



Smoking attributable deaths in Scotland: trend analysis and breakdown by disease type and age groups; 2003-2014

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Authors: Salomi Barkat, Róisín Farrell, Barbara Graham and Neil Davies

Acknowledgements: Richard Lawder, Colin Fischbacher

Contact: scotpho@nhs.net

Following the discovery of errors in the original publication, rates for gender and age group have been revised. The use of incorrect denominators in the previous calculation led to underestimated rates. The corrections made to this publication do not change any of the key messages.

Introduction

Smoking remains the world's leading cause of preventable disease and premature death. In 2014 smoking accounted for an estimated 9,948 deaths per year (351 deaths per 100,000 population) in Scotland. Although Scottish smoking prevalence has declined over the last decade,¹ there are still a considerable number of smokers (up to 30% of the population in some Scottish local authorities).² Additionally, the recent increase in popularity of e-cigarettes^{3,4} may be linked to decreases in smoking prevalence. E-cigarettes may also be partly responsible for the decreases in smoking quit attempts through smoking cessation services.⁴ Quitting smoking has numerous health benefits⁵ and can gain up to 10 years of life.⁶ With this in mind, the Scottish Government has proposed a tobacco-free Scotland by 2034, aiming to prevent people from starting to smoke and to encourage smoking cessation.⁷

This report expands on the smoking-attributable deaths analysis produced for the local profiles published by the Scottish Public Health Observatory ([ScotPHO Profiles](#)). It focuses specifically on the results by age group and disease category, as well as splitting the results by gender for the years 2013 and 2014. New analyses also show trends in smoking-attributable deaths for the years 2003 and 2008-2014. There is some discussion of current and previous methodologies used to calculate smoking-attributable deaths, as well as a full description of the current method. Time trends and other results are presented by disease type, age group and gender. Finally, conclusions are drawn on the current picture of smoking-related deaths in Scotland.

Methodology

Changes in Methodology

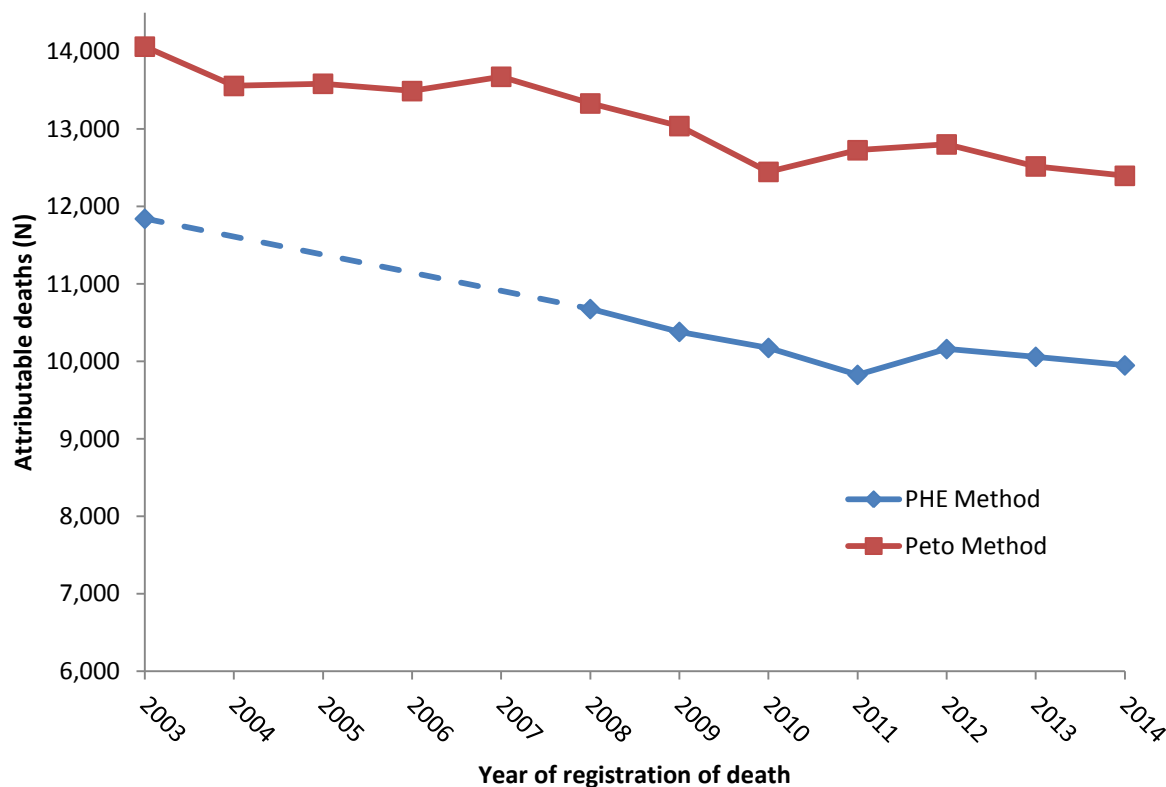
There are numerous ways of measuring smoking-attributable deaths⁸ and the ScotPHO profiles have used more than one method in previous years. Up to and including the 2013 release of the Tobacco Profiles, the Peto (1994) method was used to estimate the number of smoking-attributable deaths in Scotland. Jill Boreham, the lead statistician in the Peto-Lopez collaboration, provided estimates of smoking-attributable deaths by NHS Boards using this method for each release of the Tobacco Profiles. The Profiles last used the Peto method to calculate smoking-attributable deaths for the period 2009 to 2011.

