Original investigation

Similarities and Differences Between Sexes and Countries in the Mortality Imprint of the Smoking Epidemic in 34 Low-Mortality Countries, 1950–2014

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Abstract

Introduction: The smoking epidemic greatly affected mortality levels and trends, especially among men in low-mortality countries. The objective of this article was to examine similarities and differences between sexes and low-mortality countries in the mortality imprint of the smoking epidemic. This will provide important additions to the smoking epidemic model, but also improve our understanding of the differential impact of the smoking epidemic, and provide insights into its future impact.

Methods: Using lung-cancer mortality data for 30 European and four North American or Australasian countries, smoking-attributable mortality fractions (SAMF) by sex, age (35–99), and year (1950–2014) were indirectly estimated. The timing and level of the peak in $\text{SAMF}_{35-99}$, estimated using weighting and smoothing, were compared.

Results: Among men in all countries except Bulgaria, a clear wave pattern was observed, with $\text{SAMF}_{35-99}$ peaking, on average, at 33.4% in 1986. Eastern European men experienced the highest (40%) and Swedish men the lowest (16%) peak. Among women, $\text{SAMF}_{35-99}$ peaked, on average, at 18.1% in 2007 in the North American/Australasian countries and five Northwestern European countries, and increased, on average, to 7.5% in 2014 in the remaining countries (4% in Southern and Eastern Europe). The average sex difference in the peak is at least 25.6 years in its timing and at most 22.9 percentage points in its level.

Conclusions: Although the progression of smoking-attributable mortality in low-mortality countries was similar, there are important unexpected sex and country differences in the maximum mortality impact of the smoking epidemic driven by cross-country differences in economic, political, and emancipatory progress.

Implications: The formal, systematic, and comprehensive analysis of similarities and differences between sexes and 34 low-mortality countries in long-term time trends (1950–2014) in smoking-attributable mortality provided important additions to the Global Burden of Disease study and the descriptive smoking epidemic model (Lopez et al.). Despite a general increase followed by a decline, the timing of the maximum mortality impact differs more between sexes than previously anticipated, but less between regions. The maximum mortality impact among men differs considerably between countries. The observed substantial diversity warrants country-specific tobacco control interventions and increased attention to the current or expected higher smoking-attributable mortality shares among women compared to men.
Introduction

The smoking epidemic is currently most advanced in low-mortality countries, where it continues to have large social and economic effects, including increased levels of suffering, disease, death and associated productivity losses, and health care costs. The impact of smoking on all-cause mortality levels, all-cause mortality trends, and differences therein between countries and sexes is well documented for low-mortality countries.

As illustrated by the descriptive smoking epidemic model, the timing of the smoking epidemic has differed substantially between sexes and low-mortality countries. Among men, smoking was taken up first in Anglo-Saxon and Northwestern European countries, and an average of 25 years later in Southern and Eastern Europe. Women, in general, took up smoking about two decades later than men, and their smoking prevalence levels remained lower than the high levels observed among men. Specifically, the maximum smoking prevalence ranged from 50% to 80% for men and around 35%–45% for women. However, all countries and both sexes display a similar pattern, whereby smoking-attributable mortality increased and then declined about 30–35 years after the initial increase and subsequent decline in smoking prevalence. The peak in smoking-attributable mortality is expected to occur about 20 years later for women than for men, and to reach maximum levels of 20%–25% among women and 30%–35% among men. Countries where the smoking epidemic started later may be able to introduce effective preventive interventions during an earlier phase of the smoking epidemic, and thus to have lower maximum levels of smoking-attributable mortality than countries in later phases of the smoking epidemic.

However, the exact timings and levels of the full mortality imprint of the smoking epidemic are, as yet, unknown. Let alone, differences between sexes and low-mortality countries in these timings and levels. Numerous studies have examined the progression of the smoking epidemic while using either smoking prevalence or lung cancer mortality as the outcome measure. The Global Burden of Disease study provides global, regional, and national estimates of smoking prevalence, smoking-attributable deaths, and smoking-attributable disease burden from 1990 onward. The few existing studies on more long-term trends in smoking-attributable mortality only included a few low-mortality countries. None of the earlier-mentioned studies however performed a formal and systematic analysis of country- and sex differences in the timing and level of the progression of smoking-attributable mortality.

