An assessment of the economic cost of smoking in Ireland

Technical Annex

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A report submitted by ICF International
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1 Introduction

This document is the technical annex accompanying the report "An assessment of the economic cost of smoking in Ireland". The study was commissioned by the Department of Health and provided by ICF International (ICF) and DKM Economic Consultants (DKM), with methodological inputs from Professor Anne Ludbrook (University of Aberdeen).

1.1 Purpose of the study

The purpose of this project is to contribute to the evidence base of tobacco consumption and its effects in Ireland, to help support the implementation of the recommendations made in The Tobacco Free Ireland report (2013). The study makes a meaningful contribution to the evidence base on the economic cost of smoking in Ireland. It is a particularly useful piece of research as:

- This type of study has not previously been carried out in an Irish setting;
- The majority of the studies worldwide do not cover the range of smoking related costs set out in the terms of reference. This means that they are likely to underestimate the costs associated with smoking; and
- A causal relationship to smoking has been established for more diseases than are covered in previous research.

1.2 Purpose and structure of this report

The purpose of this technical annex is to provide a more detailed description of the methodology used in the study and to present the data used in the estimation of the cost of smoking in Ireland.

The report is structured as follows:

- Section 2 details how evidence of the health effects of smoking was collected (relating to section 2 of the main report);
- Section 3 describes how evidence of the other societal effects of smoking was collected (relating to section 3 of the main report);
- Section 4 explains the methodology used to calculate the cost of smoking (relating to section 4 of the main report);
- Section 5 shows the assumptions which have been varied for the sensitivity analysis (relating to section 5 of the main report); and
- Annex 1 to Annex 7 show the data used to calculate the cost of smoking.

2 Health effects of smoking

This section provides details of the literature review strategy used to collect information on the costs associated with smoking.

2.1 Health literature review

2.1.1 Sources used

The review for the health effects relating to smoking used the strictest criteria. The review team only examined peer reviewed data. The following sources of information were used:

- The Cochrane Library;

via EBSCO[1]:

- Academic search complete;
- PsychINFO;
- PsycARTICLES;
- psycEXTRA;
- SocINDEX with Full Text;
- Child Development and Adolescent Studies
- MEDLINE with Full Text;
- CINAHL Complete; and,
- Psychology and behavioural sciences collection.

2.1.2 Search terms

The literature search targeted only papers not included in the 2014 US Surgeon General's report. Different sections of that report have different cut off dates (most are 2012, but for cancer the most recent research is 2010) so it was necessary to run two separate searches.

The first search yielded 862 results. The search covered the time period March 2012 to April 2015, and was limited to peer reviewed journals. The search terms were:

- Smoking OR cigarette OR tobacco OR second-hand smoke OR second-hand smoke OR environmental tobacco smoke; AND
- Systematic review OR meta-analysis OR controlled trial; AND
- Health impact OR health effect OR health outcome OR disease; and
- NOT Cessation.

The second search found 389 results. This search covered the time period March 2010 to March 2012 and was again limited to peer reviewed journals. The search terms used in the second literature search were:

- Smoking OR cigarette OR tobacco OR secondhand smoke OR second-hand smoke OR environmental tobacco smoke; AND
- Systematic review OR meta-analysis OR controlled trial; AND
- Cancer; and
- NOT cessation OR prevention OR non-cancer or lung cancer.

[1] EBSCO is a leading provider of online information resources to researchers in colleges and universities, research organization, and government institutions

3 Other societal impacts of tobacco use

The review of evidence for other impacts used less strict criteria. The peer reviewed data sources were examined, but more general searches for government information, non-peer reviewed academic information and information from interest groups were conducted. Search terms which were used for the research are described in Table 3.1. Document titles and descriptions were briefly examined for relevance.

Table 3.1 Search terms used for costs of smoking not related to health

Type of impact	Search terms used
Transportation	■ Hospital transport Ireland ■ Hospital transport statistics Ireland ■ Ambulance transport statistics Ireland ■ Ambulance transport Ireland ■ Proportion of patients requiring hospital transport ■ Proportion of patients requiring ambulance transport ■ Hospital transport smoking patients ■ Ambulance transport smoking patients
Lost productivity and smoking breaks	■ Smoking productivity ■ Smoking absence ■ Smoking employer cost ■ Smoker absenteeism ■ Smoking breaks ■ Smoker productivity ■ Smoker absence ■ Smoking employer ■ Smoking cost ■ Second hand smoke cost ■ Second hand smoke effects ■ Second hand smoke absenteeism ■ Second hand smoke absence ■ Smoking sick leave ■ Smoking
Carers	■ HSE Operational Plan ■ Social Care Cost Ireland Submission ■ Smoking Social Care Costs ■ The Health Consequences of Smoking ■ Smoking and Subsequent Risk of Early Retirement ■ Smoking and carers ■ Carers type of cancer ■ Carers for heart disease
Fires	■ Cost of Fires Caused by Cigarette ■ Economic Cost Of Fire ■ Npfa Usa Fire Causes ■ 2013 Irish Fire Brigade Statistics ■ Economic Cost Of Smoking
Litter	■ Economic Cost Cigarette Waste ■ Cigarette Waste ■ Litter Survey Ireland ■ Litter Management Plan ■ Anti-litter ■ Cigarette Butts ■ Annual Financial Statements Dublin City Council

4 The estimated cost of smoking

This section provides a detailed description of the methodology used to estimate the cost of smoking in Ireland. A brief summary of the methodology is provided in the main report. This section provides more information about the methodology including equations, the data used in the calculations and the data manipulations used.

4.1 The burden on health and care services

4.1.1 The burden on health care services

The methodology used in this study was similar to that used in most estimates of the health burden of smoking. It has been used by the US Surgeon General's report (2014), the HSCIC (2014) estimates of smoking related hospital admissions and deaths in the UK, by the World Health Organisation and the most recent estimates for the number of smoking related deaths in Ireland (Howell, 2008).

The number of deaths, number of inpatient hospital admissions and the number of day cases caused by smoking was calculated for each condition separately. For each condition, the formula below was used to estimate the number of hospital admissions and deaths:

$$a = \frac{[p_{cur}(r_{cur} - 1) + p_{ex}(r_{ex} - 1)]}{[1 + p_{cur}(r_{cur} - 1) + p_{ex}(r_{ex} - 1)]}$$

Where:

a = smoking attributable proportion for each disease;

p_{cur} *= proportion of current smokers;*

p_{ex} *= proportion of ex-smokers;*

r_{cur} *= relative risk for current smokers; and*

r_{ex} *= relative risk for ex-smokers.*

Once the smoking attributable proportion of each condition was established, the attributable proportion was multiplied by the total number of deaths, hospital inpatient admissions and day cases to give the total number of deaths, inpatient admissions and day cases for each condition.

The number of hospital admissions and deaths due to exposure to second-hand smoke were calculated using a two stage process. The approach used the smoking attributable proportion described in the equation above. The approach to estimating the number of hospital admissions and deaths due to exposure to second-hand smoke is summarised in the two equations below:

$$b = \frac{[p_{shs}(r_{shs} - 1)]}{[1 + p_{shs}(r_{shs} - 1)]}$$

and

$$NSB = [T - (T * a)] * [1 - (p_{cur} + p_{ex})]$$

Where:

b = Exposure to second-hand smoke attributable proportion for each disease;

p_{shs} = Proportion of non-smoking population exposed to second-hand smoke;

r_{shs} = Relative risk for people exposed to second-hand smoke;

NSB = Burden to non-smokers – the number of deaths and hospital admissions attributable to non-smokers; and

T = Total number of deaths and hospital admissions.

The attributable proportion for exposure to second-hand smoke for each disease was applied to the non-smoking health burden to estimate the number of deaths, hospital inpatient admissions and day cases due to exposure to second-hand smoke.

This approach required a large amount of data. The relative risks for each condition are detailed in Annex 4 and Annex 5. The information on the number of deaths, the number of hospital inpatient admissions and the number of day cases for conditions related to smoking are presented in Table A1.1, Table A2.1 and Table A3.1. The most recent data for the hospital inpatient admissions and day cases by health condition relate to 2013. Therefore the analysis of the health impact of smoking was carried out for the year 2013.

The assumptions about smoking prevalence rates and proportions of ex-smokers used in calculations described above are based on preliminary results of the Healthy Ireland Survey for year 2015. Table 4.1 details the smoking prevalence rate and proportion of ex-smokers that apply to different age groups used in this study.

In addition, Table 4.1 includes the assumed proportion of the non-smoker population exposed to second-hand smoke. As Ireland has legislation which prohibits smoking in the workplace that is well enforced, the figure used for exposure to second-hand smoke is that relating to exposure to second-hand smoke in the home. This is derived from a Eurobarometer study, which estimated the proportion of Irish population exposed to smoke in the home in 2009. Unfortunately, neither more recent data nor results disaggregated by gender were available at the time of writing of this study.

Table 4.1 Information on smoking prevalence rates and exposure to second-hand smoke

Indicator	Age group	Males	Females	Source
Smoking prevalence rate	Aged 20+	23.5%	20.8%	Healthy Ireland Survey, 2015
	Aged 35+	19.7%	16.6%	
	Aged 35-54	25.6%	22.3%	
	Aged 35-64	22.2%	20.0%	
	Aged 45+	18.5%	15.2%	
	Aged 55-64	18.1%	17.3%	
	Aged 65-74	17.4%	12.4%	
	Aged 65+	14.9%	10.7%	
	Aged 75+	9.1%	7.8%	
Proportion of ex-smokers	Aged 20+	33.4%	27.5%	Healthy Ireland Survey, 2015
	Aged 35+	40.1%	30.4%	
	Aged 35-54	30.1%	29.8%	
	Aged 35-64	35.8%	30.0%	
	Aged 45+	42.7%	30.3%	
	Aged 55-64	42.7%	30.3%	
	Aged 65-74	46.8%	31.1%	
	Aged 65+	48.5%	30.9%	
	Aged 75+	52.5%	30.7%	
Exposure to second-hand smoke in the home		17%	17%	Eurobarometer, 2010

Provisional results: Irish Lifestyle Survey, 2015; Eurobarometer, 2010

4.1.2 The cost to the health service

The number of inpatient hospital admissions attributable to smoking and exposure to second-hand smoke (which was calculated as described above) was multiplied by the average cost of an inpatient stay for each admission. This operation was carried out for each condition separately. An identical process was followed for day cases, where number of day cases attributable to smoking and exposure to second hand smoke was multiplied by an average cost per day case for each condition.

Healthcare cost data per condition were provided by the Health Service Executive (HSE) Healthcare Pricing Office. The data provided average inlier cost[2] information and the number of cases for each DRG code[3]. For most health conditions, multiple DRG codes were relevant. For these conditions, a weighted average (based on the number of cases for each DRG code) of the average inlier cost for all relevant DRG codes was used. A complete list of unit costs for hospital inpatient admissions is provided in Annex 6. Higher and lower costs have been used in the sensitivity analysis.

The data on hospital outpatient appointments and emergency department attendances are not broken down by health condition. This means it is not possible to estimate the number of outpatient appointments and emergency department attendances in the same way as day cases and inpatient admissions.

