STILL "THE SICK MAN OF EUROPE"?

Scottish Mortality in a European Context

1950 – 2010

An analysis of comparative mortality trends

Bruce Whyte and 'Tomi Ajetunmobi

Glasgow Centre for Population Health

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Contact details for main author:

Bruce Whyte
Glasgow Centre for Population Health
House 6,
94 Elmbank Street,
Glasgow,
G2 4DL

Tel: 0141 287 6875
Email: bruce.whyte@drs.glasgow.gov.uk
Website: www.gcph.co.uk

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Acknowledgements

This work builds on a previous comparative mortality analysis undertaken by a team led by Professor David Leon (London School of Hygiene and Tropical Medicine) for the Public Health Institute of Scotland, which was published in March 2003 as part of their report, 'Understanding the Health of Scotland's Population in an International Context'[1]. The mortality analyses were updated in 2006 by ScotPHO[2]. That analysis is superseded by the current study which presents mortality trends up to 2010.

The data used in this study have been derived from the World Health Organisation's Statistical Information System (WHOSIS). The authors are grateful to have been able to use this resource but accept full responsibility for the accuracy of the data preparation, analysis and interpretation undertaken as part of this study.

We would especially like to thank Professor Leon for providing the STATA programs used in the original analysis, which have been updated and amended for the current study. The authors would also like to thank Gerry McCartney, David Walsh, Carol Tannahill, Diane Stockton, David Brewster and Jennie Coyle for their comments and advice on various earlier drafts of the report.

Executive summary

The results reported here provide a contemporary summary of Scotland's mortality position relative to 19 other mainly Western European countries[i] and highlight emerging trends. Scottish mortality trends are shown for a 60 year period, 1950 – 2010, although across Europe the length of follow-up varies by country. There are two main sets of analyses: i) all cause mortality trends broken down by gender and by age grouping (infancy, childhood, younger working adults, working age and elderly); and ii) cause specific mortality trends for 13 causes[ii] broken down by gender within the working age adult population (15-74 years).

All-cause mortality by age group

Infant mortality rates in Scotland have fallen by 90% over the last 60 years. It is notable that in Scandinavian countries (with the exception of Denmark) infant mortality rates have been the lowest in Western Europe, consistently. Scotland's relative ranking on infant mortality compared to other European countries has become progressively poorer for both sexes, albeit the differences in mortality between countries are much smaller than they were.

Mortality rates among Scottish **children** (aged 1-14 years) have decreased considerably since 1950, as have child mortality rates in other Western European countries. Across Western Europe mortality rates have converged and rates for most of the selected European countries are now very similar to Scottish rates.

Mortality rates for Scottish men of **working age** (15-74 years) have been falling at a similar pace to other Western European countries, but have remained consistently higher than the Western European average; currently, Scottish rates are around 20% higher. For women, while there have been reductions in mortality rates, the Western European country mean has fallen at a faster pace than Scottish mortality. Consequently, a gap has emerged whereby female working age mortality in Scotland has remained at least 30% higher than the Western European mean since the 1970s. Scotland has had the highest mortality in Western Europe among working age men and women since the late 1970s.

Mortality among **younger working age adults** (aged 15-44 years) in Scotland is a cause for concern. While mortality did reduce from the 1950s to the mid 1980s, this decline stalled for men from 1982 onwards and from 1987 for women. Since then there has been no net improvement in mortality in this age group among men or women. These trends are unusual in a European context. In all of the other 19 European countries included in this study (with one exception: Northern Ireland) there have been reductions in mortality for men and women in recent years, albeit to varying degrees.

Scotland's relative ranking in relation to younger working age mortality compared to other European countries has become progressively worse for both sexes over the last 55 years. It is now the highest among the 16 Western European countries compared in this study. In comparison to England and Wales in 2009, younger working age mortality was 46% higher in Scotland for women and 54% higher for men.

[i] In the majority of analyses Scotland is compared to a set of Western European countries but comparisons have also been made to two Eastern European countries, Poland and Hungary.
[ii] Oesophageal, stomach, colorectal, pancreatic, lung and breast cancer; ischaemic heart disease; cerebrovascular disease; chronic obstructive pulmonary disease; chronic liver disease, including cirrhosis; external causes; suicide; and, motor vehicle accidents.

Mortality rates for **elderly** (aged 75 years and over) males have reduced in Scotland and Western Europe. The Scottish mortality rate has remained consistently above the Western European country mean, but in recent years the Scottish mortality rate has moved towards convergence with the Western European mean. In contrast, while mortality among elderly women has been steadily reducing in Scotland, the rate of reduction has not kept pace with reductions in the Western European country mean. As a result, elderly female mortality in Scotland has been the highest among the Western European countries compared in this study since 2002.

Mortality from specific causes in the working age population (15-74 years)

Patterns of working age mortality for the 13 specific causes we have analysed vary greatly by cause and by gender. Of the six cancers analysed (oesophageal, stomach, colorectal, pancreatic, lung and breast), with the exception of oesophageal cancer, many show reductions in mortality and/or improvements in Scotland's relative position compared to other countries – although Scotland often still has one of the highest rates among the countries compared and there are gender differences evident for lung cancer.

Mortality rates for **oesophageal cancer** among Scottish men aged 15-74 years have risen since 1970 and are now the highest in Western Europe: in 2009 the male mortality rate was 71% above the Western European mean. Oesophageal cancer mortality for Scottish women in the same age group has been the highest in Western Europe since the early 1980s and in 2009 was 96% above the Western European average.

Mortality due to **stomach cancer** in Scotland has been steadily decreasing since 1950 for both men and women. For men aged 15 -74 years there has been a reduction of 84% between 1950 and 2010. There was an equivalent reduction of 90% among women over the same time period. Scottish rates of stomach cancer mortality lie close to the Western European average.

Male and female **colorectal cancer** mortality in the working age population has reduced significantly since 1955. Scotland's male mortality rate reduced by 56% in the period 1955-2010 and the reduction for women over the same period was by 62%. For both men and women, the Scottish mortality rate has gradually converged towards the Western European mean and as a result Scotland's relative ranking compared to other countries has improved.

Despite relatively little change in the mortality rate for **pancreatic cancer** in Scotland over the last 55 years, because of rises in mortality in other countries, Scotland's position relative to the Western European mean has improved for both men and women.

Mortality from **lung cancer** in men has declined from the peak levels seen between the mid 1960s and the end of the 1970s and the Scottish rate is moving down toward the Western European mean. By 2010, the mortality rate was 60% of its level in 1979, one of the last peak years. The trend for Scottish women is very different: the mortality rate rose steadily from the 1950s, stabilised at the beginning of the 1990s but has shown no sign of reduction since then. This represents approximately a 25 year peak in female lung cancer mortality. Scotland has had the highest or second highest lung cancer mortality in Western Europe for women for the last 50 years.

Female breast cancer mortality rates in Scotland increased up until the mid 1980s but have fallen steeply since the mid 1990s. By 2010, the Scottish mortality rate was 33% lower than in 1950. The Scottish mortality trend is converging toward the Western European mean.

Turning now to deaths from the main causes other than cancer, Scottish male mortality rates for **ischaemic heart disease** (IHD), while still among the highest in Western Europe, have reduced and converged toward the Western European mean. Finnish male IHD mortality overtook the Scottish rate in 2009. Female IHD mortality in Scotland has reduced by over 80% since 1950, but has remained higher than in other Western European countries for the last 55 years.

Despite dropping significantly, Scottish male and female mortality from **cerebrovascular disease** has been the second highest in Western Europe for the last 55 years, second only to Portugal. However, Scottish mortality rates have been gradually converging with the Western European mean.

Mortality due to **chronic obstructive pulmonary (lung) disease (COPD)** among men in Scotland has been in decline since the mid 1960s and by 2010 the mortality rate had dropped by 82% from the level in 1963. However, despite this due to greater mortality reductions in other countries, since 2000 (with the exception of one year), Scotland has had the highest rate of male mortality from COPD in Western Europe. For women, the mortality trend has been relatively flat, and female mortality has been the second highest in Western Europe since 1993.

Scottish mortality rates from **chronic liver disease, including cirrhosis** have risen steeply since the early 1990s among men and women. By 2000, the male mortality rate was six times higher than in 1950 and the female rate five times higher. However, in more recent years there have been reductions: male mortality in 2010 had reduced by 20% from a peak in 2002; female mortality had reduced by 27% from a peak in 2006. Scottish male mortality became the highest in Western Europe in 2001, but since 2007 Scotland has moved down in ranking slightly due to a drop in mortality in Scotland and a rise in Finnish mortality. Female mortality rose to the highest in Western Europe in 1998 and has stayed in that position since.

Deaths from **external causes** – which include deaths from injuries, poisonings, accidents, suicide and homicide – rose to a peak in the late 1970s for men and women and have since reduced: by 32% among men and by 43% among women since 1979. The Scottish mortality rate for men is close to the Western European average, while the rate for Scottish women has risen above the Western European mean in recent years.

Within the group of 'external causes'**, male suicide** rates in Scotland rose from the mid 1970s to a peak in 1993. Following a period of stability, the male suicide rate declined from 2003 onwards, but the rate remains (in 2010) 50% higher than in 1968. The female suicide rate is about a third of the male rate and has remained relatively stable since the early 1980s. Scottish suicide rates for men and women of working age are above the Western European mean level.

Mortality from **motor vehicle accidents (MVAs)** rose in Scotland from the 1950s to the early 1970s, and has been decreasing since then. In 2010, male mortality had reduced by 76% from its peak level in 1974, while female mortality had reduced by a

similar amount from its peak in 1978. For most of the last 55 years, Scotland's mortality rate from MVAs has been lower than the Western European average, but in many European countries reductions in MVA mortality have been more pronounced and rates of MVA mortality are now lower than in Scotland.

In summary, mortality in the working age population remains comparatively high and mortality for circulatory diseases and many cancer related diseases is higher than in most other Western European countries. However, there have been notable improvements in Scottish mortality for a range of major conditions – both in terms of absolute trends and in relation to Scotland's relative position in a Western European context. Growing concerns are evident, however, in relation to all-cause mortality among the younger working age population and elderly women, and for female lung cancer.

1. Background and introduction

1.1 Background

In March 2003 Professor David Leon and colleagues at the London School of Hygiene and Tropical Medicine produced a detailed report for the Public Health Institute of Scotland, which focused on understanding Scotland's health in an international context. A major component of this work was a comparative mortality analysis, which used World Health Organisation (WHO) population and mortality data to examine mortality trends from 1950 to 2000 in 20 European countries.

This work was undertaken in part because of the 'absence of any existing systematic description of how mortality rates in Scotland compare with those in other European countries', and partly to improve understanding of the health of Scotland in an international context. In 2006 the mortality analyses were updated by ScotPHO, enabling Scottish trends to be presented up to 2003 and a more complete comparison of mortality trends in Scotland and other European countries in the period 1950-2000 to be made.

The principal aims of this current report are to provide a more up-to-date comparison of Scotland's mortality rates relative to other European countries and to highlight developing trends.

1.2 Introduction

The analysis methodology adopted in this study is very similar to that taken by Leon and colleagues in 2003. However, given changes in coding and availability of data, some minor changes to the analyses have been necessary and these are detailed in the 'Data sources and methods' section of this report, below.

We have considered mortality in five different age groups – infancy (the first year of life), childhood (1-14 years of age), younger working adults (15-44 years), working age adults (15-74 years) and the elderly (75 years and older) – and by specific causes of death for working age adults. Each analysis compares Scottish trends with those for a selection of other European countries and against the mean, minimum and maximum Western European rates. In total 20 countries, including Scotland, are included in these comparative analyses: the majority are from Western Europe, but two Eastern European countries – Poland and Hungary – are included.

The main differences between the current approach and the original analysis (in 2003) and the ScotPHO update (of 2006) are that:

- *Scottish data are now available for a full 60 year period from 1950 to 2010*
- *Data for the other Western European countries have been extended, allowing for data up to 2009 to be included in the comparison of Western European country means, minimums and maximums and data up to the period 2001-2005 to be used to compare Scotland's overall ranking*[iii]
- *A comparison of mortality among younger working age adults (15-44 years of age) has been added, reflecting concerns about trends (and inequalities*[3]*) in avoidable deaths in this age group*

[iii] The most recent year for which mortality data are available varies by country. For this reason the comparison of Scotland's ranking against other Western European countries is only presented up to 2001-2005.

A description of the findings from each of these analyses is given in the results section, accompanied by a selection of graphs illustrating the actual mortality trends. The full set of analysis graphs are presented as a series of excel workbooks which can be accessed on the GCPH website, along with this report at: http://www.gcph.co.uk/work_programmes/understanding_glasgows_health/scottish_mortality_in_europe. A table detailing these graphs is provided in the appendices of this report (Appendix Table 6).

2. Data sources and methods

2.1 Mortality and population data

Mortality data were obtained from the World Health Organisation Statistical Information System (WHOSIS): see www.who.int/whosis/mort/download/en/index.html. The WHO Mortality Database contains counts of deaths by country, five-year age group, sex, individual year and cause of death, coded according to the International Classification of Diseases (ICD) in use at the time of death registration in each country. These are official national statistics as they have been transmitted to the WHO by the authorities of the countries concerned, having been compiled on the basis of reports provided at registration of death. In addition, corresponding mid year population estimates were obtained from the same WHO website.

One final point to make in regard to these data is that both the population and the death registrations data are periodically updated and revised retrospectively by WHO[iv]. Therefore, mortality rates derived using these data are liable to change. One of the potential knock-on effects after such revisions is that Scotland's ranking compared to other countries may change slightly, particularly in the most recent periods. These points are worth bearing in mind for the future, if these analyses are updated.

2.2 Countries and time period

Mortality trends were analysed across 20 European countries (see Appendix Table 1) for the period 1950-2010, subject to data availability. The smallest Western European countries (e.g. Iceland, Luxembourg) were not included because mortality rates were too variable on a year by year basis. For Germany, the rates from former West Germany were used until 1989 and those from the united Germany starting from 1990. The drawback of this approach is that as mortality rates in Eastern Germany have generally been higher than in Western Germany, this leads to a slight 'step effect' in the mortality trends for Germany around 1990. Two Eastern European countries, Poland and Hungary, were included but only for country-specific comparison. They were not included in the comparisons of mortality ranking over time, which were limited to Western European countries (described later in more detail (see 2.4.2)).

It is worth noting that there are gaps in data availability for particular countries in specific years in the study period, 1950 – 2010. Appendix Table 2 summarises these gaps.

2.3 Causes of death

2.3.1 Choice of age groups and causes

Mortality was studied for all causes across five age groups: infant mortality (under 1 year), child mortality (1-14 year olds), younger working age mortality (15-44 year olds)[v], working age mortality (15-74 year olds) and mortality in the elderly (75 years and older). Specific causes of death were examined only for the adults aged 15-74 years. This follows the approach taken by Leon et al previously, who pointed out that Scotland's mortality compares particularly poorly with other countries in this age group. The causes selected for analysis were those that account for most deaths, together with several of particular interest to the Scottish situation (such as liver disease). The 13 causes included

[iv] For this study data were extracted from the WHO database in April 2012. At this point in time, the last data update to the database had been in November 2011.

[v] This age group is included as an addition to the previous analyses, reflecting concerns about trends in avoidable deaths in this age group.

were: *oesophageal, stomach, colorectal, pancreatic, lung and breast cancer; ischaemic heart disease; cerebrovascular disease; chronic obstructive pulmonary disease; chronic liver disease, including cirrhosis; external causes; suicide; and, motor vehicle accidents.*[vi]

2.3.2 International Classification of Diseases (ICD)

Since the beginning of the 20th century, causes of death have been coded according to the International Classification of Diseases (ICD). This has been revised approximately every ten years. The ICD revisions that have been used since 1950 are ICD6 to ICD10. Appendix Table 3 lists the 13 causes analysed, along with their relevant ICD codes under each revision. Appendix Table 4 indicates the range of years in which each ICD revision was used by country.

In Switzerland, an aggregated version of the ICD10 coding scheme (see Appendix Table 3) has been used for data from 1995 onwards. The use of this aggregated data limits the comparisons that can be made at a cause specific level for Switzerland. It is not possible to derive comparable figures *for chronic obstructive pulmonary disease*, *motor vehicle accidents* and *chronic liver disease, including cirrhosis* using this aggregated coding system. Swiss mortality trends for these causes are included in charts but are restricted to the period for which data are available i.e. 1951-1994.

In this study a broader definition of suicide has been applied than was used in the two previous related reports[1,2]. In line with the approach taken in many recent studies and that advocated by ScotPHO[vii], the definition of suicide we have used was widened to include *'Injury undetermined whether accidentally or purposely inflicted'* along with *'Suicide and self inflicted injury'*. This improves cross-country comparability, but limits the length of trends that can be presented because ICD6/7 mortality data from WHOSIS cannot be aggregated in this way. Therefore, trends for most countries start with the introduction of the ICD8 classification in the late 1960s – usually 1968 or 1969.

There are other gaps in the time series for specific countries where mortality data were not available – Appendix Table 2 provides further detail.

2.3.3 Coding

As five different ICD revisions have been used over the past 50 years, this invariably has given rise to some problems with coding, due to changes in nomenclature, methods of diagnosis, classification and coding instructions. Two issues need to be considered: first, coding practices may change when a new ICD revision is introduced, and secondly there will be differences in certification and coding between countries in any particular period/ ICD revision. For some countries, this may lead to 'step effects' in the trend line at the time when a new ICD version was introduced. We have chosen to use the codes that we deem to be most compatible with Scottish practice i.e. those which minimise any inflections in the Scottish trends, even though this might occasionally cause sudden discontinuities in the trends for other countries. Analysis of these discontinuities is beyond the scope of this report.

[vi] There are other causes that could have been included (e.g. mental health conditions, alcohol and drug related conditions) but comparisons can be difficult to make due to definitional differences related to the use of different ICD revisions. The potential for further comparative analysis of different causes is discussed in the conclusion section of this report.

[vii] See http://www.scotpho.org.uk/health-wellbeing-and-disease/suicide/data/international

Causes of death for which specific problems are known to exist include:

Ischaemic heart disease: the main problem here lies in the broadening of the category 'arteriosclerotic heart disease, including coronary disease' from ICD6/7 to 'ischaemic heart disease' in ICD8. The term 'coronary heart disease' has progressively replaced more non-specific terms such as 'myocardial degeneration and arteriosclerosis'[4]. Similarly, the term 'cerebrovascular disease' was used specifically from ICD8 onwards, but was included in ICD7 versions as 'vascular lesions affecting the central nervous system'.

Chronic obstructive lung disease: this is a relatively recent term which has also been described as chronic bronchitis and emphysema. Until 1968, it was often categorised with 'other respiratory diseases', for which reason this category has been included for ICD revision 6/7 and 8. Only with the ninth ICD revision was it given a category of its own.

2.4 Statistical aspects

2.4.1 Age standardised rates

When comparing mortality rates between different countries, it is necessary to take account of differences in the age composition of populations both between countries and over time. To do this we have adjusted the rates using direct age standardisation. This method averages age-specific rates in a study population using as weights the population distribution of a specified population. We have used the European standard population[5] (See Appendix Table 5).

2.4.2 Western European country means, minimums and maximums

For each year considered, we have calculated the Western European[viii] country mean as a simple average of all the rates. So the countries contributing are those in Appendix Table 1 but with four excluded for various reasons – Belgium[ix], Greece[x], Poland and Hungary[xi] – leaving 16 contributing to the calculation. In addition, for each year we have identified the minimum and maximum rate among the comparison countries. For each cause of death, these rates are displayed in a graph for the period 1955 to 2009. These cut-off time points were chosen due to the availability of data for most countries over this period. In each graph, mortality rates for Scotland are superimposed, to illustrate Scotland's position in Western Europe.

2.4.3 Rank position

To quantify Scotland's position in Western Europe, we calculated each country's rank position for every year. Subsequently the mean rank position for every five-year period from 1956 to 2005 was determined, to take account of random variation. For each five-year period, Scotland's rank position has been added to the graphs that contain the minimum, maximum and mean rates. The country with the highest mortality rate was defined as rank position one, and that with the lowest as rank position 16.

[viii] The term Western Europe has been adopted to describe the countries included for simplicity, although arguably a more accurate geographical label might be *Western and Central Europe* given the inclusion of the former East Germany within Germany.

[ix] Data on certain causes of death in Belgium cannot be compared to other countries because an aggregated version of ICD10 has been in use.

[x] Mortality data were only available for Greece from 1961.

[xi] Hungary and Poland are excluded because their recent history as communist countries makes them less comparable to other parts of Western Europe.

The most recent year for which mortality data are available varies by country. For this reason the comparison of Scotland's ranking against other Western European countries is only presented in the graphs up to 2001-2005.

3. Results

Notes
i. Mortality rates are reported as deaths per 100,000 per year. The one exception to this is infant mortality rates, which are reported as deaths in the first year of life per 1000 live births per year.

ii. The data described below relate to Scottish trends for the years 1950 to 2010. The length of mortality trends for other European countries varies and not all extend to 2010.

iii. Only a selection of all the trend graphs are shown in this report. Appendix Table 6 lists the full series of graphs which can be accessed on line at: http://www.gcph.co.uk/work_programmes/understanding_glasgows_health/scottish_mortality_in_europe

3.1 All cause mortality

3.1.1 Infants (0-1 years old) *(Fig A1M – A7F)*

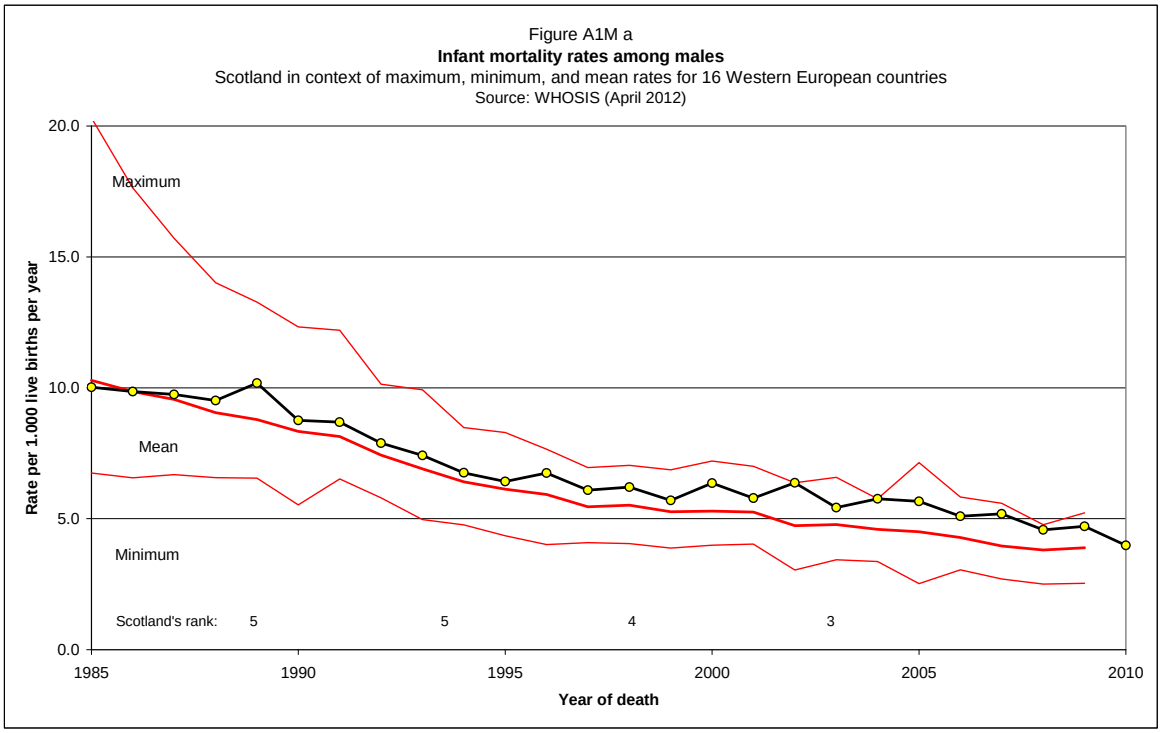
Scottish trends

Mortality rates for both boys and girls have declined significantly between 1950 and 2010: from 43.0 to 4.0 and from 33.8 to 3.4 per 1000 per year respectively. By 2010, therefore, the infant mortality rates for boys and girls had fallen by 90% from the levels in 1950. In 2010 there were 119 male infant deaths and 99 female infant deaths.

Relative position in Europe

Since the early 1960s, Scottish rates for both boys and girls have quite closely followed the Western European country mean. It is notable though that since the mid 1990s male infant mortality in Scotland has been at least 10% higher than the Western European mean (see Fig A1Ma over last 20 years). Scotland's relative ranking on infant mortality compared to other European countries has become progressively poorer for both sexes, albeit the differences in mortality between countries are much smaller than they were. In the period 2001-2005 male infant mortality in Scotland was the third highest in the Western European countries compared and female infant mortality was fourth highest (Figures A1M and A1F).