Further details of the method are given in the [ScotPHO Ready Reckoner](#) publication. Using the Peto method, the total number of deaths attributable to smoking in Scotland in 2009 (as per the Ready Reckoner) was estimated to be around 13,044, or 24% of all deaths.

The methodology used for the 2015 release of the Tobacco Profiles was changed to that used by Public Health England (PHE) Profiles.⁹ This ensured that the smoking-attributable deaths figures were more directly comparable between England and Scotland, as well as taking into account the risk of death among ex-smokers. The new PHE method, used throughout this report, estimates the number of smoking-attributable deaths in Scotland to be around 10,381 in 2009, or 406 per 100,000 population.

It is important to note that these methods are not directly comparable – they use different data sources and different approaches to estimating smoking attributable deaths (Figure 1). The estimated numbers of smoking attributable deaths for both methods are shown in Appendix 1, Table 1.

Figure 1 - Estimated deaths attributable to smoking in Scotland using the Peto and Public Health England methods; 2003-2014



Note: Y-axis does not start at zero.

Current Methodology

The method used for the analyses presented in this report is the one used by Public Health England. In the absence of direct information on individual smoking histories, a proxy measure is used to calculate the proportion of deaths which are due to smoking. Only deaths for those aged 35 and older are included, as the likelihood of younger individuals dying from smoking is low.

Four categories of mortality related to smoking were defined using the Tenth revision of the International Classification of Diseases (ICD-10). For each of these categories, a smoking-attributable fraction (SAF) was calculated. The following ICD10 codes were used:

Cancers	C00-C14, C15, C16, C25, C32, C33-34, C53, C64-C66, C68, C67, C80, C92
Cardiovascular diseases	I20-I25, I00-I09, I26-I51, I60-I69, I70, I71, I72-I78
Respiratory diseases	J10-J18, J40-J42, J43, J44
Digestive diseases	K25-K27

Each disease has its own associated gender and age-specific risk. These can be found in the [Statistics on Smoking in England 2013 publication](#) (Table B.2).

A combined age-gender specific rate was then calculated for current and ex-smokers. This was divided by 100 to give the proportions of current and ex-smokers, specific to each age and gender. To do this, the following information from the Scottish Health Survey was used:

- Scotland-specific smoking prevalence, for current and ex-smokers
- Age-specific prevalence across Scotland, for current and ex-smokers

This current and ex-smoker prevalence information was then used to calculate the smoking-attributable fraction (SAF), the fraction of deaths which could be attributed to smoking. The SAF was calculated for Scotland using the following equation:

$$SAF = \frac{(prev_{current} \times (prev_{current} - 1) + prev_{ex} \times (prev_{ex} - 1))}{(1 + prev_{current} \times (prev_{current} - 1) + prev_{ex} \times (prev_{ex} - 1))}$$

These SAFs were multiplied by the number of deaths for Scotland. They were then added together to obtain the total number of deaths attributed to smoking, which gave the numerator value for Scotland.

The denominator used mid-year population estimates from the [National Records of Scotland](#). This information was then used to calculate a directly age-sex standardised rate per 100,000 population, using the 2013 European Standard Population.

It is difficult to determine the exact extent to which deaths from certain causes are associated with smoking. These causes include: external causes (including fires, suicides, and accidents), neonatal deaths (including stillbirths), all other deaths under 35 years, and deaths from cirrhosis of the liver. Therefore, none of these deaths were attributed to tobacco, even though some of them would have been due to smoking.

Results

The following sections expand on the data presented in the [ScotPHO Profiles tool](#), presenting a breakdown of the data by single years, gender and disease type and by gender and age group, for the years 2013 and 2014.

Based on the newer PHE method of calculation, smoking caused an estimated 9,948 deaths in Scotland in 2014, of which 5,697 were in men and 4,251 in women (Table 1).