Such a systematic analysis, however, can not only improve our understanding of the differences in the mortality impact of the smoking epidemic between countries and sexes, but its outcomes could also be used to estimate the future impact of the smoking epidemic in low-mortality countries. Although the smoking epidemic is most advanced in low-mortality countries, it is expected to have an important imprint on population health for many years to come, particularly among women.

This article systematically examines similarities and differences between sexes and 34 low-mortality countries in the mortality imprint of the smoking epidemic, and particularly in the level and timing of the maximum mortality impact.

Data and Methods

Data and Setting

The analysis includes the national populations of 30 European countries, United States, Canada, Australia, and New Zealand, by sex and age (35–99), for the period 1950–2014.

Lung cancer mortality deaths by age (35–39, ..., 75–79, 80+), country, sex, and calendar year were retrieved from the WHO Mortality Database, updated April 11, 2018. All-cause mortality deaths and exposure data for the corresponding populations were retrieved from HMD, downloaded September 29, 2018. When necessary, additional lung cancer mortality data were used or additional calculations were applied. See Appendix I for the data and years used by country.

The countries were organized into six main groups: North American/Australsian countries (Australia, Canada, New Zealand, United States), Northern Europe (Denmark, Finland, Norway, Sweden), Western Europe (Austria, Belgium, France, Germany (west), Iceland, Ireland, Luxembourg, Netherlands, Switzerland, United Kingdom), Southern Europe (Greece, Italy, Portugal, Spain), Central Europe (Czech Republic, Germany (east), Hungary, Poland, Slovakia, Slovenia), and Eastern Europe (Belarus, Bulgaria, Estonia, Latvia, Lithuania, Ukraine, Russia).

Smoking-Attributable Mortality Fractions

For each country and year, age (x)- and sex (s)-specific smoking-attributable mortality fractions (SAMF_{x,s}) were estimated by applying a simplified indirect Peto–Lopez method. The Peto–Lopez method indirectly estimates smoking prevalence based on—predominantly—country-level observed lung cancer mortality rates, and subsequently applies the standard epidemiological population-attributable fraction formula and Relative Risks (RRs) of dying from smoking to estimate smoking-attributable mortality. Whereas the original Peto–Lopez method does so by cause of death, the simplified version does so for all causes combined. The method takes into account that not all lung cancer deaths are attributable to smoking and includes deaths from other causes that could be attributed to smoking.

First, the lifetime smoking prevalence (p) by 5-year age groups and sex was indirectly estimated based on country-, age- and sex-specific lung cancer mortality rates while controlling for lung cancer mortality that is not because of smoking. This was done by comparing the country-specific rates with the aggregated age- and sex-specific lung cancer rates of smokers and never-smokers (smoothed) in the ACS CPS-II study. Subsequently, the sex-specific lifetime smoking prevalence by single year of age was obtained by Loess smoothing.

Second, the share of all-cause mortality because of smoking (SAMF) was calculated by: SAMF_{x,s} = p_{x,s} (RR_{x,s}−1)/(p_{x,s} (RR_{x,s}−1)+1), where p_{x,s} reflect the obtained sex-specific estimates of the lifetime smoking prevalence by single year of age, and RR_{x,s} reflect the relative risks of dying from smoking by single year of age and sex. RR by 5-year age groups (35–39, 40–44, ..., 80–84, 85+) and sex were obtained by dividing the respective all-cause mortality rates among CPS-II current smokers by the respective all-cause mortality rates among CPS-II never smokers. To control for the exposure of smokers to other risk factors, the excess risk was reduced by 30%. We obtained the RR_{x,s} by single year of age by applying a second-degree polynomial thereby keeping the RR_{x,s} stable from age 90 onward for men and from age 87 onward for women.

The subsequent Loess smoothing over age of the SAMF_{x,s} led to a negligible difference in the overall estimate of the impact of smoking on mortality.

Analysis

To determine the year in which the impact of smoking was greatest, SAMFs across ages 35–99 (SAMF) were obtained by weighting the SAMF_{x,s} by age-specific death numbers for each sex, year, and country. Subsequently, the trends in SAMF over time were smoothed and the
maximum of this smoothed trend was obtained. This procedure proved more accurate than first applying either age-period or age-period-cohort models to the data, and then obtaining the maximum from these models.