Figure A1M a
Infant mortality rates among males
Scotland in context of maximum, minimum, and mean rates for 16 Western European countries
Source: WHOSIS (April 2012)



Country-specific comparisons

In the 1950s, there were large differences in European infant mortality rates with very high rates in Southern Europe, and Portugal in particular. However, over the last 60 years infant mortality rates have decreased in all countries and converged. Now, differences between countries are small: in 2008, minimum and maximum rates ranged between 2.5 and 4.8 per 1000/year for boys and 2.1 and 4.8 per 1000/year for girls. Infant mortality rates in Scandinavian countries, with the exception of female infant mortality in Denmark in recent years, have been consistently among the lowest in Western Europe.

Figure A1M

Infant mortality rates among males

Scotland in context of maximum, minimum, and mean rates for 16 Western European countries

Source: WHOSIS (April 2012)

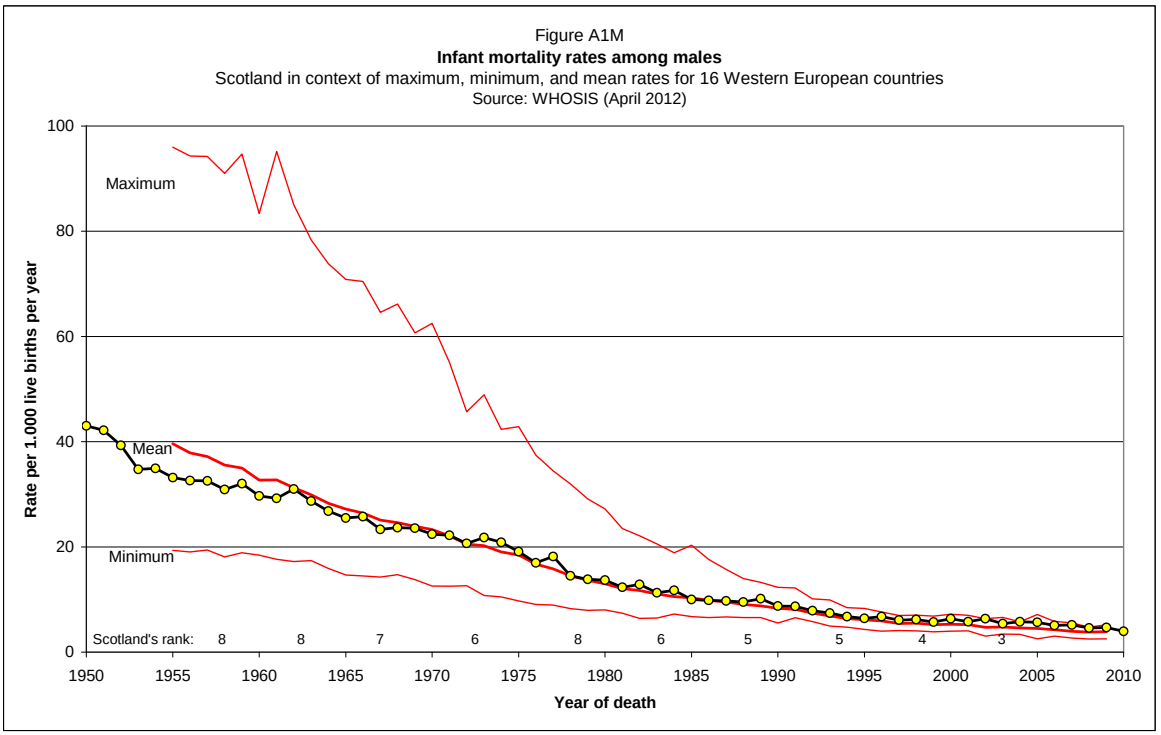
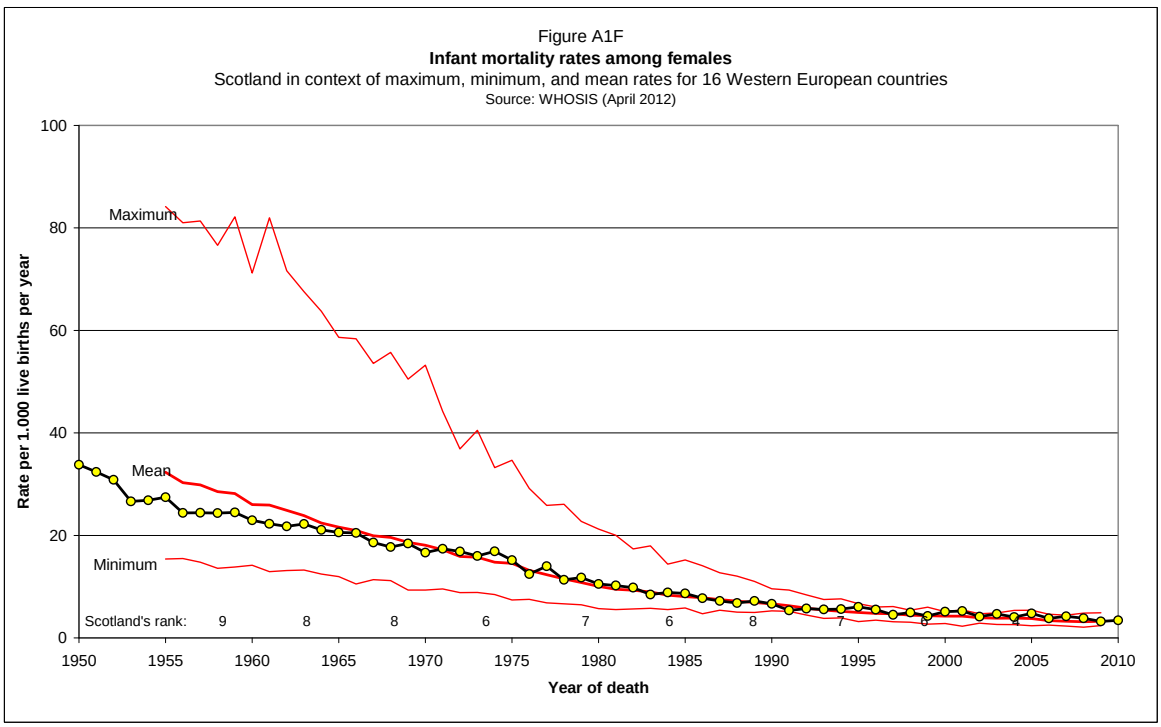


Figure A1F

Infant mortality rates among females

Scotland in context of maximum, minimum, and mean rates for 16 Western European countries

Source: WHOSIS (April 2012)



3.1.2 Children (1-14 years old) *(Fig B1M – B7F)*

Scottish trends

Since 1950, mortality rates in children have decreased considerably, dropping from 114.0 in 1950 to 13.1 in 2010 for boys, and from 86.2 to 10.0 for girls: representing decreases of 89% and 88%, respectively. In 2010 there were 52 deaths among boys aged 1-14 years old and 38 among girls.

Relative position in Europe

Rates in Scotland in the 1950s were close to the European minimum and they have continued to reduce since. However, the more rapid decrease in the Western European country mean has meant that Scottish rates have moved closer to this mean since 1975 and Scotland's relative position compared to other countries has deteriorated slightly. In 2001-2005, Scotland had the fifth highest mortality among the 16 Western European countries compared for both boys and girls (Figures B1M and B1F).

Country-specific comparisons

In the 1950s, large differences existed between the mortality rates of Western European countries. In Southern Europe, childhood mortality was very high: at the extreme, Portugal had four times Scotland's rate. Rates in all countries have since decreased with convergence around the Western European country mean. As a result, recent rates for most of the selected European countries are very similar to Scottish rates. Hungary and Poland are the exception, where rates remain slightly higher.

Figure B1M
All cause mortality age standardised rates among males aged 1-14 years
Scotland in context of maximum, minimum, and mean rates for 16 Western European countries
Source: WHOSIS (April 2012)

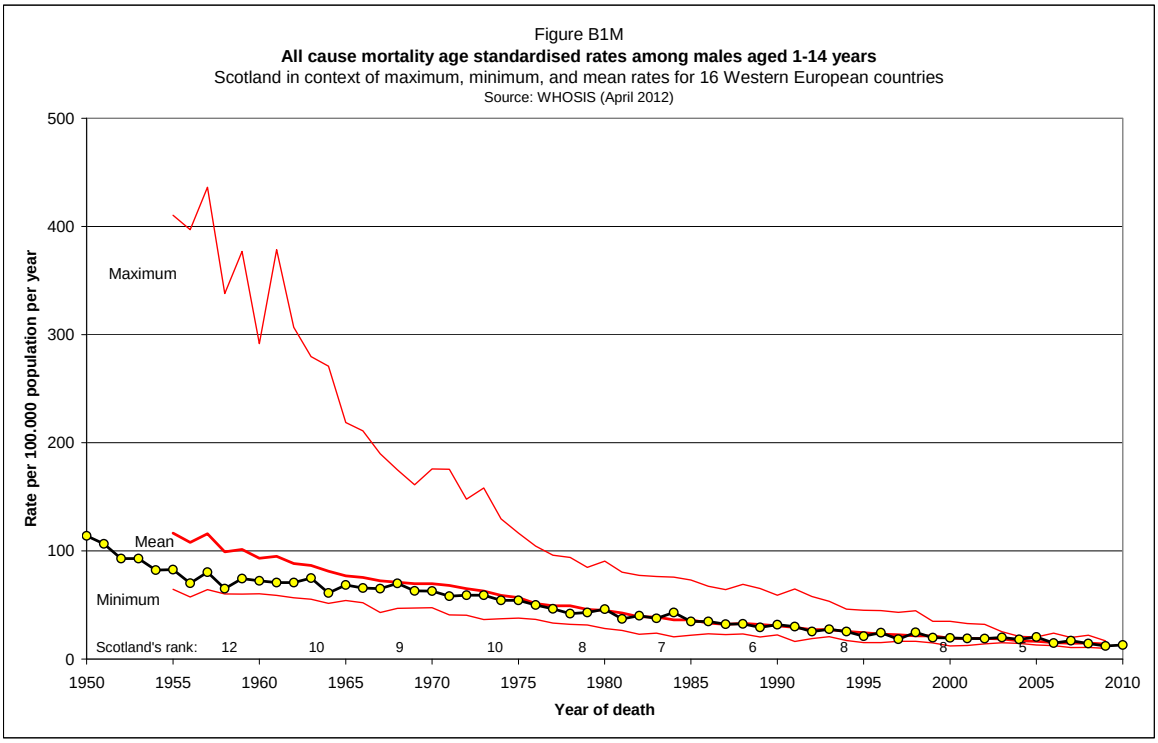
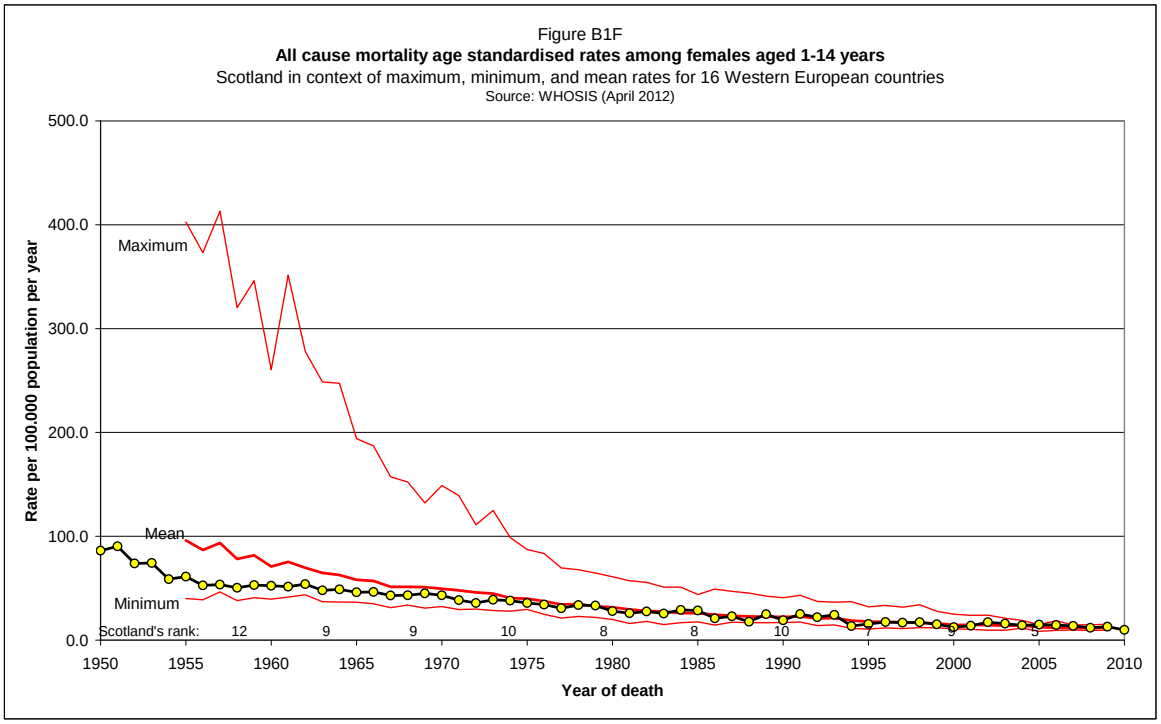


Figure B1F
All cause mortality age standardised rates among females aged 1-14 years
Scotland in context of maximum, minimum, and mean rates for 16 Western European countries
Source: WHOSIS (April 2012)



3.1.3 Adults of working age (15-74 years old) *(Fig C1M – C7F)*

Scottish trends

Following a period of stability since the 1950s, male mortality rates have been decreasing since the 1970s. In 1950 the male mortality rate was 1,253.4 per 100,000. By 2010 this had reduced to 560.8 per 100,000, representing a decrease of 55%. The female mortality rate has declined steadily over the last 60 years from 881.2 per 100,000 in 1950 to 352.3 in 2010, representing a decrease of 60% over the period. In 2010 there were 12,151 male deaths and 8,538 female deaths in this age group.

Relative position in Europe

Over the last 60 years there have been downward trends in mortality in this age group in the majority of Western European countries and they have had consistently lower mortality rates than in Scotland. Moreover, the decline in mortality has generally been greater in other European countries than in Scotland. As a result, apart from a few exception years[xii], Scotland has had the highest mortality rates for men in Western Europe since 1978 and for women since 1958 (Figures C1M and C1F).

In men, Scottish mortality rates have been falling at a similar pace to the Western European country mean and have, accordingly, remained consistently higher than this mean. In 1955, the Scottish rate was 21% above the Western European country mean and in 2009 – after many years of fluctuation – was again 21% above the mean. For women, however, the Western European country mean has fallen at a faster pace than the Scottish rate. Consequently, the difference between these rates has increased: in 1955, the mortality rate for Scottish women was 17% higher than the Western European country mean, but by 1976 this gap had widened to 30% and since then Scottish female working age mortality has remained at least 30% higher than the Western European mean.

[xii] The exceptions are: between 1965-75 when for a few years female mortality rates were slightly higher in Ireland; in 1995 and 1999 when mortality among Danish women was higher; and in 1990 when Finnish men had slightly higher mortality.

Figure C1M

All cause mortality age standardised rates among men aged 15-74 years

Scotland in context of maximum, minimum, and mean rates for 16 Western European countries

Source: WHOSIS (April 2012)

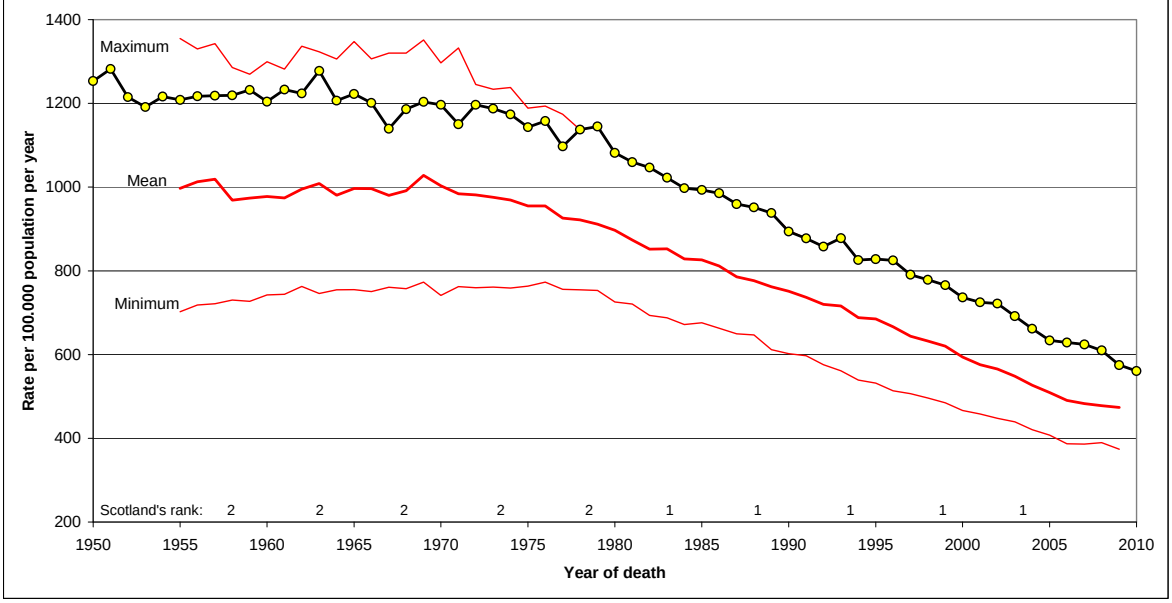
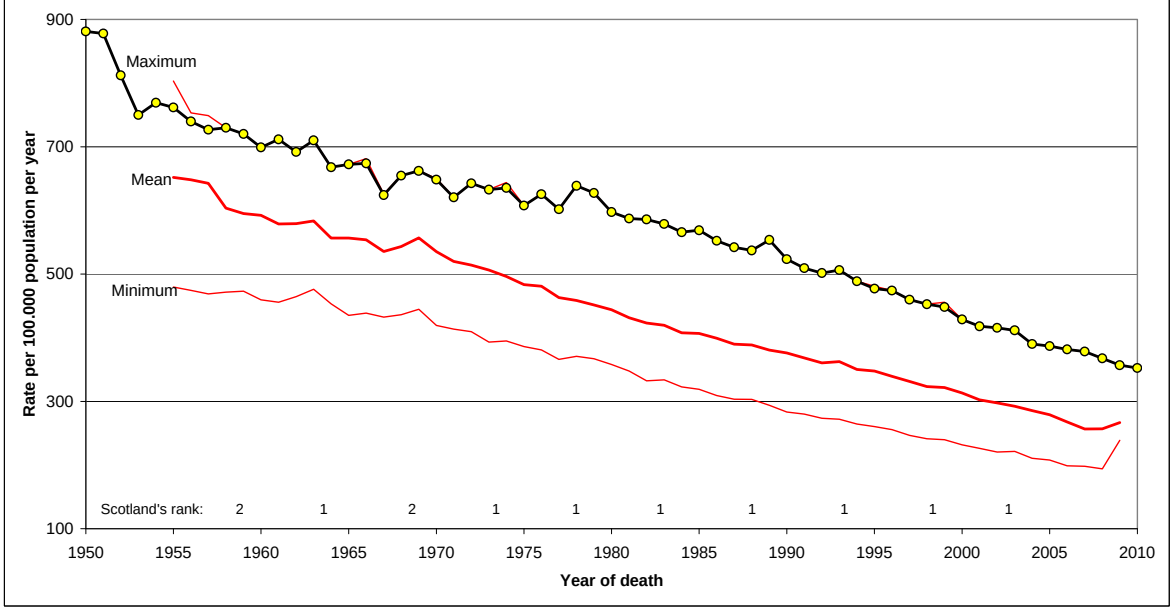


Figure C1F

All cause mortality age standardised rates among women aged 15-74 years

Scotland in context of maximum, minimum, and mean rates for 16 Western European countries

Source: WHOSIS (April 2012)



Country-specific comparisons

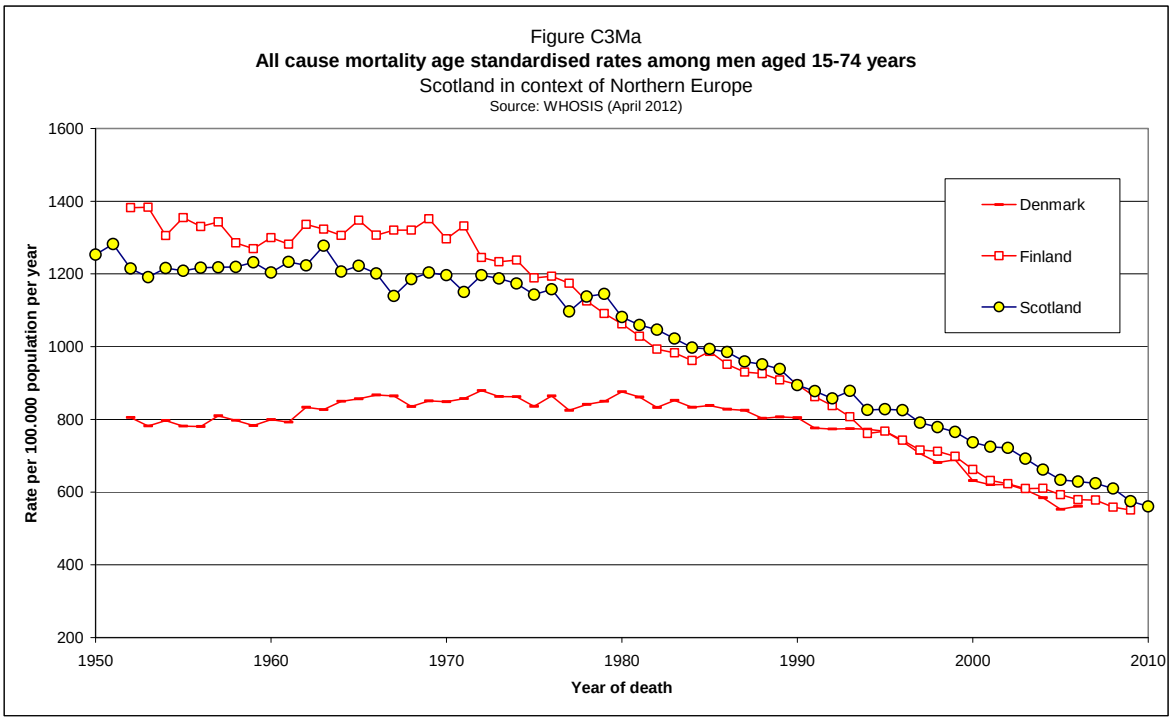
Comparisons between Scotland and other individual countries present a varied picture. For example, in 1950 Scottish male mortality was 13% higher than in England and Wales. This gap widened, particularly from the 1970s onward, and in 2009 Scottish male mortality rates were 32% higher than in England and Wales. The equivalent female mortality gap has widened, but only slightly over the last 60 years; in 1950, female working age mortality rates were 26% higher in Scotland than in England and Wales and by 2009 Scottish rates were 31% higher.

In contrast, the gap in working age mortality between Scotland and some countries has narrowed considerably; for example, the gap in male mortality between Scotland and the Netherlands has narrowed both relatively and in absolute terms. In 1950, male Scottish working age mortality was 70% higher than in the Netherlands, representing an absolute gap in mortality of 514 deaths per 100,000. However, by 2010 Scottish mortality was only 41% higher relatively and 162 deaths per 100,000 higher in absolute terms.

A number of countries have actually made a 'step-change' in rank position over the past 60 years. For men, the positions of Ireland and Denmark deteriorated and those of Austria and France improved; for women the positions of Denmark and the Netherlands deteriorated while those of Finland, France, Spain and Italy improved.

The trends in working age mortality rates in countries often compared with Scotland are worthy of specific consideration. Finland had very high mortality rates for men until 1970. Thereafter their rates dropped steeply and since the early 1990s Finnish male mortality has been consistently lower than Scottish male mortality in this age group, although by 2009 the gap had narrowed and the rates in both countries were comparable (Figure C3Ma). In contrast, female working age mortality in Finland has been below the Scottish rate since the late 1950s and a large gap has now developed due to a steeper drop in female mortality in Finland than in Scotland.

Figure C3Ma
All cause mortality age standardised rates among men aged 15-74 years
Scotland in context of Northern Europe
Source: WHOSIS (April 2012)



Danish mortality trends are also of particular interest. Denmark's mortality ranking relative to other countries has worsened over the period 1950-2010 for both men and women. In 1955, Denmark had the fourth lowest male mortality rate among the countries analysed, but by 2006, after a rise in the mortality rate from the 1960s to 1980 and then a slight reduction in recent years, Denmark had the third highest male mortality among its working age population (Figure C3Ma, above). For women, a similar, if more pronounced, trend is apparent. From having the fourth lowest mortality rate in 1955, mortality rates actually increased slightly between the mid 1970s and 1990s before dropping again more recently, leading to Denmark having the second highest mortality rate for working aged women in 2006.