Disease type by gender

A larger proportion of deaths among men than women were attributable to smoking, with an estimated 23% (5,697) of all deaths among men aged 35 and over being attributable to smoking in 2014. This compares with 16% (4,251) of all deaths among women in 2014 (Table 1). The percentage of smoking-attributable deaths in both males and females has changed little between 2013 and 2014 across all disease categories.

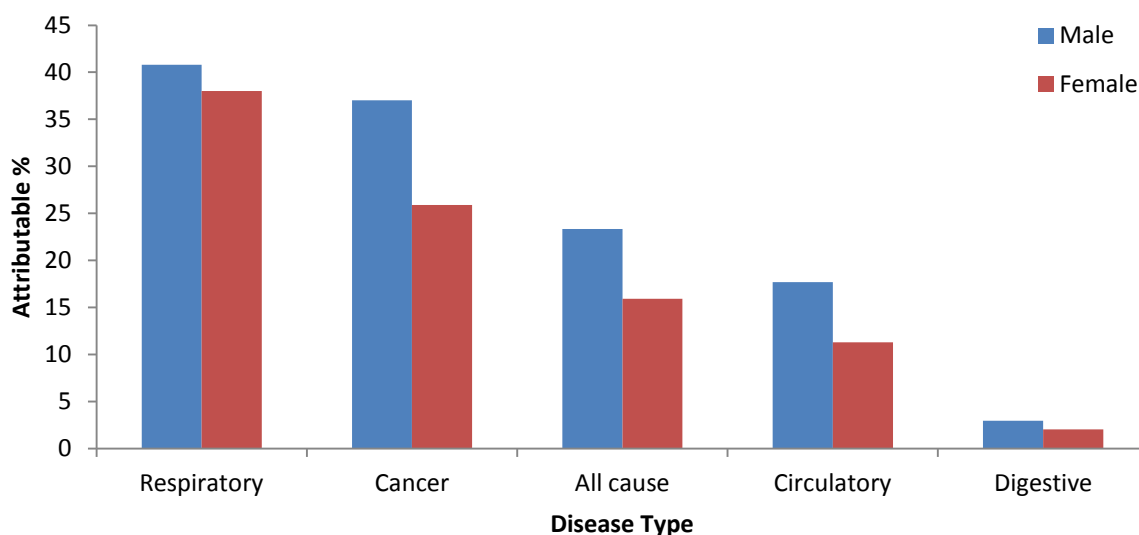
Table 1: Estimated deaths attributable to smoking in Scotland as a percentage of all deaths by disease and gender; 2013 and 2014

Cause of Death	Males			Females		
	Observed deaths	Attributable Deaths	Percentage Attributable	Observed deaths	Attributable Deaths	Percentage Attributable
2013						
All cause	24,330	5,816	24	27,188	4,243	16
Cancer	8,212	3,043	37	7,838	1,999	26
Circulatory	7,634	1,408	18	7,874	852	11
Digestive	1,348	38	3	1,479	29	2
Respiratory	3,245	1,328	41	3,763	1,364	36
2014						
All cause	24,400	5,697	23	26,730	4,251	16
Cancer	8,269	3,061	37	7,806	2,021	26
Circulatory	7,431	1,315	18	7,537	849	11
Digestive	1,443	43	3	1,474	30	2
Respiratory	3,133	1,279	41	3,554	1,351	38

In both time periods, for males and females, cancer was consistently the leading cause of smoking related deaths. Of all deaths in men due to cancer in 2014, 3,061 (37%) were estimated to be due to smoking, while the equivalent number for women was 2,021 (26%). Numbers of smoking-related deaths were higher for males in all disease categories, apart from respiratory diseases, where the estimated number of deaths was marginally higher in women. This was true of both periods: however, a larger percentage of respiratory deaths were attributable to smoking in males than females (Table 1).

Smoking accounted for a larger proportion of deaths due to respiratory disease than any other disease group (Figure 2) in both males and females in 2014.

Figure 2 - Estimated deaths attributable to smoking in Scotland as a percentage of all deaths from that disease by gender; 2014



Age group by gender

In all age categories, the numbers of smoking related deaths were higher in men than in women (Table 2). In 2014, the highest percentages of deaths attributable to smoking were in the 55-64 age group in men and in the 65-74 age group in women, while the percentage of deaths due to smoking was lower in the oldest age groups (Figure 3).