[2] The average cost for each DRG code excluding excess bed days

[3] Diagnosis-Related Group code are a system used to categorise hospital cases into groups based on disease, procedures and comorbidities

The cost of outpatient appointments and emergency department attendances has been estimated by approximating the total number of episodes[4] attributable to smoking and exposure to second-hand smoke. This has been estimated by calculating the percentage of inpatient and day cases that are attributable to smoking and exposure to second hand smoke, and multiplying this percentage to the total number of outpatient appointments and emergency department attendances. This is summarised by the equation below:

$$OHA_A = \frac{(IA_A + DC_A)}{(IA_T + DC_T)} * OHA_T * P_{OHA}$$

Where:

OHA_A = Other hospital episodes attributable to smoking or exposure to second-hand smoke (outpatient appointments and emergency department admissions)

IA_A = Inpatient admissions attributable to smoking and exposure to second-hand smoke;

DC_A = Day cases attributable to smoking and exposure to second-hand smoke;

IA_T = Total inpatient admissions;

DC_T = Total day cases;

OHA_T = Total number of other hospital episodes (outpatient appointments and emergency department attendances); and

P_{OHA} = Unit cost of other hospital episode (outpatient appointments and emergency department attendances).

The cost of health conditions attributable to smoking to primary care services, services and the cost of prescription items used to treat conditions attributable to smoking was difficult to estimate. This is because of a lack of data for primary care appointments by condition and age. In order to estimate the primary care costs, a ratio from other studies has been applied. A study by Callum et al (2010) estimates that for the UK approximately 55% of health care costs fall in primary care services (GP consultations, prescription items issued, etc.). A separate study for Wales estimated that primary care costs accounted for one third (33%) of the total cost of smoking to the health service[5].

The percentages from the Callum study have been used to estimate the smoking attributable cost to primary care services in Ireland. The estimated secondary care cost (described above) was divided by the proportion of the total health service cost it represented (45%). This provided an estimated total attributable cost of smoking to the health service. The cost for primary care was then calculated using the total health service cost.

4.1.3 The cost of hospital transportation

The number of hospital transportation journeys caused by smoking has been estimated. This was done for emergency hospital journeys and non-emergency hospital transportation.

The cost of hospital transportation for emergency hospital transport was estimated as the multiple of the number of Clinical Status 1 ECHO ambulance calls attributable to smoking and the average cost of an emergency ambulance journey. Clinical Status 1 ECHO ambulance calls are defined as calls reporting an immediately life-threatening cardiac or respiratory arrest (Healthcare Information and Quality Authority, 2010)[6].

[4] A hospital episode is a collective name for all hospital admissions, outpatient appointments and emergency department attendances

[5] Philips and Bloodworth (2009) Cost of smoking to the NHS in Wales

[6] www.hiqa.ie/system/files/Pre_Hospital_Emergency_Care_KPIs.pdf

The Clinical Status 1 ECHO calls were used as a measure of hospital transportation costs because they relate specifically to heart disease and chronic airway obstruction conditions[7]. Both of these conditions have a proven causal relationship to smoking (see Annex 5) and are likely to result into incidents that require emergency ambulance journeys. Other smoking related conditions relevant for this study either did not have such an obvious link to emergency hospital transportation requirements or there was no data that would link specific number of ambulance journeys to them.

There were 2,923 Clinical Status 1 ECHO calls in 2013 (Health Service Data Report, 2015)[8]. The number of Clinical Status 1 ECHO calls attributable to smoking was estimated, based on this number, by a three-step process:

- The number of Clinical Status 1 ECHO calls resulting from other chronic airway obstruction and other heart disease was estimated. The estimate was based on a calculation of the proportion of deaths resulting from each of these conditions in total deaths caused by both conditions (see Table A1.1 in Annex 1). The total number of ECHO calls was then multiplied by the proportion of deaths attributable to each condition to estimate the separate numbers of ECHO calls related to chronic airway obstruction and heart disease.
- The proportion of ECHO calls attributable to smoking was calculated separately for each of these conditions according to the following formula:

$$a = \frac{[p_{cur}(r_{cur} - 1) + p_{ex}(r_{ex} - 1)]}{[1 + p_{cur}(r_{cur} - 1) + p_{ex}(r_{ex} - 1)]}$$

  Where:

  a = Smoking attributable proportion for each condition;

  p_{cur} *= Proportion of current smokers;*

  p_{ex} *= Proportion of ex-smokers;*

  r_{cur} *= Relative risk for current smokers; and*

  r_{ex} *= Relative risk for ex-smokers.*

- The number of Clinical Status 1 ECHO calls caused by each condition was multiplied by the corresponding smoking attributable proportion. This yielded the estimated number of Clinical Status 1 ECHO calls attributable to smoking for each condition.

The estimates of the total volume of Clinical Status 1 ECHO calls calculated in this way are presented in Table 4.2.

[7] More specifically, Clinical Status 1 ECHO calls are made in cases of respiratory and cardiac arrests, which sit in the "other heart disease" relative risk category. Therefore the relative risk for "other heart disease" has been used in these calculations

[8] Available at http://www.hse.ie/eng/services/publications/corporate/performancereports/datareportjan.pdf

Table 4.2 Number of Clinical Status 1 ECHO calls, 2013

Clinical Status 1 ECHO calls, by attributed cause	Number
Overall	2,923
Related to heart disease	1,677
Related to chronic airway obstruction	1,246
Related to heart disease and attributable to smoking	247
Related to chronic airway obstruction and attributable to smoking	996

Health Service Data Report, 2015 and ICF calculations

No estimates of the average cost of an emergency ambulance journey were available. Therefore, the unit cost of ambulance transportation was taken from the unit cost of health and social care (2013)[9] for the UK, appropriately adjusted for currency and Purchasing Power Parity differences.

To estimate the ambulance transportation cost in Ireland, the costs in England were adjusted using UK and Ireland purchasing power parities (PPPs). PPPs are indicators of price level differences across countries. They indicate how many currency units a particular quantity of goods and services costs in different countries. PPPs can be used as currency conversion rates to convert expenditures expressed in national currencies into an artificial common currency (the Purchasing Power Standard, PPS), taking account of the effect of price level differences across countries[10].

The purchasing power parities for England and Ireland were taken from the Eurostat data for 2013. Use of exchange rates was not necessary because GBP to EUR conversion was already included in the purchasing power parities calculations, as described below. This has been done using the formula below. The first term on the right hand side of the formula describes what would have been the cost of ambulance transportation in England in terms of EUR in EU28. This is then multiplied by the purchasing power parity for Ireland to arrive at the total amount of EUR to be spent on the healthcare service to cover its cost in Ireland.

$$AT_{IE} = \frac{AT_{EN}}{PPP_{ENG}} * PPP_{IE}$$

Where:

AT_{IE} = Ambulance transportation cost in EUR in Ireland;

HC_{EN} = Ambulance transportation cost in GBP in England;

PPP_{ENG} = Purchasing power parity for the UK (i.e. how many GBP have to be spent in the UK to buy the same amount of goods that can be bought for 1 EUR in the EU28); and

PPP_{IE} = Purchasing power parity for Ireland (i.e. how many EUR have to be spent in Ireland to buy the same amount of goods that can be bought for 1 EUR in the EU28).

This calculation gives a value of €280 per Clinical Status 1 ECHO journey[11]. The average cost was multiplied by the number of journeys to estimate the cost of emergency ambulance transport attributable to smoking.

[9] Personal Social Services Research Unit (PSSRU) (2013) Unit Costs of Health and Social Care 2013

[10] Eurostat definition, available at: http://ec.europa.eu/eurostat/web/purchasing-power-parities/overview

[11] This may be a conservative estimate. Ambulance journeys are likely to have a longer duration in Ireland than England because of a more dispersed population

The total number of non-urgent and planned hospital transportation journeys was estimated at 350,000 (HSE)[12]. The proportion of these journeys attributable to smoking and exposure to second hand smoke is assumed to be the same as that of inpatient and day case admissions (3.3%). The number of journeys attributable to smoking was calculated by multiplying the estimated proportion of journeys by the total number of non-urgent journeys.

The average cost of a non-emergency ambulance journey has been taken from the unit cost of health and social care (2006)[13] for the UK. This value was adjusted for inflation to 2013 price levels and converted into Irish values using the equation above, giving a value of €70 per journey. The average cost was multiplied by the number of journeys to estimate the cost of non-emergency ambulance transport attributable to smoking.

4.1.4 The cost of caring for patients with health conditions caused by tobacco use

4.1.4.1 Formal carers

There is a limited amount of evidence on the relationship between smoking and demand for care services. Both of the studies located which did attempt this estimated the relative risk of smokers requiring care. The same approach is used here. There is significant uncertainty attached to this estimate due to the lack of evidence in this area. The research selected for the estimation is by Landman Economics (2014) and relates to the UK. This was preferred as the care system in the UK is more closely matched to Ireland than the care system in the USA. The research was conducted for an anti-smoking charity (ASH). The approach does seem to be valid, and in the absence of any other information the research was used here.

The relative risks for smoking individuals requiring residential and domiciliary care are:

- Residential care: No significant result – the relative risk of smokers requiring residential care is the same as for non-smokers;
- Domiciliary care relative risk for smokers compared to those who have never smoked: 1.937.

The lack of a significant result in comparing access to residential care of smokers as compared to non-smokers may seem surprising. However, due to their greater likelihood of suffering a premature death, smokers are less likely to enter residential care. The relative risks are for the population over 50 years of age.

The smoking attributable proportion for domiciliary care was calculated in a similar way as in other cases requiring smoking attributable proportion, using the following formula:

$$d = \frac{[p_{cur}(r_{cur} - 1)]}{[1 + p_{cur}(r_{cur} - 1)]}$$

Where:

d = Smoking attributable proportion for domiciliary care;

p_{cur} *= Proportion of current smokers; and*

r_{cur} *= Relative risk for current smokers.*

The number of individuals receiving domiciliary care in Ireland is not known. In the absence of those data it was assumed that spending on domiciliary care was divided equally among care users and the smoking attributable fraction was multiplied by the total budget for domiciliary care in Ireland to estimate the cost of smoking for formal care. This assumption will not accurately reflect reality, as some patients are likely to receive more support than

[12] McCreanor, P. (HSE), Priority Dispatch System Operating in the NAS

[13] Personal Social Services Research Unit (PSSRU) (2006) Unit Costs of Health and Social Care 2013

others. However, it was felt that this simplifying assumption was acceptable as smokers were likely to be represented throughout the distribution of support – from small quantities to high levels of support.

4.1.4.2 *Informal carers*

No data were located that would allow estimation of the cost of informal care. Therefore the cost of informal care was assessed qualitatively. In-depth interviews were carried out with three organisations:

- The Irish Care Alliance;
- The Carers Trust (in Northern Ireland); and
- Carers Northern Ireland.

These interviews were used to investigate the number or proportion of people receiving care for smoking related illnesses; the type of support carers need to provide for smoking related conditions; how frequently people need support for smoking related conditions and what type of individuals provide informal care. No quantitative data were obtained from these interviews.

4.2 The productivity cost of smoking

4.2.1 The productivity loss from smoking breaks

A variety of methods are used in the literature to estimate the cost of smoking breaks. The methods typically use *ad hoc* assumptions that are not underpinned by previous systematic research. As a result, estimates of productivity losses vary substantially. Here an assumption that smokers smoke approximately 20% of their daily cigarette consumption at work is used (Tsai et al, 2005 and Hallamore, 2006). Ireland strictly enforces a general smoking ban in workplaces, which means that each smoking break consists of:

- Exiting the workplace to smoke a cigarette and then returning back; and
- The actual smoking of the cigarette.