3.1.4 Young working age adults (15-44 years old) *(Fig CA1M – CA7F)*

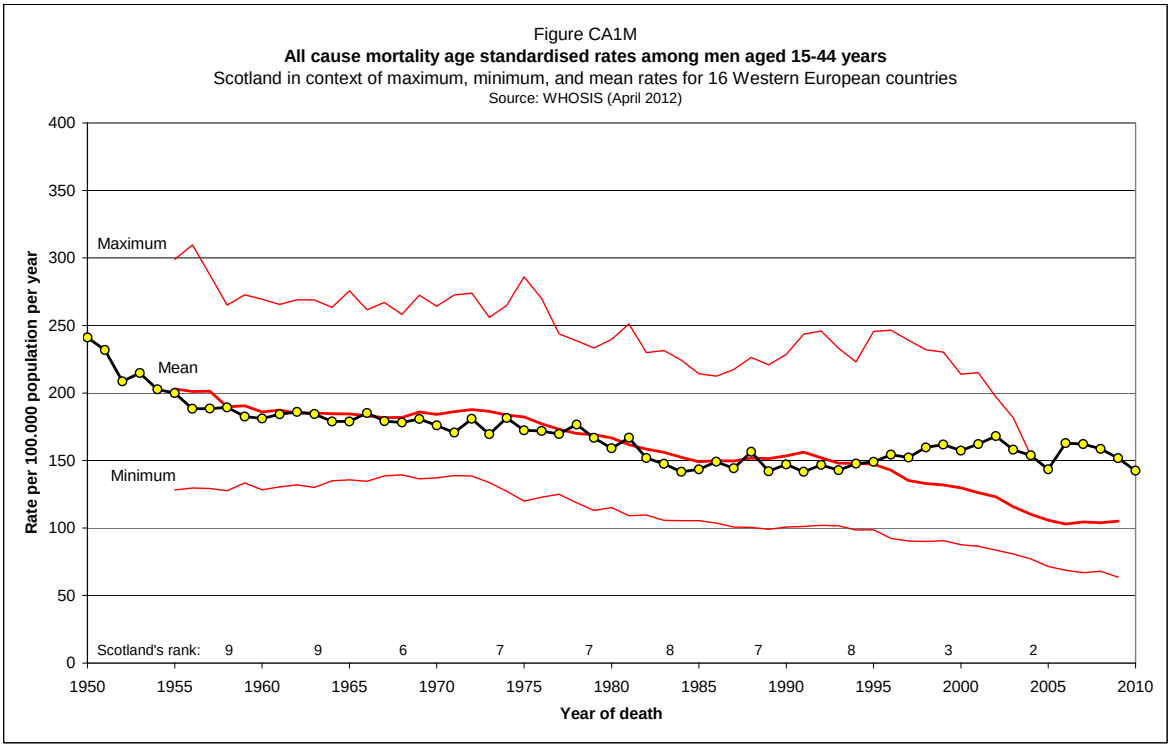
Scottish trends

In this age group, mortality rates for both sexes have reduced in the last 60 years, from 241.1 per 100,000 in 1950 to 142.4 in 2010 for men and from 234.6 to 70.2 for women. However, the decline in mortality stalled – from 1984 onwards for men and from 1987 for women. Since then there has been no net improvement in mortality in this age group among men or women, and among men the mortality rate actually rose by 19% from 1991-2002. More encouragingly, in the last four years (2006-2010) male mortality has dropped in consecutive years. However, among women the rate has been relatively static. In 2010 there were 1,475 male deaths and 754 female deaths in this age group.

Relative position in Europe

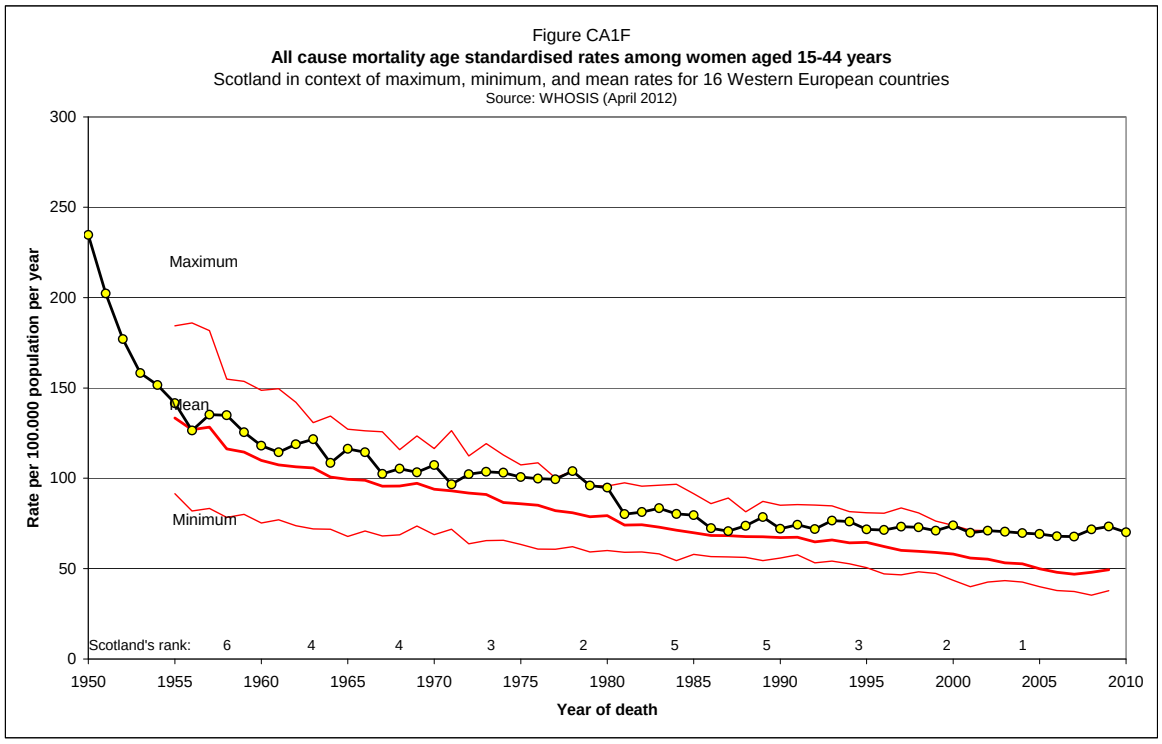
Until the mid 1990s, Scottish mortality rates among younger working age men followed a similar trajectory to the Western European country mean, but since then the Scottish mortality rate has been static, or increasing, while the Western European mean has continued to drop. This has led to deterioration in Scotland's relative position since 1994. In 2009 Scottish mortality among younger working age men was 44% higher than the Western European country mean (Figures CA1M & CA1F).

Figure CA1M
All cause mortality age standardised rates among men aged 15-44 years
Scotland in context of maximum, minimum, and mean rates for 16 Western European countries
Source: WHOSIS (April 2012)



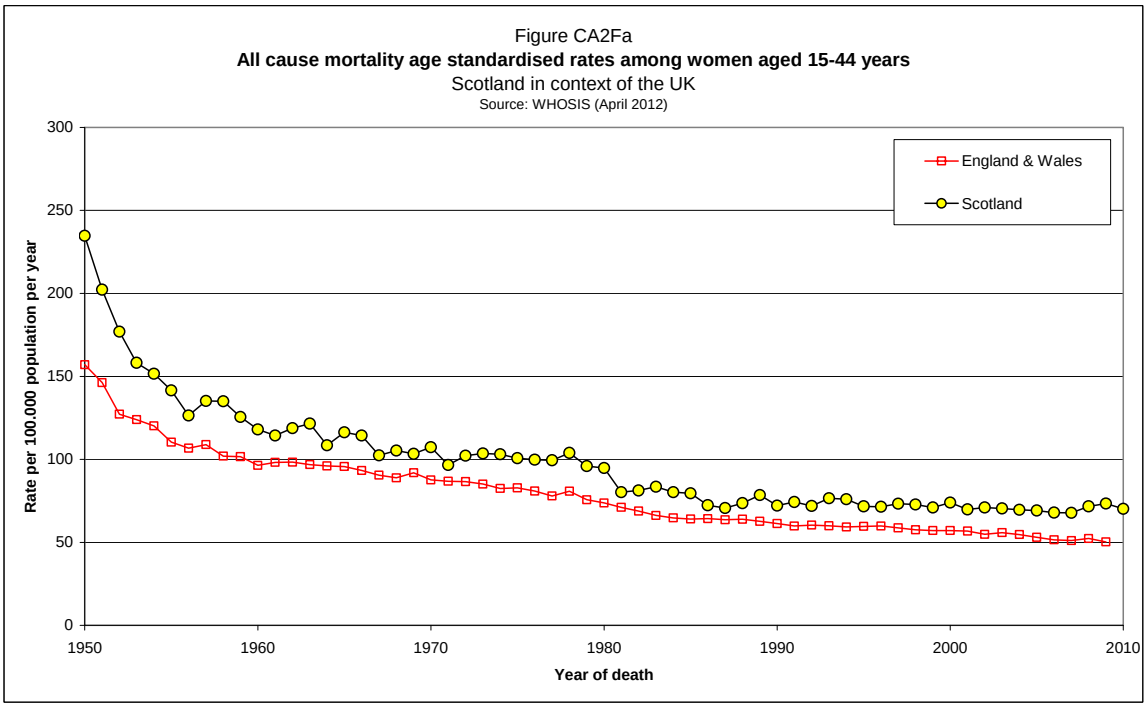
For women there has been a similar trend. Scottish mortality among younger working age women has been higher than the Western European country mean since the late 1950s but Scotland's relative position has deteriorated noticeably from the early 1990s onwards. In 2009, the mortality rate among younger working age women was 48% higher than the Western European country mean.

As a result of these trends compared to other European countries, Scotland's relative ranking for younger working age mortality has become progressively worse for both sexes over the last 55 years. In the late 1950s Scottish male mortality in the age group was ranked ninth highest, but by 2004 Scotland was ranked first (highest). The pattern for women is similar. In the late 1950s, Scottish female mortality in this age group was ranked sixth highest, but since 2002 Scotland has been ranked first (highest).



Country-specific comparisons

Young working age mortality for both sexes in Scotland has been consistently higher than that in England and Wales over the last 60 years. Moreover, it is notable that the gap between Scotland, and England and Wales has widened for men, from being 24% higher in 1950 to 54% higher in 2009, with the gap further widening significantly from the mid 1990s onward. For women the gap has fluctuated, narrowing and then widening. In 2009 younger working age female mortality was 46% higher in Scotland than in England and Wales (Figure CA2Fa).



In comparison to the majority of other European countries in the study, Scotland's position has deteriorated and this is particularly notable from the mid 1990s onward.

3.1.5 Elderly people (over 75 years old) *(Fig D1M – D7F)*

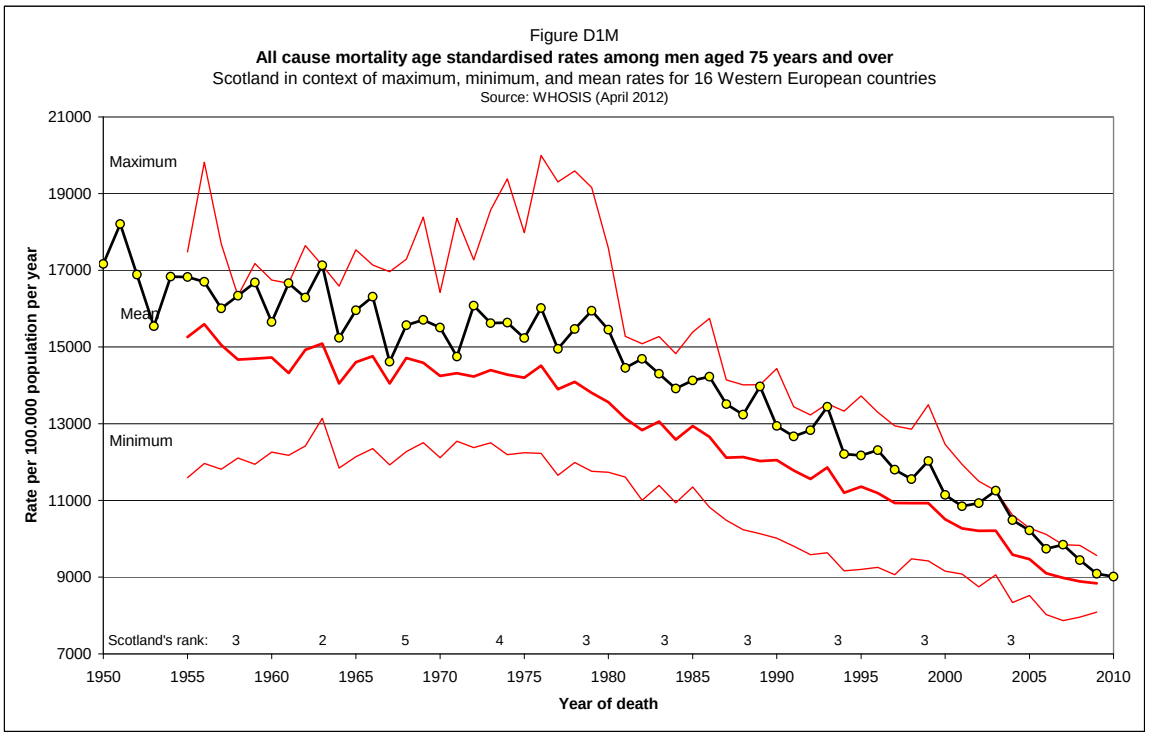
Scottish trends

In this older age group, mortality rates decreased modestly in men in the period 1950-1980, followed by a steeper decline up to 2010. Overall, elderly male mortality in Scotland reduced by 47% between 1950 and 2010. For women, there has been a steady reduction in mortality resulting in an overall reduction of 51% in the period 1950-2010. In 2010 in Scotland, 13,641 elderly men and 19,329 elderly women died.

Relative position in Europe

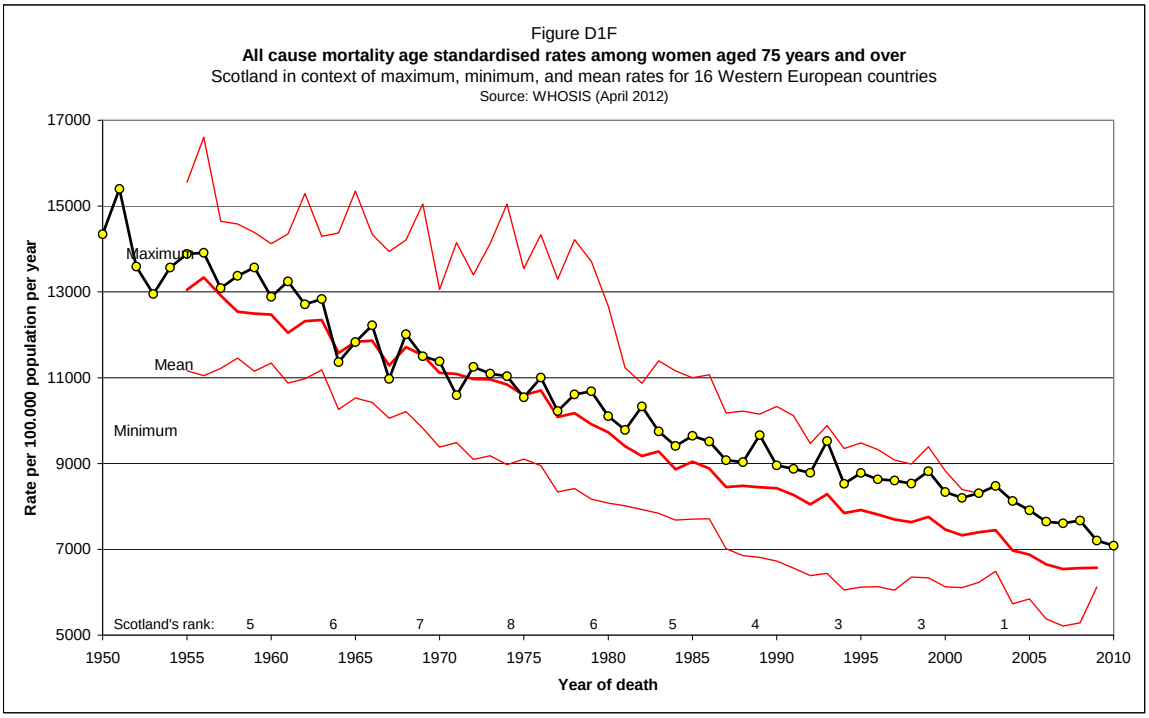
As mortality rates for elderly males have reduced in Scotland and Western Europe, Scottish mortality rates have remained consistently above the Western European country mean. However, in the most recent years – from 2008 onwards – the Scottish mortality rate has moved towards the Western European mean (Figure D1M). In 2001-2005, Scotland had the third highest mortality among elderly men in the 16 Western European compared.

Figure D1M
All cause mortality age standardised rates among men aged 75 years and over
Scotland in context of maximum, minimum, and mean rates for 16 Western European countries
Source: WHOSIS (April 2012)



In contrast, while the elderly female mortality rate has been steadily reducing in Scotland the rate of reduction has not kept pace with reductions in the Western European country mean. As a result, elderly female mortality in Scotland has been the highest among the Western Europe countries compared in this study since 2002 (Figure D1F).

Figure D1F
All cause mortality age standardised rates among women aged 75 years and over
Scotland in context of maximum, minimum, and mean rates for 16 Western European countries
Source: WHOSIS (April 2012)



Country-specific comparisons

For men, as mortality has reduced, there has been a degree of convergence in mortality rates in this age group. For example, mortality rates in the Scandinavian countries and in the countries of Southern Europe, while still lower, are much closer to the Scottish rate. Elderly male mortality in Scotland has been consistently higher than in England and Wales. In 2009, the Scottish rate was 12% higher.

Female mortality trends in this age group for Scotland have not reduced to the same extent as in other Western European countries, leading to a worsening in Scotland's position. For example, Scotland's position has notably deteriorated in comparison to France, Switzerland, Italy and Spain over the last 55 years due to greater reductions in mortality rates in these countries.

As with men, elderly female mortality in Scotland has been consistently higher than in England and Wales. In 2009, the Scottish rate was 14% higher.

3.2 Cause specific mortality (15-74 year olds)

The analysis of cause specific mortality is limited to working age adults - the 15-74 years age group. Leon's original report pointed out that it was in the working age population that Scottish mortality compared most poorly with other Western European countries. For this reason, mortality in this age group was explored in more detail for specific causes and that is the approach that has been adopted in the current study also.

3.2.1 Oesophageal cancer *(Fig E1M – E7F)*

Scottish trends

The mortality rate for men rose steadily from 1970 to 1991 and has since remained relatively unchanged; the mortality rate in 2010 was 62% higher than in 1950. The mortality rate for women has fluctuated over the last 60 years. It rose from the late 1960s into the early 1990s, but has since reduced to a rate below that in 1950. In 2010, 341 men and 106 women (aged 15-74), respectively, died from this cause.

Relative position in Europe

Until 1970, Scottish rates in men were close to the Western European country mean. Since then, Scottish rates have risen steadily away from the mean and are now the highest in Western Europe. In 2009 the Scottish male mortality rate was 70% above the Western European mean (Figure E1M). For women, while the Scottish mortality rate has fluctuated, the mortality rate in other countries that historically had higher mortality (e.g. Finland and Ireland) has dropped. As a result Scotland has had – with the exception of a few individual years – the highest female mortality rate from oesophageal cancer among Western European countries since 1981 (Figure E1F). In 2009, the mortality rate for oesophageal cancer among women in this age group was 96% above the Western European mean.

Figure E1M
Oesophageal cancer mortality age standardised rates among men aged 15-74 years
Scotland in context of maximum, minimum, and mean rates for 16 Western European countries
Source: WHOSIS (April 2012)

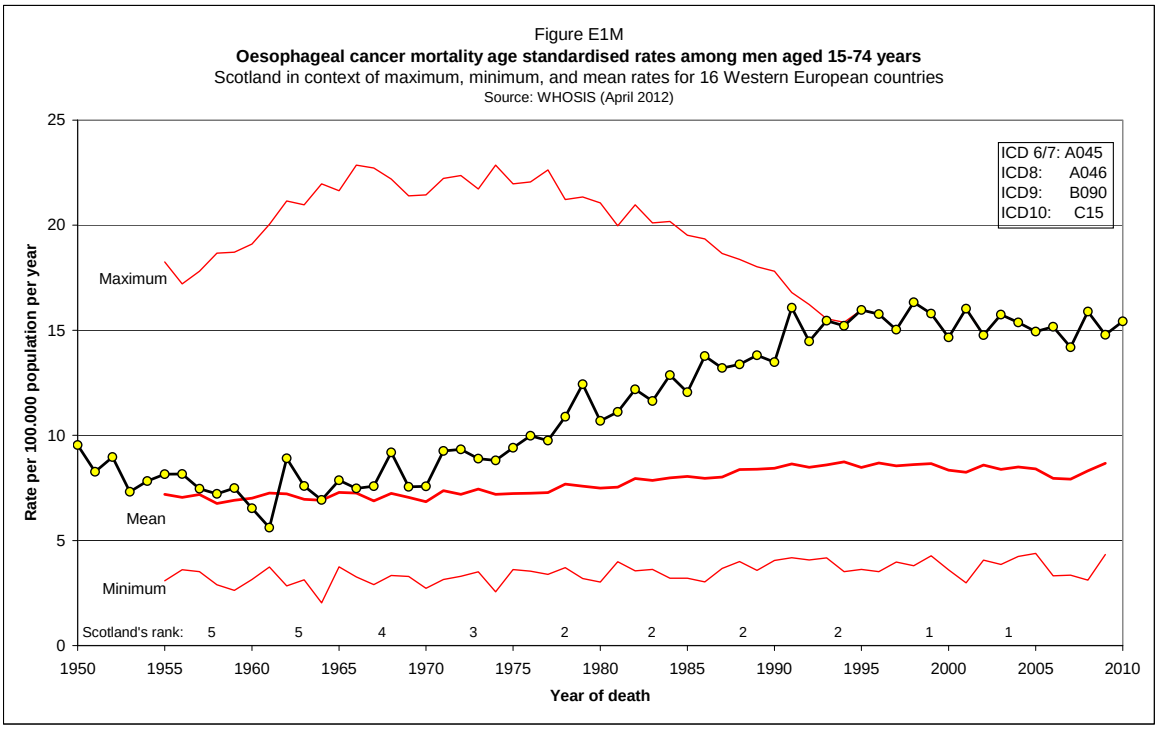
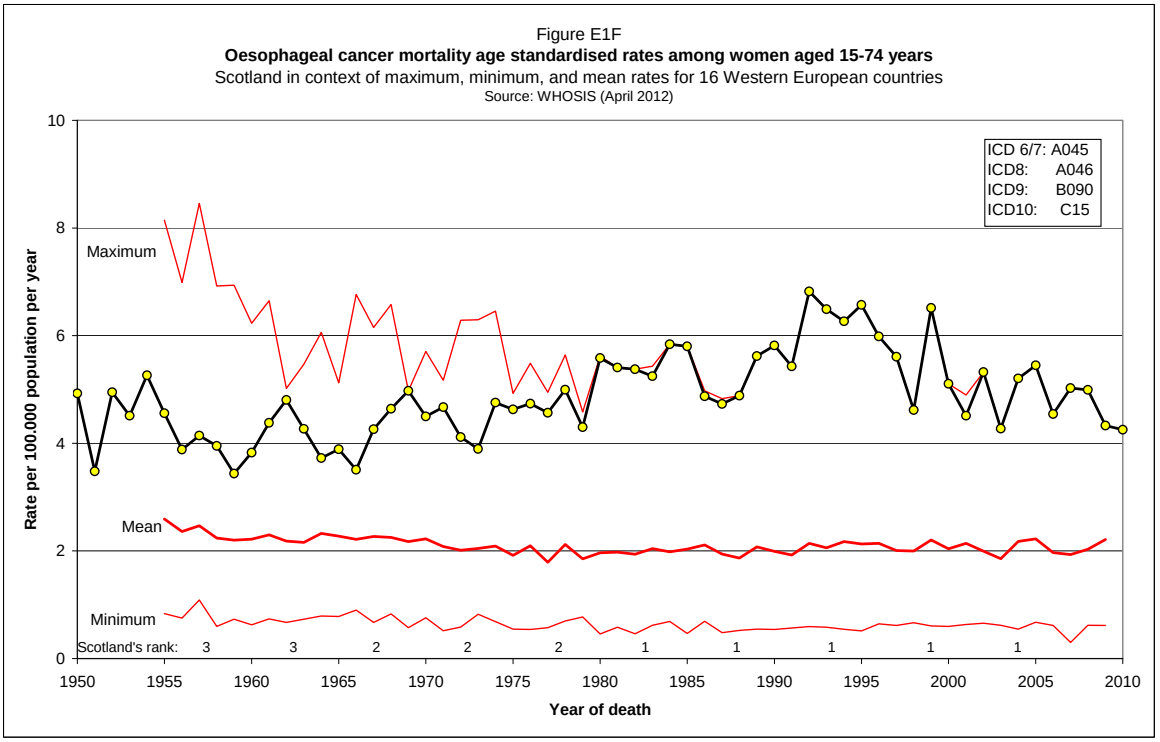


Figure E1F
Oesophageal cancer mortality age standardised rates among women aged 15-74 years
Scotland in context of maximum, minimum, and mean rates for 16 Western European countries
Source: WHOSIS (April 2012)

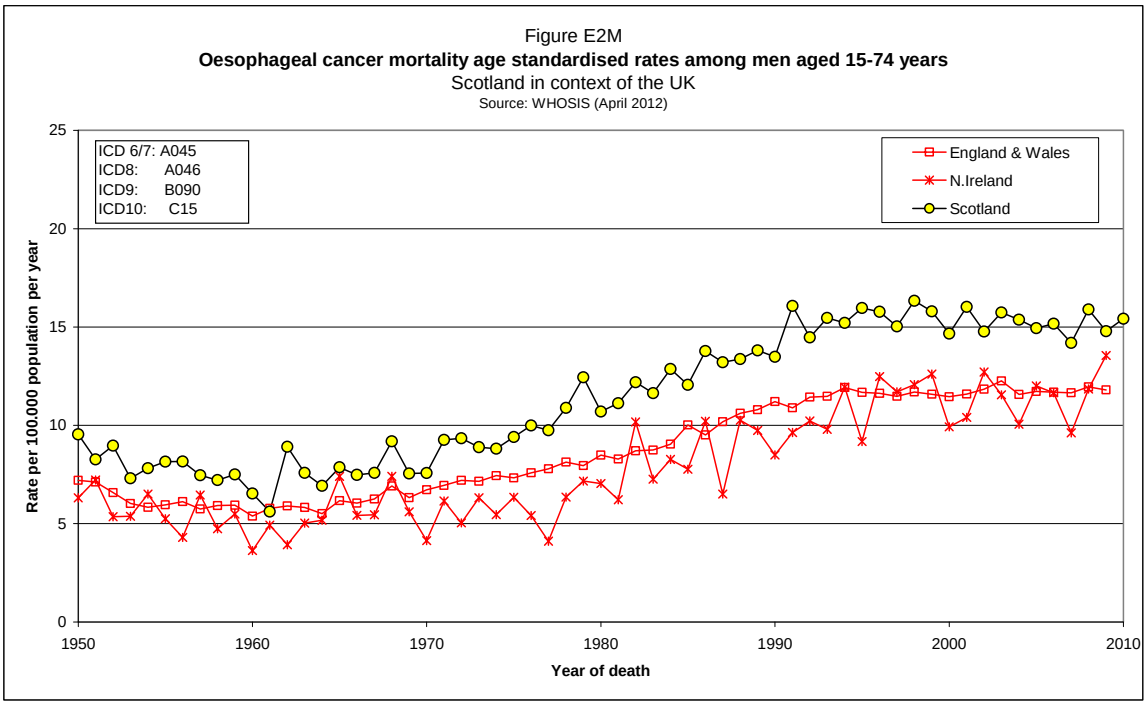


Country-specific comparisons

In men, a wide variety of trends are observed: mortality rates in England and Wales, and Northern Ireland have risen in a similar way to Scotland, but remain at a lower level (Figure E2M); in Northern Europe, rates have decreased in Finland but increased in Denmark; France and Switzerland had very high mortality rates which have fallen and are now clearly much lower than in Scotland. Rates in Ireland, Netherlands and Belgium have been increasing since the 1970s but remain lower than in Scotland. In the other countries, mortality has remained reasonably stable, with the exception of Hungary, where mortality peaked in 1997 and has since fallen to a level below that in Scotland.

