females aged (20–24 years old)	Italy		21.3%	21.6%	0.3%
(Andreeva, 2007)	Ukraine				OR: 0.517 (95%CI 0.262–1.017)

Table D.16: Youth smoking behaviour

Study	Country	Impact	% Reduction
(WHO, 2007)		Reduction in prevalence among teenagers living in communities with smoke-free law versus none	17.2%
(Farkas et al., 2000) Based on two	US	Ever-smoking prevalence among	26% (95%CI 12–38%)

national surveys conducted in 1993–94 and 1996–7		employed 15–17 year olds living in smoke-free home vs. homes with no smoking restrictions	
(Farkas et al., 2000) Based on two national surveys conducted in 1993–94 and 1996–7	US	Ever-smoking prevalence among employed 15–17 year olds working in smoke-free workplace versus workplace with no smoking restrictions	32%

Table D.17: Domestic trickle down

Study	Country	Impact	Before	After	Reduction
(Evans et al., 2007) Smoking at home	Ireland		58%	50%	5%
(Andreeva, 2007) Edin, Scotland Chances of household restrictions with smoking restrictions to isolated premises at their work	Ukraine				1.44 (95% 1.03–2.01)
(Edwards et al., 2008) Self-reported ETS in all households. (42% of household had one or more smoker)	New Zealand				20%
(Fong et al., 2006) Smoking allowed in the home. This was similar to decrease of 82–76% over same period for UK.	Ireland		85%	80%	5%

Attitudes and social norms

Table D.18: Attitudes of citizens towards smoke-free laws in European countries

Author	Country	Key finding
(European Commission, 2007)	EU	Most people are totally or somewhat in favour of smoking bans in offices and other indoor workplaces (86%), and indoor public space (84%), restaurants (77%), and bars or pubs (61%). Only 9% and 16% of people were totally opposed to smoking bans in restaurants and bars or pubs, respectively.
(Gallus et al., 2006)	Italy	In 2001, 83.3% favoured a smoking ban in public places, such as pubs or restaurants. This figure increased to over 90%. Based on a survey of 3,114 Italian adults interviewed in March–April 2005, *the proportion in favour of separate smoking areas in cafés, restaurants, and other areas open to the public, and smoking ban in their absence were:* —All the population: strongly in favour, 68.1%; strongly against, 2.7% —Current smokers only: strongly in favour, 44.4%; strongly against, 6.6% *The proportion in favour of an extension to forbid smoking in every workplace, including private ones, were:* —All the population: strongly in favour, 55.5%; strongly against, 2.9% —Current smokers only: strongly in favour, 33.5%; strongly against, 8.5%
(Directorate for Health and Social Affairs, 2005)	Norway	Support for the smoke-free law increased from 47% in survey 6 months before to 58% 6 months after implementation. In different national surveys support for smoke-free bars/restaurants increased from 54% before the legislation to 68% 1 year after. A survey in May 2005, a year after the legislation, found that 77% thought the law had been a success. Among a cohort of hospitality industry employees (from 48% pre to 51% 3 months post implementation, with 18–22% neutral and the proportion opposed remaining at 30–31%).
(Hilton et al., 2007)	Scotland	The number of bar workers who agreed with the proposed legislation on smoking went from 69% (before) to 79% (post) implementation, and the numbers agreeing there was a need to protect the health of workers were 80% (before) and 81% (post). 49% thought the legislation would harm business (before) to fewer than 20% (post). Pre implementation 70% thought legislation would encourage smokers to quit; post implementation the figure was 60%.
(Mullally, et al., 2007	Ireland	The general public agreed SHS exposure raises non-smokers' risk of asthma (84–92%), of lung cancer (86–94%), and of heart disease (76–88%). Bar workers identified SHS as risk factor for all three diseases, percentage was substantially lower than GPs or general public. 42% of non-smoking bar workers felt they had moderate risk of lung cancer.
(Richmond, et al., 2007) Edin, Scotland	Scotland	49% staff supported the ban before implementation and 50% after, with no differences according to the type of facility. Bar staff (and customers) in affluent areas were more likely to support the ban both pre and post implementation ($p < 0.001$). Customer complaints were more common

		in deprived areas ($p < 0.001$) and deprived areas were more likely to report a decline in business, and less likely to report improvements ($p < 0.001$). In the most affluent areas, 97% reported that customers supported the ban pre and post implementation. In the most deprived group, only 11% initially supported the ban but this increased to 14% after implementation.
(Hara and Satu, 2007)	Finland	In 1974 85% Finnish of the adult population was in favour of prohibiting smoking in public places. In 2005 62% (and 77% in 2007) thought smoking should be prohibited in restaurants and bars. In 2007 13% were strictly against restrictions.
(Office of Tobacco Control, 2005)	Ireland	Support for the Irish smoke-free law among the public increased from 67% before, to 82% 4 months after implementation, and 93% after 1 year.
(Fong et al., 2006)	Ireland	Support for total bans among Irish smokers increased in all venues, including workplaces (43–67%), restaurants (45–77%), and bars/pubs (13–46%). Overall 83% of Irish smokers reported that the smoke-free law was a "good" or "very good" thing. Figures are based on a prospective cohort study of adult smokers in Ireland surveyed before the law (Dec 2003–Jan 2004) and 8–9 months after the law (Dec 2004–Jan 2005).
(Royal College of Physicians, 2005)	Ireland	Percentage support among smokers for smoke-free policy: pre-policy (Dec 2003 to Jan 2004) to post-policy (Dec 2004 to Jan 2005): —workplaces: 38–47% (UK); 44–67% (Ireland) —restaurants: 33–47% (UK); 46–77% (Ireland) —bars/pubs: 6–12% (UK); 6–48% (Ireland).
(Pursell et al., 2007)	Republic of Ireland (ROI)	Survey of approx 288 (pre) and 220 (post—1 year after ban) bar workers in public houses (pubs) in three areas. Support for legislation increased from 59.5% (pre) to 76.8% (post). Support increased among smokers from 39.4% (pre) to 66.7% (post) ($p < 0.001$). Support increased among non-smokers from 66.8% (pre) to 81.2% (post) ($p = 0.003$). Percentage agreeing that legislation would make bars more comfortable and was needed to protect workers' health rose from 75% (pre) to over 90% (post) ($p < 0.001$). Perceptions that legislation has a negative impact on businesses rose from 50.9% (pre) to 62.7% (post) ($p = 0.008$) and that fewer people would visit pubs (41.8–62.7%, $p < 0.001$). Overall support for ban increased two to three-fold post implementation.
(Smokefree England, 2008 www.smokefreeengland.co.uk/thefacts/latest-research.html)	England	Department of Health survey findings, July 2007: 98% of the general public aware of the law. 75% of adults expressed their support for the law and 79% believe new law will have a positive effect on people's health August 2007: 87% of businesses thought implementation had gone well and 78% think the legislation is a "good idea".
(Smokefree England, 2008, www.smokefreeengland.co.uk/thefacts/latest-research.html)	England	ONS survey (fieldwork Oct and Nov 2006) Support for smoke-free law 77%: 53% of people strongly support the law; 24% support the law; 15% disagree with the new law.
Deputy Chief Medical	England	75% adults support the smoke-free legislation

Officer, Department of Health, England (Presentation)		More smokers agree (47%) than disagree (37%) with the legislation.
(Haw, 2007)	Scotland	97.2% compliance with smoking regulation in the year following implementation, based on 80,832 inspections of pubs and other workplaces.

Table D.19: Attitudes of citizens towards smoke-free laws in non-European countries

Author	Country	Main results
(Edwards et al., 2008) 2003 Smoke-free Environments Amendment Act (smoking ban Dec 2004)	New Zealand	By 2006 population surveys showed over 90% agreement with the right to live and work in a smoke-free environment, and for indoor workers, including bar/restaurant workers, to work in a smoke-free environment. Support was similar among men and women, Maori and non-Maori and all income groups. Support was less strong among smokers.
(Edwards et al., 2008)	New Zealand	60–70% before and at the time of implementation, rising to 75–90% afterwards.
Cherner, Smokefree California	US California	According to the 2004 Field Research poll: —90% Californians said they approve of the smoke-free workplace law —52% of former smokers who quit in the past 10 years said that having smoke-free public places made it easier for them to quit smoking —69% of current smokers who attempted to quit in the past 10 years said that smoke-free public places helped them reduce the number of cigarettes they smoke —Among people who moved to the state after the law went into effect, 93% approve of the law and 91% said they would recommend that other communities adopt a similar smoke-free policy —74% Californians, including nearly half of those who were smokers, agreed that smoking should be prohibited in the outdoor dining areas of restaurants.
Thomson and Wilson (2006)	New Zealand	Between 2004 (before) and 2005 (after) public support for smoke-free bars rose from 56% to 69%. Between 2004 and 2005 support for the rights of bar workers to have smoke-free workplaces rose from 81% to 91%. The proportion of bar mangers who approved smoke-free bars increased from 44% to 60% between November 2004 and May 2005.