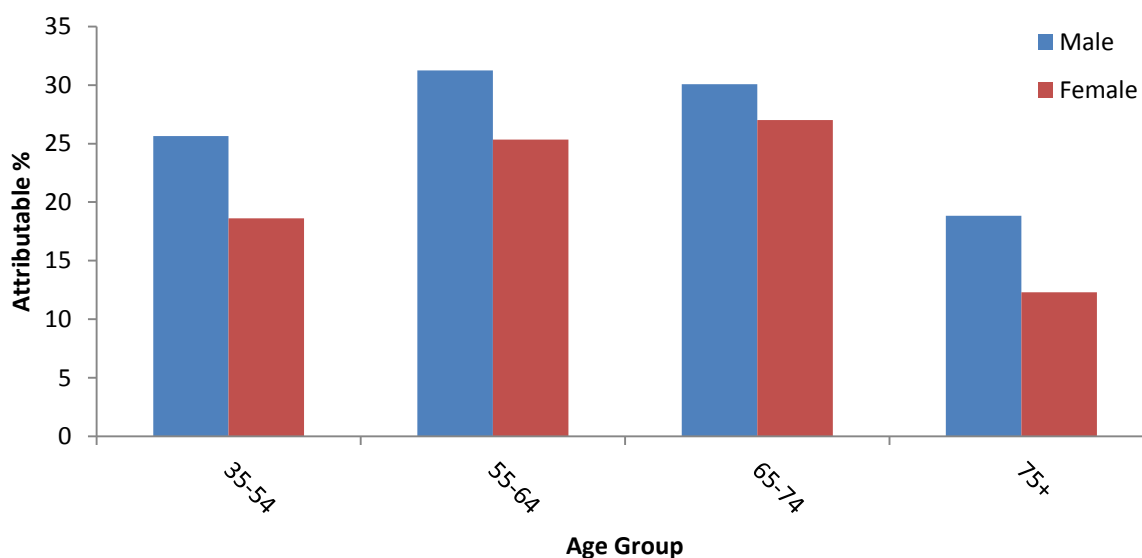
Table 2: Estimated deaths attributable to smoking in Scotland, as a percentage of all deaths, by age and gender; 2013 and 2014

Age Group	Males			Females		
	Observed deaths	Attributable Deaths	Percentage Attributable	Observed deaths	Attributable Deaths	Percentage Attributable
2013						
35-54	1,732	455	26	1,264	233	18
55-64	2,873	897	31	2,054	543	26
65-74	5,631	1,781	32	4,370	1,111	25
75+	14,094	2,684	19	19,500	2,356	12
2014						
35-54	1,712	439	26	1,259	234	19
55-64	2,836	886	31	2,055	520	25
65-74	5,646	1,697	30	4,164	1,124	27
75+	14,206	2,675	19	19,252	2,372	12

In 2014 the highest number of smoking-attributable deaths in both men and women was in the 75+ age group but the percentage of deaths due to smoking was lowest in this age group.

In summary, there were more smoking related deaths in males than in females in all age categories. Although the highest number of smoking-attributable deaths was in the 75+ age group, the percentage of deaths that were attributable to smoking was relatively low in this age group (Figure 3). These figures highlight the particular impact of smoking on those of middle age, with around 29% of all deaths in those aged 55-64 and 65-74 being due to smoking.

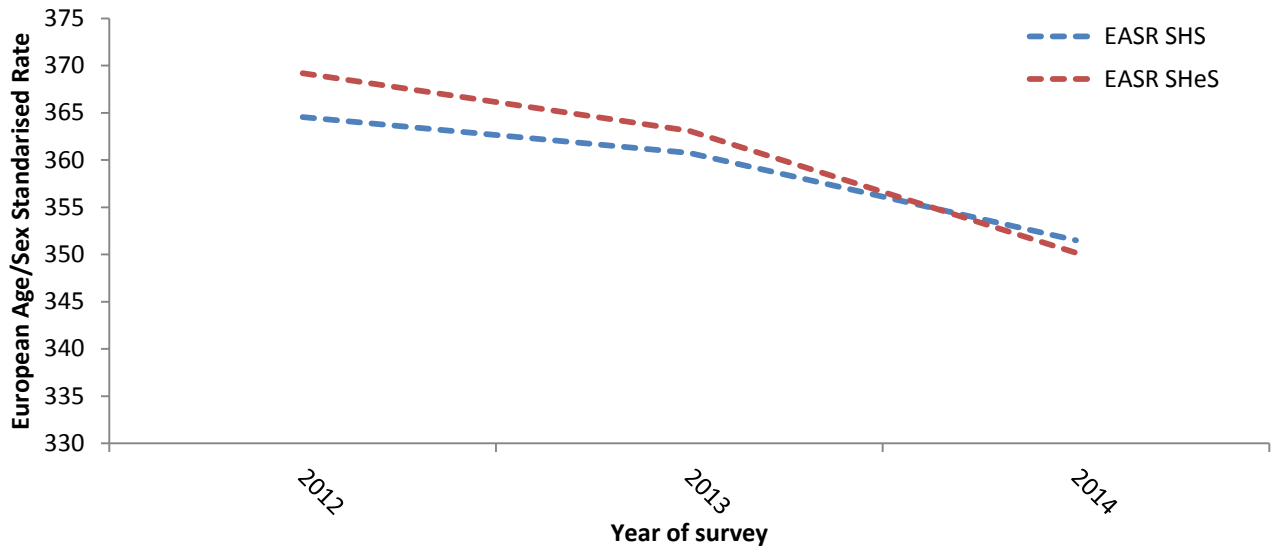
Figure 3 - Estimated deaths attributable to smoking, as a percentage of all deaths in Scotland, by age group and gender; 2014