It is assumed that each smoking break defined in this way takes on average 8 minutes (Tsai et al, 2005; Parrot et al, 2000 and Berman et al, 2013). This is a conservative estimate of smoking break duration. Some studies estimate as much as 20 minutes spent per each cigarette smoked at work (Hallamore, 2006).

In addition, it is necessary to account for employers' willingness to permit smoking breaks during work time. Following Parrot, et al. (2000), it was assumed that 50% of employers do not restrict smoking breaks and the rest forbid the practice. This assumption is clearly a simplification of reality as many employers are likely to restrict smoking time only partially. However, the assumption reflects different attitudes of employers towards smoking reasonable accurately and accounts for the fact that employees can smoke cigarettes during officially sanctioned work breaks, such as lunch break. These breaks take place regardless of smoking and thus do not imply productivity losses.

Using the assumptions described above, the total productivity losses associated with smoking breaks were calculated using the following formula:

$$C_b = (N * P * 250 * AVG_s * \alpha * \beta * \gamma) * W/Day$$

Where:

C_b = Total costs of smoking breaks;

N = Total worker population;

P = Smoking prevalence rate;

AVG_s = Number of cigarettes smoked per day;

α = Percentage of cigarettes smoked in work time (assumed 20%);

β = Minutes spent smoking per cigarette (assumed 8 mins);

γ = percentage of establishments where extra smoke-breaks allowed (assumed 50%);

Day = Length of a day in minutes; and

W = Average daily output.

Various data sources were used to identify the number of people who are employed (taken from the NQHS and CSO), the smoking prevalence rate and the number of cigarettes smoked per day (taken from the Healthy Ireland Survey, 2015 and Smoking in Ireland 2013: Synopsis of Key Patterns statistics, 2013), output per worker hour (Eurostat)[14] and an average length of a working day (from the CSO). These sources, together with the values used, are presented in Table 4.3. The calculation of the cost of smoking breaks to the economy assumes that average productivity is the same for smokers and non-smokers.

Table 4.3 Data sources and values used in calculation of productivity losses due to smoking breaks

Indicator	Value	Source
Number of employed people	1,272,020	QNHS and CSO, 2013
Smoking prevalence rate (all ages)	23%	Healthy Ireland Survey, 2015
Number of cigarettes smoked per day	9.8	Smoking in Ireland 2013: Synopsis of Key Patterns
Output per worker hour	€48.8	Eurostat, 2013[15]
Average length of working day (hours)	7	QNHS, 2013

4.2.2 The cost of additional absence of smokers compared to non-smokers

The method used to estimate the cost of smokers taking more days off work than non-smokers is described below. The method involved three main steps:

- Calculate absence rates of smokers and non-smokers;
- Estimate the difference between the two; and
- Multiply smokers' extra days of absence by the average productivity.

[14] The average output per worker has been used as a simplifying assumption for the calculation of loss of productivity. This assumes that smoking prevalence and the level of smoking consumption is even throughout society. There is evidence that unemployed persons and people working in lower skilled jobs are more likely to smoke than people employed in higher skilled employment. Productivity estimates by occupational group were not, however, available

[15] Eurostat, Labour productivity per hour worked, tsdec310

The absence rates[16] for smokers and non-smokers were calculated from the general absence rate using the following formulas:

$$RoA = P * \alpha * x + (1 - P) * x$$

$$x = RoA/(P * \alpha + 1 - P)$$

Where:

RoA = Rate of absence (Collected on national level);

P = Smoking Prevalence (Collected on national level);

α = Percentage of additional sick leave for smokers (value based on studies mentioned below);

x = Rate of absence for non-smokers (to be calculated); and

*α * x = Rate of absence for smokers (to be calculated).*

It was assumed that smokers take, on average, 45% more days of sick leave per year than non-smokers. This estimate was an average from two studies (Lundborg et al, 2007 and Weng et al, 2012) that were either based on large national datasets or on meta-analysis of multiple recent studies and use of advanced statistical methods to control for confounding factors. These studies were considered as robust sources for assumptions because of their breadth and sophisticated estimation techniques.

After the estimation of smoker and non-smoker absence rates, the extra days of absence (D) per year for smokers were calculated as:

$$D = \alpha * x - x$$

The total loss of productivity due to smokers having longer absence than non-smokers was calculated using the equation below:

$$C_s = N * P * D * W$$

Where:

C_s = Total costs of higher absence rates of smokers;

N = Total worker population;

P = Smoking prevalence rate;

D = Extra days of absence taken by a smoker per year; and

W = Average daily output per worker.

This approach required data on employment (from QNHS), output per worker hour (from Eurostat), smoking prevalence rate (from Smoking in Ireland: Synopsis of Key Patterns, 2013) and the average absence from work (Irish Business and Employers Confederation - IBEC). According to the IBEC survey, the national average absence from work was 5.5 days in 2013. The remaining values used in the above calculations are identical as in the sub-section 4.2.1 and can be found in Table 4.3.

[16] Defined as days of absence per year

4.2.3 Other types of productivity loss

The other type of productivity loss is through a loss of output due to premature deaths attributable to smoking and exposure to second-hand smoke. The method used to estimate the loss of productivity from premature death is described below. It involved three steps:

- Estimating the proportion of deaths for each condition that relate to working age individuals. This has been assumed to be the number of deaths for individuals aged between 35 and 65 years. The proportion has been taken from the CSO statistics on deaths by age, with the number of deaths for individuals aged under 65 divided by the total number of deaths. This proportion has then been multiplied to the number of premature deaths attributable to smoking and exposure to second-hand smoke for each condition. This gives a total number of premature deaths for the working age population attributable to smoking and exposure to second-hand smoke.
- Estimating the average number of working life years lost for each condition. The average age of death for all cases under the age of 65 was calculated for each condition. The data from the CSO uses five year age bands, so the mid-point of the age range was used as the age of death (for example for the 35-39 age group the mid-point of 37.5 years was used). The age of death was multiplied by the number of deaths in each age group and the value for all age groups summed. This was then divided by the total number of deaths for individuals under 65 for each condition, to give an average age of death. The average age of death was subtracted from 65 to give the number of working years lost due to premature death.
- The number of working age deaths was multiplied by the number of working life years lost, the employment rate (as not all cases of death among the working age population will be of employed people) and the average output per worker (in GVA) to give the sum of lost productivity due to premature death attributable to smoking and exposure to second-hand smoke. This is summarised in the equation below.

$$LP_{PD} = WAD_{Cond} * ER * WYL_{Cond} * AO$$

Where:

LP_{PD} = Lost productivity due to premature death attributable to smoking and second-hand smoke;

WAD_{Cond} = Number of working age deaths attributable to smoking and exposure to second-hand smoke for each health condition (categorised as deaths under the age of 65);

ER = Employment rate in Ireland;

WYL_{Cond} = Working years lost per premature death for each condition; and

AO = Annual output per worker (GVA).

4.3 The cost of fires started from smoking materials

There are good quality of data on the number of fires and deaths caused by fires. The method used to estimate the cost of fires started from smoking materials was straightforward: the total number of fires caused by smoking materials (see Table 4.4) was multiplied by the average cost of a fire. The cost figures presented in Table 4.4 were used for this. They include the average response, the property damage and injuries cost[17]. Other

[17] These values have been converted into Irish values using the method set out in section 4.1.2

types of costs[18] associated with fires were not considered relevant to fires started from smoking materials and matches.

The cost of fatalities was calculated separately. The number of deaths from fires caused by smoking materials was multiplied by the value of a statistical life.

Table 4.4 Data sources and values used in calculation of smoking costs resulting from fires caused by smoking materials

Indicator	Value	Source
Number of fires caused by smoking materials	380	Department for Environment, Community and Local Government Fire Service Statistics, 2013[19]
Number of deaths caused by smoking materials	1	
Average cost of fire - response	€4,470	UK Department for Community and Local Government, 2008[20]
Average cost of fire - property damage	€3,690	
Average cost of fire - injuries costs	€2,100	
Average value of statistical life year	€2.0 million	WebTAG, 2014[21]

4.4 The cost of smoking-related littering

The cost of littering caused by smoking is difficult to measure with any precision. The majority of research estimating the cost of littering multiplies the total budget for street cleaning and litter management by the proportion of litter which is smoking related materials. This study follows the same methodology, assuming that approximately 54% of all street cleaning and litter management budget is spent on cleaning of smoking related materials (Department of the Environment, Community and Local Government). This is a simplified estimate of the cost of littering for two reasons:

- A proportion of the street cleaning and litter management which will be assigned as a cost of smoking is likely to be incurred in the absence of any smoking; and
- It does not include any additional costs such as loss of business (through customers avoiding areas due to litter) or further environmental costs.

Despite these limitations, this method still appears to be the most appropriate way to estimate the cost of smoking related litter. To estimate the cost of littering, data were collected on the total value of local authority budgets and the proportion of local authority spending that was allocated to street cleaning and litter management[22]. The total local authority budget was multiplied by the proportion spent on cleaning streets and litter management for each local authority and adjusted for inflation. These figures were summed

[18] Lost business per fire, criminal justice system costs per fire, costs to police per fire, costs to the prison service per fire and cost of non-detected arson per fire

[19] The Community and Local Government Fire Service Statistics reported only 230 fires in 2013 because these did not include the number of fires in Dublin. The number of fires in Dublin in 2013 was estimated to form the same proportion of fires started from smoking materials as in the years 2010 and 2011 (for which Dublin data were available). Thus, Dublin was estimated to account for approximately 40% of all fires started from smoking materials in 2013, i.e. approximately 150 fires. This figure was added to the 230 fires reported by the Community and Local Government Fire Service Statistics to produce an estimate of 380 fires caused by smoking materials in 2013

[20] Converted to 2013 Ireland prices using xe.com historical exchange rates, Eurostat Price index (implicit deflator), 2010=100 [nama_10_gdp]; currency exchange from www.xe.com; date of conversation 10/06/2008

[21] This figure is derived from the UK value for 2010 (£1.6 million) and converting this to Irish values using to € at the Purchasing Power Parity Exchange rate for the year in question (2010), then uplifting the value to the reference year (2013) by reference to the change in average hourly earnings in Ireland (as reported by the CSO)

[22] http://localauthorityfinances.com

across local authorities to calculate the total spending on street cleaning and litter management in 2013 (see Table 4.5).

The total value of local authority spending on street cleaning was multiplied by the proportion of litter which is reported to be smoking related materials.