Smoothing of the SAMF involved Loess smoothing with—in general—span 0.75 and degree 2. To improve the fit, a span of 0.5 was used for Australian, Canadian, French, and Spanish women; and a span of 1.5 for Icelandic men. For Latvia and Lithuania, a span of 2.0 and degree 1 was used to avoid focusing too much attention on the existing fluctuations. Appendix II illustrates that the smoothing we applied nicely captures the trend over time while ensuring that the year in which the maximum is reached is not influenced by fluctuations.

Results

Looking at the trends in smoothed smoking-attributable mortality fractions over ages 35–99 (referred to as SAMF from here onward) from 1950 to 2014 (Figure 1; Supplementary Figure 1), among men a clear wave pattern of an increase followed by a decline in all countries except Bulgaria can be observed. Among women, an increase followed by a peak and—in most cases—a subsequent decline was observed in the four North American/Australasian countries and five Northwestern European countries (Denmark, Norway, Iceland, Ireland, United Kingdom) (see as well Figure 2); and an upward trend in SAMF was observed in most of the remaining countries. For women in Belarus, Russia, and Ukraine, SAMF levels have been consistently low, and a peak occurred earlier than among men. Among Bulgarian men and women, minimal declines in SAMF levels were observed. Because the observed maxima in these five instances most likely do not depict the actual peak of the smoking epidemic, they were disregarded.

Among men, the peak in SAMF was, on average, reached in 1986, at 33.4% (Table 1). SAMF peaked early among men in North American/Australasian and Northwestern European countries (1980, on average) but also in the Czech Republic (1977) (Table 1; Figure 2; Supplementary Table 1). In the majority of these countries, men and women, minimal declines in SAMF levels were observed. Because the observed maxima in these five instances most likely do not depict the actual peak of the smoking epidemic, they were disregarded.

Among men, the peak of this smoothed trend was obtained. This procedure proved more accurate than first applying either age-period or age-period-cohort models to the data, and then obtaining the maximum from these models.

The maximum level of SAMF was, on average, 11.6 percentage (Table 1). The average difference between men and women in the timing of the peak was 24.2 years (unweighted average) for the nine countries in which the peak has already been reached among women (Table 1). In the North American/Australasian countries, this difference was even slightly higher, at 25.8 years. Across all countries, the minimum sex difference in the timing was 25.6 years. On average, the difference was at least 36.4 years for the nine remaining Northwestern European countries, at least 23 years in Central and Southern Europe, and at least 16.3 years in Eastern Europe. Figure 2 clearly depicts this general pattern but also shows important exceptions for individual countries, including Iceland (15 years’ difference) and the Czech Republic (37 years’ difference).

The maximum level of SAMF was, on average, 11.6 percentage points lower among women than among men in the nine countries for which the peak among women has already been reached (Table 1; Figure 3). The sex difference was greater in the four North American/Australasian countries than in the two Northern European countries.

Appendix II illustrates that the smoothing we applied nicely captures the trend over time while ensuring that the year in which the maximum is reached is not influenced by fluctuations.

Figure 1. Trends over time in the smoothed smoking-attributable mortality fractions (SAMF) over ages 35–99, 4 North American/Australasian countries and 30 European countries, 1950–2014*, by region and sex. *Or latest available year: Bulgaria (2010), Canada (2011), Greece (2013), New Zealand (2013), Ukraine (2012), Russia (2013). North American/Australasian countries = Australia, Canada, New Zealand, USA. Northern European countries = Denmark, Finland, Norway, Sweden. Western European countries = Austria, Belgium, United Kingdom, France, West Germany, Iceland, Ireland, Luxembourg, Netherlands, Switzerland, United Kingdom. Southern European countries = Greece, Italy, Portugal, Spain. Central European countries = Czech Republic, East Germany, Hungary, Poland, Slovakia, Slovenia. Eastern European countries = Belarus, Bulgaria, Estonia, Latvia, Lithuania, Ukraine, Russia.
Across all countries, the maximum average sex difference in the SAMF level is 22.9 percentage points. The maximum average sex difference was smallest in the remaining Northern European countries, at 18.9 percentage points; followed by Southern Europe (21.9), Western Europe (24.2), Central Europe (27), and Eastern Europe (34.3).