Table D.20: Compliance with smoking bans in eight countries

Author	Country	Main results
(Directorate for Health and Social Affairs, 2005)	Norway	Before the smoke-free legislation, 43% of bar/restaurant employees thought that many guests would refuse to obey the law. However, 4 months after implementation, only 7% reported many guests refusing to comply.
(Smokefree, 2007)	England	Overall compliance of premises and vehicles in December 2007 (n = 23.009) and first 6 months of legislation (July–Dec) (n = 379,990): —98.7% compliant of no-smoking (no evidence of management knowingly permitting smoking) and 98.2%, respectively —94.4% compliant in terms of signage (required no smoking signage being displayed prominently) and 86.6%, respectively —Compliance rates varied little by regions.
(Office of Tobacco Control, 2005)	Ireland	Compliance (no smoking observed on the premises) with the smoke-free legislation is very high: —9 months after its introduction, compiled inspection data show overall compliance in workplaces was 94% (ranging from 89% in pubs to 98% in restaurants) —Compliance of office and factory workplaces in the Health and Safety Inspection Programme was 92%, in almost 7,500 inspections —Complaints to the smoke-free compliance line were concentrated in the first month (677 complaints, 30% of all calls in the first year), and then declined to around 150 per month over the first year and to fewer than 120 calls per month in 2005 —98% people believe workplaces are healthier because of the smoke-free law, including 94% of smokers —96% people feel smoke-free law is success, including 89% of smokers —93% people think smoke-free law is a good idea, including 80% of smokers. (Within a month of ban 97% compliance rate had been achieved in all workplaces, including bars.)
(Lund and Helgason, 2005)	Norway	Better compliance with total ban vs. smoke-free areas. 75% of general public support ban.
(Clancy et al., 2007)	Ireland	Compliance remains at nearly 100%.
(Eadie et al, 2007)	Scotland	There were interviews with 70 bar workers, customers, and bar proprietors in eight bars in three contrasting communities in same local authority. Compliance varied with violations more prevalent in deprived communities. Factors influencing compliance include smoking norms, management competency, and management attitudes towards the ban.
(Edwards et al., 2008) 2003 Smoke-free Environments Amendment	New Zealand	Observed compliance in pubs and bars in 2005–06 close to 100%. Number of complaints fell rapidly after the first month, with less than 20% per month since October 2005.

Act (smoking ban Dec 2004)		Only five complaints resulted in prosecutions. Anecdotal reports suggest that there may be greater non-compliance in licensed premises in more remote rural areas, and in smaller businesses with a high proportion of smokers.
Thomson and Wilson (2006)	New Zealand	During the first 10 months of the smoke-free bars policy, there were only 196 complaints to officials about smoking in the over 9,900 licensed premises.
(Weber et al., 2003, cited in Edwards et al., 2008)	US California	Patron compliance (defined as no smoking patrons observed in the venue when inspected) increased 92.2–98.5% between 1998 and 2002 for bars with restaurants, and 45.7–75.8% in free-standing bars.
(Skeer et al,. 2004, cited in Edwards et al., 2008)	US, Boston	3 months after comprehensive smoke-free regulations, a random sample of 102 bars found only three patrons smoking inside, and that complete removal of ash-trays had occurred. After 8 months, only six violation notices had been issues to free standing bars.
(McCaffrey et al., 2007, cited in Edwards et al., 2008)	Ireland	Study in 39 Dublin pubs visited 7–12 months after the smoke-free legislation found that of over 2,500 customers, none were smoking inside the pubs.
(Gallus et al., 2006)	Italy	Out of about 6,000 checks by the Police and other civil forces, fewer than 100 (1.5%) violations observed.
(Fong et al., 2006)	Ireland	At the post legislation wave (8–9 months after law implementation (Dec 2004 to Jan 2005), 94% of Irish smokers (N = 640) reported that pubs were enforcing the law "totally", 5% said "somewhat", and 2% said "not at all".
Deputy Chief Medical Officer, Department of Health, England (Presentation)		Over 98% compliance with the legislation.
(Haw, 2007)	Scotland	97.2% compliance with smoking regulation in the year following implementation (n = 80,832 inspections of pubs and other workplaces).
(Global Smokefree Partnership, 2007)	Multiple	Compliance in Ireland (94%), New York City (97%), New Zealand (97%), Italy (98.2%), Massachusetts (96.3%), and Scotland (95.9%).

Economic effects

Table D.21: Tobacco industry

Study	Country	Setting	Change in sales of cigarettes
(Cesaroni et al., 2008)	Italy	Work and public places (ban 2005)	–5.5% (in 2005 cf. 2004)
(Spizzichino, 2007)	Italy		–6.1% (in 2005 cf. 2004)
(Rogerson, 2007)	Scotland	Benson & Hedges and Dunhill maker Gallaher (however firm posted a 4.9% rise in underlying profit)	−3% to –4%
(Lambert and Butler)	England and Wales	Convenience store on 11 Feb 2008	–4% (in 2007)
(Champman et al., cited in Royal College of Physicians, 2005)	Australia		–3.4%
(Nogues, 2008) 21 months after smoking ban in province of Malaga	Spain		–10%
Smoke-free public places in Ireland	Ireland		–8.7% (in 2004 after ban) –3.4% (in 2003) –1.2% (in 2002)
Smoke-free public places in Ireland	Ireland	Gallaher Tobacco	–10.7% (from Jan 2004)
(Global Smokefree Partnership, 2007) In first 6 months after ban	Ireland		–16%
(Global Smokefree Partnership, 2007) In first 11 months after ban	Italy		–5.7%
(Global Smokefree Partnership, 2007) In first year after ban	New Zealand		–1.5%
(Global Smokefree Partnership, 2007)	Norway		–14.1%

In first year after ban			
Study	Country	Reduction in demand for cigarettes	Change in sales of cigarettes
Health Regulatory Impact Assessment—(Gallaher Ltd.)	Northern Ireland	4%	–0.1%
	England	4%	–3% per annum
		20%	–15%
(Gallus et al., 2006) Jan–April 2004 versus same period in 2005. Official legal sales (million kg of cigarettes)	Italy		–8.9%
(Surgeon General, 2006) If US workplaces implemented 100% smoke-free policy	US	950 million fewer cigarette packs being smoked	
Study	Country	Setting	Change in sales of tobacco products
	Italy		–6.6% per capita
(Spizzichino, 2007)	Italy		–5.9% (in 2005) +1.1% (in 2006, after 6% increase in price)

Table D.22: Hospitality sector

	Change from pre-ban to post-ban	Reference	Country
Bar and pub sales	+0.5% (95% CI: –0.28% to +1.284%; mean 7.1)	(NHS Health Scotland et al., 2005)	Review (n = 1, California
	–4.4% (in 2004) –4.2% (in 2003)	(Office of Tobacco Control, 2005)	Ireland
	–1%	(Lund, 2007)	Norway
	Approx. –4% (in 1st quarter of 2005)	(Edwards et al., 2008) *This effect was not sustained.*	New Zealand
	+0.6%	(Thomson and Wilson, 2006) Seasonally adjusted bar sales between the first three-quarters of	New Zealand

		2004 (before ban) versus same period in 2005 (after ban)	
	+5.8%	(Melia, *The Irish Independent*, 14 Sept 2005) Annual increase July 2004–05 in sales of beer, wine and spirits and food in pubs	Ireland
	–11% (drink sales) –3% (food sales)	(BBC News, 22 March 2007) Scottish Licensed Trade Association survey for Scottish pubs (only one-third members responded out of total 1,500).	Scotland
	–10% (p = 0.02, 95% CI: –19% to –2%)	(Adda et al., 2006). Based on 1590 pubs before ban (Feb 24–Mar 10 2006) and after (3–31 2006)	Scotland
Hotel room revenues	–0.054% (95% CI: –0.128% to +0.02%; mean 2.43)	(NHS Health Scotland et al., 2005)	Review
Restaurant/licensed café sales	+0.25% (95% CI: −1.32 to 1.81)	(Bartosch and Pope, cited in Royal College of Physicians, 2005)	Massachusetts, US
	+0.25% (95% CI: –1.32% to +1.81%)	(NHS Health Scotland et al., 2005)	Review (n = 11, Australia and US)
	+6%	(Lund and Helgason, 2005)	Norway
	+9.3%	(Thomson and Wilson, 2006) Seasonally adjusted restaurant and café sales between the first three-quarters of 2004 (before ban) versus same period in 2005 (after ban)	New Zealand
	+7%	(Americas for Non-smokers' Rights,	Florida (US)