Single Year Trend Analysis

The Scottish Household Survey (SHS) and Scottish Health Survey (SHeS) both report on smoking status. The Scottish Household Survey, which is used in the ScotPHO profiles analysis, holds data on ex-smokers from 2012; Scottish Health Survey, used throughout this report, has ex-smoker data for the years 2003 and 2008-2014. The figures presented in the ScotPHO profiles are 2-year averages calculated using SHS data. However, to gain a longer time trend SHeS data was used to generate data for single years. SHS and SHeS data for years 2012-2014 were compared as a measure of reliability, and the results are shown in Figure 4 and in Appendix 1 (Table 2). The number of estimated deaths and European Age/Sex Standardised Rate (EASR) are both very similar in each dataset, giving confidence in the robustness of the two sources.

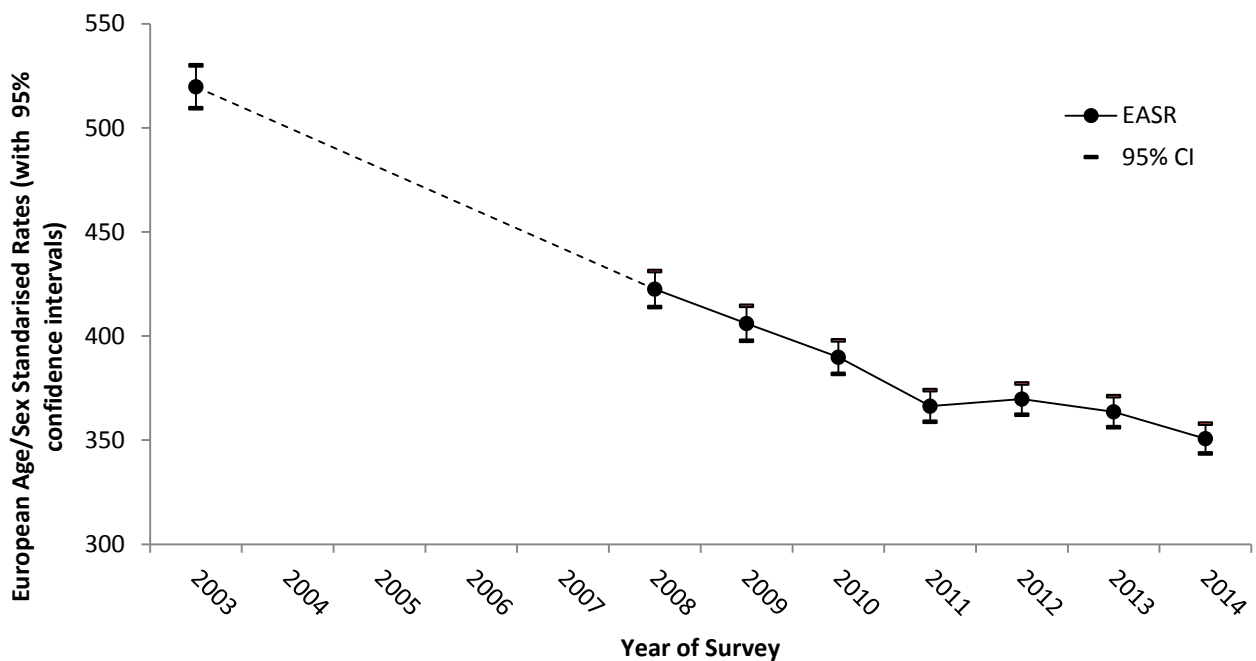
Figure 4 – Estimated rate (EASR per 100,000 population) of deaths attributable to smoking in Scotland; 2012-2014



Note: Y-axis does not start at zero.

Figure 5 (Appendix 1; Table 3) shows that there has been a decrease in the rate (EASR) of smoking-attributable deaths in Scotland between 2003 and 2014. Although survey data from 2004-2007 is not available, the data from 2008-2014 show a general decline in the number of smoking-attributable deaths since 2003.