### Discussion

#### Summary of Results

Among men, a clear wave pattern was observed in all 34 low-mortality countries except Bulgaria, with SAMF peaking, on average, at 33.4% in 1986. Among women, SAMF in the four North American/Australasian countries and in Denmark, Iceland, Ireland, Norway, and the United Kingdom peaked, on average, at 18.1% in 2007—in line with the early peak among men in these country groups. Among women in the remaining countries, SAMF is increasing, and reached, on average, 7.5% in 2014. The (maximum) mortality impact was greatest among men in most CEE countries (especially Russia, at 44%) and among women in Denmark (22.5%) and was smallest among men in Sweden (16%) and among women in Southern and Eastern Europe (4% in 2014). The average observed difference between women and men in the year in which the maximum was reached was 24.2 years, with a minimum of 25.6 years for all countries.

#### Comparison to Previous Research

The reported sex-specific estimates of the exact timings and levels of the peak in smoking-attributable mortality fractions for European regions and individual European and North American/Australasian countries are novel in the context of the previous research outlined in the Introduction section.

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**Table 1. The Average Timing and Level of the Peak in Smoothed Smoking-Attributable Mortality Fractions (SAMF) Over Ages 35–99, 4 North American/Australasian Countries and 30 European Countries, 1950–2014*, by Region and Sex**

| Region                  | Men   | Men#  | Women | Women# | Women@  | M – W | N       | M – W | N       | M – W | N       |
|-------------------------|-------|-------|-------|--------|---------|-------|---------|-------|---------|-------|---------|
| All countries           | 33.2  | 33.4  | 10.3  | 18.1   | 7.5     | 11.6  | 9       | 26.9  | 25      | 22.9  | 34      |
| N. America/Australasia  | 32.2  | 32.2  | 17.5  | 17.5   | NA      | 14.7  | 4       | NA    | NA      | 14.7  | 4       |
| Northern Europe         | 26.9  | 26.9  | 14.0  | 17.9   | 10.0    | 6.9   | 2       | 18.9  | 2       | 12.9  | 4       |
| Western Europe          | 32.6  | 32.6  | 12.4  | 19.0   | 9.6     | 10.7  | 3       | 24.2  | 7       | 20.1  | 10      |
| Southern Europe         | 26.1  | 26.1  | 4.2   | NA     | 4.2     | NA    | NA      | 21.9  | 4       | 21.9  | 4       |
| Central Europe          | 37.5  | 37.5  | 10.5  | NA     | 10.5    | NA    | NA      | 27.0  | 6       | 27.0  | 6       |
| Eastern Europe          | 38.2  | 40.3  | 3.9   | NA     | 3.9     | NA    | NA      | 34.3  | 7       | 34.3  | 7       |

*Or latest available year: Bulgaria (2010), Canada (2011), Greece (2013), New Zealand (2013), Ukraine (2012), Russia (2013).
#Only those countries for which the max has already been reached. For men in all countries except Bulgaria. For women in Australia, Canada, New Zealand, USA, Denmark, Norway, Iceland, Ireland, United Kingdom (N = 9).
@Only those countries for which the max has not yet been reached.
The estimates support the more general statements on the timing and levels of the peaks for different regions in the smoking epidemic model by Lopez et al.11 These estimates show a general (indication of) a wave-shaped pattern over time; a clear distinction in the timing of the maximum mortality impact between the North American/Australasian countries and North-western European countries on the one hand (early), and the Southern and Eastern European countries on the other (late); and the existence of important differences between sexes in the timing and level of the smoking epidemic.

Important additional observations include smaller differences between regions in the timing of the maximum mortality impact; a greater maximum mortality impact among men, with considerable diversity between countries; and larger sex differences in the timing of the maximum mortality impact.
The current analysis reveals that, on average, the maximum impact was reached in 1980 for the North American/Australasian countries and Northwestern European countries, and in 1993 for the Southern and Eastern European countries. This difference is smaller than the 25-year difference obtained in the smoking-epidemic model—although their comparison also included Latin America, where, on average, the smoking epidemic started later than in Southern and Eastern Europe.31

The maximum mortality impact of smoking was highest among men in Eastern Europe, particularly in Russia, at 44.4%; and among women in Denmark, at 22.5%. These findings are in line with the maximum smoking-attributable mortality of 20%–25% for women in the smoking epidemic model but are considerably higher than the maximum of 30%–35% for men.