In women, mortality rates in most countries have remained low and stable, albeit with year to year fluctuation. In Finland, mortality has decreased sharply and the country has gone from having the highest female oesophageal cancer mortality rate to now having one of the lowest. In contrast, oesophageal cancer mortality rates have been gradually increasing rates in the Netherlands for both sexes since the 1970s.

Figure E2M
Oesophageal cancer mortality age standardised rates among men aged 15-74 years
Scotland in context of the UK
Source: WHOSIS (April 2012)



3.2.2 Stomach cancer *(Fig F1M – F7F)*

Scottish trends

Mortality due to stomach cancer in Scotland has been steadily decreasing since 1950 for both men and women. The male rate dropped from 47.4 per 100,000 in 1950 to 7.4 in 2010, a reduction of 84%, while among women the rate dropped from 30.7 per 100,000 in 1950 to 3.1 in 2010, a reduction of 90%. In 2010, 166 men and 75 women aged 15-74 died of stomach cancer in Scotland.

Relative position in Europe

Mortality rates from stomach cancer have been steadily decreasing throughout Europe over the last 60 years and the mortality rate in Scotland has closely followed the Western European country mean rate for both men and women. In 2001-2005, male stomach cancer mortality in Scotland was fifth highest among the 16 Western European countries compared and female stomach cancer mortality was eight highest (Figures F1M and F1F).

Figure F1M

Stomach cancer mortality age standardised rates among men aged 15-74 years

Scotland in context of maximum, minimum, and mean rates for 16 Western European countries

Source: WHOSIS (April 2010)

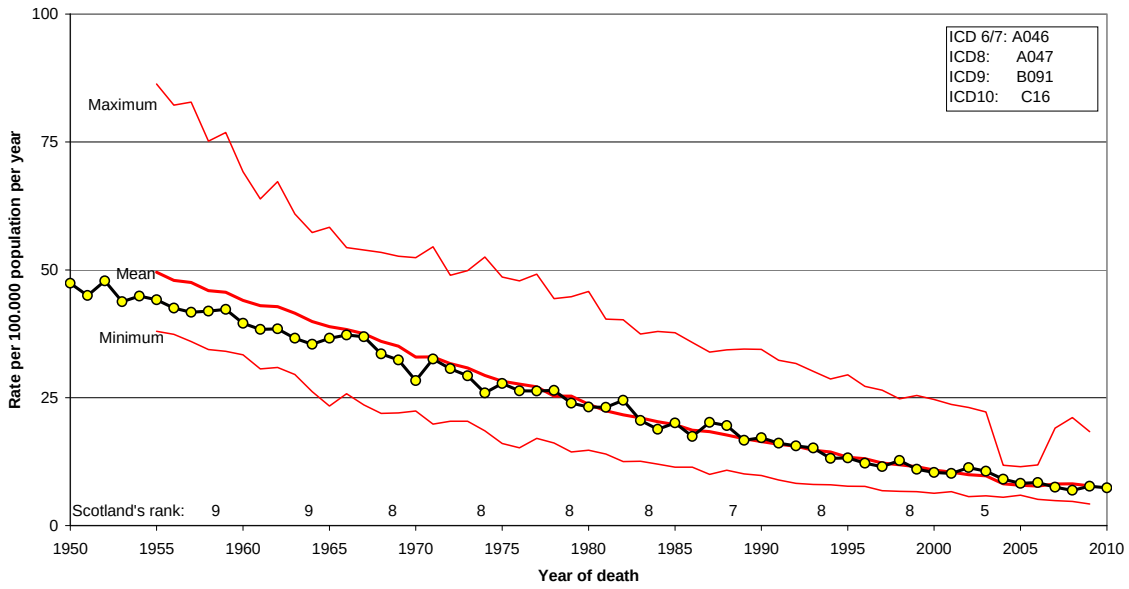
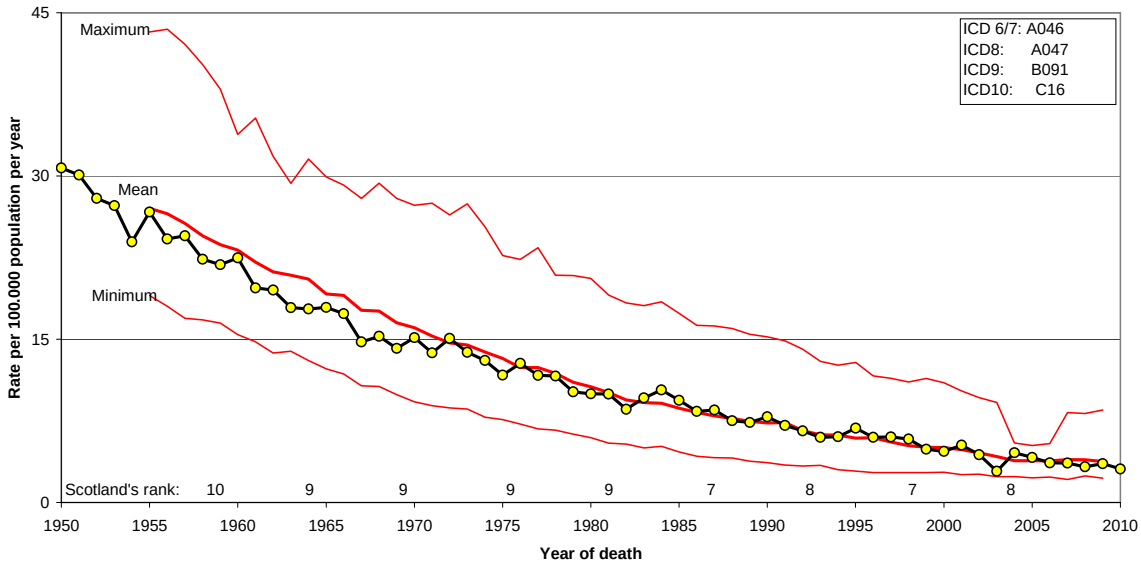


Figure F1F

Stomach cancer mortality age standardised rates among women aged 15-74 years

Scotland in context of maximum, minimum, and mean rates for 16 Western European countries

Source: WHOSIS (April 2010)



Country-specific comparisons

Mortality rates in Western European countries have reduced and converged over the last 55 years. It is notable though that Portugal and Italy both still have higher stomach cancer mortality than Scotland for both men and women. In Finland, which had very high rates in the early 1950s, there has been a large drop in mortality and from the early 1980s mortality for both men and women has been very similar to that in Scotland. In Hungary and Poland, mortality from stomach cancer for both men and women remains higher than in Scotland but has been declining in line with the trends across Western Europe.

3.2.3 Colorectal cancer *(Fig G1M – G7F)*

Scottish trends

Colorectal cancer mortality rates in men fell between 1955 and the early 1980s and after a period of stability dropped again from 2000 onwards. By 2010, the mortality rate for males had dropped by 56% compared to the rate in 1955. In women, the rate has fallen steadily since 1955 and by 2010 had dropped by 62% compared to the rate in 1955. In 2010, 392 men and 294 women (aged 15-74), respectively, died from this cause.

Relative position in Europe

The Western European country mean rose slightly for men in the 1960s and then started to decline from mid 1990 onwards, for women there has been a decline in the Western European mean since the mid 1970s. For both men and women the Scottish rate has gradually converged toward the mean. To illustrate this, the Scottish mortality rate for males was 82% above the Western European mean in 1955 but by 2009 was only 9% above the mean. In line with these trends, Scotland's relative ranking in terms of colorectal cancer mortality has improved for both men and women.

Up until the early 1970s, Scottish colorectal cancer mortality rates were the highest in Western Europe for men and women. However, by 2001-2005 Scotland had the fourth highest male mortality rate among the comparator countries and the fifth highest rate of female mortality. Although comparisons cannot be made across the full range of countries for more recent years, it looks likely that because of further reductions in Scottish mortality, particularly among men, Scotland's relative position may improve further (Figures G1M & G1F).

Figure G1M
Colorectal cancer mortality age standardised rates among men aged 15-74 years
Scotland in context of maximum, minimum, and mean rates for 16 Western European countries
Source: WHOSIS (April 2012)

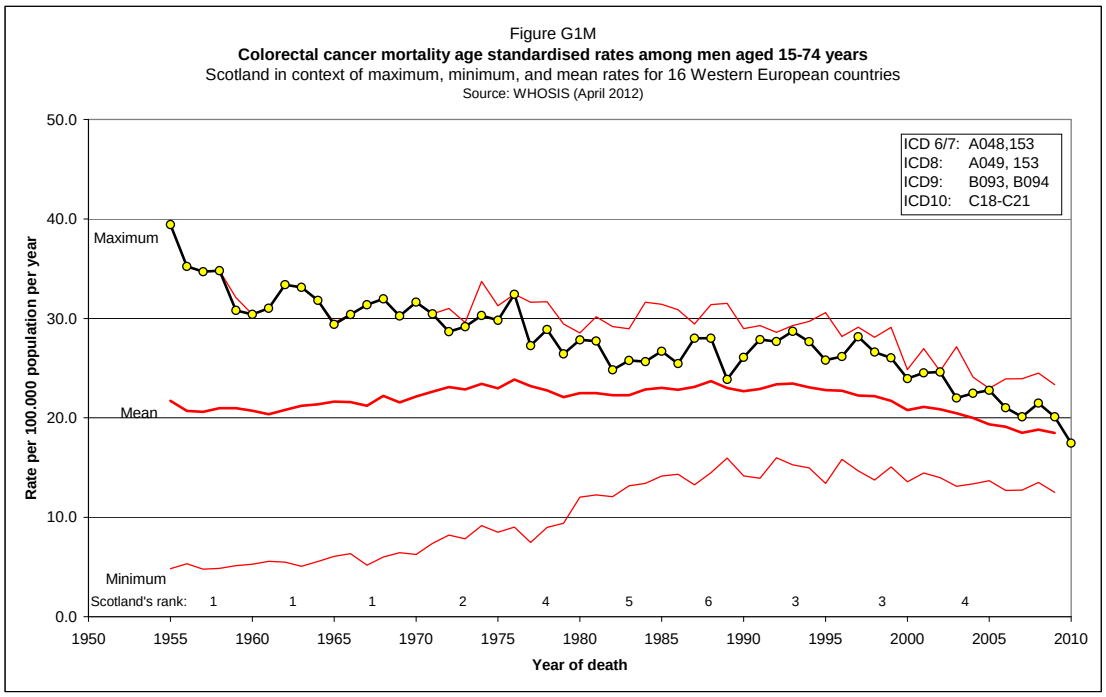


Figure G1F
Colorectal cancer mortality age standardised rates among women aged 15-74 years
Scotland in context of maximum, minimum, and mean rates for 16 Western European countries
Source: WHOSIS (April 2012)

Country-specific comparisons

In recent years, Scottish male colorectal cancer mortality rates among the working age population have been lower than Danish, Irish and Portuguese rates. Among women, mortality rates in Denmark and Norway have been consistently higher than the Scottish rate in more recent years. Male colorectal cancer mortality rates in Hungary and Poland have risen since the 1960s, particularly among men, and Hungarian rates are now much higher than Scottish rates.

3.2.4 Pancreatic cancer *(Fig H1M – H7F)*

Scottish trends

Mortality due to cancer of the pancreas in men rose from 1955 to a peak in the early 1970s, and with the exception of another isolated peak in 1977 has declined steadily since. By 2010, pancreatic cancer mortality among males in Scotland had declined to the same level it had been at in 1955. There has been a similar, if less pronounced, upward and then downward trend in female mortality, which in 2010 was 7% lower than it had been in 1955. In 2010, 198 men and 157 women (aged 15-74), died from this disease.

Relative position in Europe

The Western European country mean has also shown a pattern of increase followed by a slight decrease among men, while for women an initial slight increase has given way to a stable mean rate. The mortality rate among Scottish men, which was above the average from the 1950s to the mid 1970s, converged to the Western European mean and since the early 1990s has been below this mean. The pancreatic cancer mortality rate for Scottish women converged towards the Western European country mean in the late 1980s and early 1990s and has since fluctuated close to this mean.

For both men and women, Scotland has improved its rank position relative to other Western European countries: male pancreatic cancer mortality in Scotland was ranked third highest of the countries compared in 1956-1960, but only twelfth highest in 2001-2005; the ranking of female mortality over the same period shifted from second to ninth highest (Figures H1M & H1F).

Figure H1M

Pancreatic cancer mortality age standardised rates among men aged 15-74 years

Scotland in context of maximum, minimum, and mean rates for 16 Western European countries

Source: WHOSIS (April 2012)

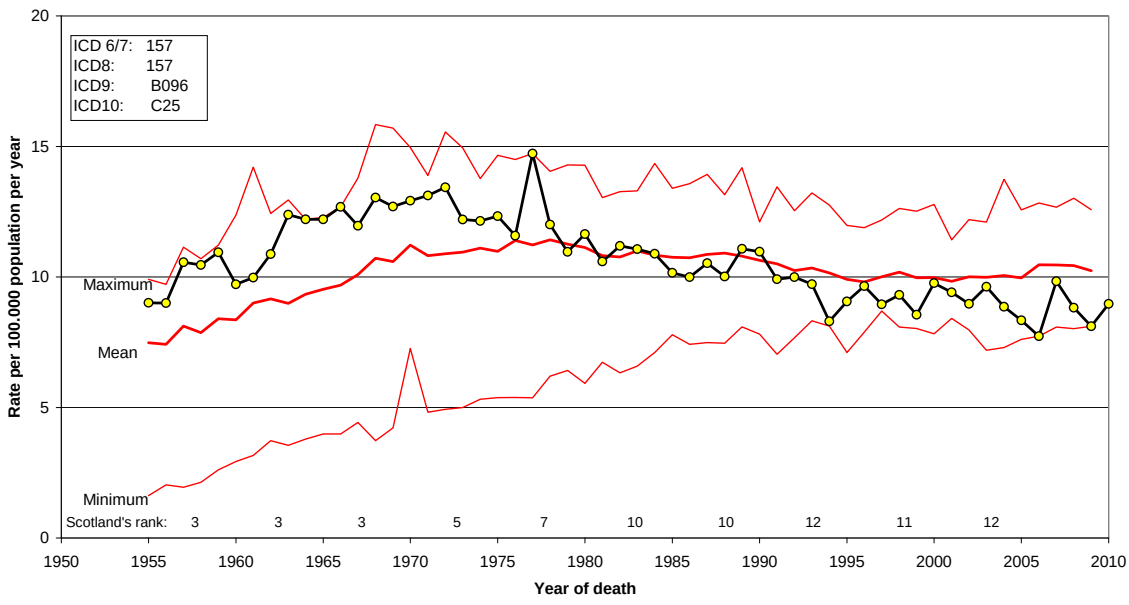
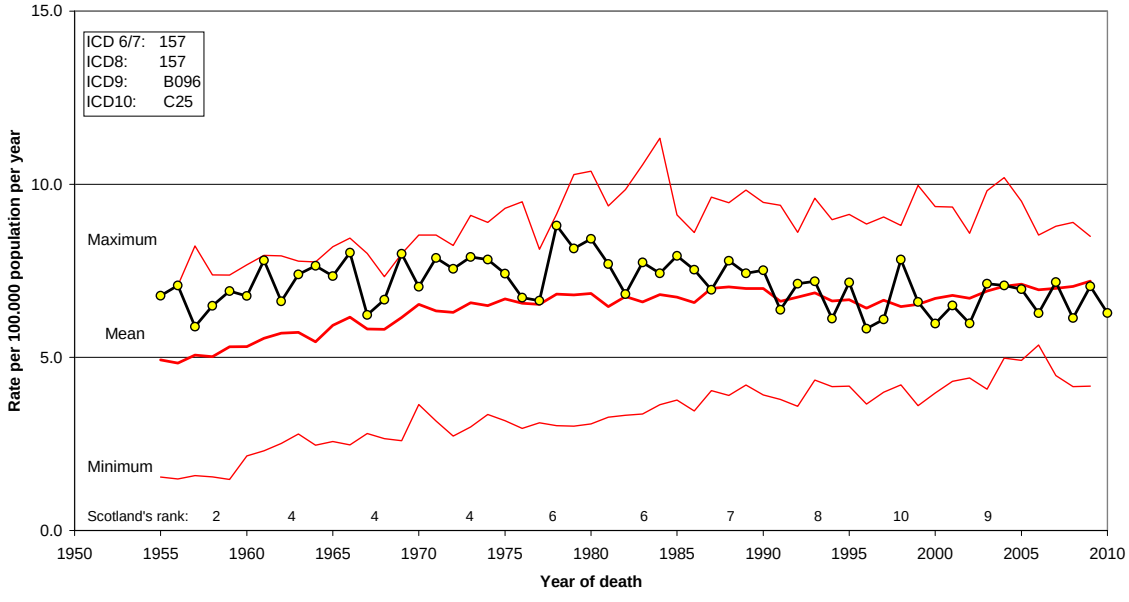


Figure H1F

Pancreatic cancer mortality age standardised rates among women aged 15-74 years

Scotland in context of maximum, minimum, and mean rates for 16 Western European countries

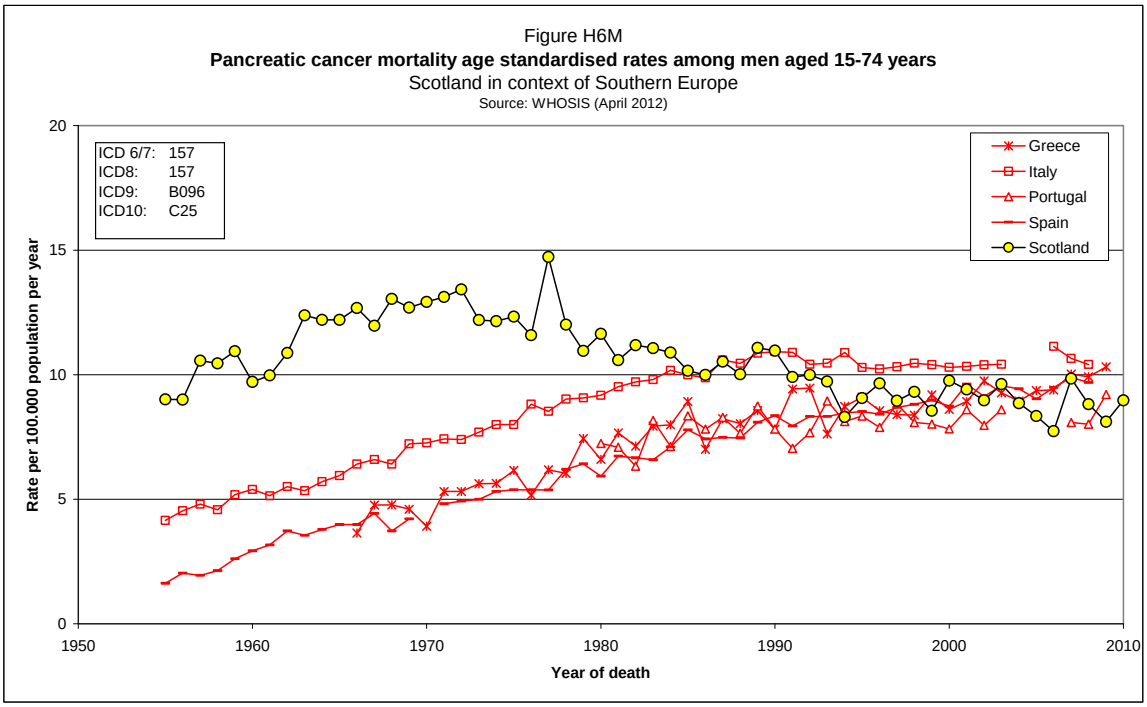
Source: WHOSIS (April 2012)



Country-specific comparisons

These changes are partly as a consequence of steady increases in mortality in Southern European countries (Figure H6M), and less pronounced increases in countries such as Austria and Germany. Scottish mortality rates for both sexes are very similar to the rates in England and Wales.

Figure H6M
Pancreatic cancer mortality age standardised rates among men aged 15-74 years
Scotland in context of Southern Europe
Source: WHOSIS (April 2012)



3.2.5 Lung cancer *(Fig I1M – I7F)*

Scottish trends

Male and female lung cancer mortality rates display distinct trends. Mortality from lung cancer in men has declined from peak levels between the mid 1960s and the end of the 1970s. By 2010, the male lung cancer mortality rate was 23% lower than in 1950 and was 60% of its level in 1979 (one of the last peak years for lung cancer mortality among Scottish men) (Figure I1M). The trend in women is very different to this. The female lung cancer mortality rate rose steadily from the 1950s, stabilised at the beginning of the 1990s and has shown no sign of reduction since (Figure I1F). This represents approximately a 25 year peak for female lung cancer mortality. In comparison, the period over which male lung cancer mortality peaked – approximately 15 years between 1964 and 1979 – was much shorter. The female lung cancer rate in 2010 was more than three times the rate in 1950. In 2010, there were 1175 deaths from lung cancer among 15-74 year old men in Scotland and 1062 deaths among women.

Relative position in Europe

Like the Scottish trend, the Western European country mean for men also shows an increase followed by decrease over the period studied. Scotland's male mortality peaked earlier than the Western European mean, and there is now a pronounced downward convergence of the Scottish rate towards the Western European mean. In 1955, Scotland's male lung cancer mortality rate was twice the Western European mean, but by 2009 the Scottish rate was only 33% higher.

The Western European country mean for female lung cancer mortality has been increasing, but at a much slower pace than in Scotland, resulting in a very marked divergence of the Scottish rate away from the mean, from the 1960s to early 1990s. More recently, as the Scottish rate has plateaued and the Western European mean has continued to rise, the gap has narrowed slightly. In 2009, Scottish female mortality from lung cancer in this age group was 72% higher than the Western European mean.