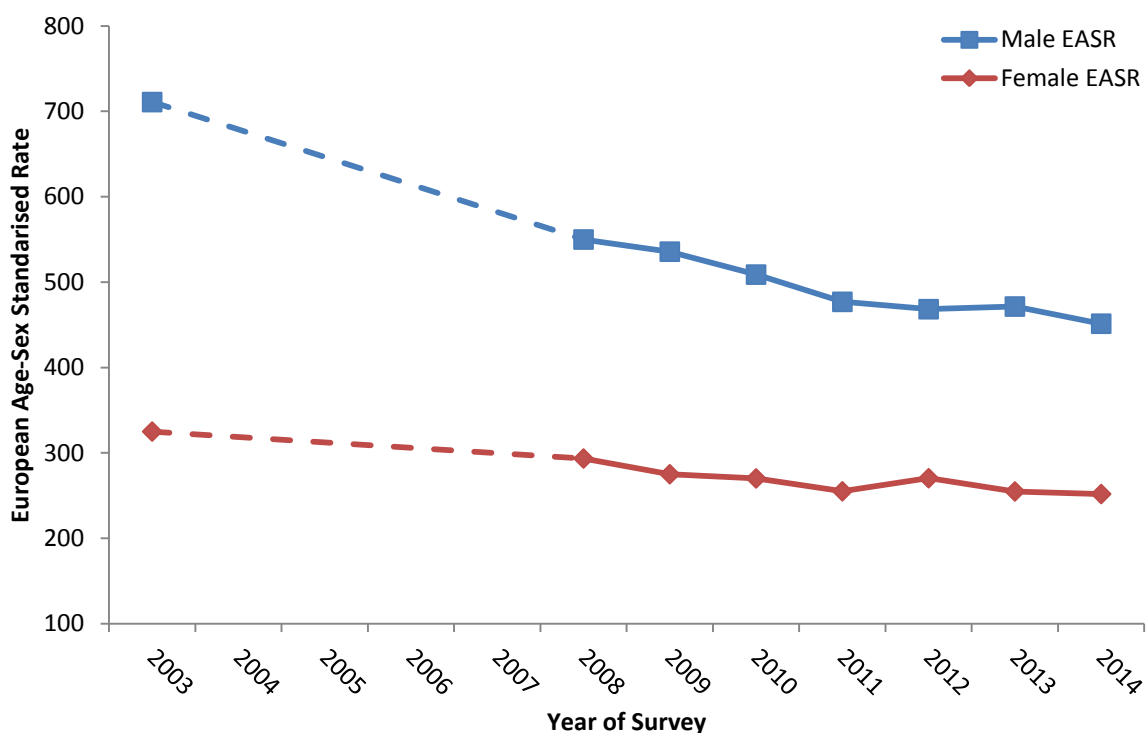
Figure 5 –Estimated rate (EASR per 100,000 population) of deaths attributable to smoking in Scotland (and 95% confidence intervals); 2003, 2008-2014



Note: Y-axis does not start at zero.

Figure 6 shows that both genders showed a decrease in the number of smoking-attributable deaths across the time period. The decrease in smoking-attributable deaths is more pronounced in males than females (see Figure 6; Appendix 1 – Table 4).

Figure 6 – Estimated rate (EASR per 100,000 population) of deaths attributable to smoking in Scotland by gender; 2003, 2008-2014