The reported sex differences in the timing of the maximum mortality impact (24 years for the nine countries with a peak among women; a
The observed important sex differences in the timing and the level of the (maximum) mortality impact can be linked to sex differences in smoking prevalence about 30–40 years earlier.11 This sex difference in smoking prevalence can be explained by men, in general, being more prone to take up risky behaviors than women.46 As the position of women in society changed with the rise in women’s labor force participation,43 and as cultural prohibitions against smoking among women were challenged during periods of war and (political) liberalization,10 women started taking up smoking several decades after men.11 Because, by that time, the negative effects of smoking on health were much more known, smoking among women never reached the enormously high levels observed among men.

The observed important country differences in the sex difference in the timing and the level of the (maximum) mortality impact could point to country differences in the interaction of socioeconomic, cultural, and material circumstances with emancipatory factors.43 Important to note is that, because the timing of the maximum level differs between men and women, in some countries women now have similar or higher smoking-attributable mortality fractions than men. Supplementary Figure 1 clearly shows that this is currently the case for Australia, Canada, Denmark, Iceland, Ireland, New Zealand, Norway, Sweden, the United Kingdom, and the United States; and soon will be the case for a wide range of Northwestern European countries. The other European countries are likely to follow, with the probable exception of most Eastern European countries, where SAMF levels among men are highest and SAMF levels among women have remained very low in recent years.

Evaluation of Data and Methods
In this article—and in line with most previous research—an indirect method for estimating smoking-attributable mortality was used to avoid relying on incomplete detailed historical smoking prevalence data, to facilitate the use of high-quality cause-of-death information, and to capture the effects not only of smoking prevalence, but of smoking duration and smoking intensity.44,45 The Global Burden of Disease (GBD) study, till last year, also relied—albeit solely for cancer and chronic respiratory diseases—on an indirect method.20,21

As an indirect approach, in the current analysis, an adapted simpler version of the Peto–Lopez method is used.23,24 This is because, the Peto–Lopez method has been widely used in the field, among which in the GBD study.5,20,25 The adapted version requires even less information while leading to similar outcomes. More recently, a regression-based indirect method has been developed by Preston, Glei, and Wilmoth, leading as well to different variants.46,47 Although these methods will result in slightly different estimates,24 the timing of the peak of the mortality impact will hardly be affected.

Some assumptions underlying the adapted Peto–Lopez method are important to consider.

First, the estimates of smoking-attributable mortality rely heavily on the RR’s of dying from smoking from the ACS-CPSII study in 1982–1988. The sex difference in RRs in this study (2.15 for men; 1.72 for women) will therefore partly determine the sex difference in smoking-attributable mortality. Because the RR’s are not country-specific, the country differences in the mortality impact of smoking are likely underestimated, because populations differ in their risk of dying from smoking. The use of a time-independent RRs could influence the timing of the maximum impact of smoking, but the sex and the country differences in the timing of the maximum impact of smoking would remain largely unaltered.

Second, country differences in smoking-attributable mortality are likely affected by the assumption of the same ratio for each country between background lung cancer mortality (lung cancer mortality
not because of smoking) and smoking-attributable lung cancer mortality. However, especially in CEE countries, lung cancer mortality is likely affected to a certain extent by environmental factors, like air contamination and exposure to hazardous occupational agents.

Thus, whereas the observed sex and country differences in the timing of the maximum mortality impact of the smoking epidemic seem rather robust, the (maximum) SAMF values and their comparison across countries are affected by the method used to estimate smoking-attributable mortality. Caution is therefore warranted. However, the observed differences between countries and sexes in smoking-attributable mortality fractions seem largely in line with respective differences in smoking prevalence around 1980. Also, it is important to note that when attempting to study smoking-attributable mortality over an extended period of time, reliance on an indirect estimation method is a necessity.

Conclusions and Implications

The systematic analysis of long-term time trends (1950–2014) in smoking-attributable mortality in 34 low-mortality countries revealed clear similarities and differences between sexes and countries in the mortality imprint of the smoking epidemic.