		2005) Effect 1 year after state smoking ban in 2003.	
Patronage (no. of customers or tourists)	−14% (p = 0.02; 95% CI: −26% to −2%)	(Adda et al., 2006). Based on 1,590 pubs before ban (24 Feb to 10 Mar 2006) and after (3–31 May 2006)	Scotland
	9.5% higher in non-smoking café	Kunzli., et al (2005)	Switzerland
	+3.2% (in 2004 vs. 2003)	Office of Tobacco Control (2005)	Ireland
	+11% (p = 0.060)	(McCaffrey et al., 2006) (n = 39 public houses before ban and 1 year later)	Ireland
	No change (between 2003/04 and 2005/06)	(Edwards et al., 2008)	New Zealand
	+9.6%	(Gallus et al., 2007) Survey in March–April 2005 and same period 2005 (self-report visits to cafés and restaurants)	Italy
	−7.4%	(Gallus et al., 2007) Survey in March–April 2005 and same period 2005 (self-report visits to cafés and restaurants)	Italy
	−16%	(Fong et al., 2006) Have you avoided going to pub because of law (among Irish smokers post-legislation (n = 632)	Ireland
	−18%	(Fong et al., 2006) Have you avoided going to restaurants because of law (among Irish smokers post-	Ireland

		legislation (n = 640)	
	–41%	(Fong et al., 2006) Survey: Irish smokers report visiting pubs less often than a year ago post legislation (n = 640)	Ireland
	+3%	(Fong et al., 2006) Survey: Irish smokers report visiting pubs more often than a year ago post legislation (n = 640). NB: 57% said they visit the pub the same amount of time.	Ireland
	Patronage decrease: 29.1% (control 33.1%) No change: 36.6% (control 45.5%) Patronage increase: 34.3% (control 21.3%)	(Biener et al., 2007) Reports (n = 81) of changes in Boston bars patronage anywhere before and after smoking ban (vs. other Massachusetts towns with no smoking ban). p = 0.018	US Boston
	+8.6% (p = 0.609)	(Alpert et al., 2007)	Massachusetts, US
Overall hospitality sales	–7.3%	(Federation of Licensed Victuallers' Associations and BII, 2007)	England
	No change (p = 0.240)	(Alpert et al., 2007) Monthly meal tax collections	Massachusetts, US
	US$6.6 B (1995) to US$7.6 B (1998) to US$9.6 B (2002)	(Americas for Non-smokers' Rights, 2005) Eating establishments' taxable annual sales for beer and wine 1995 (smoke-free restaurants) to 1998 (smoke-free bars) to 2002	California, US

Drink sales	–7.4%	Federation of Licensed Victuallers' Associations and BII (2007)	England
Food sales	–0.6%	(Federation of Licensed Victuallers' Associations and BII, 2007) n = 2708, response rate 15.9%	England
Employment in hospitality sector	–2.4% (2003 to 2004) +0.6% (in 2004 compared to 2002)	(Office of Tobacco Control, 2005)	Ireland
	–8.82% (p = 1.176)	(McCaffrey et al., 2006) (n = 39 public houses before ban and 1 year later)	Ireland
	–15% (establishments)	(YLE News, 17 Dec 2007) Number of establishments that have cut staff because of sales drop	Finland
	+24% (pubs, bars and taverns)* +9% (cafes and restaurants) –8% (clubs)	(Thomson and Wilson, 2006) Average employment in first three-quarters of 2004 (before ban) versus same period in 2005 (after ban) *Might have high patronage around major sport series	New Zealand
	No change (p = 0.683)	(Alpert et al., 2007) Number of workers employed in food services and drinking places. (Number of workers increased in accommodation industry but not significant, p = 0.926)	Massachusetts, US
	+19.5%	(Americas for Non-smokers' Rights,	California, US

		2005) Increase 19.5% from 1992 to 2000 in number of individuals employed in eating and drinking places (vs 13.5% for all employment statewide over same period)	
VAT from hospitality industry	+5%	(Lund, 2007) In the first 16 months after the ban versus the same interval the year before	Norway
Number of bars	+3.5%	(Americas for Non-smokers' Rights, 2005) From April 2002 to May 2004 (smoke-free law implemented on 23 June 2003)	New York
	−7.3% (2005) −4.7% (2006)	AHA (n.d.) Change in number of pub licences in 2005 and 2006 (2004 = +2.4%; 2003 = −1.7%)	Ireland

Table D.23: Other sectors

	Change from pre-ban to post-ban	Study	Country
Gambling revenues	−14%	Lal et al. (2008) Mean level of monthly electronic gaming machine expenditure, July 1998 to Dec 2005.	Australia (VIC)
	−15%	(Rogerson, *The Herald*, 3 March 2007) Impact on RANK (Mecca bingo and	Scotland

		Grosvenor casinos). *One in 10 of Scotland's bingo halls has shut down since ban.*	
Smoking breaks at work	See note	(Jones, *Daily Express*, 29 February 2008) Three 15-minute smoking breaks a day cost employers 195 working hours per annum for each worker.	England

Appendix E: Technological strategies for controlling secondhand smoke

Table E.1: List of selected studies on technological strategies for controlling secondhand smoke

Reference	Type of article	Sample size	Year of data collection	Location	Setting	Study design	Outcome measure	Technology considered
(Akbar-Khanzadeh, 2003)	Peer-reviewed journal article	8 restaurants and 97 non-smoking subjects (40 restaurant employees, 37 patrons, and 20 referents)		Metropolitan Toledo, Ohio	8 restaurants (6 restaurants with a bar and 2 without) 15 designated non-smoking rooms, 14 designated smoking dining rooms, and 7 bars	Observational comparison study (with control group): non-smoking and smoking dining rooms	Air contaminants: personal and area samples for fluorescent particulate matter, nicotine, respirable suspended particles, solanesol, and ultraviolet particulate matter, CO (8 hours) Urinary cotinine and nicotine (pre work, post work and 18-hour post exposure)	Designated smoking areas with ventilation
(ASH Scotland, 2004)	Charity report					Not applicable		
(Bialous and Glantz, 2002)	Peer-reviewed journal article		Jan 2001 to March 2002			Literature review: review of tobacco industry documents		Ventilation approaches

						available on the internet		
(Broadbent, 2005)	Independent report					Not applicable		
(Carrington et al., 2003)*	Peer-reviewed journal article	Total number of sample locations for 60 pubs include 683 smoking ares and 112 non-smoking areas.		Greater Manchester, UK	Bars	Random selection of bars Observational comparison study	Min, max and median secondhand smoke markers: respirable suspended particulate matter, ultrviolet light-absorbing particulate matter, fluorescent particulate matter, solanesol particulate matter	Electrostatic precipitators and extractor fans
(De Gids and Opperhuizen, 2004)	Government sponsored report	111 articles included in review	Articles published from 1975 to 2004)	n/a	Hospitality industry	Literature review	Whether or not ventilation and air cleaning can contribute to the reduction of exposure to ETS	Ventilation and air cleaning technologies
(Drope et al., 2004)	Peer-reviewed journal article			US		Literature review: tobacco industry documents		Ventilation approaches
(Environmental Protection Agency, 2008)	Scientific Association report					Not applicable		Air cleaning devices
(Geens et al., 2006)	Peer-reviewed journal article					Review		
(German Cancer Research Center, 2007)	Foundation report					Not applicable		
(Hammond, 2002)*	Conference	75 restaurants	Not cited	26 cities	Restaurants	Not cited	Mean nicotine levels	Designated smoking areas with

	proceeding							ventilation
(Jacobs et al., 2006)	Industry sponsored report		30 January 2006	Haarlem	Jacobus Pieck restaurant	Case study: smoke room with and without an air purifier, and in a smoke-free room	Aldehydes, volatile organic compounds, and nicotine	Designated smoking rooms with a decentralised smoke displacement system using recirculation and filtration
(Jenkins et al., 2001)	Peer-reviewed journal article	1 restaurant/pub			Restaurant/pub	Case study	ETS components	Designated smoking areas with heat-recovery ventilation system
(Kotzias et al, 2006)	Not-for-profit, international medical organisation	INDOORTRON facility, a 30m^3 walk-in type environmental chamber	Not cited	Not cited	INDOORTRON facility, a 30m^3 walk-in type environmental chamber	Two series of experiments to test the impact of ventilation rates on ETS components	ETS components (VOCs, carbonyl compounds, inorganic gases)	Ventilation rates in indoor environmental chamber
(Milz et al., 2007)	Peer-reviewed journal article	4 restaurants 2 restaurants smoke-free restaurants and 2 restaurants with dedicated smoking rooms Smoke-free office (reference site)		Two cities in Norwest Ohio, Toledo, and Bowling Green	Restaurants	Observational comparison study: with and without smoking rooms (with control site)	Carbon dioxide Ultrafine particle concentrations	Smoking rooms
(Piha, 2006)	Government report					Not applicable		
(Pilkington and	Peer-reviewed					Literature review:		Ventilation