For male lung cancer mortality, Scotland's relative position has improved slightly. In the period 2001-2005, the Scottish male mortality rate was the second highest among the Western European countries compared and in individual years from 2003 onwards Scottish male mortality has been ranked third or fourth highest. Scotland's ranking looks likely to improve further if current trends continue. The situation for female lung cancer

mortality in Scotland is much less encouraging. Scotland has had the highest or second highest lung cancer mortality in Western Europe for women for the last 50 years.

Figure I1M
Lung cancer mortality age standardised rates among men aged 15-74 years
Scotland in context of maximum, minimum, and mean rates for 16 Western European countries
Source: WHOSIS (April 2012)

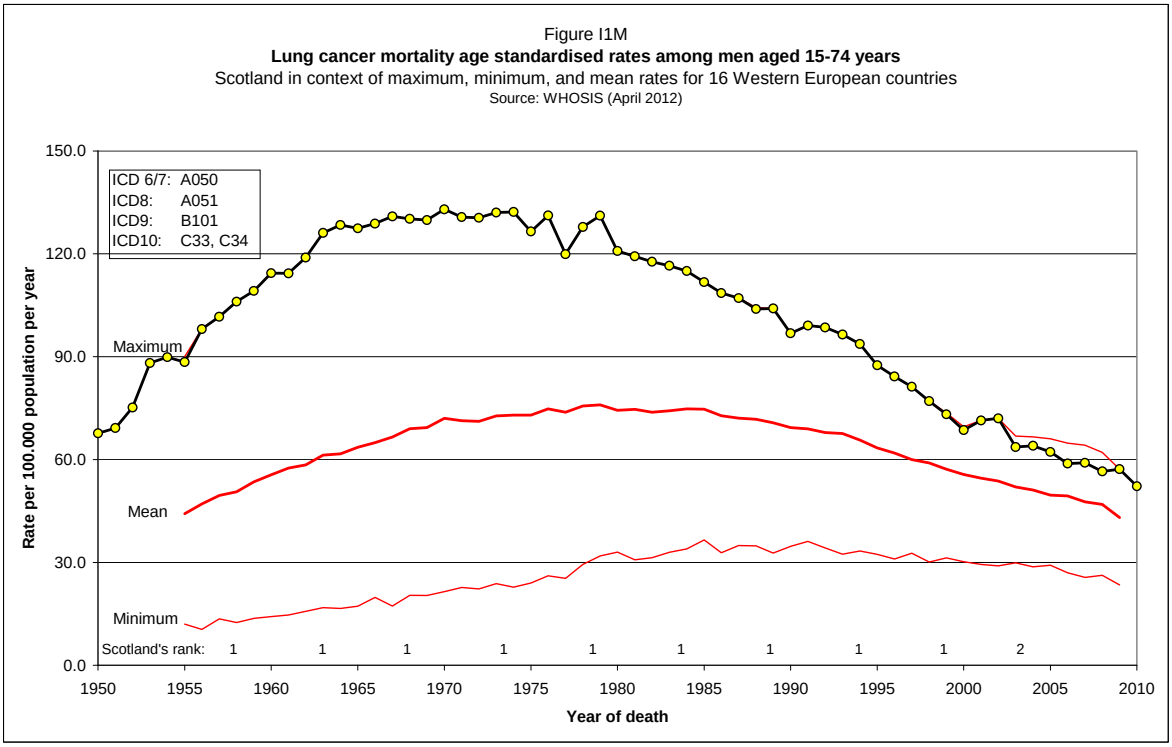
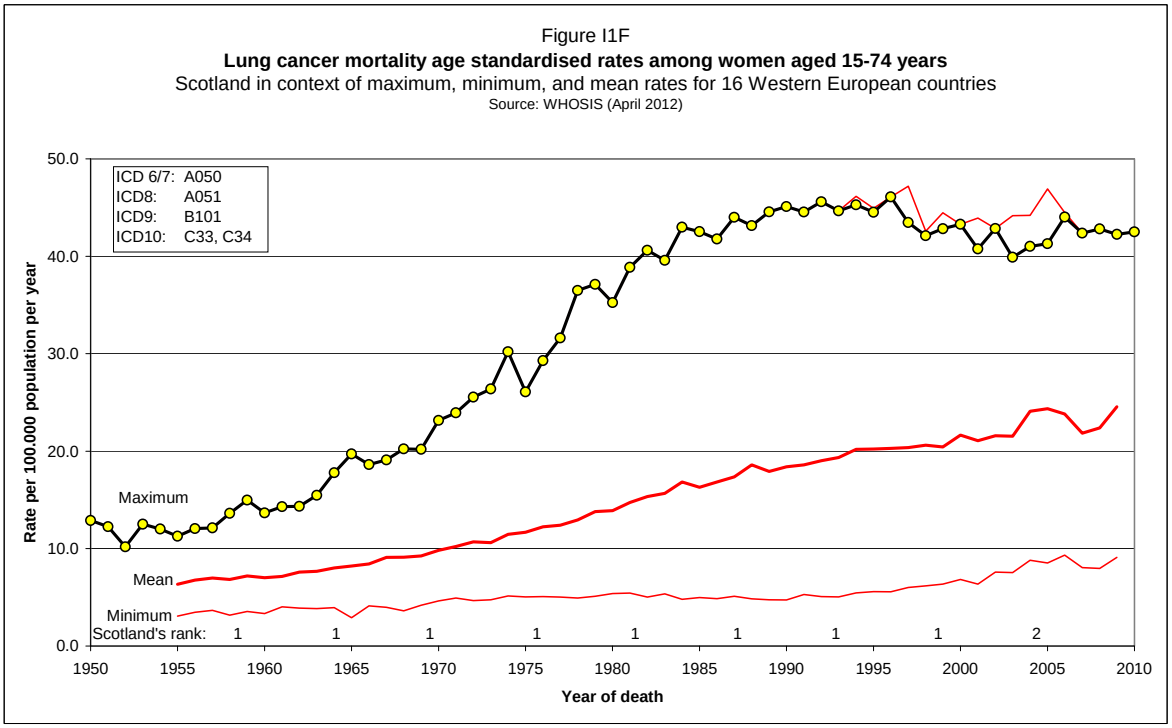


Figure I1F
Lung cancer mortality age standardised rates among women aged 15-74 years
Scotland in context of maximum, minimum, and mean rates for 16 Western European countries
Source: WHOSIS (April 2012)



Country-specific comparisons

The gap in male lung cancer mortality between Scotland and many other countries has narrowed, in tandem with mortality rates dropping. The Scottish male lung cancer mortality rate dipped below the rates in France, Spain and Greece in 2003, appears to be lower than in Belgium (although there are only a few years to compare), looks likely to drop below the Danish rate beyond 2006 (where comparisons stop) if current trends continue, and, by 2010, had reduced to a level close to the rates in Austria and Germany.

A different set of trends is apparent in Hungary and Poland where male mortality rates climbed steeply from the 1960s into the 1990s and, while now dropping, remain notably higher than the Scottish mortality rate.

Although Scottish female lung cancer mortality rates have stabilised, there is currently no sign of a drop in mortality. The gap between Scotland and some other countries has narrowed because lung mortality in some countries is rising. For example, lung cancer mortality rates in Denmark and Scotland have been very similar since the mid 1990s, after steep rises in preceding years in Denmark. The trend in female lung cancer mortality in the Netherlands, France, Germany, Austria, Poland and Hungary is upward leading to a narrowing of the gap with Scottish rates. In 2009 the rates in Hungary slightly exceeded those in Scotland.

3.2.6 Breast cancer *(Fig J1F – J7F)*

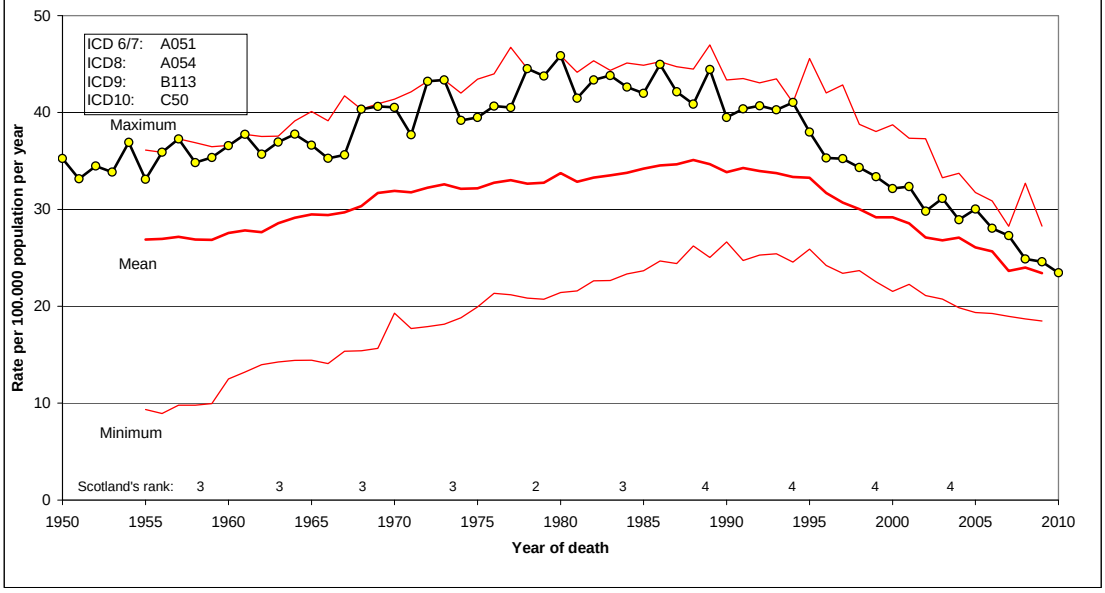
Scottish trends

Female breast cancer mortality rates in Scotland increased up until the mid 1980s. Since the mid 1990s, rates have been falling steeply. By 2010, the Scottish mortality rate (23.5 per 100,000) was 33% lower than in 1950. In 2010, there were 550 female deaths from breast cancer among 15-74 year olds in Scotland.

Relative position in Europe

The Western European country mean has followed a similar trajectory to Scotland's: rising to a peak in the late 1980s and then declining. Since the mid 1990s, Scotland's mortality from breast cancer has dropped more rapidly than in many other countries, resulting in a trend toward convergence with the Western European country mean (Figure J1F). In the period 2001-2005, Scottish female breast cancer mortality was fourth highest among the 16 Western European countries compared.

Figure J1F
Breast cancer mortality age standardised rates among women aged 15-74 years
Scotland in context of maximum, minimum, and mean rates for 16 Western European countries
Source: WHOSIS (April 2012)



Country-specific comparisons

Scottish rates are not the highest in Western Europe, but as noted above are above average. Mortality rates in Scandinavian countries (excluding Denmark), in Austria and Switzerland, and in most Southern European countries are still considerably lower than in Scotland. However, the mortality rates of other parts of the UK, France, Germany and Italy are now at a similar level to the Scottish rate and in recent years Scottish female

breast cancer mortality has been lower than in Denmark, the Netherlands, Ireland and Hungary.

3.2.7 Ischaemic heart disease (IHD) *(Fig K1M – K7F)*

Scottish trends

Mortality rates for IHD in men increased from the 1950s, reached a plateau in the mid 1960s until the late 1970s, and then started to decline at a steady rate. By 2009, male IHD mortality was at 97.1 per 100,000, 72% lower then the rate in 1950. The mortality trend for women has been different. Over the last 60 years, the female IHD mortality rate has been in intermittent decline. This trend has become more marked since the late 1970s. By 2009, female mortality had dropped by 83% from its level in 1950 to 33.1 per 100,000. In 2010, 2,142 men and 839 women (aged 15-74), died from this cause.

Relative position in Europe

From the 1950s to the 1970s, Scottish male IHD mortality rates, while higher overall, ran in parallel to the Western European country mean, which peaked in the 1970s. Over the last 30 years the Scottish rate, while remaining the highest in Western Europe, has been converging toward the Western European mean; the gap has narrowed from Scotland being 73% higher than the mean in 1955 to 39% higher in 2009. Despite this, Scotland has had the highest male IHD mortality among the 16 Western European countries compared since 1989 (Figures K1M and K1F).

Figure K1M
Ischaemic heart disease mortality age standardised rates among men aged 15-74 years
Scotland in context of maximum, minimum, and mean rates for 16 Western European countries
Source: WHOSIS (April 2012)

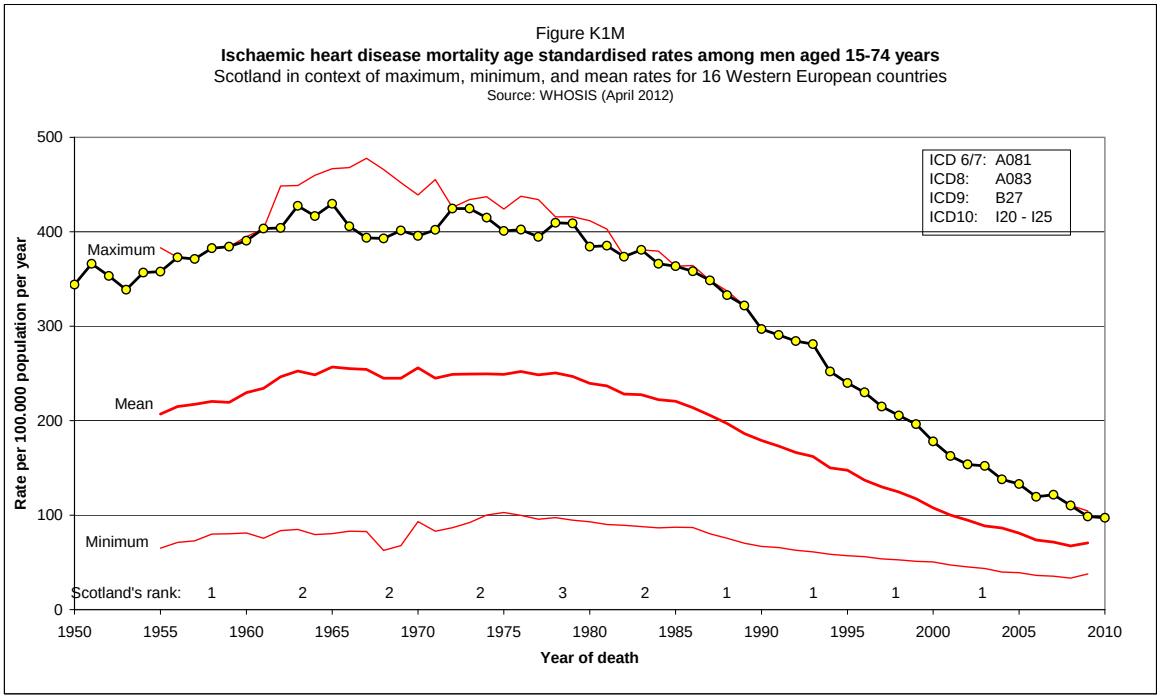
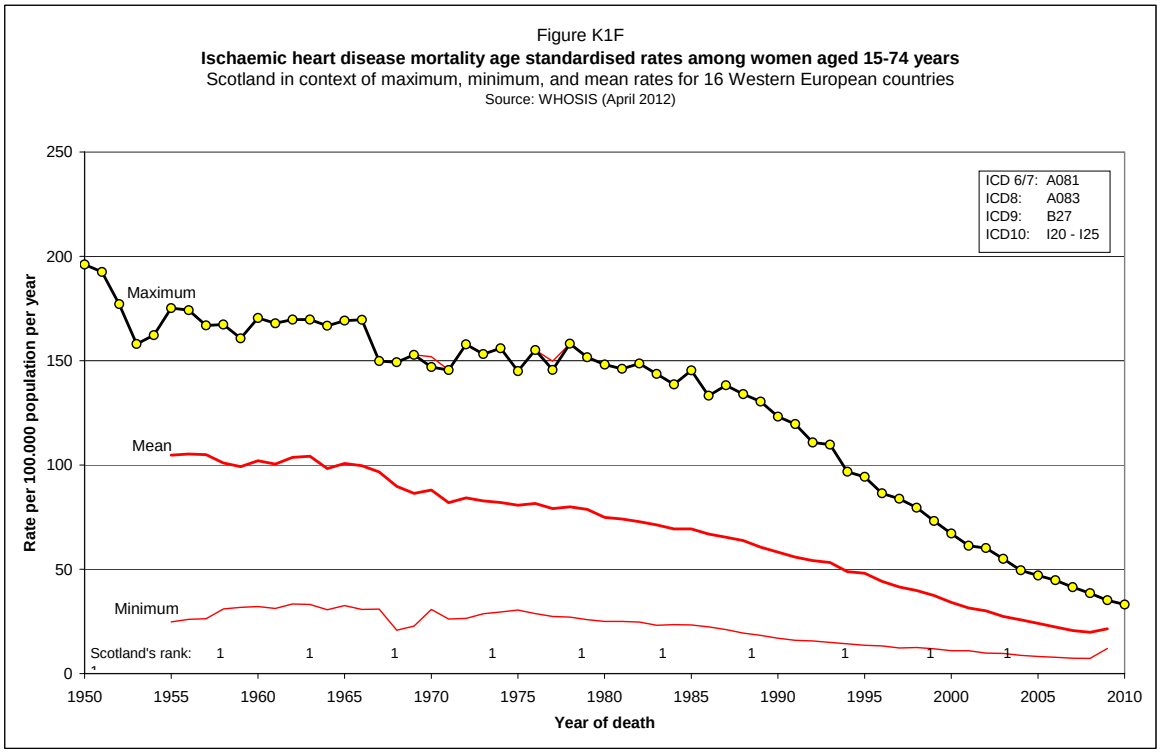


Figure K1F

Ischaemic heart disease mortality age standardised rates among women aged 15-74 years

Scotland in context of maximum, minimum, and mean rates for 16 Western European countries

Source: WHOSIS (April 2012)



For women, the Western European mean slowly fell from the 1950s onwards while the (higher) Scottish rate remained stable until the late 1970s, leading to a divergence in the two curves. The Scottish rate then started to fall and it has been converging with the Western European mean since the early 1980s. The extent of Scotland's excess IHD mortality among women, compared to the Western European mean, has fluctuated over the last 55 years, but in 2009 the Scottish rate was 64% higher than the mean. IHD mortality among working age Scottish women has been the highest among the 16 Western European countries compared for the last 55 years.

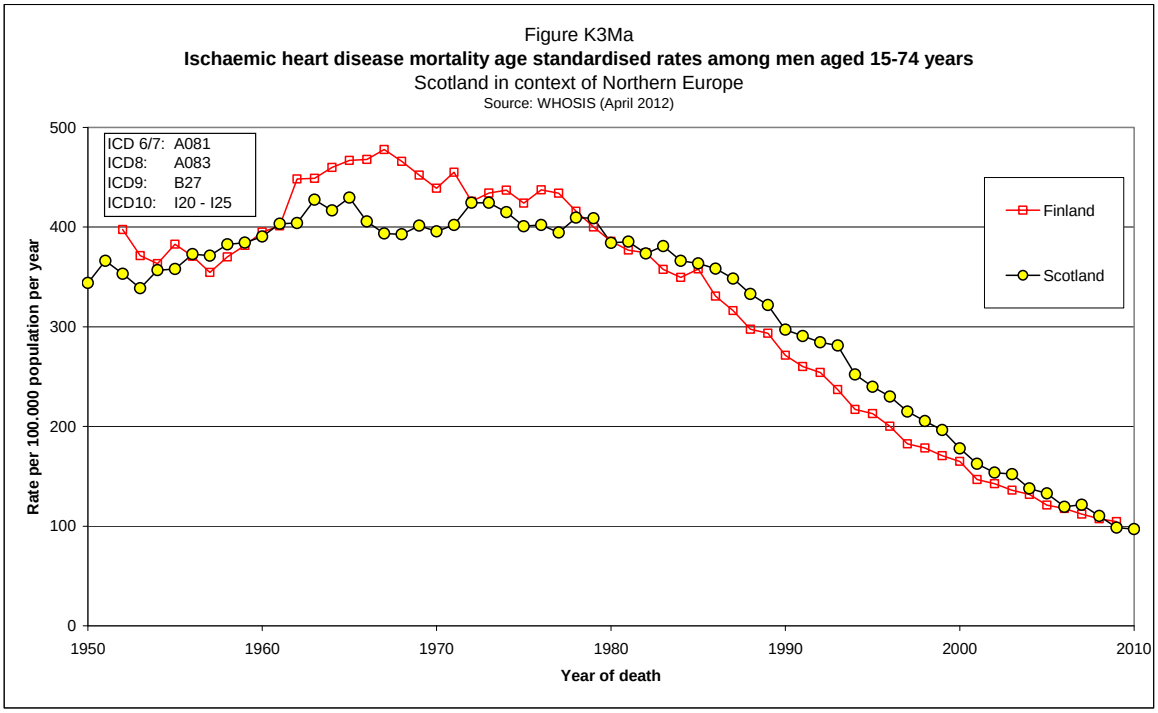
Country-specific comparisons

Among men, the Scottish mortality rate has been higher than that in England and Wales throughout the period studied, and much higher than in the majority of Scandinavian countries with the exception of Finland. The Finnish rate was higher than the Scottish rate for most of the 1960s and up to the late 1970s, when the Finnish rate dipped below Scotland's. Most recently, in 2009, the Finnish rate was again slightly higher than Scotland's (Figure K3Ma). In 2009, the Scottish rate was only marginally higher than that in Ireland and the gap between Scotland and the Germanic countries and countries of Southern Europe had narrowed notably compared with earlier decades.

While Scottish IHD mortality rates in women have consistently been the highest in Western Europe since the 1950s, the gap in mortality between Scottish rates and those in the majority of other Western European countries has narrowed in the last 30-40 years.

In Eastern Europe, Polish rates have been close to Scottish rates for both sexes since 1999, while Hungarian rates for both men and women overtook the Scottish rates in the mid 1990s.

Figure K3Ma
Ischaemic heart disease mortality age standardised rates among men aged 15-74 years
Scotland in context of Northern Europe
Source: WHOSIS (April 2012)



3.2.8 Cerebrovascular disease *(Fig L1M – L7F)*

Scottish trends

There has been a steady downward trend in cerebrovascular disease mortality among working age men and women in Scotland over the last 60 years. Male mortality in 2010 was 18% of the 1950 level, while for women the mortality rate in 2010 was 12% of the rate in 1950. In 2010, 526 men and 416 women (aged 15-74) died from this cause.

Relative position in Europe

The Western European country mean rate has been declining for both men and women for this cause for the last 55 years. At the same time Scottish mortality rates have been gradually converging with the Western European mean. For example, in 1955, Scottish male mortality from this cause was 34% higher than the Western European average and by 2009 this gap had narrowed to 18% (Figure L1M). Among women, there has also been a gradual convergence toward the Western European country mean, although the relative gap in mortality (as opposed to the absolute gap) has not narrowed. In 2009, cerebrovascular disease mortality among working age women in Scotland was 44% higher than the Western European average compared to 39% higher in 1955 (Figure L1F).

Despite these trends, Scotland's mortality ranking among the 16 Western European countries compared has remained unchanged: Scottish male and female mortality from cerebrovascular disease has been the second highest in Western Europe - second only to Portugal – over the last 55 years.