The general observed (indications of a) wave pattern in smoking-attributable mortality, combined with population-specific evidence on the current phase in the progression of the epidemic, provide clear indications of the future progression of the smoking epidemic. Among men, the impact on mortality will further decline, possibly at a reduced rate that will start first in North American/Australasian and Northwestern European countries. Among women, the maximum mortality impact is expected to be reached relatively soon in Sweden, the Netherlands, Switzerland, Finland, Austria, Germany, Luxembourg, Italy, the Czech Republic, and Hungary; based on either a deceleration of the current increase in SAMF or (increasingly) small differences in SAMF levels between men and women. Among women in the remaining, mostly CEE countries, SAMF levels could continue to rise for another 20 years, given the increasing trends in smoking prevalence up to 2005.

The observed considerable diversity between countries and sexes, driven by country differences in the economic, political, and emancipatory progress, clearly points to the importance of country-specific tobacco control interventions. Although lessons can certainly be learned from good practice in the forerunner countries, an adjustment to fit the specific national context seems appropriate as well. Increased attention for the current or expected higher shares of mortality because of smoking among women compared to men is warranted as well.

Supplementary Material

Supplementary data are available at Nicotine and Tobacco Research online.

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Conflict of Interests

None declared.

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Appendix I. Countries included in the analysis and their data availability

| Country         | Start year | End year | Additional data sources                          |
|-----------------|------------|----------|--------------------------------------------------|
| Australia       | 1950       | 2014     | For 1953–1985, lung cancer mortality data for the Czech Republic were estimated using data from WHOsis on former Czechoslovakia. |
| Austria         | 1955       | 2014     | For 1970–1972, lung cancer deaths were obtained from the Archive DahlWitz Hoppegarten. For 1991–2014, lung cancer mortality data from www.gbe-bund were used. |
| Belarus         | 1981       | 2014     | For 1991–2014, lung cancer mortality data from www.gbe-bund were used. |
| Belgium         | 1954       | 2014     | For 1991–2014, lung cancer mortality data from www.gbe-bund were used. |
| Bulgaria        | 1964       | 2010     | For 1991–2014, lung cancer mortality data from www.gbe-bund were used. |
| Canada          | 1950       | 2011     | For 1991–2014, lung cancer mortality data from www.gbe-bund were used. |
| Czech Republic  | 1953       | 2014     | For 1953–1985, lung cancer mortality data for the Czech Republic were estimated using data from WHOsis on former Czechoslovakia. |
| Denmark         | 1951       | 2014     | For 1953–1985, lung cancer mortality data for the Czech Republic were estimated using data from WHOsis on former Czechoslovakia. |
| Estonia         | 1981       | 2014     | For 1953–1985, lung cancer mortality data for the Czech Republic were estimated using data from WHOsis on former Czechoslovakia. |
| Finland         | 1952       | 2014     | For 1953–1985, lung cancer mortality data for the Czech Republic were estimated using data from WHOsis on former Czechoslovakia. |
| France          | 1950       | 2014     | For 1953–1985, lung cancer mortality data for the Czech Republic were estimated using data from WHOsis on former Czechoslovakia. |
| Germany         | 1970       | 2014     | For 1953–1985, lung cancer mortality data for the Czech Republic were estimated using data from WHOsis on former Czechoslovakia. |
| Germany, East   | 1970       | 2014     | For 1953–1985, lung cancer mortality data for the Czech Republic were estimated using data from WHOsis on former Czechoslovakia. |
| Greece          | 1981       | 2013     | Eurostat data were used to obtain lung cancer deaths for 2004–2006. WHOsis exposure data instead of HMD exposure data were used to calculate lung cancer mortality rates. |
| Hungary         | 1955       | 2014     | For 1953–1991, data for Slovakia were estimated using data from WHOsis on former Czechoslovakia. |
| Iceland         | 1951       | 2014     | For 1953–1991, data for Slovakia were estimated using data from WHOsis on former Czechoslovakia. |
| Ireland         | 1950       | 2014     | For 1953–1991, data for Slovakia were estimated using data from WHOsis on former Czechoslovakia. |
| Italy           | 1951       | 2014     | For 1953–1991, data for Slovakia were estimated using data from WHOsis on former Czechoslovakia. |
| Latvia          | 1980       | 2014     | For 1953–1991, data for Slovakia were estimated using data from WHOsis on former Czechoslovakia. |
| Lithuania       | 1981       | 2014     | For 1953–1991, data for Slovakia were estimated using data from WHOsis on former Czechoslovakia. |
| Luxembourg      | 1967       | 2014     | For 1953–1991, data for Slovakia were estimated using data from WHOsis on former Czechoslovakia. |
| Netherlands     | 1950       | 2014     | For 1953–1991, data for Slovakia were estimated using data from WHOsis on former Czechoslovakia. |
| New Zealand     | 1950       | 2013     | For 1953–1991, data for Slovakia were estimated using data from WHOsis on former Czechoslovakia. |
| Norway          | 1951       | 2014     | For 1953–1991, data for Slovakia were estimated using data from WHOsis on former Czechoslovakia. |
| Poland          | 1959       | 2014     | For 1953–1991, data for Slovakia were estimated using data from WHOsis on former Czechoslovakia. |
| Portugal        | 1955       | 2014     | For 1953–1991, data for Slovakia were estimated using data from WHOsis on former Czechoslovakia. |
| Russia          | 1980       | 2013     | For 1953–1991, data for Slovakia were estimated using data from WHOsis on former Czechoslovakia. |
| Slovakia        | 1953       | 2014     | For 1953–1991, data for Slovakia were estimated using data from WHOsis on former Czechoslovakia. |
| Slovenia        | 1985       | 2014     | For 1953–1991, data for Slovakia were estimated using data from WHOsis on former Czechoslovakia. |
| Spain           | 1951       | 2014     | For 1953–1991, data for Slovakia were estimated using data from WHOsis on former Czechoslovakia. |
| Sweden          | 1951       | 2014     | For 1953–1991, data for Slovakia were estimated using data from WHOsis on former Czechoslovakia. |
| Switzerland     | 1951       | 2014     | For 1953–1991, data for Slovakia were estimated using data from WHOsis on former Czechoslovakia. |
| Ukraine         | 1981       | 2012     | Eurostat data were used to obtain lung cancer deaths for 2004–2006. |
| United Kingdom  | 1950       | 2014     | Eurostat data were used to obtain lung cancer deaths for 2004–2006. |
| United States   | 1950       | 2014     | Eurostat data were used to obtain lung cancer deaths for 2004–2006. |
Appendix II. Trends over time in the smoothed smoking-attributable mortality fractions (SAMF) over ages 35–99, 4 North American/Australasian countries and 30 European countries, 1950–2014*, by sex and country. (a) Men, (b) women. *Or latest available year: Bulgaria (2010), Canada (2011), Greece (2013), New Zealand (2013), Ukraine (2012), Russia (2013).