Gilmore, 2004)	journal article					web-based search of tobacco industry documents made public through litigation		approaches
(Pion and Givel, 2004)	Peer-reviewed journal article	Lambert airport—2 tests	1997–98, and again in 2002	Lambert Airport—near smoking room 4C (15 Dec 1997 to 26 Feb, 1998). Sea-Tac airport—indoor bar remote from entrances. Lambert Airport—near smoking room 4C (26 Sept 2002)	Airport smoking room	Repeated observational design	Average nicotine vapour concentrations (air monitoring)	Smoking rooms
(Pirkle et al., 1996)	Peer-reviewed journal article	Persons aged 2 months and older (n = 16818) and measurements of serum cotinine from persons aged 4 years and older (n = 10642)	25 October 1988 to 21 October 1991	US	National	Nationally representative cross-sectional survey	Serum cotinine levels in non-tobacco users	Not applicable
(Repace, 2000)	Government sponsored report					Workshop on ventilation engineering controls		Ventilation approaches

						for ETS in the hospitality industry, attended by ventilation experts		
(Repace and Johnson, 2006)	Professional society article	One Pub	13 December 2002 and 10 December 2002	Near Toronto	The Black Dog Pub	Observational design comparing pre and post voluntary smoking ban in smoking and non-smoking areas of pub	Respirable suspended particles and carcinogenic particulate polycyclic aromatic hydrocarbons, carbon dioxide	Designated smoking areas with displacement ventilation
		Two pubs	6 March 2003	Mesa, Arizona	TGI Fridays pubs and Macaroni Grill pub			
		Six pubs	12 December 2002, 6:00 pm to 12 midnight	Ottawa	Pubs (smoke-free)	Observational design		
(Smoke Free Systems, 2001)	Industry report	3 sampling points (including one control) across 8 hour day	1 Feb 2001 at 8:45 am to 4:10 pm	Library on the 8th floor of Uusimaa Industrial Safety District Building	Workplace—Library	Case study	Nicotine 3-ethyle pyridine TVOC	Smoking station
(Smokefree Northern Ireland)	Government agency report					Not applicable		
(Stantec Consulting, 2004)	Non-profit association sponsored report	3 food and beverage establishments with both smoking and non-smoking sections Also one control non-smoking location.	3-day testing at each location during February 2004	Ontario, Canada	Restaurants and bars	Comparison observational design smoking sections versus non-smoking sections	Nicotine and 3-ethenyl pyridine and ultraviolet-absorbing particulate matter, fluorescing particulate matter, and solanesol. Personal air samples from one	Designated smoking rooms ventilated by an energy/heat recovery or designated smoking

		In each location 3 area samples in both non-smoking and smoking sections (2 locations had DSR and 1 location DSA).					non-smoking and one smoking section staff.	area
(Surgeon General, 2006)	Government report					Review		
(Theodor Sterling Associates, 2007)	Industry sponsored report	12 hospitality venues where smoking is allowed (3 indoor samples in each venue and 1 outdoor location)	November 2006	Cardiff, Wales, and London	Hospitality	Comparison of indoor and outdoor air quality measurements	Carbon dioxide, nitrogen dioxide, carbon monoxide, respirable suspended particles, particulate matter ($PM_{2.5}$ and PM_{10})	Ventilation systems using dilution ventilation principles
(Vaughan and Hammond, 1990)*	Professional association journal				Office buildings	Before and after observational design: smoking restriction to a snack bar on one floor	Nicotine measurements	Designated smoking room
(Wagner et al., 2004)	Peer-reviewed journal article	27 laboratory experiments			Simulated smoking room	Laboratory experiments	Rates of ETS leakage to a non-smoking area	Designated smoking room
(WHO, 2007)	International organisation report					Not applicable		

(*Cited in Surgeon General, 2006)

Appendix F: Cost-effectiveness of smoking cessation

Table F.1: Cost-effectiveness of public policies for smoking cessation

Intervention	Country	Reference	Cost results	Additional comments
Inpatient SC therapy (behaviour modification and NRT)	Austria	(Schoberberger and Zeidler, 2007)	(health impact)	Therapy obtains abstinence rates of 38% at the 1 year follow-up. Health benefits were noticed first of all with pulmonary diseases but also with hypertension and hypercholesteremia.
Standard SC (trained in interviewing and advising with a manual)	Denmark	(Kjaer et al., 2007)	(health impact)	1 in 6 smokers are smoke-free after 12 months. Rates of continued abstinence are nearly 20%. Five determinants influence continued abstinence: gender, age, degree of nicotine dependence, format, and setting of cessation service.

Nation-wide treatment service	UK	(Low et al., 2007)	(social impact—distributional issues)	Smoking cessation tends to be more successful among affluent than disadvantaged groups. Service expansion was successful in increasing the overall number of quitters, and the service continued to exacerbate inequality in smoking prevalence between deprived and affluent wards in Derwentside, former PCT in North East of England.
SmokeStop therapy	Netherlands	(Christenhusz et al., 2007)	Over 12 months, avg patient receiving SST generated €581 in health care costs, including the costs of the SC programme, vs. €595 in the minimal intervention group. The SST is also associated with a lower average number of exacerbations (0.38 vs. 0.60) and hospital days (0.39 vs. 1) per patient, and a higher number of quitters (20 vs. 9) at lower total costs.	Findings are robust and insensitive to changes in parameters. After 1 year, SmokeStop therapy is more cost effective than minimal intervention, with cost-savings per additional quitter, prevented exacerbations and hospital days at lower or equal costs.
Quitline (with work legislation)	Ireland	(Flannery and Cronin, 2007)	(health impact)	Smokers' quitline established in 1999. At 6 months post-ban: 33% of callers had quit, 72% had attempted to quit on at least one occasion. At 1 year: 22% remained quit and 60% who quit said the quitline was either a significant or important aspect.
Brief interventions in primary care	UK	(NICE, 2006)	Costs are estimated to be £5.4 million. Extrapolated data from the cost of treating acute MI and stoke (£1.5 billion per year, 1998) indicates that cost savings of £20.7 million over 11 years for avoided events possible.	

Bupropion vs. NRT	Sweden	(Bolin et al., 2006)	Total health care costs averted with bupropion vs. nicotine patches was SEK 50,073,220 (€5,419,424.601) for men and SEK 72,727,847 (€7,871,334.881) for women. Indirect costs accounted for a saving of SEK 122,305,699 (€13,237,145.8) for men, and SEK 11,956,131 (€12,117,012.06) for women. Compared with nicotine gum, bupropion results in health care savings of SEK 59,177,442 (€6,404,774.55) for men and SEK 85,962,911 (€9,303,765.858) for women. The indirect costs averted were SEK 144,543,099 (€15,643,899.6) for men and SEK 132,311,792 (€14,320,105.25) for women. The incremental saving of bupropion compared with nicotine patches including indirect costs was SEK 23,400 (€2,532.582) for men and SEK 16,600 (€1,796.62) for women. Incremental saving of bupropion compared with nicotine gum including indirect costs was SEK 33,300 (€3,604.1) for men and SEK 26,500 (€2,868.1) for women.	Direct costs from diagnosis-specific hospital care, nationally representative GP costs; and indirect costs from lost productivity and future consumption were estimated. Use of bupropion compared with nicotine patches resulted in 1,073 additional QALYs in men and 5,201 QALYs in women. Compared with nicotine gum, bupropion resulted in 4,814 additional QALYs in men and 6,147 additional QALYs in women. Stochastic sensitivity analyses showed that there was an 80% chance of bupropion being cost-saving in comparison with nicotine patches. Comparisons with NRT were more favourable. Bupropion is a CE therapy in comparison with nicotine patches or nicotine gum.