Table 4.5 Local authority budgets for street cleaning and litter management, 2015 (adjusted for inflation and converted to 2013 prices)

Local Authority	Total Budget (€ mil)	Budget for street cleaning (€ mil)
Carlow	52.0	0.8
Cavan	55.2	0.5
Clare	100.9	2.7
Cork City	154.7	7.5
Cork County	293.5	3.8
Donegal	133.1	1.8
Dublin City	790.1	43.9
Dun Laoghaire - Rathdown	166.7	7.4
Fingal	215.5	6.9
Galway City	76.9	2.8
Galway County	106.9	2.2
Kerry	125.8	3.2
Kildare	138.1	3.8
Kilkenny	66.6	1.9
Laois	55.9	0.8
Leitrim	35.0	0.2
Limerick	158.2	5.2
Longford	38.7	1.0
Louth	94.4	3.1
Mayo	129.4	1.5
Meath	99.4	2.0
Monaghan	55.5	1.0
Offaly	58.0	0.7
Roscommon	54.4	0.5
Sligo	61.6	0.9
South Dublin	222.6	8.2
Tipperary	140.8	2.6
Waterford	121.6	4.6
Westmeath	65.4	2.0
Wexford	100.5	2.2
Wicklow	100.1	1.9
Ireland	**4067.2**	**127.8**

http://localauthorityfinances.com/

4.5 Welfare losses associated with smoking-related morbidity and mortality

4.5.1 The cost of loss of welfare from morbidity

The individual cost for morbidity was calculated using the number of hospital appointments attributable to smoking and exposure to second-hand smoke and the Quality of Life Years (QALY) utility lost as a result. A QALY is a measure of the state of health of a person in which the benefits, in terms of length of life, are adjusted to reflect the quality of life. One QALY is equal to one year of life in perfect health[23]. The utility values of the QALY provide information on the quality of life for an individual.

The loss of QALYs in 2013 as a result of smoking was used to estimate the welfare loss to individuals from morbidity caused by smoking. This is not a straightforward approach as the morbidity statistics measure incidence of hospital appointments, and a single individual may have more than one incidence of a condition within a year. Therefore the number of inpatient and day case admissions cannot be used as a measure of number of individuals contracting a condition in the calculation of the total loss of welfare from morbidity.

The number of appointments can be converted to an approximate number of people if there is information on the proportion of appointments that are 'new patients' who have not previously interacted with the health care system for that condition. No evidence was located on the proportion of inpatient or day case admissions that were first time attendances. However, HSCIC data suggest that in England 30% of outpatient appointments are first time attendances[24]. It was assumed that the figure in Ireland would be broadly similar and that number of outpatient appointments that were first appointments for the condition (30%) represented the number of patients contracting the condition in 2013[25].

The statistics for outpatient appointments are not broken down by condition. The total number of outpatient appointments attributable to smoking and exposure to second-hand smoke was multiplied by the proportion of inpatient and day cases attributable to smoking and exposure to second-hand smoke for each condition. This generated an estimate of the number of inpatient appointments by condition attributable to smoking and second-hand smoke. This operation is summarised by the equation below:

$$OA_{Cond} = \frac{(IA_C + DC_C)}{(IA_A + DC_A)} * OA_T$$

Where:

OA_{Cond} = Outpatient appointment attributable to smoking or exposure to second-hand smoke for each condition;

IA_C = Inpatient admissions attributable to smoking and exposure to second-hand smoke for each condition;

DC_C = Day cases attributable to smoking and exposure to second-hand smoke for each condition;

IA_A = Total inpatient admissions attributable to smoking and exposure to second-hand smoke;

DC_A = Total day cases attributable to smoking and exposure to second-hand smoke; and

[23] https://www.nice.org.uk/glossary?letter=q

[24] Health and Social Care Information Centre (HSCIC) (2015) Hospital Outpatient Activity - 2013-14 (England)

[25] Health and Social Care Information Centre (HSCIC) (2015) Hospital Outpatient Activity - 2013-14 (England)

OA_T = Total number of outpatient appointments attributable to smoking and exposure to second-hand smoke.

The value of QALY utility lost in 2013 was calculated by subtracting the QALY utility value for an individual suffering from a health condition from the population average QALY utility score (0.84)[26]. The change in utility score was then multiplied by the number of patients contracting the condition in 2013 to give the total loss of QALY utility and the duration of life expected following contraction of the disease. This was used as an estimate of the number of patients contracting a condition. The National Centre for Pharmacoeconomics estimates the value of one QALY at €45,000[27]. The monetary value of the loss of QALY utility was calculated by multiplying the total loss of utility by €45,000.

This methodology was followed for each condition separately. The calculation for each health condition is summarised in the equation below:

$$LU_{Cond} = (30\% * OA_{Cond}) * (PQ - CQ_{Cond}) * LE_{Cond} * €45{,}000$$

Where:

LU_{Cond} = The monetary value of the loss of QALY utility for each health condition;

OA_{Cond} = The number of outpatient appointments attributable to smoking and exposure to second-hand smoke for each health condition;

PQ = The population average QALY utility score;

CQ_{Cond} = The average QALY utility score for an individual with the health condition; and

LE_{Cond} = The average duration of life following contracting each health condition.

The QALY utility values for each health condition are presented in Annex 7.

This calculation is likely to provide an underestimate of the true loss of QALY welfare as a result of smoking. This is because individuals who were already suffering from a smoking related health condition prior to 2013 could experience a worsening of their condition, which would lead to a further loss of welfare.

4.5.2 The cost of premature mortality

The cost of premature deaths caused by smoking and exposure to second-hand smoke was estimated by multiplying the number of deaths by the value of a statistical life (VoSL). VoSL estimates in Ireland are based on equivalent UK figures (WebTAG). The latest version of WebTAG (2014) estimates the VoSL at €2.0 million[28]. This estimate includes a cost for lost productivity, a human cost based on willingness to pay for reduced risk of death and a medical cost. As the medical costs and lost productivity from premature death have already been calculated for smoking, these costs have been removed from the VoSL. Therefore the VoSL value used in the calculations for premature deaths was €1.3 million.

The VoSL was multiplied by the number of premature deaths to estimate the loss of welfare due to premature deaths attributable to smoking and exposure to second-hand smoking.

[26] UK Health Survey, 2013

[27] http://www.ncpe.ie/about/

[28] This figure is derived from the UK value for 2010 (£1.6 million) and converting this to a value for Ireland using to € at the Purchasing Power Parity Exchange rate for the year in question (2010) (as described in section 4.1.2), then uplifting the value to the reference year (2013) by reference to the change in average hourly earnings in Ireland (as reported by the CSO)

5 Sensitivity analysis

A sensitivity analysis was carried out as part of the research. Sensitivity analysis is an exercise which measures how using different assumptions used in a calculation affect the outcome. In this case the assumptions and values used to calculate the economic impact of smoking in Ireland were varied. By doing this, a range of values of the cost of smoking was derived. It can confidently be stated that the true value lies within these bounds.

5.1 Assumptions which were varied

All of the calculations carried out for the sensitivity analysis followed the methodology set out in section 4 but the assumptions underpinning the calculations were altered. The assumptions that were varied are presented in Table 5.1.

The most significant variation was the choice of health conditions used in the analysis. In the lower and central estimates, only conditions that have a causal relationship with smoking and exposure to second-hand smoke were included. In the high estimate, conditions with a suggestive relationship to smoking and exposure to second-hand smoke were also included.

Table 5.1 Assumptions varied in the sensitivity analysis

Assumption	Low estimate value	Central estimate value	High estimate value	Source
Health conditions used	Conditions listed in Table A4.1 to Table A4.5; and Table A5.1	Conditions listed in Table A4.1 to Table A4.5; and Table A5.1	Conditions listed in Table A4.1 to Table A4.6; and Table A5.1 and Table A5.2.	Multiple sources, see Annex 4 and Annex 5.
Level of exposure to second-hand smoke	8%	17%	17%	Eurobarometer
Average cost of inpatient admissions	See Table A6.1	See Table A6.1	See Table A6.1	Department of Health (England) (2013) Payment by Results in the NHS: tariff for 2013 to 2014
Percentage of health care cost attributable to primary care	33%	55%	55%	Callum et. Al (2010); Phillips and Bloodworth (2009)
QALY utility value for individuals with smoking related health conditions	See Table A7.1	See Table A7.1	See Table A7.1	Multiple sources, see Annex 7
Unit cost of hospital transport	Emergency: €235 Non-emergency: €58	Emergency: €280 Non-emergency: €70	Emergency: €317 Non-emergency: €88	PSSRU
Proportion of cigarettes smoked at work	15%	20%	25%	ICF variation
Duration of smoking break	6 minutes	8 minutes	20 minutes	Berman et al., 2013
Percentage of additional sick leave for smokers	39%	45%	50%	Lundborg et al, 2007 and Weng et al, 2012
Number of sick days taken	4.4	5.5	9.5	UK Office for National statistics; IBEC and Department of Public Expenditure and Reform
Number of fires	Smoking materials only	Smoking materials only	Includes fires caused by matches	Department for Environment, Community and Local Government Fire Service Statistics
Litter that is smoking related	49%	54%	59%	Department for Environment, Community and Local Government

ANNEXES

Annex 1 Number of deaths from smoking related conditions

Table A1.1 presents the number of deaths from health conditions related to smoking in Ireland. The data were downloaded from the Central Statistical Office website for each relevant condition[29].

Table A1.1 Number of deaths in Ireland by condition, 2013

Condition	Number of deaths - males	Number of deaths – females	Deaths attributable to smoking - males	Deaths attributable to smoking - females
Cancer (all age 35+)				
Cancer of trachea and bronchus and lung[30]	1,113	772	985	584
Oral and upper respiratory cancers	112	46	83	24
Oesophageal cancer	256	122	183	76
Cancer of the larynx	53	4	44	3
Stomach cancer	179	121	49	16
Kidney cancers	167	93	61	8
Cervical	0	72	0	9
Bladder	147	64	69	21
Pancreatic cancer	239	270	58	74
Leukaemia	164	108	40	12
Liver cancer	173	120	40	23
Colorectal cancer	593	431	173	107
Cancer of other unspecified area	154	154	86	35
Cardiovascular disease				
Coronary heart disease (age 35 – 54)	201	33	106	19
Coronary heart disease (age 55 – 64)	342	74	118	19
Coronary heart disease (65 – 74)	608	219	133	36
Coronary heart disease (75+)	1,569	1,653	128	140
Coronary Heart Disease (exposure to second-hand smoke)	2,729	1,983	36	32
Cerebrovascular disease (age 35 – 54)	49	21	23	11
Cerebrovascular disease (age 55 – 64)	66	45	20	16
Cerebrovascular disease (65 – 74)	137	101	28	23
Cerebrovascular disease (75+)	570	1,005	55	23
Aortic aneurysm (35+)	167	109	109	62
Atherosclerosis (35+)	38	58	11	7
Other arterial disease (35+)	74	67	13	13
Other heart disease (35+)	873	1,116	170	123
Stroke (exposure to second-hand smoke)	562	808	6	10

[29] http://www.cso.ie/px/pxeirestat/Statire/SelectVarVal/Define.asp?maintable=VSA08

[30] Including exposure to second-hand smoke

Condition	Number of deaths - males	Number of deaths – females	Deaths attributable to smoking - males	Deaths attributable to smoking - females
Respiratory disease				
Chronic obstructive pulmonary disease (35+)	85	88	77	74
Chronic airway obstruction (35+)	740	738	598	583
Pneumonia (age 35 - 64)	19	16	6	7
Pneumonia (age 65+)	376	573	96	79
Influenza (age 35 - 64)	2	0	1	0
Influenza (age 65+)	5	9	1	1
Mycobacterium tuberculosis (35+)	11	5	2	1
Other effects				
Peptic ulcer disease (35+)	34	38	18	18
Diabetes	128	124	15	12
Rheumatoid arthritis	12	49	3	8

Irish Central Statistical Office data on causes of deaths - http://www.cso.ie/px/pxeirestat/Statire/SelectVarVal/Define.asp?maintable=VSA08

Annex 2 Number of hospital inpatient admissions for smoking related conditions

The number of hospital inpatient admissions for health conditions related to smoking is presented in Table A2.1. The number of hospital admissions is based on data provided by the Irish Healthcare Pricing Office for 2013. More specifically, the Healthcare Pricing Office provided data on the total number of hospital inpatient discharges, which were assumed to be equal to the total number of inpatient admissions.