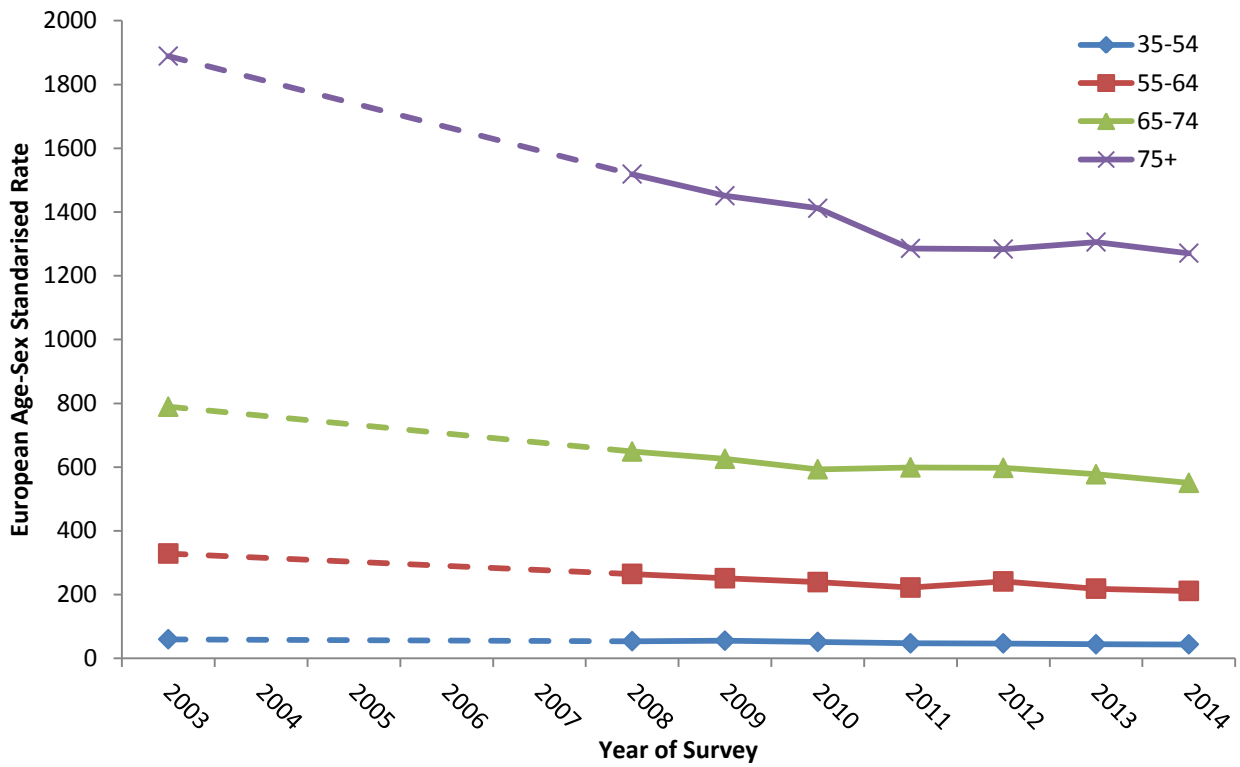


Note: Y-axis does not start at zero.

Note: Rates have been revised because the previous use of incorrect denominators led to underestimated rates.

A general downward trend since 2003 is also evident across age groups. Since 2008, a slower decline is seen, especially among those aged 65 and above. The largest percentage decrease based on rates since 2003 has been seen in the 55-64 age group (36%) (see Figure 7; Appendix 1 – Tables 5 and 6).

Figure 7 –Estimated rate (EASR per 100,000 population) of deaths attributable to smoking in Scotland by age group; 2003, 2008-2014



Note: Rates have been revised because the previous use of incorrect denominators led to underestimated rates.

Conclusions

For some diseases, such as those relating to digestion, only a small proportion of deaths are caused by smoking; however, over 30% of cancer deaths are caused by smoking and around 40% of deaths from respiratory disease are smoking-related. Cancer accounts for the largest number of smoking-attributable deaths.

In all age categories, over 10% of deaths are caused by smoking, rising to around 29% in middle age. A higher percentage of middle-aged deaths (55-64, 65-74) are attributed to smoking than in other age group, with males particularly affected. The number of deaths caused by smoking in the over 75 age group is larger than any other group. However, the proportion of smoking-attributable deaths in over 75 year olds is the lowest of all age groups.

Over the period 2003-14, a clear downward trend in the number of deaths attributable to smoking is apparent. There have been decreases in the number of smoking-attributable deaths for both males and females, although these decreases have been markedly steeper in males. Similarly, the estimated number of deaths has fallen among all age groups since 2003, with the largest absolute decreases in the 65-74 and 75+ age groups. However, the largest percentage reduction based on the EASR was seen in the 55-64 age group (36%).

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Appendix 1

Table 1: Estimated deaths attributable to smoking in Scotland using the Peto et al. and Public Health England (PHE) methods; 2003-2014

Year	PHE Method	Peto Method
2003	11,841	14,064
2004	-	13,557
2005	-	13,584
2006	-	13,490
2007	-	13,675
2008	10,676	13,330
2009	10,381	13,038 ¹
2010	10,174	12,447
2011	9,826	12,726
2012	10,159	12,802
2013	10,059	12,517
2014	9,948	12,396

¹The Smoking Ready Reckoner published in 2012 reported 13,044 smoking-attributable deaths. This table contains figures following the same method but using updated data, therefore the figures do not match exactly.

Table 2: Estimated deaths attributable to smoking with EASR per 100,000 population; 2012-2014 (PHE method)

	2012	2013	2014
Deaths SHS	9,992	10,015	9,958
Deaths SHeS	10,159	10,059	9,948
EASR SHS	365.1	361.3	352.2
EASR SHeS	369.7	363.6	350.7

SHS: Scottish Household Survey; SHeS: Scottish Health Survey; EASR: European Age-Sex Standardised Rate

Table 3: Estimated rate (EASR per 100,000 population) of deaths attributable to smoking in Scotland (and 95% confidence intervals); 2003, 2008-2014 (PHE method)

Year	Deaths	EASR	LCL	UCL
2003	11,841	519.7	509.4	530.0
2004	-	-	-	-
2005	-	-	-	-
2006	-	-	-	-
2007	-	-	-	-
2008	10,676	422.5	413.9	431.2
2009	10,381	406.0	397.7	414.5
2010	10,174	389.8	381.8	397.9
2011	9,826	366.3	358.8	374.0
2012	10,159	369.7	362.2	377.2
2013	10,059	363.6	356.2	371.1
2014	9,948	350.7	343.6	357.9

EASR: European Age-Sex Standardised Rate; LCL: Lower Confidence Limit (95%); UCL: Upper Confidence Limit (95%).