Booklet delivered by cardiac nurses with special training in SC	Norway	(Quist-Paulsen et al., 2006)	Total additonal costs associated with SC programme over usual care were NOK 510 (€63) per patient. In the low-risk group (patients with stable CHS), the ICER associated with the SC programme over usual care was NOK 42,500 (€5,230) at 5 yrs and NOK 2,300 (€280) in the lifetime perspective. In the high-risk group (patients after MI), the ICER associated with SC over usual care was NOK 9,800 (€1,200) at 5 yrs and NOK 900 (€110) in lifetime perspective. The SC programme remained highly CE even if the cost of the programme were increased. It compared favourably with other treatment modalities.	Direct costs were nursing time, booklet, office rental, and telephone calls. Costs of NR were not included as these were not significantly different between groups. Hospitalisation costs due to future MI or stroke were also excluded as they were characterised as highly uncertain.
Specialist services	UK (England)	(Godfrey et al., 2006)	Average cost per life year gained (LYG) was £684 (95%CI: 557 to 811), falling to £438 when savings in future healthcare costs were counted. With worst case assumptions, the estimate CE rose to £2,693 per LYG saved (£2,293 including future healthcare costs) and fell to £227 (£102) under the most favourable assumptions.	Findings are comparable to previous published studies. English smoking cessation services provided CE services operating well below the benchmark of £20,000 per QALY that is used by NICE. Different factors influence cost per client and net cost per LYG, indicating decision makers should be careful in setting performance targets for these services.

Specialist services + NRT + bupropion	UK (England)	(Godfrey et al., 2006)	Total mean smoking cessation services costs were £254,400 (95% CI: 557.2 to 811.3). Median cost was £214,900. When only smoking cessation costs were included, the cost per LYG was £684.2 (95%CI: 557.2 to 811.3; median £544.2). When both costs of service and health care cost-savings were included, the cost per LYG was £437.7 (95%CI: 311.2 to 564.2; median 292.6). After combining the worst case assumption, the net cost per LYG was £2,293 (95% CI: 536 to 4,050).	Direct costs to health and social care system included staff costs, space occupied by the services, provision of computing facilities, the provision of NRT, and bupropion. Results of regression analysis showed that longer group behavioural sessions were assoicated with lower CE, whereas services offering shorter programmes of group behavioural support sessions had higher CE. A higher number of smokers setting quit dates and using NRT/bupropion also significantly increased the CE of smoking cessation services. In 2000/01, English smoking cessation services provided CE services operating well below the threshold of £20,000 per QALY used by NICE.

Pharmacotherapies (bupropion, nicotine patch, gum, spray, inhaler) vs. GP counselling alone vs. no treatment	Canada, France, Spain, Switzerland, UK, and US	(Cornuz et al., 2006)	The cost per LYG with cessation counselling only compared with no treatment for 45-year-old men and women respectively was: $190 and $288 in Spain, $375 and $567 in Switzerland, $389 and $588 in Canada, $479 and $724 in France, $623 and $941 in the US, and $773 and $1,168 in the UK. The min. and max. ICERS for each pharmacotherapy in persons aged 45 were: —$2,230 for men in Spain and $7,643 for women in the US for nicotine gum —$1,758 for men in Spain and $5,131 for women in UK for nicotine patch —$1,935 for men in Spain and $7, 969 for women in the US for nicotine spray —$3,480 for men in Switzerland and $8,700 for women in France for nicotine inhaler —$792 for men in Canada and $2,922 for women in US for bupropion.	Estimates of treatment efficacy were obtained from meta-analyses, based on systematic reviews. Review included approx. 15 primary studies. Direct costs included costs of NRT, bupropion, and GP time. A discount rate of 3% per annum was applied. In each case, bupropion and, second, the patch were the most CE treatments. In each country, pharmacotherapies for SC would be considered favourable in terms of CE compared with several other common preventive drug treatments.

Advice from GP	Sweden	(Lofroth et al., 2006)	The CE ratios ranged from €3,653 per QALY gained (including cost of productivity losses, at a discount rate of 3% and at any duration of treatment) to €4,410 (excluding cost of productivity losses, at a discount rate of 5% and at any duration of treatment).	Study compared three methods for prevention CVD. Health care costs included were for anti-smoking counselling, consultation, blood pressure-lowering drugs, lipid-lowering drugs, and MI and stroke treatment. Value of lost productivity was included (difference between annual gross income for patients with MI or stroke and the general population). The smallest variation in CE ratios was observed with the smoking cessation method offered to a 70-year-old woman with serum cholesterol of 5.0 mmol/L and a systolic blood pressure of 139 mmHg. Authors suggested that resources allocated to smoking cessation should be increased by 124%.

Group courses, individual courses, quick interventions, NRT	Denmark	(Olsen et al., 2006)	Incremental CE ratios for SC strategies over no intervention was €1,358 (95%CI: 1,320 to 1,396) in whole sample, €1,090 (95%CI: 1,065 to 1,116) for men, €1,361 (95%CI: 1,326 to 1,395) for women, €1,114 (95%CI: 1,090 to 1,137) for light smokers, €1,362 (95%CI: 1,325 to 1,400) for heavy smokers, €1,361 (95%CI: 1,326 to 1,396) in a pharmacy setting, €1,058 (95%CI: 1,036 to 1,081) in a hospital setting, €9,651 in age group 25–34 yrs, €1,984 (95% CI: 1,907 to 2,060) in age group 35–54 yrs, €673 (95% CI: 664 to 681) in those aged 55+. Probabilistic sensitivity analysis showed that probability of being CE at different thresholds was higher for men, light smokers and participants at hospitals compared with women, heavy smokers, and participants in pharmacies.	Direct costs were restricted to those associated with NRT and instructor personnel time. Regression analysis showed that covariates gave only a moderate explanation of cost variation. Cessation courses other than individual and group (quick courses) were slightly cheaper. Group courses were slightly more expensive than individual courses. The extra cost of smoking cessation strategies over no intervention was: €450 in whole sample; €423 for men, €450 for women, €442 for light smokers, €438 for heavy smokers, €464 in a pharmacy setting, €426 in a hospital setting, €415 in age group 25–34 yrs, €446 in age group 35–54 yrs, and €443 in those 55+ yrs. SC strategies were CE in Denmark, but with exception of youngest group of smokers, there were only moderate differences between sub-groups. In general, SC strategies were more CE when offered to men, older persons and light smokers.
Opiod antagonists (naltrexone) vs. placebo or vs. alternative therapeutic control for SC	Meta-analysis	(David S, Lancaster T, Stead LF, Evins AE; 2006)	4 trials of naltrexone failed to detect a significant difference in quit rates between naltrexone and placebo.	Not possible to confirm or refute whether naltrexone helps smokers quit.

5 face-to-face SC interventions by GP or specialised counsellors	Netherlands	(Feenstra et al., 2005)	For 75-year implementation, net value of the intervention at 2000 level prices was €1.7 × 10^9 for telecounselling, €0.52 × 10^9 for minimal counselling, €3.8 × 10^9 for minimal counselling and NRT, €7.8 × 10^9 for intensive counselling without NRT, €7.3 × 10^9 for intensive counselling and bupropion. For 75-year implementation, cost per LYG was €1,400 for TC, €1,800 for MC and NRT, €6,200 for IC and NRT, and €4,300 for IC and bupropion Cost per QALY gained was €1,100 for TC, €1,400 for MC and NRT, €4,900 for IC and NRT, and €3,400 for IC and bupropion	Health service costs included counsellor time, GP time and self-help manuals, prescriptions of NRT, chest physician time, lung cancer time, prescriptions of bupropion, overhead costs, and cost of assistance. Costs of adverse events ommitted. Minimal counselling (MC) dominated all other interventions for every implementation period. Assuming 75 yrs implementation, the MC intervention yielded 330,000 life-years and 410,000 QALYs, and resulted in cost-savings of €1.4 billion. The cost-savings were higher than the intervention costs (€250 million). Sensitivity analyses showed the results were robust to variations in resources used, different time horizons, and the percentage of smokers that take up the intervention. CE became less attractive as the discount rate increased. All five SC interventions were CE in comparison with current practice. Minimal GP counselling was even cost-saving.
Finance incentives for SC treatment	Meta-analysis	(Kaper et al., 2005)	When a full benefit was compared with a partial or no benefit, the costs per quit varied between $260 and $2,330.	There is some evidence that healthcare financing systems directed at smokers which offer a full financial benefit can increase the self-reported prolonged abstinence rates at relatively low costs when compared with a partial benefit or no benefit.