The list of conditions is longer than in the case of deaths as it also includes non-fatal conditions.

Table A2.1 Number of hospital inpatient admissions by condition, 2013

Condition	Number of inpatient admissions – males	Number of inpatient admissions – females	Inpatient admissions attributable to smoking - males	Inpatient admissions attributable to smoking - females
Cancer (all age 35+)				
Cancer of trachea and bronchus and lung[31]	1,682	1,264	1,488	956
Oral and upper respiratory cancers	626	237	466	122
Oesophageal cancer	500	237	358	148
Cancer of the larynx	267	47	221	36
Stomach cancer	511	304	140	41
Kidney cancers	523	229	191	20
Cervical	0	374	0	46
Bladder	913	312	429	100
Pancreatic cancer	363	358	88	98
Leukaemia	564	371	136	41
Liver cancer	367	147	84	28
Colorectal cancer	1,836	1,141	537	284
Cancer of other unspecified area	393	348	220	78
Cardiovascular disease				
Coronary heart disease (age 35 - 54)	2,043	576	1,079	339
Coronary heart disease (age 55 - 64)	2,780	779	960	199
Coronary heart disease (65 - 74)	3,289	1,237	718	205
Coronary heart disease (75+)	2,519	1,773	206	150
Coronary heart disease (exposure to second-hand smoke)	10,706	4,377	143	70
Cerebrovascular disease (age 35 - 54)	488	376	231	194
Cerebrovascular disease (age 55 - 64)	668	427	198	153
Cerebrovascular disease (65 - 74)	1,056	650	215	147

[31] Including exposure to second-hand smoke

Condition	Number of inpatient admissions – males	Number of inpatient admissions – females	Inpatient admissions attributable to smoking - males	Inpatient admissions attributable to smoking - females
Cerebrovascular disease (75+)	1,398	1,806	135	41
Aortic aneurysm (35+)	551	210	358	120
Atherosclerosis (35+)	1,001	585	294	71
Other arterial disease (35+)	393	306	70	57
Other heart disease (35+)	10,130	7,750	1,974	854
Stroke (exposure to second-hand smoke)	3,007	2,802	34	36
Respiratory disease				
Chronic obstructive pulmonary disease (35+)	305	427	275	357
Chronic airway obstruction (35+)	6,718	6,831	5,430	5,396
Pneumonia (age 35 – 64)	1,159	1,066	374	435
Pneumonia (age 65+)	3,397	3,347	868	460
Influenza (age 35 – 64)	35	40	11	16
Influenza (age 65+)	20	28	5	4
Mycobacterium tuberculosis (35+)	113	56	23	10
Reproductive conditions				
Foetal death and stillbirths (all ages)	-	340	-	25
Ectopic pregnancy (all ages)	-	1,130	-	148
Erectile dysfunction (20+)	9	-	2	-
Oral clefts (less than one year)	-	173	-	8
Perinatal effects (all ages)	-	4,964	-	380
Low birth weight (less than one year)[32]	-	3,088	-	241
Other effects				
Cataract (45+)	57	45	7	5
Macular degeneration (45+)	61	109	26	39
Hip fractures (age 55 – 64)	91	175	3	6
Hip fractures (age 65 – 74)	217	376	21	27
Hip fractures (age 75+)	650	1,798	81	212
Peptic ulcer disease (35+)	456	347	248	161
Periodontitis (35+)	0	0	0	0
Diabetes (type 2) (35+)	2,394	1,363	274	128
Rheumatoid arthritis (35+)	109	191	24	32
Dental caries (all ages)	61	66	8	13
Crohn's disease (35+)	242	312	43	48
Low bone density (45+)	-	212	7	8

[32] Including exposure to second-hand smoke

Condition	Number of inpatient admissions – males	Number of inpatient admissions – females	Inpatient admissions attributable to smoking - males	Inpatient admissions attributable to smoking - females
Middle ear disease (exposure to second-hand smoke)	315	170	16	9

Data on hospital admissions from Healthcare Pricing Office

Annex 3 Number of day cases for smoking related conditions

Table A3.1 reports the number of day cases for health conditions related to smoking. It is based on data provided by the Irish Healthcare Pricing Office that described the total number of hospital discharges in 2013. More specifically, the number of day cases was calculated as the total number of patient discharges minus the total number of inpatient discharges.

The list of conditions is longer than in the case of deaths as it also includes non-fatal conditions.

Table A3.1 Number of day cases by conditions, 2013

Condition	Number of day cases – males	Number of day cases – females	Day cases attributable to smoking - males	Day cases attributable to smoking - females
Cancer (all age 35+)				
Cancer of trachea and bronchus and lung[33]	1,378	1,421	1,218	1,075
Oral and upper respiratory cancers	421	146	313	75
Oesophageal cancer	577	225	413	141
Cancer of the larynx	284	55	235	42
Stomach cancer	605	295	166	40
Kidney cancers	655	207	240	18
Cervical	0	394	0	49
Bladder	687	337	323	108
Pancreatic cancer	353	326	85	89
Leukaemia	3,210	2,194	775	242
Liver cancer	115	70	26	13
Colorectal cancer	2,599	1,410	760	351
Cancer of other unspecified area	524	490	294	110
Cardiovascular disease				
Coronary heart disease (age 35 - 54)	791	259	418	153
Coronary heart disease (age 55 - 64)	1,333	466	460	119
Coronary heart disease (65 - 74)	1,468	724	320	120
Coronary heart disease (75+)	757	425	62	36
Coronary Heart Disease (exposure to second-hand smoke)	4,370	1,880	58	30
Cerebrovascular disease (age 35 - 54)	10	18	5	9
Cerebrovascular disease (age 55 - 64)	12	34	4	12
Cerebrovascular disease (65 - 74)	14	16	3	4
Cerebrovascular disease (75+)	5	4	0	0
Aortic aneurysm (35+)	56	11	36	6
Atherosclerosis (35+)	216	100	64	12
Other arterial disease (35+)	363	549	64	103
Other heart disease (35+)	2,752	1,345	536	148

[33] Including exposure to second-hand smoke

Condition	Number of day cases – males	Number of day cases – females	Day cases attributable to smoking - males	Day cases attributable to smoking - females
Stroke (exposure to second-hand smoke)	11	11	0	0
Respiratory disease				
Chronic obstructive pulmonary disease (35+)	344	470	310	393
Chronic airway obstruction (35+)	746	752	603	594
Pneumonia (age 35 - 64)	22	32	7	13
Pneumonia (age 65+)	24	23	6	3
Influenza (age 35 - 64)	0	2	0	1
Influenza (age 65+)	0	0	0	0
Mycobacterium tuberculosis (35+)	52	34	11	6
Reproductive conditions				
Foetal death and stillbirths (all ages)	-	0	-	0
Ectopic pregnancy (all ages)	-	55	-	7
Erectile dysfunction (20+)	157	-	43	0
Oral clefts (less than one year)	-	5	-	0
Perinatal effects (all ages)	-	75	-	6
Low birth weight (less than one year)[34]	-	45	-	4
Other effects				
Cataract (45+)	1,955	2,889	251	298
Macular degeneration (45+)	3,905	5,292	1,662	1,912
Hip fractures (age 55 - 64)	0	0	0	0
Hip fractures (age 65 - 74)	0	0	0	0
Hip fractures (age 75+)	0	0	0	0
Peptic ulcer disease (35+)	414	332	225	154
Periodontitis (35+)	0	0	0	0
Diabetes (type 2) (35+)	4,133	2,837	473	267
Rheumatoid arthritis (35+)	1,812	4,096	392	684
Dental caries (all ages)	2,219	1,996	66	392
Crohn's disease (35+)	1,227	1,301	219	201
Low bone density (45+)	-	280	-	10
Middle ear disease (exposure to second-hand smoke)	1,279	826	66	43

Data on hospital admissions from Healthcare Pricing Office

[34] Including exposure to second-hand smoke

Annex 4 Relative risks used for current and ex-smokers for smoking related conditions

Table A4.1 to Table A4.5 report the relative risk for current and ex-smokers for health conditions where a causal relationship with smoking has been established. The data are taken from two main sources: Statistics on Smoking (2014) produced by the UK's Health and Social Care Information Centre (HSCIC)[35], and the US Surgeon General report (2014)[36].

Table A4.6 presents the relative risk for current and ex-smokers for health conditions where a relationship with smoking has been suggested in the literature, but a causal relationship has not yet been established. These health conditions have been used in the sensitivity analysis calculations.

Table A4.1 Cancers with a causal relationship with smoking

Condition	ICD10 code	Relative risk Males		Relative risk females		Source
		Current	Ex-smoker	Current	Ex-smoker	
Lung cancer	C34	23.26	8.70	12.69	4.53	HSCIC Statistics on Smoking 2014
Cancer of trachea and bronchus	C33	23.26	8.70	12.69	4.53	HSCIC Statistics on Smoking 2014
Oral and upper respiratory cancers	C00-C14	10.89	3.40	5.08	2.29	HSCIC Statistics on Smoking 2014
Oesophageal cancer	C15	6.76	4.46	7.75	2.79	HSCIC Statistics on Smoking 2014
Cancer of the larynx	C32	14.60	6.34	13.02	5.16	HSCIC Statistics on Smoking 2014
Stomach cancer	C16	1.96	1.47	1.36	1.32	HSCIC Statistics on Smoking 2014
Kidney cancers	C64-C66	2.50	1.70	1.40	1.10	HSCIC Statistics on Smoking 2014
Cervical	C53	-	-	1.59	1.14	HSCIC Statistics on Smoking 2014
Bladder	C67	3.27	2.09	2.22	1.89	HSCIC Statistics on Smoking 2014
Pancreatic cancer	C25	2.31	1.15	2.25	1.55	HSCIC Statistics on Smoking 2014
Leukaemia	C91-C96	1.80	1.40	1.20	1.30	HSCIC Statistics on Smoking 2014
Liver cancer	C22	1.70	1.40	1.70	1.40	US Surgeon General 2014
Colorectal cancer	C18-C20	2.14	1.47	2.14	1.47	US Surgeon General 2014
Cancer of unspecified area	C80.0	4.40	2.50	2.20	1.30	HSCIC Statistics on Smoking 2014

Source: HSCIC (2014); US Surgeon General (2014)

[35] The Health and Social Care Information Centre (HSCIC), (2014), Statistics on Smoking 2014

[36] US Surgeon General, (2014), The Health Consequences of Smoking—50 Years of Progress