Table 4: Estimated rate (EASR per 100,000 population) of deaths attributable to smoking in Scotland by gender; 2003, 2008-2014 (PHE method)

Year	Male				Female			
	Deaths	EASR	LCL	UCL	Deaths	EASR	LCL	UCL
2003	6,987	710.9	692.7	729.4	4,853	325.0	315.9	334.4
2004	-	-	-	-	-	-	-	-
2005	-	-	-	-	-	-	-	-
2006	-	-	-	-	-	-	-	-
2007	-	-	-	-	-	-	-	-
2008	6,081	549.9	535.1	565.0	4,595	293.4	284.9	302.0
2009	6,036	535.7	521.3	550.5	4,346	275.0	266.9	283.4
2010	5,847	508.8	495.0	522.8	4,328	270.1	262.1	278.3
2011	5,680	476.9	464.0	490.0	4,146	255.0	247.2	262.9
2012	5,705	468.3	455.7	481.1	4,455	270.3	262.4	278.4
2013	5,816	471.4	458.9	484.2	4,243	254.8	247.2	262.6
2014	5,697	451.3	439.3	463.6	4,251	251.8	244.2	259.5

EASR: European Age-Sex Standardised Rate; LCL: Lower Confidence Limit (95%); UCL: Upper Confidence Limit (95%).

Note: Rates have been revised because the previous use of incorrect denominators led to underestimated rates.

Table 5: Estimated rate (EASR per 100,000 population) of deaths attributable to smoking in Scotland per age group; 2003, 2008-2014 (PHE method)

Year	35-54				55-64				65-74				75+			
	Deaths	EASR	LCL	UCL	Deaths	EASR	LCL	UCL	Deaths	EASR	LCL	UCL	Deaths	EASR	LCL	UCL
2003	842	60.0	56.0	64.3	1,877	328.8	314.0	344.0	3,451	789.3	763.0	816.2	5,671	1888.9	1833.3	1945.6
2004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2007	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2008	806	53.9	50.2	57.7	1,700	264.8	252.3	277.7	2,947	648.7	625.4	672.7	5,223	1518.9	1473.5	1565.3
2009	833	55.4	51.7	59.3	1,638	251.3	239.3	263.8	2,891	626.0	603.4	649.4	5,019	1450.9	1406.8	1496.0
2010	782	51.6	48.1	55.4	1,586	239.2	227.5	251.2	2,771	593.2	571.2	615.8	5,036	1411.5	1369.5	1454.5
2011	726	47.1	43.7	50.7	1,495	222.1	210.9	233.6	2,816	599.0	577.0	621.7	4,788	1285.7	1247.1	1325.1
2012	728	47.0	43.6	50.5	1,595	241.2	229.5	253.3	2,925	597.4	575.9	619.6	4,911	1283.6	1245.7	1322.3
2013	688	44.2	40.9	47.6	1,440	218.7	207.6	230.3	2,892	577.4	556.4	599.0	5,040	1305.8	1267.8	1344.5
2014	673	44.0	40.8	47.5	1,406	211.5	200.5	222.9	2,822	550.5	530.3	571.3	5,047	1270.8	1234.2	1308.1

EASR: European Age-Sex Standardised Rate; LCL: Lower Confidence Limit (95%); UCL: Upper Confidence Limit (95%).

Numbers of estimated deaths may not add up to the yearly totals due to rounding.

Note: Rates have been revised because the previous use of incorrect denominators led to underestimated rates.

Table 6: Difference between estimated rates (EASR per 100,000 population) and number of deaths attributable to smoking in Scotland per age group; 2003 and 2014

	35-54		55-64		65-74		75+	
	EASR	Deaths	EASR	Deaths	EASR	Deaths	EASR	Deaths
2003	60.0	842	328.8	1,877	789.3	3,451	1888.9	5,671
2014	44.0	673	211.5	1,406	550.5	2,822	1270.8	5,047
<i>Difference</i>	26.7%	169	35.7%	471	30.3%	629	32.7%	624

EASR: European Age-Sex Standardised Rate.

Note: Rates have been revised because the previous use of incorrect denominators led to underestimated rates.