Figure L1M

Cerebrovascular disease mortality age standardised rates among men aged 15-74 years

Scotland in context of maximum, minimum, and mean rates for 16 Western European countries

Source: WHOSIS (Dec 2012)

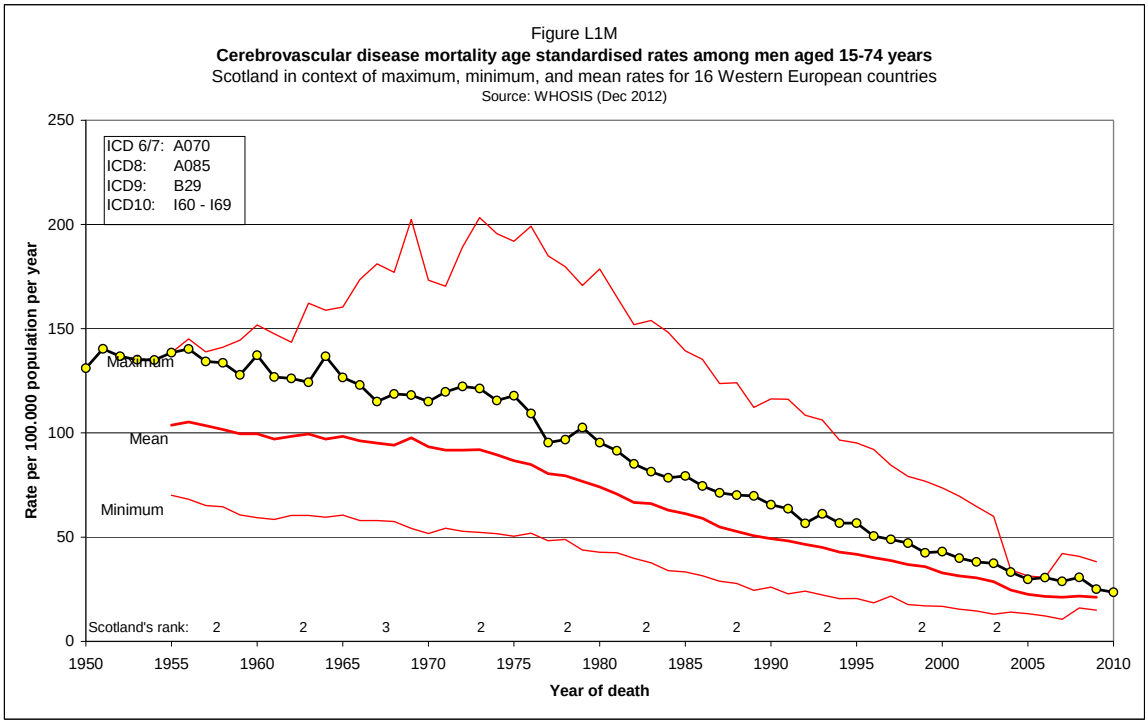
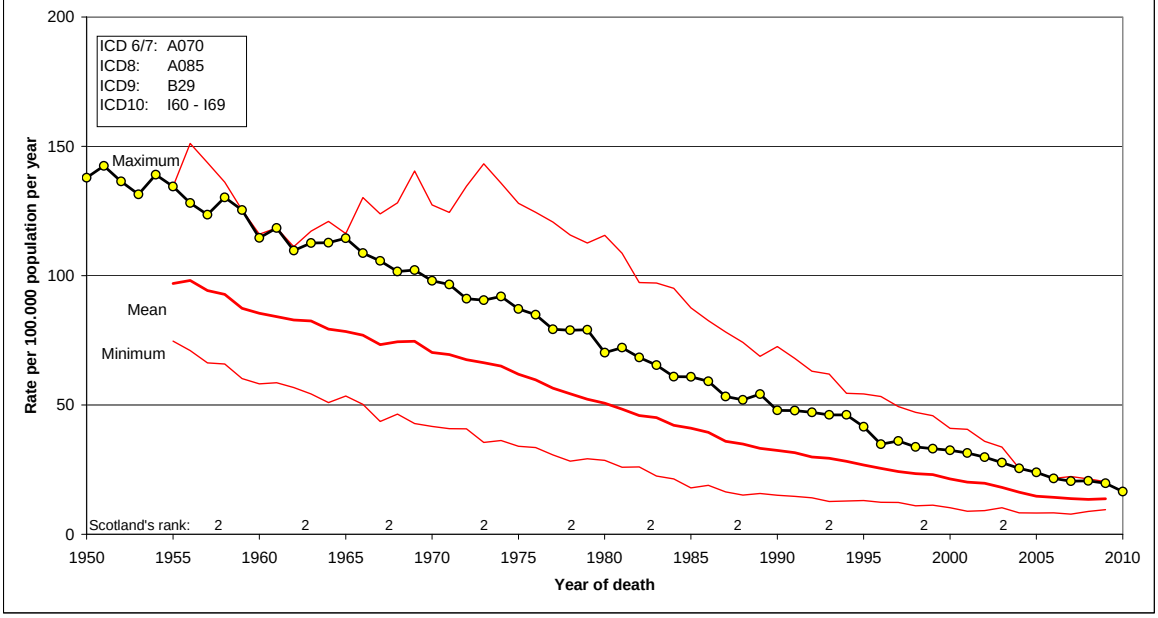


Figure L1F

Cerebrovascular disease mortality age standardised rates among women aged 15-74 years

Scotland in context of maximum, minimum, and mean rates for 16 Western European countries

Source: WHOSIS (Dec 2012)



Country-specific comparisons

There has been a general narrowing of the mortality gap with other countries for both sexes. Notably, in 2009, male mortality in Finland slightly exceeded the Scottish rate and from the late 1990s the mortality rates for males in Greece (not included in the 16 country comparison shown in Figure L1M) have exceeded those for Scotland.

Cerebrovascular disease mortality rates for males and females in Hungary and Poland have been reducing but remain considerably higher than Scottish rates.

3.2.9 Chronic Obstructive Pulmonary Disease (COPD) *(Fig M1M – M7F)*

Scottish trends

Following a peak in around 1963, mortality due to COPD in men started a long period of decline. In 1963, the Scottish male mortality rate was 110.4 per 100,000, but by 2010 the rate had dropped to 19.7 per 100,000, representing a reduction of 82% from the level in 1963. The pattern for women was very different, with a slight rise from 1955 to 1970, followed by a relatively flat trend since (ignoring occasional year to year fluctuations). In 2010, 448 men and 575 women (aged 15-74) died from this cause.

Relative position in Europe

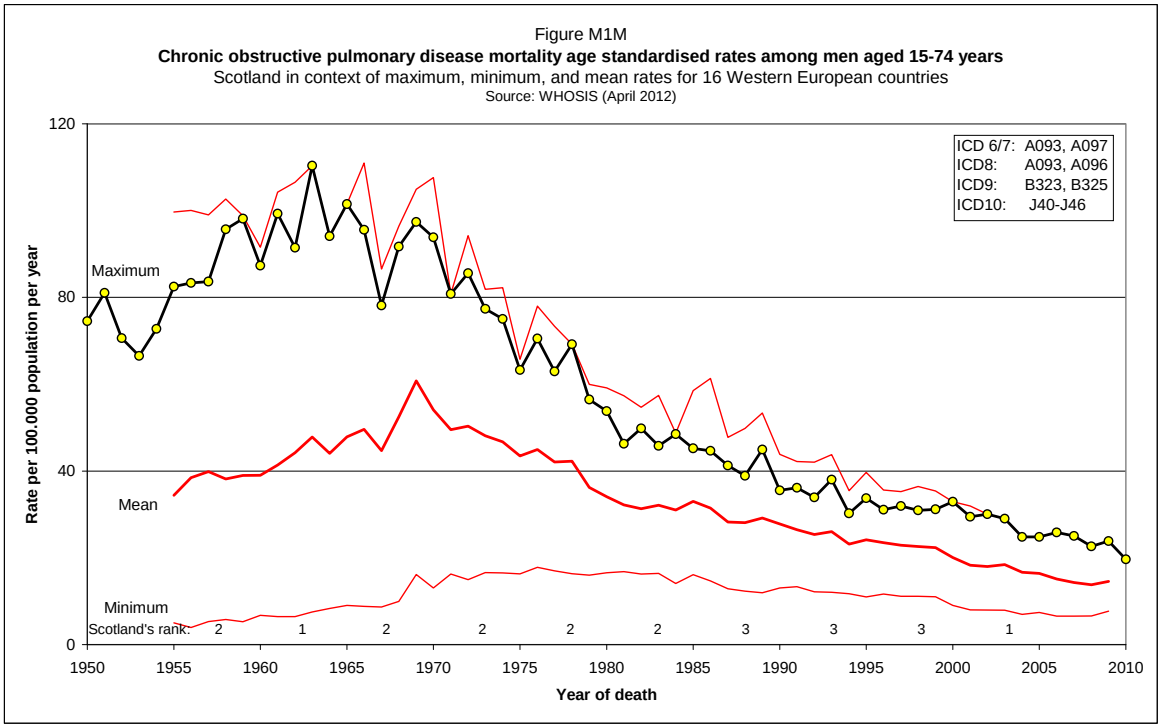
In men, the Western European country mean rate has been falling since 1969. However, the Scottish rate has been consistently higher, and despite some convergence towards the Western European mean, Scotland's relative ranking overall has deteriorated. Scotland has had the highest rate of male mortality from COPD in Western Europe, since 2000 barring one year (Figure M1M). For women, the Western European mean COPD mortality rate has remained relatively stable, while the Scottish rate has risen since the early 1970s leading to a worsening in Scotland's position relative to other countries (Figure M1F). Scotland has had the second highest rate of female COPD mortality in Western Europe since 1993 and the highest rate since 2007, although only a smaller subset of countries can be compared from this year onward.

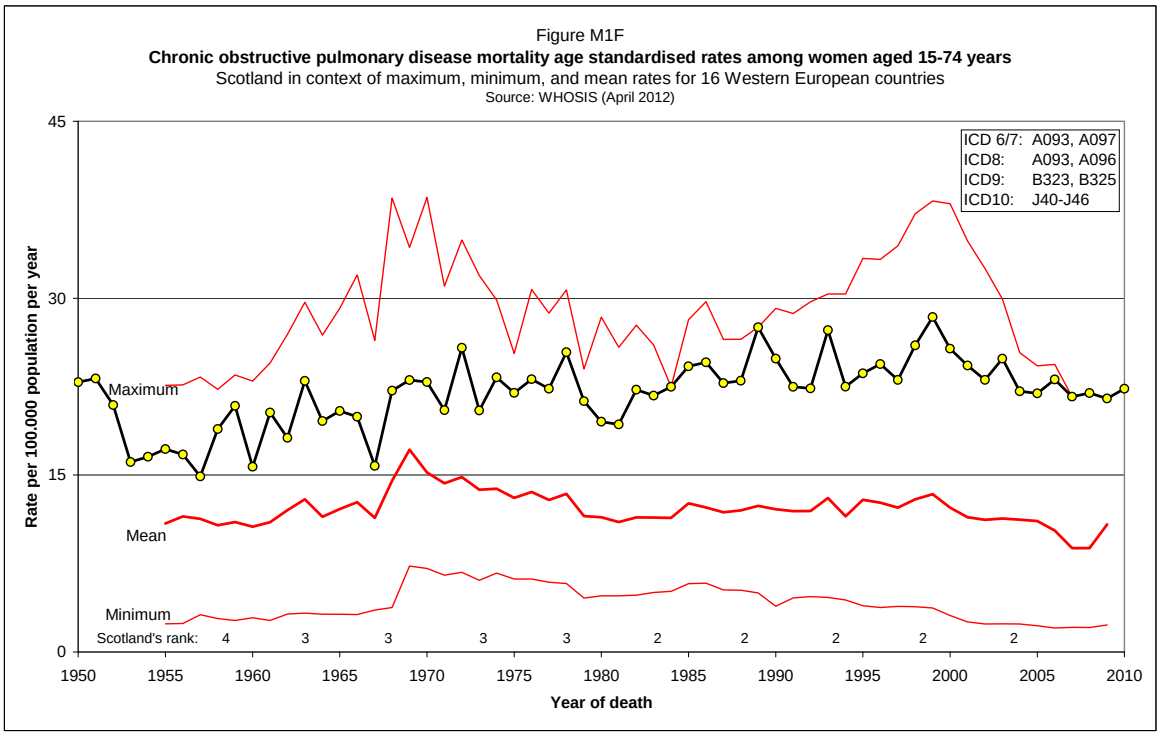
Figure M1M

Chronic obstructive pulmonary disease mortality age standardised rates among men aged 15-74 years

Scotland in context of maximum, minimum, and mean rates for 16 Western European countries

Source: WHOSIS (April 2012)





Country-specific comparisons[xiii]

Among men, Scotland has had one of the highest mortality rates from this cause of any of the comparator countries in Western Europe. Despite a narrowing of the European gap in male mortality from this cause, most notably between Scotland and the Scandinavian and German countries, Scottish rates have remained higher. Rates for Scottish men have been close to those in Northern Ireland and England and Wales since 1970.

Among women, Scotland has also had one of the highest COPD mortality rates in Western Europe over most of the period studied. In 2009, Scottish rates were approximately 50% higher than the rates in England and Wales, two to three times higher than the rates in the Central European countries (Germany, Switzerland and Austria) and many times greater than the rates in Southern European countries. Danish rates are, however, comparable to the Scottish rates. Rates in Denmark increased very steeply from the early 1970s and despite dropping from 2000, remained higher than Scottish rates in 2006 – the last year for which we have a comparison.

3.2.10 Chronic liver disease, including cirrhosis[xiv] *(Fig N1M – N7F)*

Scottish trends

Scottish mortality rates from chronic liver disease were essentially static between 1950 and the early 1970s. From the 1970s onward, mortality for both sexes increased significantly and by 2000 male mortality was six times the rate it had been in 1950 while female mortality was five times the rate. The steepest rise in mortality happened in a relatively short 10-11 year period from 1992, when male mortality nearly trebled and female mortality rates doubled. However in more recent years there have been reductions: male mortality in 2010 had dropped by 21% from 2002 levels, while for

[xiii] No Swiss data available from 1995 onwards due to their use of an aggregated ICD10 coding scheme which makes it impossible to calculate mortality for this cause on the same basis as for other countries.
[xiv] In the previous report this section was labelled 'Liver Cirrhosis', but in this report has been renamed as 'Chronic liver disease, including cirrhosis' in line with the definition used by NCHOD (National Centre for Health Outcomes Development) – see http://www.nchod.nhs.uk/

women mortality had reduced by 27% from a peak in 2006. In 2010, 613 men and 286 women (aged 15-74) died from this cause in Scotland.

Relative position in Europe

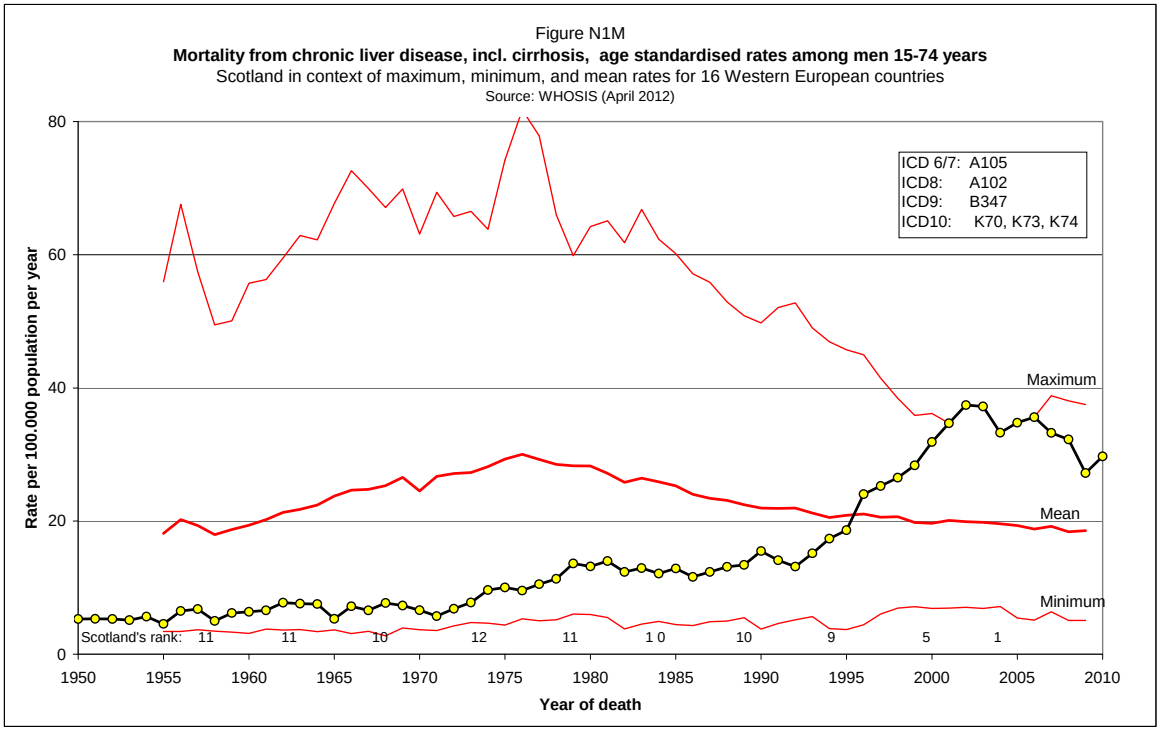
The Western European mean rates for men and women have exhibited similar patterns – with slight upward trends that peaked in the mid-1970s, followed by a gradual decline. This trend, together with the steep rise in Scottish chronic liver disease mortality until the mid 2000s, resulted in Scotland's rank position deteriorating dramatically from the mid 1990s onwards. Scottish male mortality from this cause became the highest in Western Europe in 2001, although since 2007 Scotland has moved down in ranking slightly due to a drop in mortality in Scotland and rises in two other countries. Female mortality in Scotland rose to be the highest in Western Europe in 1998 and has stayed in that position since (Figures N1M and N1F).

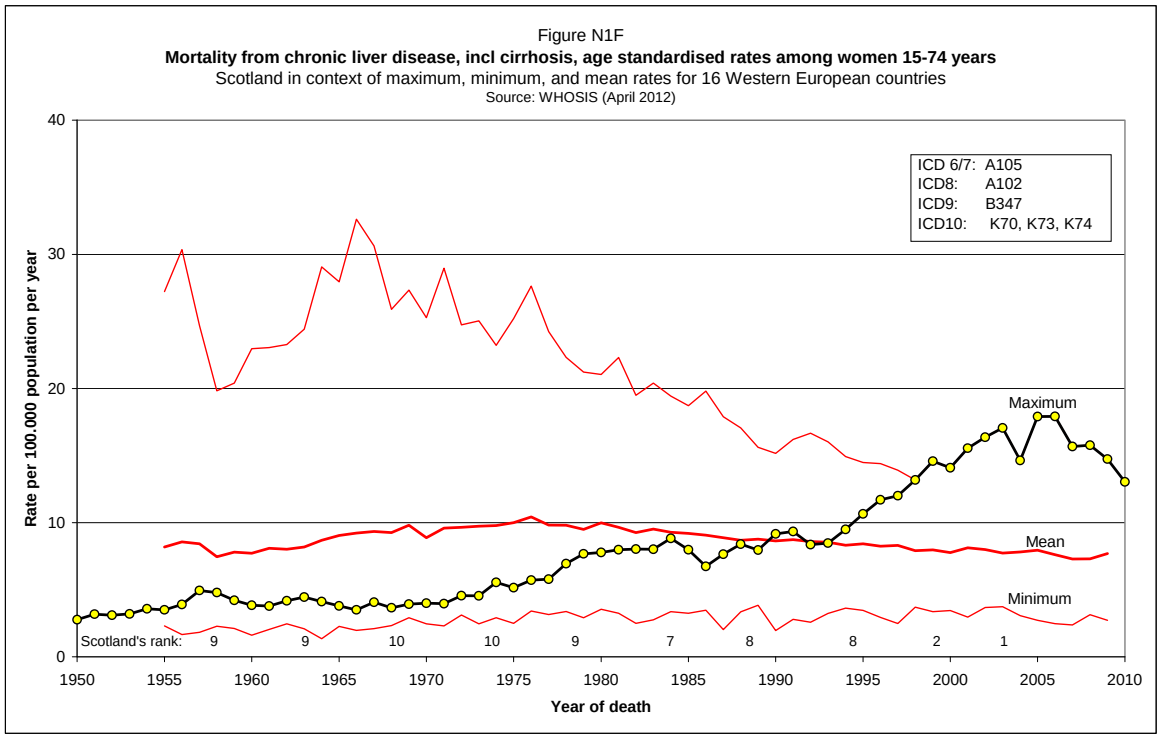
Figure N1M

Mortality from chronic liver disease, incl. cirrhosis, age standardised rates among men 15-74 years

Scotland in context of maximum, minimum, and mean rates for 16 Western European countries

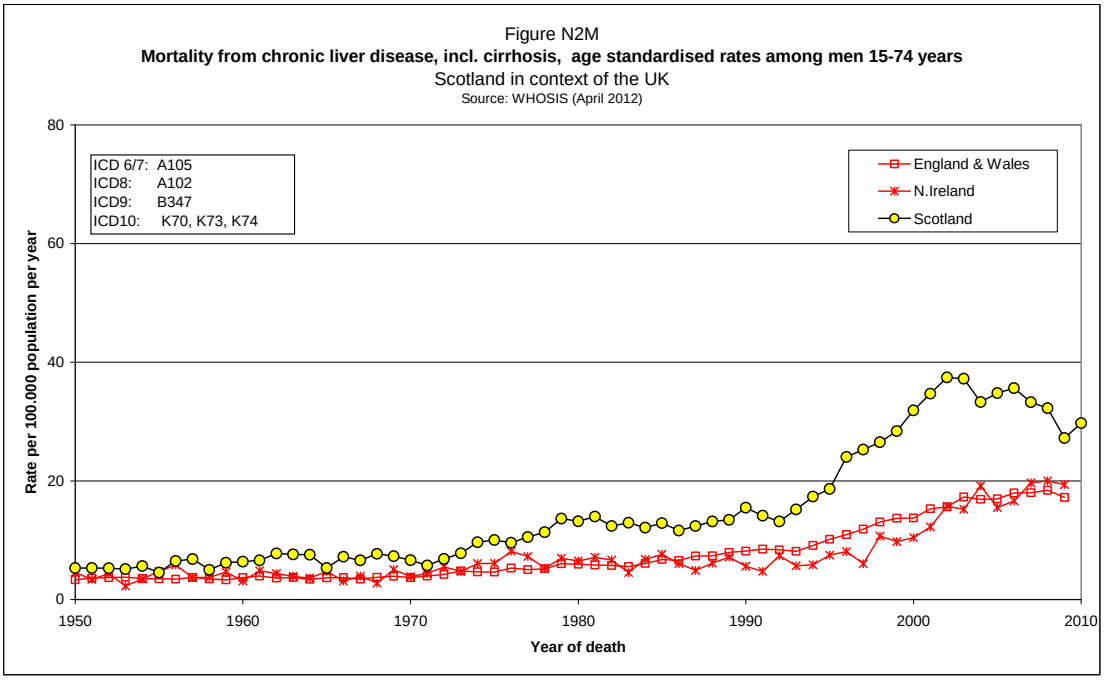
Source: WHOSIS (April 2012)





Country-specific comparisons

As outlined above, Scotland's chronic liver disease mortality rose sharply in the 1990s. This resulted in an increasing gap (or excess) in comparison to rates in England and Wales and Northern Ireland. The excess in male mortality reached a peak in 2002, at which point mortality was 140% higher in Scotland than in England and Wales. Since then this gap has reduced, due to a drop in the Scottish male mortality rate, and in 2009 the Scottish rate was 'only' 58% higher than England and Wales (Figure N2M). For women, there was a similar pattern: a widening of the gap in the 1990s, followed by a slight narrowing in the late 2000s. In 2009, Scottish female mortality from chronic liver disease was 70% higher than the rate in England and Wales.



As Scottish mortality rose in the 1990s, the opposite was happening in France, Austria, Germany and countries in Southern Europe, which previously had high mortality and whose rates were declining.

Notably, since 2007, the Finnish male mortality rate – which has been rising – moved above the Scottish rate. In 2009, Austrian male mortality also exceeded the Scottish rate, but this is in contrast to the overall profile of Austrian liver disease mortality, which has been on a long-term downward trend.

Chronic liver disease mortality in Hungary is on a downward trajectory but is still much higher than in Scotland for both males and females. Polish and Scottish mortality rates are very similar.

3.2.11 External causes *(Fig O1M – O7F)*

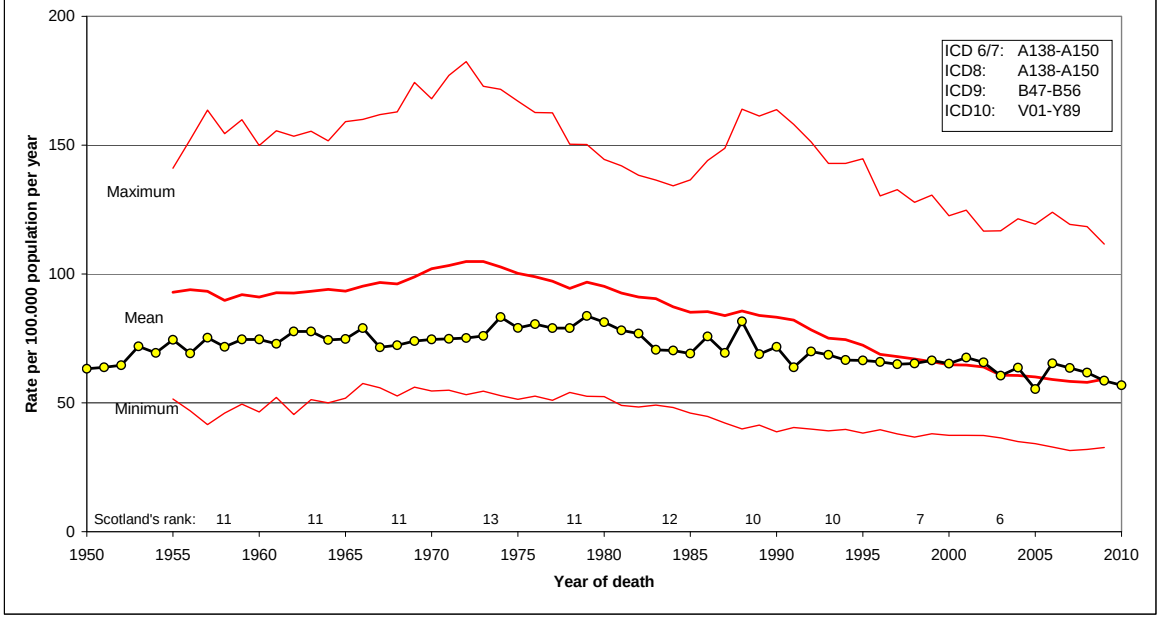
Scottish trends[xv]

In Scotland, deaths from external causes – which include deaths from injuries, poisonings, accidents, suicide and homicide – rose to a peak in the late 1970s for men and women. Rates have reduced since 1979 by 32% for men and by 43% for women, although the female mortality rate has remained relatively stable for the last 15 years. In 2010, 1,104 men and 435 women (aged 15-74) died in Scotland from external causes.