### a) Men

| Country                      | 1960 | 1980 | 2000 |
|------------------------------|------|------|------|
| Australia                    |      |      |      |
| Austria                      |      |      |      |
| Belarus                      |      |      |      |
| Belgium                      |      |      |      |
| Bulgaria                     |      |      |      |
| Canada                       |      |      |      |
| Czech Republic               |      |      |      |
| Denmark                      |      |      |      |
| Estonia                      |      |      |      |
| Finland                      |      |      |      |
| France                       |      |      |      |
| Germany                      |      |      |      |
| Germany, East                |      |      |      |
| Germany, West                |      |      |      |
| Greece                       |      |      |      |
| Hungary                      |      |      |      |
| Iceland                      |      |      |      |
| Ireland                      |      |      |      |
| Italy                        |      |      |      |
| Latvia                       |      |      |      |
| Lithuania                    |      |      |      |
| Luxembourg                   |      |      |      |
| Netherlands                  |      |      |      |
| New Zealand                  |      |      |      |
| Norway                       |      |      |      |
| Poland                       |      |      |      |
| Portugal                     |      |      |      |
| Russia                       |      |      |      |
| Slovakia                     |      |      |      |
| Slovenia                     |      |      |      |
| Spain                        |      |      |      |
| Sweden                       |      |      |      |
| Switzerland                  |      |      |      |
| Ukraine                      |      |      |      |
| United Kingdom               |      |      |      |
| United States of America     |      |      |      |

* Or latest available year: Bulgaria (2010), Canada (2011), Greece (2013), New Zealand (2013), Ukraine (2012), Russia (2013).
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