Table A4.2 Cardiovascular disease with a causal relationship with smoking

Condition	ICD10 code	Age	Relative risk Males		Relative risk females		Source
			Current	Ex-smoker	Current	Ex-smoker	
Coronary heart disease	I20-I25	35-54 55-64 65-74 75+	4.2 2.5 1.8 1.4	2.0 1.6 1.3 1.1	5.3 2.8 2.1 1.4	2.6 1.1 1.2 1.2	HSCIC Statistics on Smoking 2014
Cerebrovascular disease	I60-I69	35-54 55-64 65-74 75+	4.4 3.1 2.2 1.6	1.1 1.1 1.1 1.1	5.4 3.7 2.6 1.3	1.3 1.3 1.3 1.0	HSCIC Statistics on Smoking 2014
Aortic aneurysm	I71	35+	6.21	3.07	7.07	2.07	HSCIC Statistics on Smoking 2014
Atherosclerosis	I70	35+	2.44	1.33	1.83	1.00	HSCIC Statistics on Smoking 2014
Other arterial disease	I72-I78	35+	2.07	1.01	2.17	1.12	HSCIC Statistics on Smoking 2014
Other heart disease	I00 – I09; I26 – I51	35+	1.78	1.22	1.49	1.14	HSCIC Statistics on Smoking 2014

Source: HSCIC (2014); US Surgeon General (2014)

Table A4.3 Respiratory disease with a causal relationship with smoking

Condition	ICD10 code	Age	Relative risk Males		Relative risk females		Source
			Current	Ex-smoker	Current	Ex-smoker	
Chronic obstructive pulmonary disease	J40-J43;J47	35+	17.10	15.64	12.04	11.77	HSCIC Statistics on Smoking 2014
Chronic airway obstruction	J44	35+	10.58	6.80	13.08	6.78	HSCIC Statistics on Smoking 2014
Pneumonia	J12 – J18	35-64 65+	2.50 2.00	1.40 1.40	4.30 2.20	1.10 1.10	HSCIC Statistics on Smoking 2014
Influenza	J10-J11	35-64 65+	2.50 2.00	1.40 1.40	4.30 2.20	1.10 1.10	HSCIC Statistics on Smoking 2014
Mycobacterium tuberculosis	A15 – A19	35+	2.30		2.30		US Surgeon General 2014
Asthma		-	-	-	-	-	

Source: HSCIC (2014); US Surgeon General (2014)

Table A4.4 Reproductive conditions with a causal relationship with smoking

Condition	ICD10 code	Relative risk Males		Relative risk from maternal smoking		Source
		Current	Ex-smoker	Current	Ex-smoker	
Foetal death and stillbirths	P95; Z31.1; Z37.3; Z37.4; Z37.6; Z37.7			1.47		Marufu, T C et al. 2015
Ectopic pregnancy	O00			1.91		US Surgeon General 2014
Erectile dysfunction	F52.2; N48.4	1.7	1.6			US Surgeon General 2014
Oral clefts	Q35-Q37			1.28		US Surgeon General 2014
Perinatal effects	Multiple from P00.0 to P77			1.50		US Surgeon General 2014
Low birth weight				1.4		US Surgeon General 2004
Fertility	-	-	-	-	-	

Source: Marufu, T C et al. 2015; US Surgeon General (2014)

Table A4.5 Health conditions for which a causal relationship with smoking has been established

Condition	ICD10 code	Age	Relative risk Males		Relative risk females		Source
			Current	Ex-smoker	Current	Ex-smoker	
Cataract	H25 – H26, H28.1, H28.2	45+	1.54	1.11	1.54	1.11	HSCIC Statistics on Smoking 2014
Macular degeneration	H35.3	45+	2.97	1.88	2.97	1.88	US Surgeon General 2014
Hip fractures	S72.0 – S72.2	55-64 65-74 75+	1.17 1.41 1.76	1.02 1.08 1.14	1.17 1.41 1.85	1.02 1.08 1.22	HSCIC Statistics on Smoking 2014
Peptic ulcer disease	K25 – K28	35+	5.40	1.80	5.50	1.40	HSCIC Statistics on Smoking 2014
Periodontitis	K05.2 – K05.6	35+	3.97	1.68	3.97	1.68	HSCIC Statistics on Smoking 2014
Diabetes (type 2)	E11	35+	1.37	1.14	1.37	1.14	US Surgeon General 2014
Rheumatoid arthritis	M05 – M06	35+	1.89	1.25	1.75	1.25	US Surgeon General 2014
Dental caries	K02	35+	1.76	1.39	1.76	1.39	US Surgeon General 2014
Crohn's disease	K50	35+	2.1	1.0	2.1	1.0	HSCIC Statistics on Smoking 2014
Low bone density		45+			1.25		US Surgeon General 2014
Diminished health status		-	-	-	-	-	
Adverse surgical outcomes related to wound healing and respiratory complications		-	-	-	-	-	
Negative effects on the immune system		-	-	-	-	-	

Source: HSCIC (2014); US Surgeon General (2014)

Table A4.6 Health conditions where evidence is suggestive of a relationship with smoking

Condition	ICD10 code	Relative risk Males		Relative risk females		Source
		Current	Ex-smoker	Current	Ex-smoker	
Cancers						
Breast cancer	C50	-	-	1.12	1.09	US Surgeon General 2014
Prostate cancer	C61	1.04	1.09	-	-	Huncharek, M. et al 2010
Nasopharyngeal carcinoma	C30.0	1.6	-	1.6	-	Wen-Qiong et al 2012
Cardiovascular disease						
Venous thromboembolism	I80-I82	1.23	1.10	1.23	1.10	Cheng, Y-J et al 2012
Respiratory conditions						
Asthma[37]		-	-	-	-	
Lower respiratory tract illnesses		-	-	-	-	
Non-specific bronchial hyper-responsiveness		-	-	-	-	
Reproductive effects						
Spontaneous abortion	O03			1.14		US Surgeon General 2014
Clubfoot	Q66.8			1.28		US Surgeon General 2014
Gastroschisis	Q79.3			1.50		US Surgeon General 2014
Sudden Infant Death Syndrome	R95			2.7		Dietz et al 2010
Congenital heart defects	Q20 – Q26			1.09		US Surgeon General 2014
Neural tube defects	Q00; Q01; Q05			1.20		US Surgeon General 2014
Other conditions						
Ophthalmopathy associated with Graves' disease	H05.0; H06.2	6.5	-	6.5	-	US Surgeon General 2004
Suicide	X70 – X84	1.81	1.24	1.81	1.24	Dianjiang L et al. 2012
Myelodysplastic syndrome (MDS)	D46	1.81	1.67	1.81	1.67	Tong, H et al 2013
Barrett's esophagus	K22.7	1.44	-	1.44	-	Andrici, J et al. 2013
Psoriasis	L40	1.78	1.62	1.78	1.62	Armstrong, A et al 2014
Multiple sclerosis	G35	1.79	-	1.36	-	O'Gorman, C. 2014
Allergic dermatitis	L23	1.21	-	1.21	-	Saulyte, J 2014
All-cause mortality						

[37] This includes: Incidence of asthma in adolescents; exacerbation of asthma among children and adolescents; asthma in adults; and a poorer prognosis for children and adolescents with asthma

Annex 5 Relative risks used for current and ex-smokers for smoking related conditions

Table A5.1 and Table A5.2 show the relative risk for non-smokers for health conditions where a causal relationship with exposure to second-hand smoke has been established. The data are taken from the US Surgeon General reports of 2006 and 2014[38].

Table A5.2 presents the relative risk for non-smokers for health conditions where a relationship with exposure to second-hand smoke has been suggested in the literature, but a causal relationship has not yet been established. These health conditions have been used in the sensitivity analysis calculations.

Table A5.1 Health conditions with a causal relationship with exposure to second-hand smoke

Condition	ICD 10	Age	Relative risk	Source
Lung cancer	C34	20+	1.29	US Surgeon General 2014
Coronary heart disease (CHD)	I20-I25	20+	1.32	US Surgeon General 2014
Stroke	I63	20+	1.25	US Surgeon General 2014
SIDS	R95	<1	1.94	US Surgeon General 2006
Middle ear disease	H65-H75	0-10	1.32	US Surgeon General 2006
Odour annoyance / nasal irritation	-	-		
Reduction in birth weight	P07	-	1.2	US Surgeon General 2014

Source: US Surgeon General (2014); US Surgeon General (2006)

[38] US Surgeon General (2014) The Health Consequences of Smoking—50 Years of Progress; and US Surgeon General (2006) The Health Consequences of Involuntary Exposure to Tobacco Smoke

Table A5.2 Health conditions where evidence is suggestive of a relationship with exposure to second-hand smoke

Condition	ICD10 code	Relative risk males	Relative risk females	Source
Cancers				
Breast Cancer	C50	-	1.14	US Surgeon General 2014
Nasopharyngeal carcinoma	C30.0	1.3	1.3	US Surgeon General 2014
Cardiovascular disease				
Atherosclerosis	I70	1.21	1.21	US Surgeon General, 2006
Respiratory conditions				
Asthma[39]	J45 – J46	1.32	1.32	Olaitan Tinuoye et al 2012
COPD	J40-J44; J47	1.7	1.7	US Surgeon General, 2006
Acute respiratory symptoms	-	-	-	US Surgeon General, 2014
Reproductive effects				
Preterm delivery	O60	-	1.86	US Surgeon General, 2014
Other effects				
Dental caries in children	K02	1.98	1.98	US Surgeon General, 2014
Allergic dermatitis	L23	1.06	1.06	Saulyte, J 2014
Allergic rhinitis	J30.1 – J30.4	1.10	1.10	Saulyte, J 2014
Meningococcal disease	A39	1.83	1.83	Kusel, J. et al. 2013
Cognitive development	F06.7	-	-	Ruoling Chen et al 2013

[39] This includes: incidence of asthma in adolescents; exacerbation of asthma among children and adolescents; asthma in adults; and a poorer prognosis for children and adolescents with asthma

Annex 6 Healthcare costs per condition

Table A6.1 shows the cost per inpatient admission for each condition. This information was provided by the HSE Healthcare Pricing Office. Table A6.2 presents the cost per day case, and the information is taken from the same source.