Relative position in Europe

The Scottish male mortality rate from external causes was slightly lower than the Western European mean, up until ten years ago, when the gap closed. The Scottish and Western European rates are now very similar (Figure O1M). The mortality trend for Scottish women has closely matched the Western European mean rate for most of the last 55 years, although the Scottish rate has risen above the Western European mean since 2006.

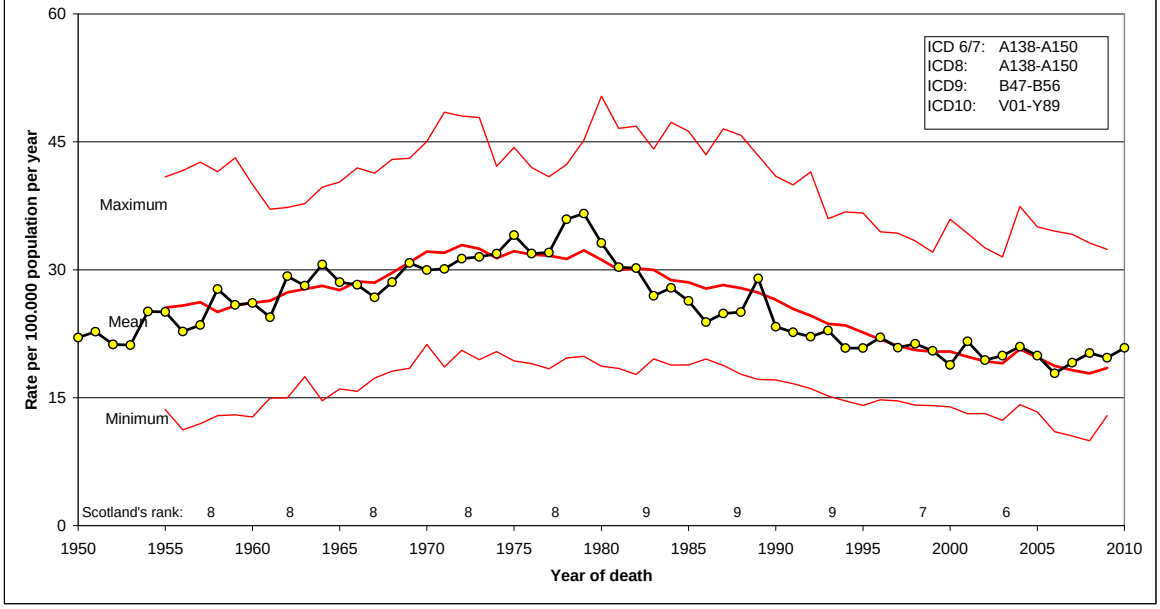
Figure O1M
External causes mortality age standardised rates among men aged 15-74 years
Scotland in context of maximum, minimum, and mean rates for 16 Western European countries
Source: WHOSIS (April 2012)



[xv] It is worth noting that deaths to non-residents of Scotland, which occurred in Scotland, are included. A notable effect of this is that the victims of the Lockerbie bombing in December 1988 are included among Scottish death registrations in 1988 and 1989.

As a result of these trends Scotland's relative mortality ranking has deteriorated for both men and women. In 1956-60, Scottish male mortality from external causes was eleventh highest of the 16 Western European countries compared, but by 2001-05 Scottish mortality from these causes was sixth highest. For women, Scotland's position deteriorated from eight to sixth highest comparing over the same periods (Figure O1F).

Figure O1F
External causes mortality age standardised rates among women aged 15-74 years
Scotland in context of maximum, minimum, and mean rates for 16 Western European countries
Source: WHOSIS (April 2012)



Country-specific comparisons

A number of countries have higher mortality rates from these causes than Scotland. Finland has the highest rate for males, which remains approximately double the Scottish rate. The rate of male mortality from external causes in Northern Ireland has exceeded the Scottish rate since 2005. In other Western European countries the male mortality rates have reduced to close to or below the Scottish rate. In 2009, male mortality rates from these causes in Hungary and Poland were both nearly double the Scottish level.

In terms of female mortality, Scotland currently has a similar rate to Northern Ireland but has had a higher rate than England and Wales consistently over the last 60 years. Female mortality rates from external causes are higher in Finland but rates in the other Scandinavian countries are similar to Scottish rates. Rates in the Netherlands, Austria, Germany and the Southern European countries are now lower than in Scotland. Female mortality rates from these causes in Hungary and Poland have been dropping and are now close to the Scottish rates.

3.2.12 Suicide[xvi] *(Fig P1M – P7F)*

Scottish trends

Mortality due to suicide in Scottish men rose from the mid 1970s to a peak in 1993. In the following ten years the male suicide rate remained at a similarly high level but from 2003 onwards has reduced slightly. The incidence of male suicide in 2010 was 50% higher than in 1968. Mortality from suicide among Scottish women is much lower than among

[xvi] The definition of suicide applied in this analysis includes 'Injury undetermined whether accidentally or purposely inflicted' along with 'Suicide and self inflicted injury'. This improves cross-country comparability, but limits the length of trends. Trends for most countries start with the introduction of the ICD8 classification in the late 1960s - usually 1968 or 1969.

men – it has been approximately a third of the male rate in recent years. The suicide rate among working age women peaked in 1979, but then reduced substantially in the early 1980s and has since been quite stable. The female suicide rate in 2010 was 26% lower than in 1968. In 2010, 547 men and 186 women (aged 15-74) committed suicide in Scotland.

Relative position in Europe

Scotland is no longer a country with a relatively low male suicide rate within Western Europe. With the rise in male suicides from the 1970s onwards, the Scottish suicide rate converged to the Western European mean (in 1992) and has remained above the mean since 1993 (Figure P1M). As a result Scotland's relative ranking has deteriorated from having the eight highest suicide rate (in 1971-1975) among the Western European countries in the study to having the third highest rate (in 2001-2005).

Fluctuations in the suicide rate among Scottish working age women over the last 40 years has meant that Scotland's relative position compared to the Western European country mean has shifted several times. The incidence of female suicide in the Scottish working age population was above the mean from 1968-1980, the rate then reduced to below the mean for 12 years (1981-1992) and, since 1993, has been above the mean. Scotland's relative ranking has deteriorated overall: in 1971-1975, the female rate was the eight highest among the Western European countries in the study, but by 2001-2005 it was the fourth highest (Figure P1F).

Figure P1M
Suicide mortality age standardised rates among men aged 15-74 years
Scotland in context of maximum, minimum, and mean rates for 16 Western European countries
Source: WHOSIS (April 2012)

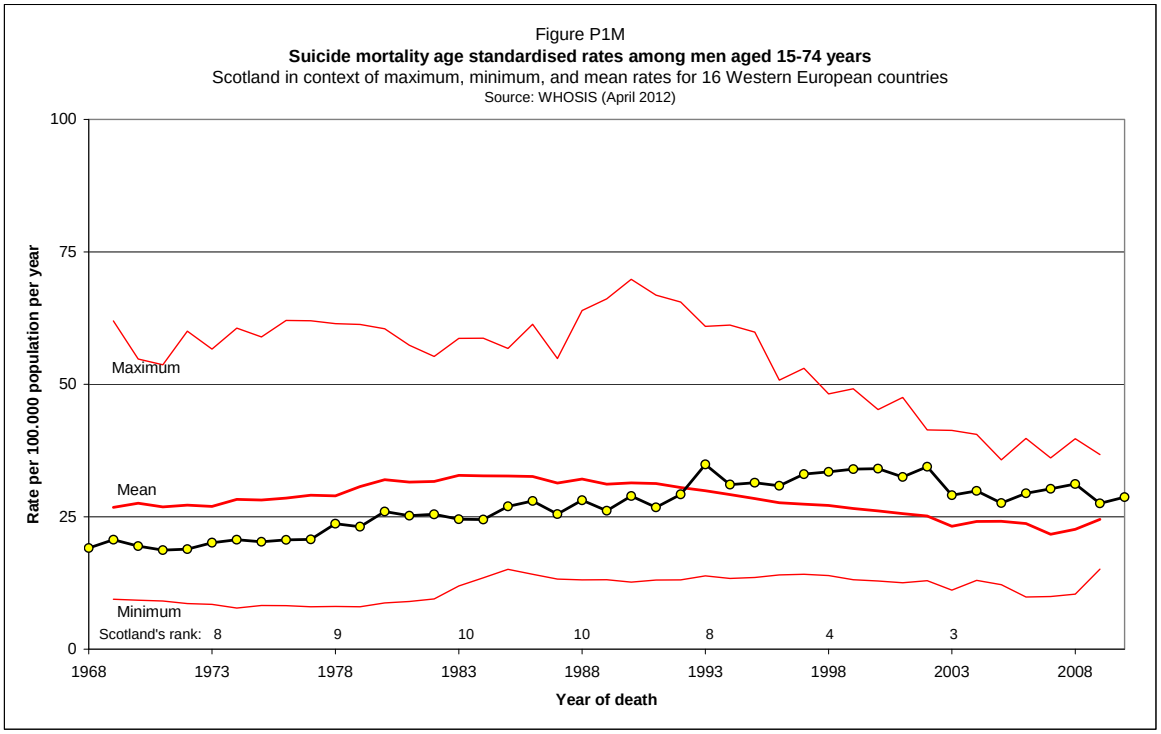
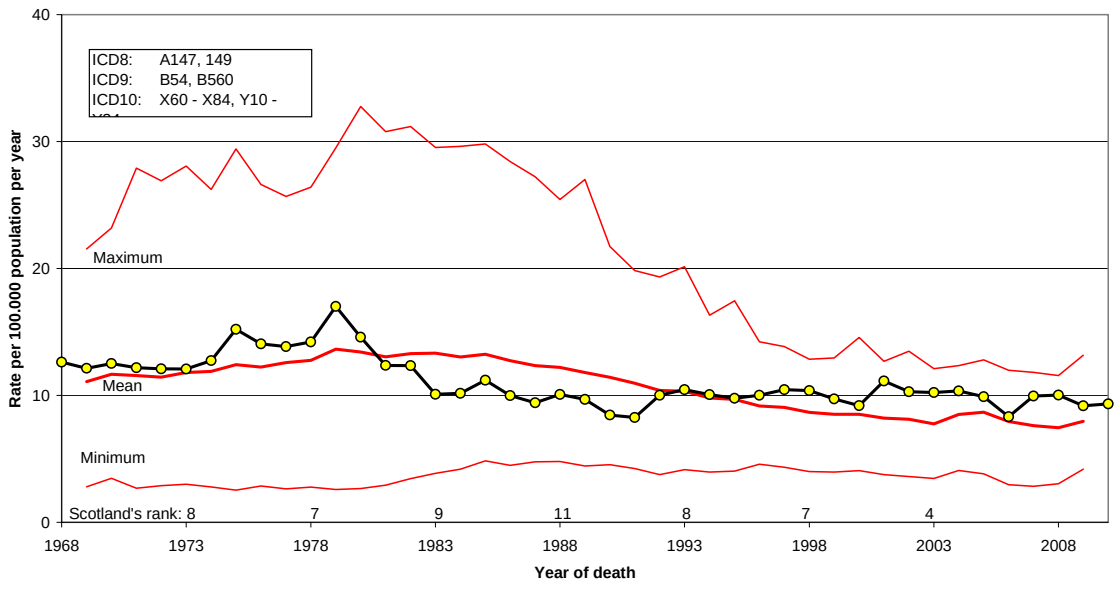


Figure P1F
Suicide mortality age standardised rates among women aged 15-74 years
Scotland in context of maximum, minimum, and mean rates for 16 Western European countries
Source: WHOSIS (April 2012)



Country-specific comparisons[xvii]

In 1968, the Scottish male suicide rate was 6% higher than the rate in England and Wales in 1968 but the rates in the two countries have diverged since, principally due to the rise in the Scottish rate. In 2010, the suicide rate among working age Scottish men was 73% higher than in England and Wales. The male suicide rate in Northern Ireland is now comparable to the Scottish rate after rising rapidly in 2005 and 2006[xviii]. Male suicide rates are comparable to Swedish rates but considerably lower than Finnish. Male suicide rates in the Southern European countries have been consistently lower than Scottish rates over the period studied.

Scottish female suicide rates are comparable to those in Northern Ireland, after rises in the Northern Irish rate from 2003 to 2007, but almost double the rates in England and Wales. The Scottish female suicide rate is similar to the Scandinavian rates – although still slightly lower than in Sweden and Finland – and also to the rates in Ireland and France. With the exception of Portugal in early 1980s to early 1990s, female suicide rates in the Southern European countries have been consistently lower than Scottish rates over the period studied.

Suicide rates for males have been consistently higher in Hungary and Poland than in Scotland. Female suicide rates are slightly higher in Hungary than Scotland but Scottish suicide rates for women have consistently exceeded rates among Polish women.

3.2.13 Motor vehicle accidents (MVAs) *(Fig Q1M – Q7F)*

Scottish trends

Mortality from motor vehicle accidents (MVAs) rose from the 1950s to the early 1970s, and has been falling since then. In 2010, male mortality from MVAs was 6.8 per 100,000 – a reduction of 76% from 1974 when mortality peaked at 28.4 per 100,000. Similarly,

[xvii] Swiss suicide data from 1995 are based on an aggregated version of ICD10 (see Table 3) and do not include deaths from 'injuries of undetermined intent'. Thus, Swiss suicide rates from 1995 onwards are not strictly comparable to the rates in other countries.
xviii These steep rises may in part be due to changes in coding.

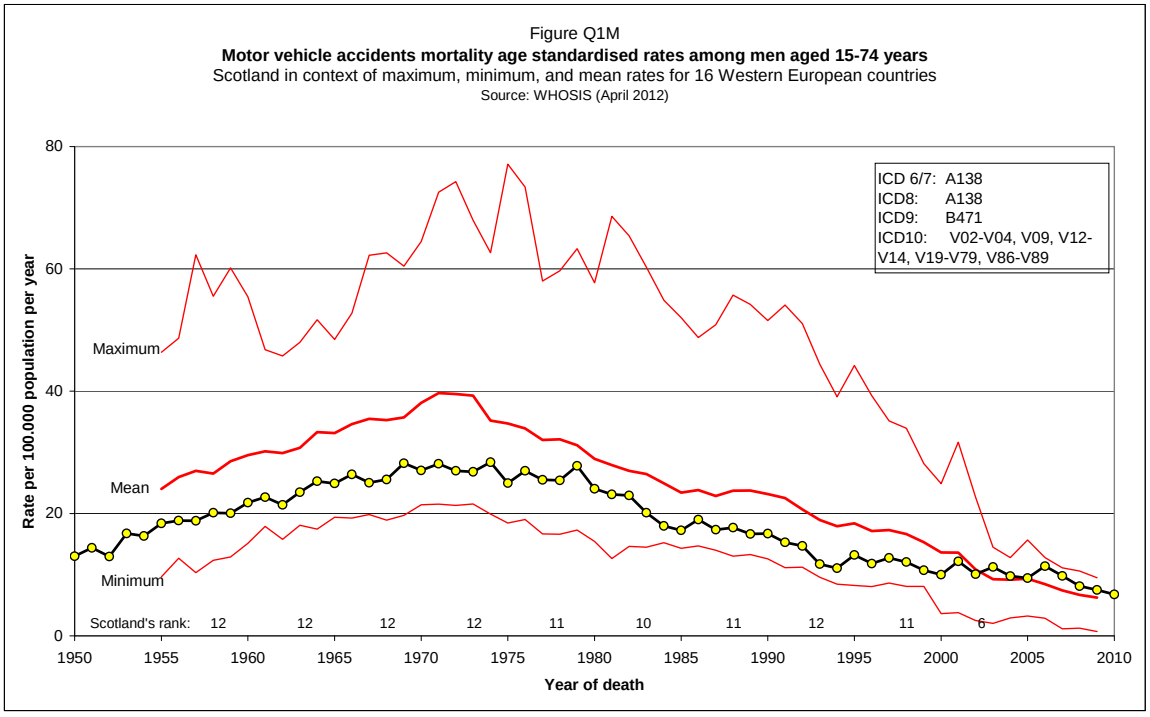
female mortality has reduced significantly from a peak of 9.8 per 100,000 in 1978 to 2.3 per 100,000 in 2010. In 2010, 128 men and 46 women (aged 15-74) died in Scotland as a result of MVAs.

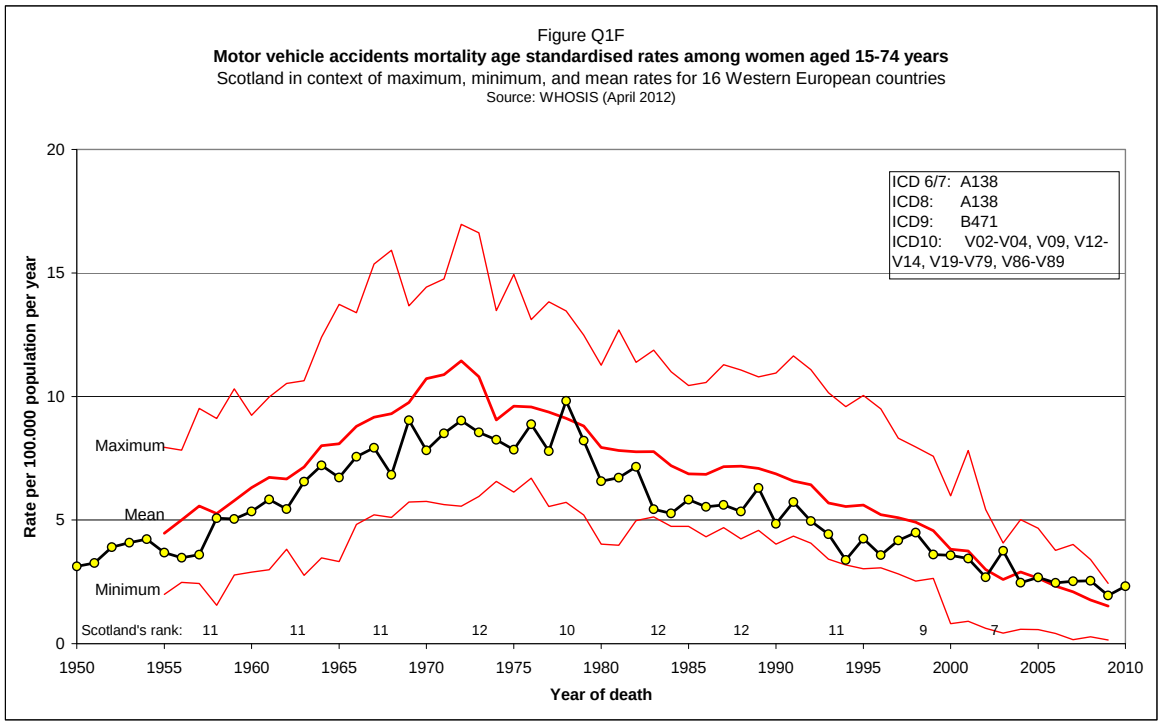
Relative position in Europe

The Western European mean mortality rate due to road accidents has followed a similar pattern to Scotland's mortality trend with a peak in the early 1970s, followed by a sustained reduction since. For most of the period since the 1950s Scotland's mortality rate has been lower than the Western European average. However in more recent years, many countries have achieved greater reductions in MVA mortality and now have a lower MVA mortality rate than in Scotland. As a result, Scottish male mortality has been above the Western European mean since 2003 and female mortality also now exceeds the mean**.**

In terms of relative ranking, Scotland's position has worsened for both men and women. In 1956-60 Scottish male MVA mortality was twelfth highest of the 16 Western European countries compared, but by 2001-05 Scottish mortality was sixth highest. For women, Scotland's position deteriorated from eleventh to seventh highest comparing over the same periods (Figures Q1M and Q1F).

Figure Q1M
Motor vehicle accidents mortality age standardised rates among men aged 15-74 years
Scotland in context of maximum, minimum, and mean rates for 16 Western European countries
Source: WHOSIS (April 2012)





Country-specific comparisons

The UK countries have had similar MVA mortality trends over the last 60 years. Rates in many of the Northern, Western and Southern European countries have come down and converged with Scottish mortality rates. There have been steep drops from year to year for some countries in particular years, suggesting a change in recording practices e.g. in France in 2000, in Portugal in 2002 and in Italy in 2003[xix]. Mortality rates in Poland and Hungary remain higher than in Scotland.

3.3 Summarised trends

In this section a brief descriptive overview of the reported trends is provided using a set of supporting tables and graphs. Tables 1 and 2 provide an overview by age group (Table 1) and by cause of death (Table 2) of the changes in absolute mortality and in Scotland's relative position in Western Europe.

Figures S1M and S1F add to the interpretation of age related mortality trends by showing for males and females the difference between Scottish mortality in each age group and the Western European mean overtime. It is clear that for both males and females that Scotland's mortality, even though there have been absolute reductions in mortality rates across all age groups in the last 60 years, has deteriorated relative to our Western European neighbours. This is particularly clear for infants, children and the younger working age population of both sexes and for elderly women.

[xix] The years noted for each country coincide with the year of introduction of ICD10 in each country.

Figure S1M
Scottish Male Mortality by age group relative to the Western European Country Mean, 3 year averages,1955-2009
Source : Source: WHOSIS (April 2012)

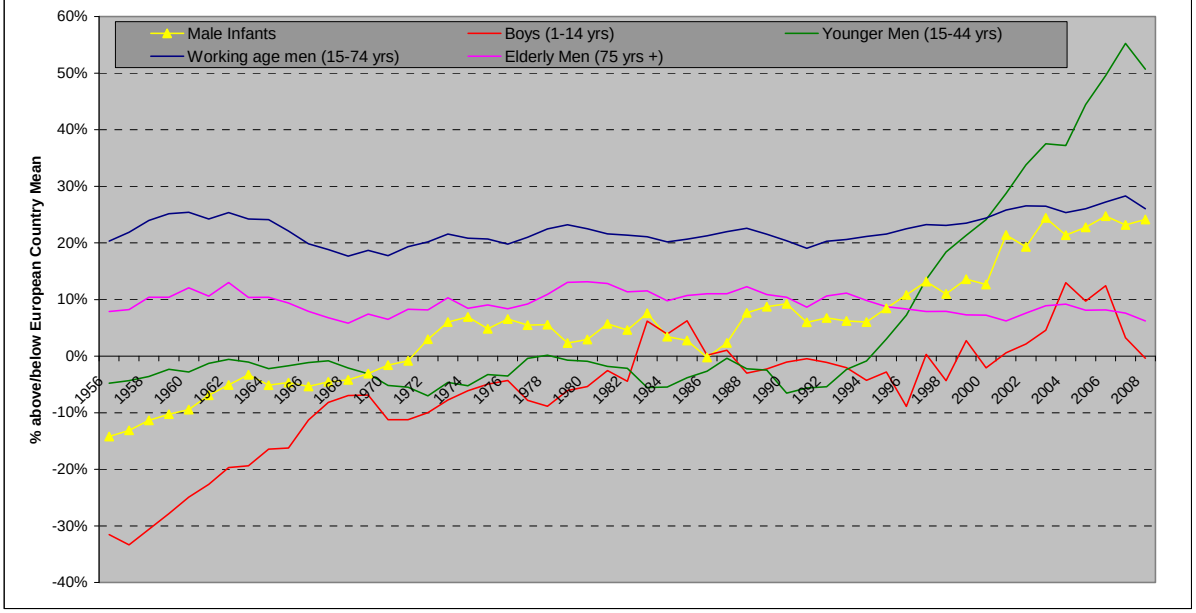
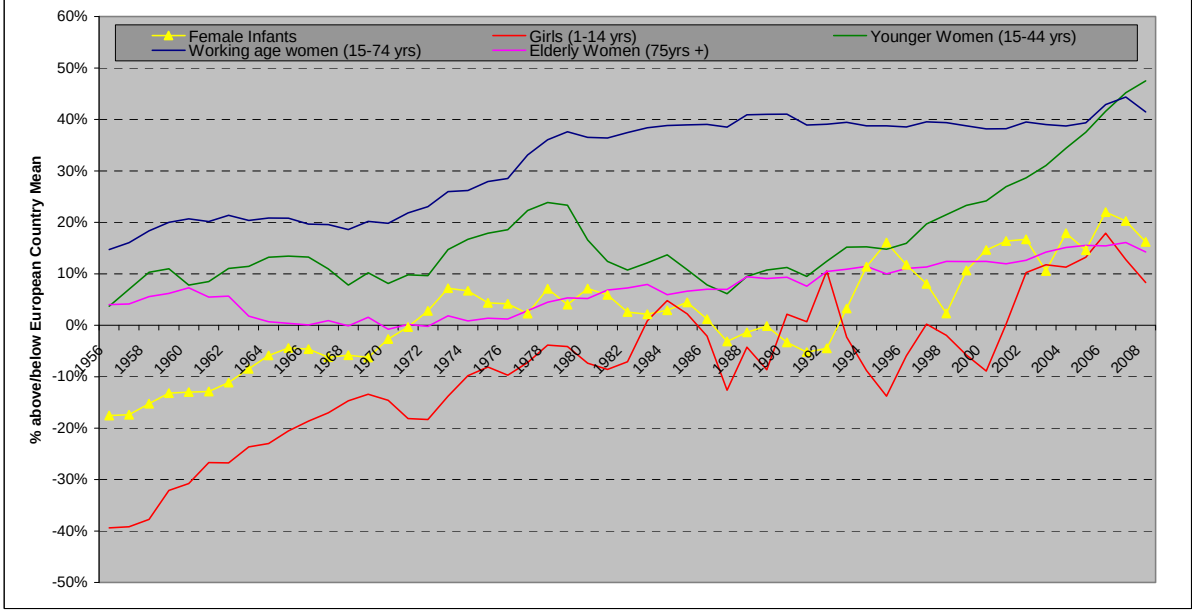


Figure S1F
Scottish Female Mortality by age group relative to the Western European Country Mean, 3 year averages,1955-2009
Source : Source: WHOSIS (April 2012)



The 13 causes of deaths considered in this analysis of working age mortality make up just less than 60% of all male deaths and female deaths in the age group (15-74 years). The study therefore has not covered all causes of death, but has focussed on the major causes of death.