Quit and Win contest	Sweden	(Johansson et al., 2005)	Total costs for a female smoker was estimated between SEK 100,000 (€11,834.32) and SEK 180,000 (21,301.78), depending on age group. For a quitter, these costs were between SEK 80,000 (€9,467.45) and SEK 150,000 (€17,751.48). Savings associated with SC amounted to about SEK 30,000 (€3,550.3) per female quitter. If disease-related morbidity productivity costs were excluded, the savings per quitter were about SEK 20,000 (€2,366.86). Intervention costs were SEK 267,000 (€31,597.63), the cost per participant was SEK 1,100 (€130.178) and the cost per quitter was SEK 7,850 (€928.99). The cost per undiscounted LYG was SEK 4,100 (€485.21). The "Quit Smoking Gals" intervention led to societal cost-savings of SEK 830,000 (€98,224.85). These savings ranged from SEK 2,620,000 (€310,059.17) to SEK 420,000 (€49,704.14) according to discount rate.	Direct costs included initial disease-specific medical treatment costs, annual disease-specific medical treatment costs, costs of death, and costs related to the intervention. Indirect costs also considered including income loss because of absence from work and morbidity productivity costs. Participant time spent attending meetings was also included. Discounting was carried out at 3%. The Quit and Win contest was associated with cost-savings and health gains among women. The construction of an optimal mix of tobacco control policies would demand economic evaluations of a wide range of tobacco control programmes.
Quitline	Sweden	(Tomson et al., 2004)	Total costs of quitline were $699.243 ($475,095 for personnel, $23,766 for materials, and $200,382 for services). Incremental cost per quitter was $1,052 using the conservative approach of 7% spontaneous smokers, and $1,360 when assuming a 31% quit rate. The incremental cost per LYG ranged from $311 (7%) to $401 (31%). When no discount rate for the benefits were considered, the cost per LYG was $29 when using a 31% quit rate.	Discounting was applied at two different rates: 3% and 5%. Quitlines were a cost-effective strategy for smoking cessation in Sweden and compared favourably with other smoking cessation policies.
Mass TV campaign	UK	(Parrott and Godfrey 2004)	Campaign cost $18 million per year and resulted in 2.5% quit rate, costing $10–20 per life-year saved.	

Brief advice	Meta-analysis	(Silagy C, Stead LF; 2004)	Brief advice from a physician in UK costs about £469 ($750) per life-year saved. A US study found that costs of physician counselling were between $705 and $988 per life-year for men, and $1,204 to $2,058 per life-year for women.	Costs of providing are ususally low if provided as a by-product of medical consultation.
Bupropion vs. placebo	Meta-analysis	(Scharf and Shiffman, 2004)		Twleve RCTs included in the review which found that bupropion SR is an effective SC aid for both men and women. However, women have less success at quitting than men, regardless of whether treated with bupropion SR (BSR) or placebo. Analysis of gender-by-treatment interaction suggested that men and women benefitted equally from BSR treatment (OR = 1.01).
3 different pharmacotherapy mixes	Spain	(Antonanzas and Portillo, 2003)	Total costs at 20 yrs were €44,033,192 for S-I, €57,623,558 for S-II, and €58,877,069 for S-III. Costs avoided during this period for each strategy when compared with current situation were: €128,211,567 for S-I, €84,558,581 for S-II, and €32,270,939 for S-III. There was a net cost saving of €28,166 per avoided death, and €3,265 per year of life saved with S-I, and €13,665 per avoided death and €1,584 per year of life saved with S-II, when compared with current situation. S-III resulted in positive ICERs, equal to €35,369 per each additional avoided death, and €4,099 per each additional year of life gained, when compared with current situation.	Strategy I = attain SC of 10% with bupropioon, 1% with patches, 1% with gum Strategy II = attain SC of 20% with patches, 3% bupropion, and 1% gum Strategy III = attain SC of 10% with gum, 3% with bupropion and 1% with patches Comparator was situation where 84% of smokers quit by willpower, 10% use GP advice, 1% use patches, 1% use gum, 1% use group therapy, and 3% use bupropion. Six previously published studies included in the review Direct costs were direct medical costs associated with the therapies and the treatment of the several smoking-related diseases. Conclusion = S-I (focused on an increased use of bupropion to stop smoking habits) was the most effective of the therapies for CS.

Community pharmacy-based	Meta-analysis	(Blenkinsopp et al., 2003)	For SC RCTs: cost of using intensive rather than standard pharceutical support was £83 per life-year saved in the Scottish trial, while the cost per life-year saved in the intervention arm ranged from £197 to £351 for men and £181 to £722 for women in the Northern Ireland trial. Evidence supports the wider provision of smoking cessation and lipid management through community pharmacies.	Interventions aimed at SC and lipid management to reduce risk factors for CHD, including combinations of education, counselling and advice, and training of pharmacists. Some of the SC studies involved NRT.
4 NRT therapies (gum patch, spray, inhaler) and bupropion as adjunct to GP advice	Switzerland	(Cornuz et al., 2003)	Counselling: cost per life-year saved ranges from €385 (45–49 yrs) to €622 (age 65–69) for men, and €468 (age 50–54) to €796 (age 25–29) for women. Pharmacological treatment: the marginal CER ranges from €1,768 to 5,879 for men and from €2,146 to €8,799 for women.	Changes in treatment effectiveness have significant impact on CE. Upper and lower bounds for 45-year-old male: gum (6,212; 3,901), patch (4,633; 2,799), nasal spray (8,700; 2,469), inhaler (10,6014; 2,298) and bupropion (6,308; 960) in EUR
OTC NRT, placebo, prescription NRT	Meta-analysis	(Hughes J. R., Shiffman S, Callas P, Zhang J; 2003)		Seven RCTs and two controlled trials were pooled. No cost information. OTC NRT is pharmacologically efficacious and produces modest quit rates similar to those seen in real world prescription practice.
Stage-based interventions to change smoking behaviour	Meta-analysis	(Riemsma et al., 2003)	One RCT estimated the marginal cost per person who quitted as £450.65, which could fall to an extreme of £265 with increased use. A second study reported an incremental CE ratio for the intervention as £300 per person who quitted.	Interventions in the review included preventive health programmes, motivational approaches, educational programmes, transtheoretical model of change-based interventions, self-help interventions, computer-based programmes, school- and office-based interventions, minimal contact, smoke-free families programmes, interactive expert systems, counselling and advice, and so on. 35 unnamed electronic databases were searched and 23 RCTs included in the review.

NRT vs. bupropion	UK (England & Wales)	(NICE, 2002)	Incremental cost per life-year saved is about £1,000–2,399 for NRT, £639–1,492 for bupropion SR, and £890–1,969 for NRT + BSR. Estimated cost of SC programme to the NHS in England and Wales would be about £67–202 million per year. Consequently, about 45,000–135,000 smokers will quit, and about 90,000–270,000 life-years saved. The average cost per life-year saved is about £750 (range: £500–1,500).	According to the available evidence, the incremental CE of BSR is generally better than that of NRT. But, this should be interpreted cautiously because of generally limited data on the relative efficacy of BSR and its possible side-effects.
Comprehensive community programmes	UK	(Stevens W, Thorogood M, Kayaikki S; 2002)	Estimated programme costs were £56,987 (alternative of no programme was zero). Incremental cost per life-year gained was £105 (95%CI: £33–391), with a modal value of £90. The incremental cost per one-year quitter was £825 (95%CI: 300–3,500).	Targeted at the Turkish community. Costs included salary, other labour expenses, non-pay costs and overheads.

Advice or counselling: only, or + NRT, or + bupropion, or + NRT and bupropion	UK	(Song F, Raffery J, Aveyard P, Hyde C, Barton P, Woolacott N; 20027)	Cost per attempt was: $5.08 with advice only; $108.72 with advice + NRT; $109.56 with advice + bupropion sustained release; $207.23 with all three. Cost per attempt was: $50.76 with counselling only; $148.44 with counselling + NRT; $149.27 with counselling + BSR; and $246.95 with all three. In comparison with advice or counselling alone, the average incremental cost per LYG was: $3,455 (range: 2,107 to 16,726) with advice + NRT; $2,150 (range: 1,182 to 14,535) with advice + BSR; $2,836 (range: 1,268 to 26,245) with advice + NRT + BSR; $1,441 (range: 439 to 8,044) with counselling + NRT; $920 (range: 306 to 7,052) with counselling + BSR; and $1,282 (range: 507 to 11,817) with counselling + NRT + BSR. Incremental cost per QALY was: $2,559 or $1,067 for NRT relative to advice or counselling, respectively; 1,593 or $681 for BSR over advice or counselling, respectively; and $2,101 or $950 for NRT + BSR relative to advice or counselling, respectively. In comparison with advice or counselling + NRT, the average incremental cost per life-year saved was $2,391 (range: 952 to 80,558) with advice, NRT & BSR, and $1,156 (range: 538 to 33,170) with counselling, NRT and BSR In comparison with advice or counselling + BSR, the average incremental cost per life-year saved was $4,322 (range: 1,385 to 288,612) with advice, NRT + BSR, and $2,123 (range: 825 to 115,445) with counselling, NRT + BSR.	Direct costs can be inferred as GP and nurse visits, BSR and NRT. All SC strategies provided a CE ratio comparable to accepted health care interventions. This conclusion held with the most pessimistic scenario. Bupropion sustained release appeared slightly more CE than NRT but this result should be interpreted with caution as data available for bupropion were more limited than those for the evidence of NRT
Non-tailored letters	Scotland	(Lennox A et al., 2001)	CER = £89 per additional quitter, under optimistic assumptions the CER is £37/quitter. Using a 5% discount rate gives a cost per LY of £50–122.	Patients costs are excluded. SC aids purchased by smokers not included.