Table A6.1 Average healthcare costs for inpatient admissions

Condition	DRG code	DRG description	Cost (€)	Low cost (€)	Central cost (€)	High cost (€)
Lung cancer	E71A	RESPIRATORY NEOPLASMS +CCC	8,793	4,384	5,405	8,793
	E71B	RESPIRATORY NEOPLASMS -CCC	4,384			
Cancer of trachea and bronchus	E71A	RESPIRATORY NEOPLASMS +CCC	8,793	4,384	5,405	8,793
	E71B	RESPIRATORY NEOPLASMS -CCC	4,384			
Oral and upper respiratory cancers, nasopharyngeal cancer	D02B	HEAD & NECK PR+MALIGNANCY/MCC	14,969	4,682	7,315	11,206
	D60A	EAR NOSE MOUTH&THROAT MAL+CSCC	11,206			
	D60B	EAR NOSE MOUTH&THROAT MAL-CSCC	4,682			
Oesophageal cancer	G03A	STOMCH,OESPH&DUODNL PR+MAL/CCC	25,645	25,645	25,645	25,645
Cancer of the larynx	D02B	HEAD & NECK PR+MALIGNANCY/MCC	14,969	4,682	7,315	11,206
	D60A	EAR NOSE MOUTH&THROAT MAL+CSCC	11,206			
	D60B	EAR NOSE MOUTH&THROAT MAL-CSCC	4,682			
Stomach cancer	G03A	STOMCH,OESPH&DUODNL PR+MAL/CCC	25,645	25,645	25,645	25,645
Kidney cancers, prostate cancer	L62A	KDNY&UNRY TRCT NEOPLASMS +CSCC	7,210	3,334	5,099	7,210
	L62B	KDNY&UNRY TRCT NEOPLASMS -CSCC	3,334			
Cervical cancer	N60A	MALIGNANCY FEM REPROD SYS +CCC	10,118	10,118	5,264	10,118
Bladder cancer	N60B	MALIGNANCY FEM REPROD SYS -CCC	4,374	3,334	5,099	7,210
	L62A	KDNY&UNRY TRCT NEOPLASMS +CSCC	7,210			
	L62B	KDNY&UNRY TRCT NEOPLASMS -CSCC	3,334			
Pancreatic cancer	H61A	MALG HEPATOBILIARY SYS PAN+CCC	9,190	4,797	5,675	9,190
	H61B	MALG HEPATOBILIAY SYS PANC-CCC	4,797			
Leukaemia	R60A	ACUTE LEUKAEMIA + CCC	46,943	14,680	22,886	46,943

Condition	DRG code	DRG description	Cost (€)	Low cost (€)	Central cost (€)	High cost (€)
	R60B	ACUTE LEUKAEMIA - CCC	14,680			
	H61A	MALG HEPATOBILIARY SYS PAN+CCC	9,190			
Liver cancer	H61B	MALG HEPATOBILIAY SYS PANC-CCC	4,797	4,797	5,099	9,190
	G60A	DIGESTIVE MALIGNANCY + CCC	8,371			
Colorectal cancer	G60B	DIGESTIVE MALIGNANCY - CCC	4,639	4,639	5,287	8,371
Cancer of unspecified area	Average of above		8,345		8,345	
	F05A	CRNRY BYPSS+INV INVES+REOP/CCC	34,942			
	F05B	CRNRY BYPSS+INV INVES-REOP-CCC	28,342			
	F06A	CRNRY BYPSS-INV INVS+REOP/CSCC	21,107			
	F06B	CRNRY BYPSS-INV INVS-REOP-CSCC	17,885			
	F10A	INTERVENTN CORONARY PR+AMI+CCC	13,834			
	F10B	INTERVENTN CORONARY PR+AMI-CCC	6,609			
	F41A	CRC DSRD+AMI+INVA INVE PR+CSCC	8,926			
	F41B	CRC DSRD+AMI+INVA INVE PR-CSCC	5,007			
	F60A	CRC DSRD+AMI-INVA INVE PR+CCC	9,655			
	F60B	CRC DSRD+AMI-INVA INVE PR-CCC	4,452			
	F66A	CORONARY ATHEROSCLEROSIS +CSCC	4,430			
	F66B	CORONARY ATHEROSCLEROSIS -CSCC	2,218			
	F72A	UNSTABLE ANGINA + CSCC	4,368			
	F72B	UNSTABLE ANGINA - CSCC	2,234			
Coronary heart disease	F74Z	CHEST PAIN	1,178	1,178	2,806	9,655
	B70A	STROKE & OTH CEREB DIS +CCC	24,000			
	B70B	STROKE & OTH CEREB DIS +SCC	9,709			
	B70C	STROKE & OTH CEREB DIS -CSCC	5,323			
Cerebrovascular disease	B70D	STRKE&OTH CEREB DIS DIE/TRN<5D	1,761	1,761	9,129	24,000
	F08A	MJR RECONSTRC VASC PR-PUMP+CCC	29,130			
Aortic aneurysm	F08B	MJR RECONSTRC VASC PR-PUMP-CCC	14,931	14,931	19,109	29,130

Condition	DRG code	DRG description	Cost (€)	Low cost (€)	Central cost (€)	High cost (€)
	F75A	OTHER CIRCULATRY SYSTEM DX+CCC	10,783			
	F75B	OTH CIRCULATRY SYSTEM DX+SMCC	5,053			
Atherosclerosis	F75C	OTHER CIRCULATY SYSTEM DX-CC	2,880	2,880	4,613	10,783
	F08A	MJR RECONSTRC VASC PR-PUMP+CCC	29,130			
	F08B	MJR RECONSTRC VASC PR-PUMP-CCC	14,931			
	F11A	AMPUTN CIRC SYS-UP LMB&TOE+CCC	50,510			
	F11B	AMPUTN CIRC SYS-UP LMB&TOE-CCC	18,892			
	F65A	PERIPHERAL VASCULAR DSRD +CSCC	6,236			
	F65B	PERIPHERAL VASCULAR DSRD -CSCC	2,642			
	F75A	OTHER CIRCULATRY SYSTEM DX+CCC	10,783			
	F75B	OTH CIRCULATRY SYSTEM DX+SMCC	5,053			
Other arterial disease	F75C	OTHER CIRCULATY SYSTEM DX-CC	2,880	2,880	7,919	10,783
	F03A	CRDC VALV PR+PMP+INV INVES+CCC	42,937			
	F03B	CRDC VALV PR+PMP+INV INVES-CCC	28,307			
	F04A	CRD VLV PR+PMP-INV INVES+CCC	28,804			
	F04B	CRD VLV PR+PMP-INV INVES-CCC	22,185			
	F61A	INFECTIVE ENDOCARDITIS +CCC	28,861			
	F61B	INFECTIVE ENDOCARDITIS -CCC	15,177			
	F62A	HEART FAILURE & SHOCK + CCC	10,126			
	F62B	HEART FAILURE & SHOCK - CCC	4,536			
	F69A	VALVULAR DISORDERS + CSCC	4,980			
	F69B	VALVULAR DISORDERS - CSCC	1,665			
	F76A	ARRHY, CARD & COND DISDR +CSCC	4,985			
Other heart disease	F76B	ARRHY, CARD & COND DISDR -CSCC	2,091	2,091	4,317	10,126
Chronic obstructive pulmonary disease	E65A	CHRNIC OBSTRCT AIRWAY DIS +CCC	6,437			
	E65B	CHRNIC OBSTRCT AIRWAY DIS -CCC	3,070	3,070	3,724	6,437
Chronic airway obstruction	E65A	CHRNIC OBSTRCT AIRWAY DIS +CCC	6,437			
	E65B	CHRNIC OBSTRCT AIRWAY DIS -CCC	3,070	3,070	3,724	6,437

Condition	DRG code	DRG description	Cost (€)	Low cost (€)	Central cost (€)	High cost (€)
Pneumonia	E62A	RESPIRATRY INFECTN/INFLAMM+CCC	8,959			
	E62B	RESPIRATRY INFECTN/INFLAM+SMCC	5,089			
	E62C	RESPIRATORY INFECTN/INFLAMM-CC	2,742	2,742	5,400	8,959
Influenza	E62A	RESPIRATRY INFECTN/INFLAMM+CCC	8,959			
	E62B	RESPIRATRY INFECTN/INFLAM+SMCC	5,089			
	E62C	RESPIRATORY INFECTN/INFLAMM-CC	2,742	2,742	5,400	8,959
Mycobacterium tuberculosis	E76Z	RESPIRATORY TUBERCULOSIS	7,900	7,900	7,900	7,900
Foetal death and stillbirths	O66Z	ANTENATAL&OTH OBSTETRIC ADM	965	965	965	965
Ectopic pregnancy	O03A	ECTOPIC PREGNANCY +CC	4,328			
	O03B	ECTOPIC PREGNANCY -CC	3,029	3,029	3,086	4,328
Erectile dysfunction	M64Z	OTHER MALE REPRODUCTIVE SYS DX	1,410	1,410	1,410	1,410
Oral clefts	D03Z	SURGCL RPR CLEFT LIP/PALATE DX	8,060	8,060	8,060	8,060
Perinatal effects	P63Z	NEO,ADMWT 1000-1249G-SIG OR PR	33,802			
	P64Z	NEO,ADMWT 1250-1499G-SIG OR PR	28,149			
	P65D	NEO,ADMWT 1500-1999G-SG OR-PRB	11,826			
	P66D	NEO,ADMWT 2000-2499G-SG OR-PRB	4,635	4,635	11,924	28,149
Low birth weight	P63Z	NEO,ADMWT 1000-1249G-SIG OR PR	33,802			
	P64Z	NEO,ADMWT 1250-1499G-SIG OR PR	28,149			
	P65D	NEO,ADMWT 1500-1999G-SG OR-PRB	11,826			
	P66D	NEO,ADMWT 2000-2499G-SG OR-PRB	4,635	4,635	11,924	28,149
Cataract	C15A	GLAUCOMA/CX CATARACT PROCS	5,929			
	C15B	GLAUCOMA/CX CATARACT PROCS, SD	1,460			
	C16Z	LENS PROCEDURES	4,341	1,460	4,931	5,929
Macular degeneration	C03Z	RETINAL PROCEDURES	4,482	4,482	4,482	4,482
Hip fractures	I78A	FRACTURE NECK FEMUR+CSCC	7,827	3,400	4,942	7,827

Condition	DRG code	DRG description	Cost (€)	Low cost (€)	Central cost (€)	High cost (€)
	I78B	FRACTURE OF NECK FEMUR-CSCC	3,400			
Peptic ulcer disease	G62Z	COMPLICATED PEPTIC ULCER	4,026			
	G63Z	UNCOMPLICATED PEPTIC ULCER	1,629	1,629	2,926	4,026
Diabetes (type 2)	K60A	DIABETES + CSCC	6,296			
	K60B	DIABETES - CSCC	3,339	3,339	3,939	6,296
Rheumatoid arthritis	I69A	BONE DISEASES AND ARTHRO +CSCC	6,763			
	I69B	BONE DISEASES AND ARTHROP-CSCC	2,617	2,617	3,330	6,763
Dental caries	D40Z	DENTAL EXTRACT & RESTORATIONS	2,657			
	D67A	ORAL&DNTAL DIS-EXTRCT&RESTN	2,332			
	D67B	ORAL&DNTAL DIS-EXTRCT&RESTN,SD	426	426	1,820	2,657
Crohn's disease	G64A	INFLAMMATORY BOWEL DISEASE +CC	4,141			
	G64B	INFLAMMATORY BOWEL DISEASE-CC	3,258	3,258	3,431	4,141
Low bone density	I69A	BONE DISEASES AND ARTHRO +CSCC	6,763			
	I69B	BONE DISEASES AND ARTHROP-CSCC	2,617	2,617	3,330	6,763
Stroke	B70A	STROKE & OTH CEREB DIS +CCC	24,000			
	B70B	STROKE & OTH CEREB DIS +SCC	9,709			
	B70C	STROKE & OTH CEREB DIS -CSCC	5,323			
	B70D	STRKE&OTH CEREB DIS DIE/TRN<5D	1,761	1,761	9,129	24,000
Middle ear disease	D63Z	OTITIS MEDIA AND URI	1,752	1,752	1,752	1,752
Reduction in birth weight	P63Z	NEO,ADMWT 1000-1249G-SIG OR PR	33,802			
	P64Z	NEO,ADMWT 1250-1499G-SIG OR PR	28,149			
	P65D	NEO,ADMWT 1500-1999G-SG OR-PRB	11,826			
	P66D	NEO,ADMWT 2000-2499G-SG OR-PRB	4,635	4,635	11,924	28,149
Venous Thromboembolism	F63A	VENOUS THROMBOSIS + CSCC	4,784			
	F63B	VENOUS THROMBOSIS - CSCC	2,213	2,213	2,697	4,784
Opthamolopathy associated with Grave's disease	C63Z	OTHER DISORDERS OF THE EYE	3,059	3,059	3,059	3,059