Behavioural support (trained occupational health adviser) + access to NRT	UK	(Cruse et al., 2001)	(Social impact) GlaxoSmithKline implemented a voluntary programme for its employees.	At 12 months (n = 123), 20% were non-smokers, of whom 15% stated they had not smoked at all for 12-month period; the other 5% had relapsed but had since successfully quit, and 2% classed themselves as non-smokers but still smoked occasionally. 52% of participants stated that regular face-to-face contact and monitoring of progress were particularly useful in helping smoking cessation, providing compelling support for the active promotion and support of SC among employees.
Unspecified	UK (England)	(Naidoo et al., 2000)	Target group 1 (reduce smoking rate from 28% in 1996 to 26% by 2005 and 24% by 2010): undiscounted cost saving was £524 M, 6% discounted cost saving was £320 M Target group 2 (reduce smoking rate from 28% in 1996 to 22% in 2005 and 17% in 2010): undiscounted cost saving was £1.14 B, 6% discounted cost saving was £680 M.	The savings made through the moderate success in cessation programmes are in themselves significant, cumulative and immediate, not just in terms of mortality and morbidity, but in use of scarce health care resources. Costs were those related to hospitalisation from the number of events of MI and stroke.
Community wide SC	UK	(Parrott and Godfrey, 1998)	Costs of £107–3,622 per life-year saved ($171–5,800).	
Pharmacy-based cessation programme	N. Ireland	(Crealey et al., 1998)	Cost per life-year saved was between $326.62 and $583.41 for men and $301.04 to $1,281.72 for women.	
Individual Treatment + brief advice + nicotine gum	UK	(Buck et al., 1997)	Programme cost £2,370 ($3,800) per life-year saved.	
Quit and Win	Sweden	(Tillgren et al., 1993)	Contest cost from $188 to $1,222 per life-year gained.	

Appendix G: Stakeholder consultation on smoke-free environments

Introduction

As part of the impact assessment exercise, DG SANCO organised two stakeholder consultation meetings (one with business organisations, the other with civil society and social partners) on 19 March 2008. The meeting was jointly facilitated by RAND Europe and DG SANCO. The purpose of the stakeholder meeting was to seek input from various stakeholders in order to make the research process as transparent as possible and obtain valuable information from stakeholders directly, information that is not always available through other data sources. During the meeting RAND presented interim study results in addition to the study's methodological approach. DG SANCO presented the five policy options under consideration in the Impact Assessment. Finally, RAND conducted an exercise to collect systematically expert knowledge and opinion on the likely effects of the proposed policies on various key inputs to the analysis.

Invitations were sent to the main stakeholders at EU level but all "spontaneous applications" from interested national organisations were also accepted. A background document was sent out to all registered participants one week prior the meeting, which included information on the objectives of the stakeholder consultation, the problem definition and analysis approach, and description of policy options.

This section summarises the key outcomes of the consultation, but does not report the quantitative responses from stakeholders on the likely effects of the proposed policies (stakeholder questions 3 and 4) since this has been summarised elsewhere in the report.

Responses to the consultation

In total 38 stakeholders attended the two meetings, and following the meetings DG SANCO received a total of 27 written responses from various organisations. Annex I contains a list of all the contributions to the consultation. Annex II lists the stakeholder consultation questions.

Summary of the contributions

This section summarises the written contributions to the consultation based on the type of organisation. Many institutions reiterated their responses to the Green Paper *Towards a Europe Free From Tobacco Smoke: Policy Options at EU Level* (DG SANCO, 2007)

Health-related organisations

The largest number (15) of written responses to the stakeholder consultation were received from health promotion organisations, including NGOs, scientific institutions, and public administration bodies

Seven health organisations provided a coordinated reply, arguing that a combination of a strong Council recommendation (policy option 4) based on article 8 guidelines and a revision of the existing directives based on the Framework Directive on Workplace Safety and Health 89/391/EEC, including in particular extending the scope of the Carcinogens and Mutagens Directive 2004/37 (policy option 5) to cover tobacco smoke, would have the biggest potential to support and/or strengthen comprehensive smoke-free legislation at national level and thus reduce exposure to tobacco smoke and the related health and economic burden. While four of these organisations assumed that the effectiveness of option 4 and 5 would be similar, the other three thought that a Council recommendation on its own would have less impact. Policy options 1 to 3 (continuing current work, open method of coordination and Commission recommendation) would have no impact on the key measures identified. The cost for industry sectors were not a primary concern for these organisations, but it was argued that the hospitality industry is not adversely affected by smoke-free legislation while spending on tobacco products is redirected to other goods and services in more labour intensive sectors.

Two organisations argued strongly in favour of binding legislation as the only viable policy option. Moreover, one health organisation felt that classifying tobacco smoke as a carcinogen would be the most important basis for policy options 3 to 5.

One health NGO felt that more attention should be given in the report to the "likely beneficial impact of reducing ETS on inequalities in health in Europe". A number of respondents provided further evidence, for example on the costs of treating cardiovascular and respiratory diseases, social effects of Scottish smoke-free legislation, and workers' exposure to tobacco smoke across the EU. All, except one health organisation (the European Foundation for the Improvement of Living and Working Conditions), completed answers to question 3 and 4 of the stakeholder consultation.

Pharmaceutical industry

There were only two responses from the pharmaceutical industry. The industry felt that the revision of binding EU legislation (such as Directive 67/548/EEC on dangerous substances in order to classify tobacco smoke as a carcinogen and the Directive on Workplace Safety and Health 89/391/EEC), complemented by a strong Council recommendation, tackling wider tobacco-control issues, would be the best way to reduce the tobacco-related burden. Moreover, smoke-free policies can be the most effective when they are complemented by effective flanking policies, such as awareness-raising campaigns and increased access to smoking cessation services and therapies.

Tobacco-related organisations

Smokers' non-government organisations
The smokers' non-government organisations (NGO) expressed concern that the policy options had less to do with "protecting" non-smokers from the effects of ETS and more to do with the "denormalisation" of smoking. This group felt that people should have the right to smoke in some public places and proprietors should have the right to accommodate adults who choose to smoke without inconveniencing those who do not wish to smoke or socialise in a smoking environment. The group argued that the Impact Assessment should examine the social and humanitarian impact a comprehensive ban would have on smokers as well as technological solutions for controlling ETS.

Manufacturers
The majority of tobacco manufacturers expressed support for an EU-wide ban with exemptions in order to accommodate the interests of those who do not wish to be exposed to ETS and those who wish to smoke in venues.

It was argued that business owners should have a role in deciding how to implement solutions that work best for their customers. In this context, it was felt the Commission should review the cost-effectiveness of various options, including the technological approaches (such as ventilation) for reducing exposure to SHS in its impact assessment.[46]

One respondent questioned the health risks of secondhand smoke to non-smokers, arguing that the concentration of chemicals contributed to indoor air by smoking is very low (below the threshold for responses to chemical exposure). It was also claimed that the proper assessment of the epidemiological studies leads to a conclusion that "persons exposed to ETS have no greater incidence of disease than non-exposed persons".

It was argued that although there may be an initial, sharp decrease in cigarette consumption over the few weeks around the implementation of the ban, sales recover after a few months and return to original levels to follow a long-term trend of gradual decline. The additional studies suggested to be incorporated in the impact assessment related to the economic impact of smoking bans on hospitality sector, impacts on smoking behaviour and cigarette sales volumes, and the effectiveness of ventilation. Overall no tobacco-related organisations completed quantitative answers to stakeholder questions 3 and 4, pointing out that it is difficult to comment on the "efficiency" of policy options without clearer indications of their policy content. However, the major EU-level association of cigarette manufacturers, supported by the associations of cigars and smoking tobacco, provided some qualitative comments on the two questions.