Condition	DRG code	DRG description	Cost (€)	Low cost (€)	Central cost (€)	High cost (€)
Myelodysplastic syndrome	Q61A	RED BLOOD CELL DISDERS + CSCC	5,867			
	Q61B	RED BLOOD CELL DISDERS - CSCC	2,984	2,984	3,762	5,867
Barrett's esophagus	G67A	OESPHS, GASTR +CSCC	4,514			
	G67B	OESPHS, GASTR -CSCC	1,638	1,638	1,989	4,514
Psoriasis	J67A	MINOR SKIN DISORDERS	2,632			
	J67B	MINOR SKIN DISORDERS, SAMEDAY	233	233	1,740	2,632
Multiple sclerosis	B68A	MLT SCLROSIS&CEREBEL ATAXIA+CC	7,902			
	B68B	MLT SCLROSIS&CEREBEL ATAXIA-CC	3,850	3,850	4,726	7,902
Allergic dermatitis	J67A	MINOR SKIN DISORDERS	2,632			
	J67B	MINOR SKIN DISORDERS, SAMEDAY	233	233	1,740	2,632
Breast cancer	J62A	MALIGNANT BREAST DISORDERS +CC	6,024			
	J62B	MALIGNANT BREAST DISORDERS -CC	2,290	2,290	5,126	6,024
Spontaneous abortion	O05Z	ABORTION+ OR PROC	1,675			
	O63Z	ABORTION-OR PROC	776	776	1,206	1,675
Gastroschisis	G12A	OTH DIGEST SYS OR PR+CCC	17,590			
	G12B	OTH DIGEST SYS OR PR+SMCC	9,051			
	G12C	OTH DIGEST SYS OR PR-CC	5,411	5,411	8,198	17,590
SIDS	Average		4,414	4,414	4,414	4,414
Congenital heart defects	F68A	CONGENITAL HEART DISEASE +CC	5,891			
	F68B	CONGENITAL HEART DISEASE -CC	5,110	5,110	5,338	5,891
Neural tube defects	B03A	SPINAL PROCEDURES + CSCC	17,124			
	B03B	SPINAL PROCEDURES - CSCC	10,208	10,208	11,550	17,124
Meningococcal infection	B72A	NRVS SYS INF EX VRL MNGTS+CSCC	19,000			
	B72B	NRVS SYS INF EX VRL MNGTS-CSCC	8,112	8,112	11,115	19,000
Prostate cancer	M60A	MALIGNANCY, MALE REPR SYS+CSCC	7,422			
	M60B	MALIGNANCY, MALE REPR SYS-CSCC	4,493	4,493	5,602	7,422

Tariff information; ICF calculations

Table A6.2 Average healthcare cost for day case

Condition			Cost (€)	Central cost (€)
Lung cancer	E71	RESPIRATORY NEOPLASMS	588	588
Cancer of trachea and bronchus	E71	RESPIRATORY NEOPLASMS	588	588
Oral and upper respiratory cancers	D60	EAR NOSE MOUTH&THROAT MAL	496	496
Oesophageal cancer	G60	DIGESTIVE MALIGNANCY	624	624
Cancer of the larynx	D60	EAR NOSE MOUTH&THROAT MAL	496	496
Stomach cancer	G60	DIGESTIVE MALIGNANCY	624	624
Kidney cancers	L62	KIDNEY&URINARY TRACT NEOPLASMS	537	537
Cervical	N60	MALIGNANCY FEMALE REPROD SYST	799	799
Bladder	L62	KIDNEY&URINARY TRACT NEOPLASMS	537	537
Pancreatic cancer	H61	MAL HEPATOBIL SYS, PANCREAS	678	678
Leukaemia	R60	ACUTE LEUKAEMIA	1,147	1,147
Liver cancer	H61	MAL HEPATOBIL SYS, PANCREAS	678	678
Colorectal cancer	G60	DIGESTIVE MALIGNANCY	624	624
Cancer of unspecified area	Average of above		671	671
	F10	INTERVENTIONAL CORONARY PR+AMI	2,752	
	F41	CRC DSRD+AMI+INVAS INVEST PR	1,055	
	F60	CRC DSRD+AMI-INVAS INVEST PR	356	
	F66	CORONARY ATHEROSCLEROSIS	352	
	F72	UNSTABLE ANGINA	412	
Coronary heart disease	F74	CHEST PAIN	225	590
Cerebrovascular disease	B70	STROKE & OTH CEREBROVAS DSRD	733	733
Aortic aneurysm	F08	MJR RECONSTRC VASC PR-PUMP	3,301	3,301
Atherosclerosis	F75	OTHER CIRCULATRY SYSTEM DX	524	524
	F65	PERIPHERAL VASCULAR DISORDERS	495	
Other arterial disease	F75	OTHER CIRCULATRY SYSTEM DX	524	505
Other heart disease	F61	INFECTIVE ENDOCARDITIS	357	332

Condition			Cost (€)	Central cost (€)
	F62	HEART FAILURE & SHOCK	354	
	F76	ARRHY, CARD ARRST & COND DSRD	331	
Chronic obstructive pulmonary disease	E65	CHRNIC OBSTRCT AIRWAY DIS	316	316
Chronic airway obstruction	E65	CHRNIC OBSTRCT AIRWAY DIS	316	316
Pneumonia	E62	RESPIRATORY INFECTN/INFLAMM	400	400
Influenza	E62	RESPIRATORY INFECTN/INFLAMM	400	400
Mycobacterium tuberculosis	E76	RESPIRATORY TUBERCULOSIS	204	204
Ectopic pregnancy	O03	ECTOPIC PREGNANCY	473	473
Erectile dysfunction	M64	OTHER MALE REPRODUCTIVE SYS DX	516	516
Oral clefts	D03	SURGCL RPR CLEFT LIP/PALATE DX	1,896	1,896
Perinatal effects	P65	NEO,ADMWT 1500-1999G-SG OP	741	
	P66	NEO,ADMWT 2000-2499G-SG OP	521	552
Low birth weight	P65	NEO,ADMWT 1500-1999G-SG OP	741	
	P66	NEO,ADMWT 2000-2499G-SG OP	521	552
Cataract	C16	LENS PROCEDURES	1,383	1,383
Macular degeneration	C03	RETINAL PROCEDURES	1,045	1,045
Peptic ulcer disease	G62	COMPLICATED PEPTIC ULCER	221	
	G63	UNCOMPLICATED PEPTIC ULCER	332	232
Diabetes (type 2)	K60	DIABETES	224	224
Rheumatoid arthritis	I69	BONE DISEASES & ARTHROPATHIES	450	450
Dental caries	D67	ORAL&DNTAL DIS-EXTRCT&RESTN	497	497
Crohn's disease	G64	INFLAMMATORY BOWEL DISEASE	1,639	1,639
Low bone density	I69	BONE DISEASES & ARTHROPATHIES	450	450
Stroke	B70	STROKE & OTH CEREBROVAS DSRD	733	733
Middle ear disease	D63	OTITIS MEDIA & URI	259	259
Reduction in birth weight	P65	NEO,ADMWT 1500-1999G-SG OP	741	
	P66	NEO,ADMWT 2000-2499G-SG OP	521	552
Venous Thromboembolism	F63	VENOUS THROMBOSIS	272	272

Condition			Cost (€)	Central cost (€)
Opthamolopathy associated with Grave's disease	C63	OTHER DISORDERS OF THE EYE	285	285
Myelodysplastic syndrome	Q61	RED BLOOD CELL DISORDERS	376	376
Barrett's esophagus	G67	OESOPHAGITIS & GASTROENTERITIS	212	212
	J67	MINOR SKIN DISORDERS	359	
	J68	MAJOR SKIN DISORDERS	264	
Psoriasis	J98	UV THERAPY	110	201
Multiple sclerosis	B68	MLT SCLROSIS&CEREBEL ATAXIA	812	812
	J67	MINOR SKIN DISORDERS	359	
Allergic dermatitis	J68	MAJOR SKIN DISORDERS	264	337
Breast cancer	J62	MALIGNANT BREAST DISORDERS	662	662
Spontaneous abortion	O63	ABORTION W/O OR PROC	181	181
Congenital heart defects	F68	CONGENITAL HEART DISEASE	852	852
Neural tube defects	B03	SPINAL PROCEDURES	1,471	1,471
Prostate cancer	M60	MALIGNANCY, MALE REPROD SYS	656	656

Tariff information; ICF calculations

Annex 7 Utility values used to calculate loss of welfare from smoking

Table A7.1 presents the QALY utility values for the general population (aged over 35), taken from the Health Survey in the UK, and the values for patients suffering from smoking related conditions. These have been taken from a variety of sources in the academic literature.

Table A7.1 Utility values for calculation of loss of welfare from smoking

Condition	Low estimate	Central estimate	High estimate
General population	0.84	0.84	0.84
Malignant neoplasm of bladder	0.87	0.8	0.62
Malignant neoplasm of cervix uteri	0.76	0.68	0.55
Malignant neoplasm of oesophagus	0.88	0.7986	0.68
Malignant neoplasm of kidney/renal pelvis/ureter	0.83	0.75	0.66
Malignant neoplasm of larynx	0.88	0.7986	0.68
Leukaemia	0.73	0.58	0.38
Malignant neoplasm of bronchus and lung	0.87	0.77	0.57
Malignant neoplasms of lip, oral cavity and pharynx	0.88	0.7986	0.68
Nasal cavity	0.88	0.7986	0.68
Malignant neoplasm of stomach	0.88	0.77	0.42
Malignant neoplasm of liver and intrahepatic bile ducts	0.79	0.72	0.69
Malignant neoplasm of colon/rectosigmoid junction/rectum	0.72	0.64	0.47
Malignant neoplasm of breast	0.806	0.721	0.668
Malignant neoplasm of pancreas	0.72	0.626	0.494
Malignant neoplasm of prostate	0.84	0.78	0.45
Malignant neoplasm of trachea	0.88	0.7986	0.68
Aortic aneurysm and dissection	0.83	0.76	0.71
Atherosclerosis	0.89	0.76	0.49
Cerebrovascular diseases	0.9	0.62	0.52
Stroke	0.62	0.47	0.31
Ischaemic heart diseases	0.88	0.64	0.45
Venous Thromboembolism	0.84	0.56	0.33
Other heart disease	0.79	0.68	0.57
Other arterial diseases	0.79	0.76	0.57
Chronic obstructive pulmonary disease	0.723	0.714	0.705
Chronic Airway Obstruction	0.723	0.714	0.705
Pneumonia	0.82	0.75	0.44
Influenza	0.82	0.75	0.44
Tuberculosis	0.75	0.71	0.67
Lower respiratory tract illnesses	0.723	0.714	0.705
Non-specific bronchial hyper-responsiveness	0.723	0.714	0.705
Diseases of middle ear and mastoid	0.723	0.714	0.705

Condition	Low estimate	Central estimate	High estimate
Asthma			0.705
Cataract	0.83	0.79	0.74
Multiple sclerosis	0.81	0.75	0.68
Crohn's disease	0.82	0.79	0.54
Diabetes	0.84	0.785	0.53
Rheumatoid arthritis	0.63	0.6	0.38
Peptic ulcer	0.874	0.806	0.738

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