It was argued that—given the FCTC process and the existing EU provisions on ETS—Policy 1 (the "status quo") is likely to have an impact on exposure to ETS which is similar to the expected impact of the four other policy options. Should a total smoking ban be considered, all policy options would decrease exposure to ETS in workplaces and public places but would increase exposure at home, since smokers would have fewer opportunities to smoke in public places. All policy options would also impact negatively on revenue and

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[46] A section on the technical approaches for controlling secondhand smoke has since been incorporated into RAND's impact assessment report.

employment in drinking establishments as well as workers' productivity due to smoking breaks outside the building.

Social partners

There was only one written response from inter-sectoral organisation representing small and medium enterprises. The organisation prefers a policy approach that would focus on awareness raising, looking at the dangers of tobacco smoke combined with exchange of good practice between member states, while leaving it to the Member States to decide for themselves which policy options they want to use.

They also felt it was not possible to respond to the stakeholder consultation questions (3 and 4) because giving an "expert guess" is too subjective and would not contribute to advancing the discussion on possible impact assessments of the different policy options.

There was only one written response received from the hospitality industry. This organisation felt it was not possible to respond to the stakeholder consultation questions (questions 3 and 4) in a meaningful way without clearer indications of their policy content.

Overall the organisation opted for the policy option "status quo". They organisation expressed concern that "any intervention at EU level is not only superfluous but would also interfere in an appropriate manner with national legislation and/or with voluntary initiatives taken at national level".

Producers of technical equipment

The two other industry groups that responded to the consultation were pro-technical solutions alliance group and a manufacturer of smoking stations and cabins. These groups felt that smoking stations and cabins are effective at protecting non-smokers from ETS and creating smoke-free workplaces, and precipitate a general decrease in smoking.

These two submissions are discussed in more detail in Chapter 10.

Annex I—List of institutional contributors to the consultation

Health-related organisations (17)

Health NGOs and health promotion

European Network for Smoking Prevention (ENSP)

European Foundation for the Improvement of Living and Working Conditions (EUROFOUND)

International Network of Women Against Tobacco Europe Board (INWAT)

Flemish Institute for Health Promotion (VIG)

German Smoke-Free Alliance

Smokefree Partnership

European Network for Smoking Prevention (ENSP)

European Heart Network (EHN)

European Federation of Allergy and Airways Diseases Patients' Associations (EFA) and International Primary Care Respiratory Group (IPCRG)

Association of European Cancer Leagues

European Union of Non-smokers

European Public Health Alliance (EPHA)

Stockholm Centre of Public Health

German Cancer Research Centre

Veneto Region, Health Department

Pharmaceutical industry

Pfizer

Association of the European Self-Medication Industry (AESGP)

Tobacco-related organisations (6)

Smokers' NGOs

Freedom Organisation for the Right to Enjoy Smoking Tobacco (FOREST)

Manufacturers

European Smoking Tobacco Association (ESTA)

European Cigar Manufacturers Association (ECMA)

Imperial Tobacco Limited

Confederation of European Community Cigarette Manufacturers (CECCM)

Groupement des Industries Européennes du Tabac (GITES)

Social partners (2)

Inter-sectoral organisations

European Association of Craft, Small and Medium-sized Enterprises (UEAPME)

Hospitality sector

HOTREC—Hotels, Restaurants & Cafés in Europe

Other (2)

Other industry

European Alliance for Technical Non-smoker Protection (EATNP)

Smokefree Systems

Annex II—List of questions asked during stakeholder consultation

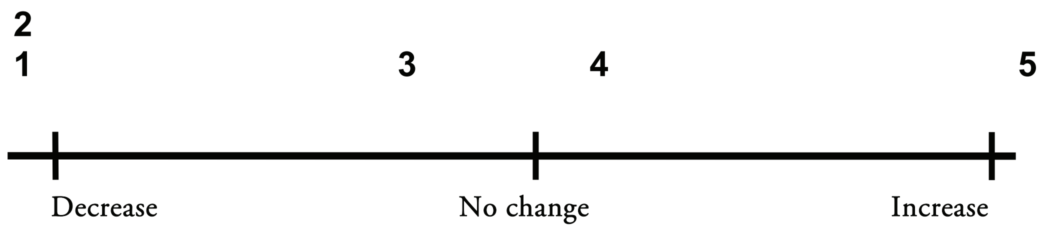
1) Is the description of the problem and its consequences adequate?
    a. Are there any important aspects of the problem and consequences that have not been addressed or been addressed insufficiently?
    b. Has the problem been defined adequately in terms of ETS prevalence?
    c. Has the problem been defined adequately in terms of ETS morbidity?
    d. Has the problem been defined adequately in terms of ETS mortality?
    e. Has the problem been defined adequately in terms of ETS health care costs?
    f. Has the problem been defined adequately in terms of ETS non-health care costs?
    g. Are you aware of any more recent evidence or data sources that are worth investigating in order to further sharpen the problem definition?

2) Are the available policy options adequately identified and analysed? Are there any other EU actions that should be considered?

3) Please rank the five possible policy options (to the extent possible) in terms of their effects on various parameters (i.e. write down "policy 1", "policy 2", etc. at the most appropriate place on each of the lines below). It is ok to write two policies on top of each other if you want to assign an equal rank.

    To further clarify this task, we provide an example below.

Exposure to ETS at home:



In this example the respondent ranked both policy option 1 and 2 as having an equally large decreasing effect on ETS exposure at home. The respondent thought that Policy 3 would not cause any change in ETS exposure at home, and that both Policy 4 and 5 had an increasing effect on ETS exposure at home, where the increasing effect of Policy 5 was considered larger than the effect of Policy 4

Social (health) impacts

Exposure to ETS in workplaces and public places:

Decrease No change Increase

Exposure to ETS at home:

Decrease No change Increase

Prevalence of active smoking and tobacco consumption

Decrease No change Increase

Uptake of smoking

Decrease No change Increase

Mortality, morbidity and disability from ETS

Decrease No change Increase

Social acceptability of smoking

Decrease No change Increase

Support for smoke-free policies

Decrease | No change | Increase

Possible other impacts (please specify)

Decrease | No change | Increase

Economic impacts

Healthcare expenditure on tobacco-related diseases (e.g. lung cancer, COPD etc)

Decrease | No change | Increase

Workers' productivity (e.g. lost wages, sick leave, etc)

Decrease | No change | Increase

Cleaning and maintenance costs

Decrease | No change | Increase

Hospitality industry revenues and employment

Decrease | No change | Increase

Tobacco industry revenues and employment:

Decrease | No change | Increase

Pharmaceutical industry revenues and employment:

Decrease | No change | Increase

Retail sector revenues and employment:

Decrease | No change | Increase

Other sectors' revenues and employment

Decrease | No change | Increase

Implementation and enforcement costs

Decrease | No change | Increase

Possible other impacts (please specify)

Decrease | No change | Increase

Environmental impacts

Indoor air pollution

Decrease | No change | Increase

Possible other impacts (please specify)

Decrease | No change | Increase

4) Please further quantify these effects (to the extent possible) the effects of the five policy options on the main inputs to the model.

Overall exposure to ETS

	2006	2008	2013				
	EB data	Current estimate	Policy 1	Policy 2	Policy 3	Policy 4	Policy 5
Indoor workplaces/offices *(QB 31b.1)*							
EU average	19%	15.4%					
25th percentile	11%	8.5%					
75th percentile	23%	19.1%					
Restaurants and bars *(QB 31b.5)*							
EU average	39%	24.0%					
25th percentile	21%	6.2%					
75th percentile	47%	41.0%					

Workers' exposure to ETS

	2006	2008	2013				
	EB data	Current estimate	Policy 1	Policy 2	Policy 3	Policy 4	Policy 5
Offices *(QB 31b.1 cross-tabulated with QB31a)*							
EU average	32%	25.5%					
25th percentile	17%	13.0%					
75th percentile	40%	32.7%					
Restaurants and bars *(QB 31b.5 cross-tabulated with QB31a)*							
EU average	70%	43.0%					
25th percentile	33%	17.6%					
75th percentile	87%	71.5%					

ETS exposure at home (any exposure; exposure assumed to be unaffected by smoking bans)

	2006	2008	2013				
	EB data	Current estimate	Policy 1	Policy 2	Policy 3	Policy 4	Policy 5
Exposure to ETS at home (QB 30)							
EU average	43%	43.4%					
25th percentile	34%	32.8%					
75th percentile	49%	51.0%					

5) Is there any supplementary data on the social (health), economic or environmental aspects of the problem which should be taken into account?