Figures T1M – T2F illustrate mortality trends for the selected causes used in the study, illustrating how the relative burden of mortality due to different causes has changed over time.

Figure T1M illustrates male mortality trends in Scotland for these causes. Looking cumulatively, total mortality from these causes has been reducing from the mid 1960s. Moreover, the relative burden of mortality due to different causes has shifted. The contributions of heart disease, cerebrovascular disease and lung cancer mortality, while still considerable, have reduced substantially. In contrast, the contribution of chronic liver disease including cirrhosis, has notably increased.

Figure T1M
Age standardised mortality rates for 10 major causes of death among Scottish men aged 15-74 years, 1955-2010
Source: WHOSIS (April 2012)

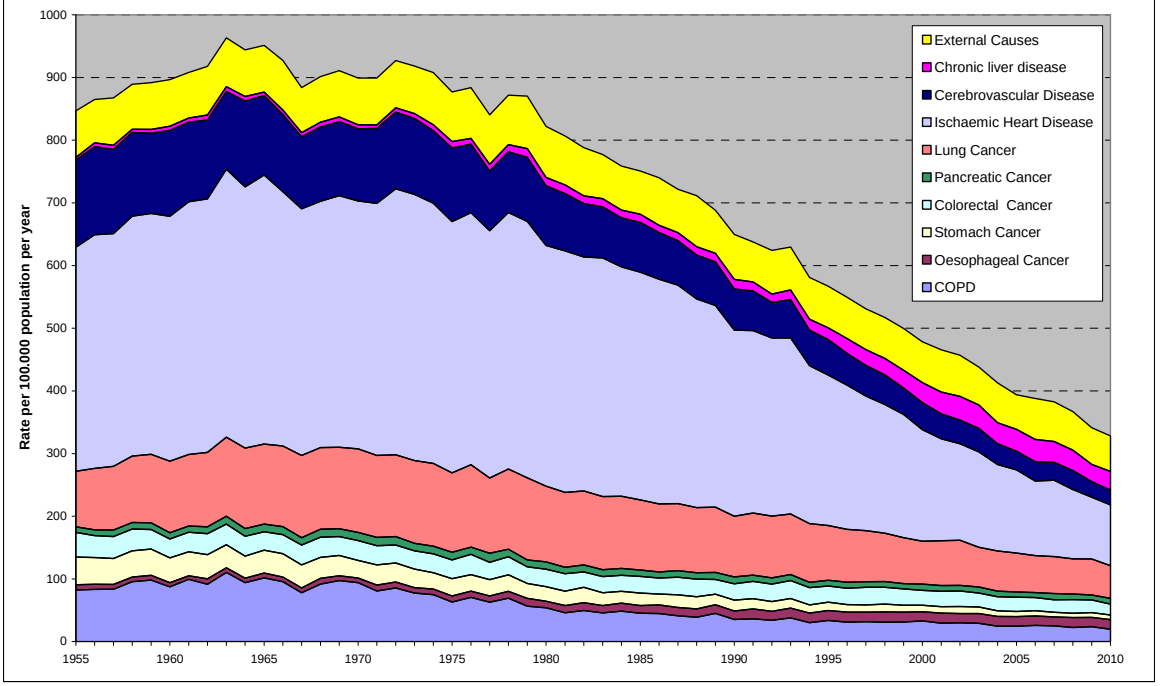


Figure T2M illustrates this in a different way by showing how the 'proportion of mortality from specific causes as a % of all selected causes' has changed in Scotland. This shows how the relative contribution of mortality from external causes, chronic liver disease including cirrhosis, lung cancer and oesophageal cancer has increased over time.

Figure T2M
Proportionate contribution of 10 major causes of death as a % of all selected causes among Scottish men aged 15-74 years, 1955-2010
Source: WHOSIS (April 2012)

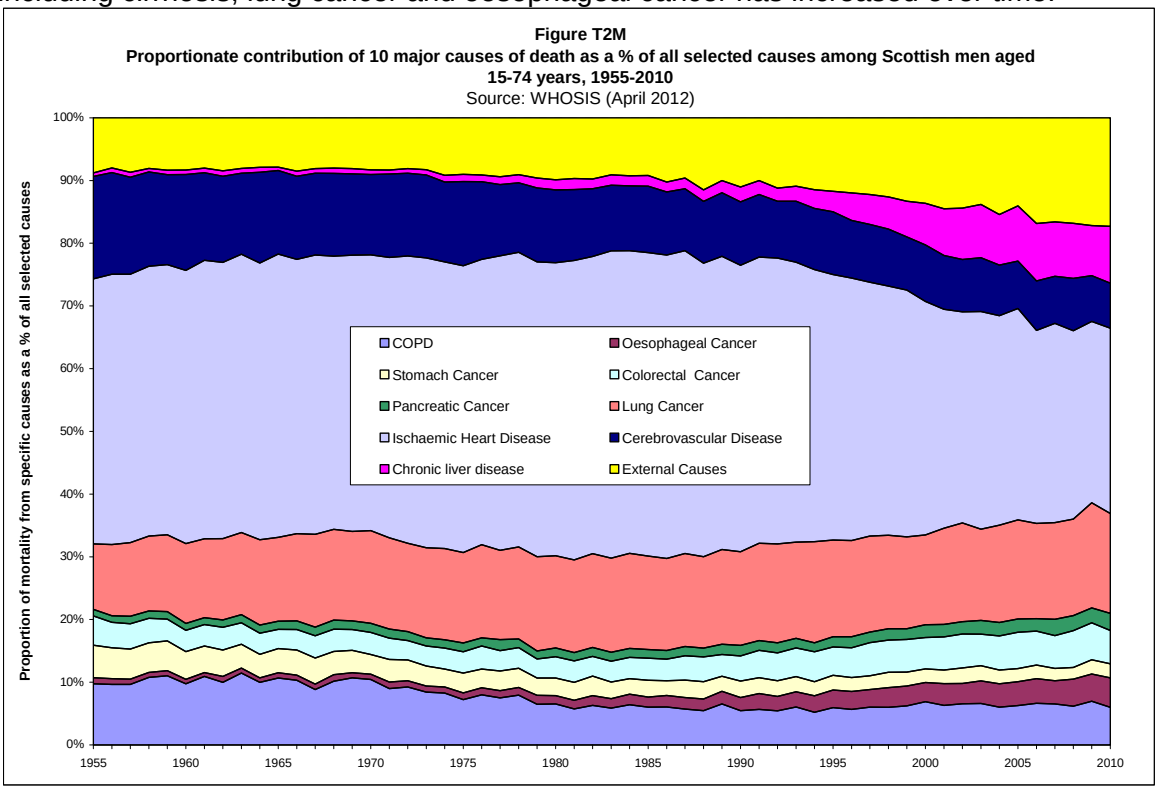
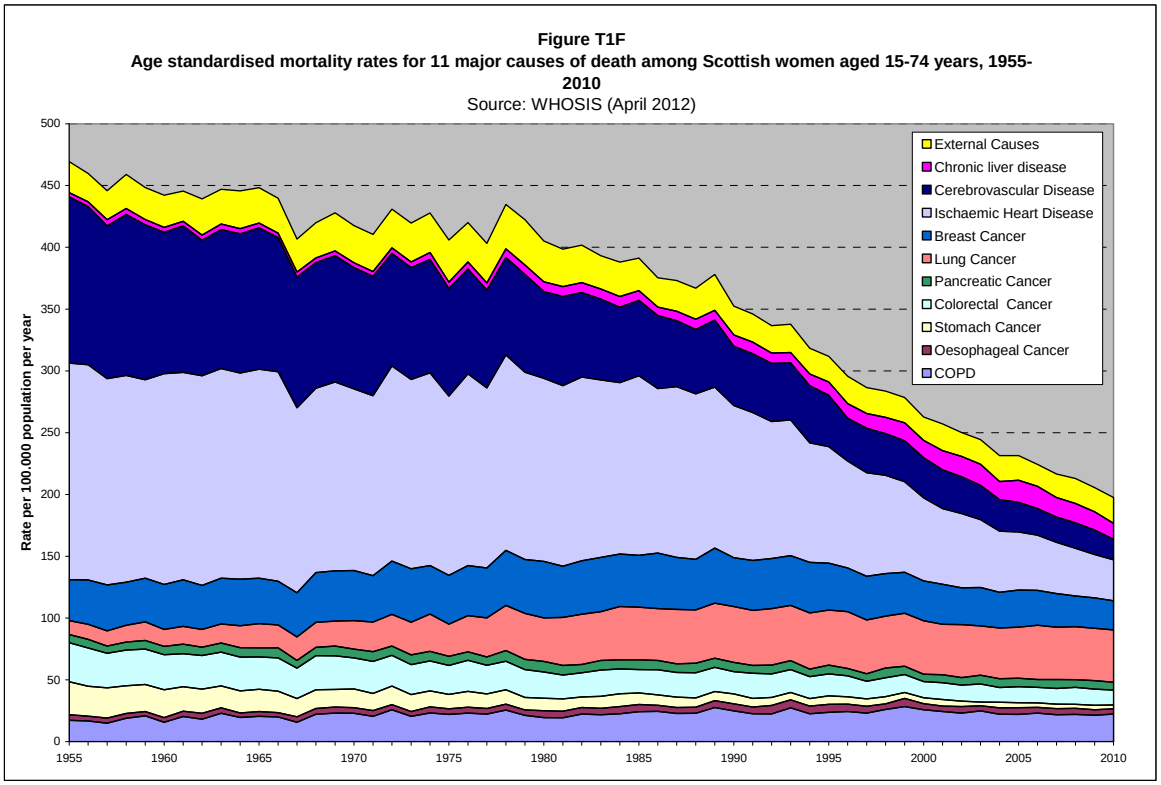


Figure T1F illustrates Scottish mortality trends for working age women for the causes selected in this study.

Figure T1F
Age standardised mortality rates for 11 major causes of death among Scottish women aged 15-74 years, 1955-2010
Source: WHOSIS (April 2012)



As with men, mortality considered cumulatively across these causes has been reducing, and the relative mortality burden due to different causes has shifted. The pattern is however slightly different from that seen for men. The contribution of heart disease and cerebrovascular disease mortality has reduced as it has for men, and the contribution of chronic liver disease has increased. In contrast to the situation for men, the contribution of lung cancer mortality has increased substantially over time for women.

Figure T2F illustrates this in a different way by showing how the relative contribution of mortality from external causes, chronic liver disease, lung cancer and COPD has increased.

Figure T2F
Proportionate contribution of 11 major causes of death as a % of all selected causes among Scottish women aged 15-74 years, 1955-2010
Source: WHOSIS (April 2012)

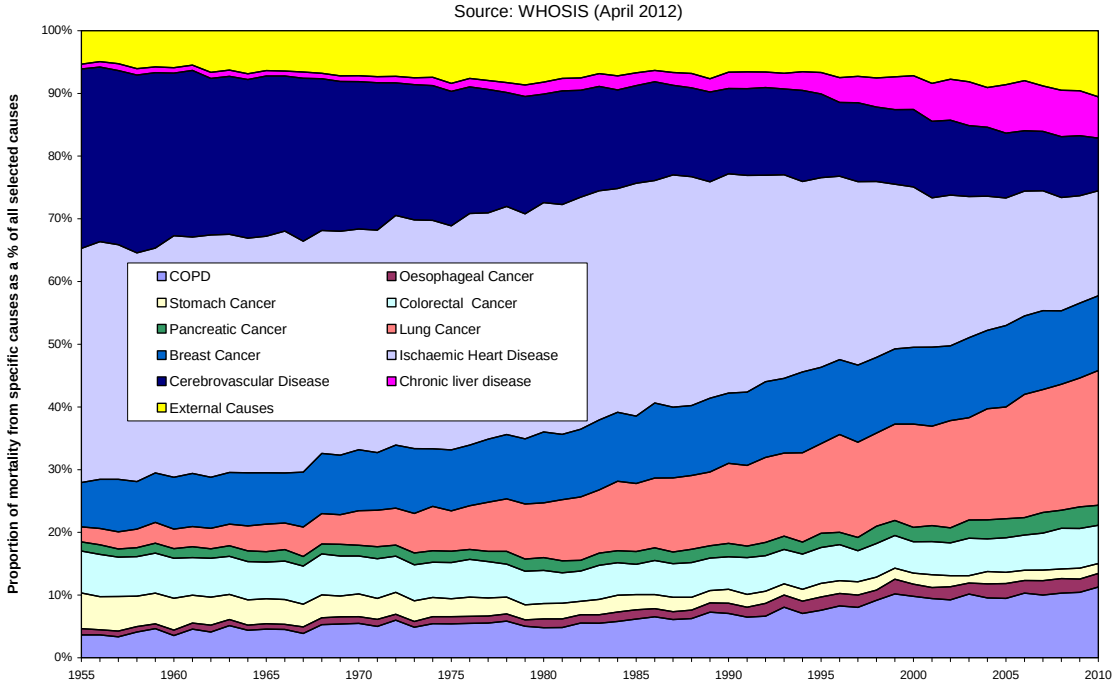


Table 1 Overview by age group of the changes in absolute mortality and in Scotland's relative position in Western Europe

Mortality by age	Scottish mortality trend - 1950 – 2010	Scotland's relative ranking* (ranks quoted are for period 2001-2005)	Other comments
Infant Mortality (deaths in first year of life)	Scottish mortality rates have fallen by 90% over the last 60 years for both sexes.	Scotland's ranking has deteriorated for both sexes – to **3rd highest** for male infants and **4th highest** for female infants.	Differences in mortality between countries are much smaller than they were.
Children (1-14 years)	Mortality rate has decreased by 89% among boys and 88% for girls, respectively.	Scotland's relative position compared to other countries has deteriorated slightly to **5th highest** for boys and for girls.	" "
Working Age Adults (15 -74 years)	Male mortality has decreased by 55% and female mortality by 60%.	Scotland has had the **highest mortality** rates for men in Western Europe since 1978 and for women since 1958.	In 2009, male mortality was 21% higher than the Western European country mean, while female mortality was 34% higher. Finnish male mortality has been lower than Scottish male mortality since 1978, but by 2009 the gap had narrowed and the rates in both countries were very similar.
Younger Working Age Adults (15 – 44 years)	Male mortality rate has decreased by 41% since 1950 and female rate by 70%. However, decline in mortality stalled in mid 1980s and since then there has been no net reduction in mortality among men or women.	In the late 1950s Scottish male mortality was ranked 9th highest, but by 2004 Scotland was ranked **1st (highest).** For women, Scotland was ranked 6th highest in late 1950s, but since 2002 Scotland has been ranked **1st (highest).**	As Scotland's relative position has deteriorated, the gap with other countries has widened. By 2009 Scottish mortality among younger working age men was 44% higher than the Western European country mean. It was 48% higher among Scottish women.
Elderly (75 years and over)	Male mortality has decreased by 47% and female mortality by 51%.	Scotland's relative position compared to other countries has been stable for men, **3rd highest** (2001-2005), but deteriorated for women and has been ranked **1st (highest)** since 2002.	Male mortality rates are converging down toward the Western European mean. In contrast, because the reduction in Scottish female mortality has not kept pace with the reduction in the Western European country mean, female rates are diverging from the mean and were 10% higher than the mean in 2009.

*Rankings are not exact, depending on the age group or cause, 2 – 3 of the 16 countries do not have complete data for the period quoted (2001-2005). This means that Scotland's ranking may be slightly better than suggested by the figures above.

Table 2 Overview by cause of death of the changes in absolute mortality and in Scotland's relative position in Western Europe

Mortality by cause	Scottish mortality trend - 1950 – 2010	Scotland's relative ranking* (most recent ranks quoted are for 2001-2005)	Other comments
Oesophageal Cancer	Male mortality rate rose through 1970s and 1980s; in 2010 male mortality was 62% higher than in 1950. The female mortality rate has fluctuated; in 2010 it was slightly below that in 1950.	Ranking has deteriorated for both sexes over the last 55 years and Scotland has been ranked **1st (highest)** for both sexes for over 15 years.	In 2009 the Scottish male mortality rate was 70% above the Western European mean and 96% higher than the mean for women.
Stomach Cancer	The male mortality rate has reduced by 84% and the female rate by 90%.	Ranking has deteriorated slightly for both sexes – to **5th highest** for male mortality and **8th highest** for female mortality.	Rates have been steadily decreasing throughout Europe over the last 60 years and the mortality rate in Scotland has closely followed the Western European country mean rate for both men and women.
Colorectal Cancer	The male mortality rate has reduced by 56% and the female rate by 62% (in this case since 1955).	Mortality ranking has improved for both sexes. Scotland was ranked 1st (highest) for both sexes in 1956-60 but is now **4th highest** for males and **5th highest** for females.	For both men and women the Scottish rate has gradually converged toward the Western European mean e.g. in 1955 Scottish male rate was 82% above the mean, by 2009 it was only 9% above the mean.
Pancreatic Cancer	No change in male mortality; female mortality has fallen by 7% (in this case since 1955).	Mortality ranking has improved for both sexes. Male mortality was ranked 3rd highest in 1956-60 but is now **12th highest**. For females ranking has improved from 2nd to **9th highest**.	Scotland's relative position has improved despite little overall change in mortality, partly due to increases in mortality in Southern European countries and less pronounced increases in countries such as Austria and Germany.
Lung Cancer	In 2010, male mortality was 23% lower than in 1950 and was 60% of its peak level in 1979. Female mortality in 2010 was more than three times the rate in 1950.	Scotland was ranked **2nd highest** for both males and females in 2001-05. This represents a slight relative improvement after decades of having highest ranked mortality.	Male mortality is converging to the Western European mean; in 1955, Scottish mortality was 100% higher than the mean, but by 2009 was only 33% higher. Female mortality has not reduced significantly in 25 years and was 72% higher than the Western European mean in 2009.
Female Breast Cancer	Mortality rate was 33% lower than in 1950.	Scotland's ranking which was **4th** highest in 2001-05 compared to 3rd highest in 1956-60.	Since the mid 1990s, Scottish mortality has fallen more rapidly than in other countries and is converging to the Western European mean – only 5% above the mean in 2009.

Mortality by cause	Scottish mortality trend - 1950 – 2010	Scotland's relative ranking* (most recent ranks quoted are for 2001-2005)	Other comments
Ischaemic Heart Disease	Male mortality was 72% lower than the rate in 1950 and female mortality 83% lower.	Remains **highest** ranked for men and women.	Scottish rates for both sexes are converging down toward the Western European mean. In 2009, the Finnish male rate was slightly higher than Scotland's.
Cerebro-vascular Disease	Male mortality was 82% lower than the rate in 1950 and female mortality 88% lower.	Scottish rates have consistently been **2nd highest** ranked for men and women.	There has been gradual convergence in male rate toward Western European mean. Among women, there has also been a gradual convergence toward mean, but the relative gap in mortality (as opposed to the absolute gap) has not narrowed.
Chronic Obstructive Pulmonary Disease	Male mortality was 74% lower than the rate in 1950 and female mortality 2% lower.	Ranking has deteriorated slightly for both sexes – to **1st (highest)** for male mortality and **2nd highest** for female mortality.	For males, mortality has been declining since 1969, but remains above Western European mean despite some convergence. For women, while the Western European (WE) mean has been decreasing since 1970, the Scottish rate has increased diverging up from the WE mean.
Chronic Liver Disease, including Cirrhosis	From the 1970s, mortality for both sexes increased greatly; by 2000 male mortality was six times the rate in 1950 and female mortality was five times higher. More recently, male and female mortality rates have dropped slightly.	Scotland's position has deteriorated significantly and mortality is **highest** ranked for both sexes among comparator countries.	From 2007 onwards Finnish male mortality – which has been on an upward trend – moved above the Scottish rate.
External Causes	Male mortality was 10% lower than the rate in 1950 and female mortality 5% lower.	Scotland's ranking has deteriorated for both sexes and is **6th highest** for both sexes among comparator countries.	For men, the Scottish and Western European rates are now very similar. The female Scottish rate has risen above the Western European mean, since 2006.
Suicide	Male mortality was 50% higher in 2010 than in 1968, but female mortality 26% lower.	Ranking for men has deteriorated to **3rd highest** and for women to **4th highest**.	Scottish suicide rates for both sexes have been above the Western European mean since 1993.
Motor Vehicle Accidents	Male mortality was 48% lower than the rate in 1950 and female mortality 26% lower. Since the peaks in mortality in the mid 1970s, mortality has dropped by over 75% for both sexes.	Ranking for men has deteriorated to **6th highest** and for women to **7th highest**.	Mortality rates in many countries have reduced and converged. However, Scotland's mortality rate, which had been lower than the Western European mean, has recently moved above the mean for men and women**.**

*Rankings are not exact, depending on the age group or cause, 2 – 3 of the 16 countries do not have complete data for the period quoted (2001-2005). This means that Scotland's ranking may be slightly better than suggested by the figures above.

4. Discussion

In Leon et al's original report, he noted that, although the Scottish population at the time (c. 2000) had one of the lowest life expectancies in Europe, in the first half of the twentieth century Scotland had comparatively better health than a number of other European countries. Leon and colleagues pointed to deterioration in Scotland's health position from the middle of the twentieth century, and asserted that Scotland's poor position was to a large extent dictated by high mortality among working age adults.

Subsequent studies have sought to explain the causes of Scotland's high mortality in comparison to England, taking account of deprivation[6,7], and in comparison to other European countries, citing particular industrial, employment, housing and cultural patterns[8] affecting Scotland and the impact on Scotland of the adoption of neoliberal policies across the UK[8,9].

One response has been to synthesise and critique a range of different hypotheses that attempt to explain Scotland's excess mortality[8,10]: the conclusion being that it is unlikely that any single cause is responsible for this phenomenon. However, it was noted that the health and social patterns that emerged during the 1980s and 1990s are closely linked to behaviours harmful to health (e.g. excessive alcohol consumption) and that these behaviours are in turn heavily influenced and shaped by the social, cultural and economic disruption which were associated with abrupt changes in the political and economic policies of the UK from the late 1970s onwards.

Many of the trends identified by Leon and colleagues in their original report continue to be relevant ten years on. However, there have also been important subtle shifts in mortality. The detail and context of these changes is examined here, in particular in relation to changes in age related mortality and cause specific mortality at working age.

Infant and children's mortality in Scotland has continued to reduce over the past 60 years, but Scotland's relative position within Europe has deteriorated, particularly for infant mortality. Scotland now has one of the highest levels of infant mortality in Western Europe. Mortality rates for both sexes are considerably higher than equivalent rates in Scandinavian countries. Male infant mortality has been at least 10% higher than the Western European country mean since 1996.

Additionally, Scotland's relative position in terms of childhood mortality – defined here as deaths at 1-14 years of age – has also deteriorated to fifth highest for boys and for girls among the Western European countries compared in this study. Overall this contrasts with the position described by Leon et al ten years ago, when 'Scotland's position (was) not exceptional for deaths in infancy and childhood'. Despite reductions in infant and childhood mortality in Scotland and bearing in mind the actual numbers of deaths involved are relatively small, the comparative worsening of Scotland's position should be a cause for some concern and future trends should be monitored closely.

In terms of overall working age (15-74 years) mortality, despite continued reductions – male mortality decreased by 55% and female mortality by 60% between 1950 and 2010 – Scotland has continued to have the highest mortality rates in Western Europe for both genders since 2000 (the last year included in Leon at al's previous analysis).

Scotland continues to have higher mortality than England and Wales and this difference has increased over time, particularly for men. In 1950 male mortality in this age group was 13% higher in Scotland than in England and Wales, but by 2009 this excess had increased to 32%; for women the equivalent excess of mortality in Scotland was 26% in 1950, and this had widened slightly to 31% in 2009.

This links to the so-called 'Scottish Effect' identified by Hanlon et al, who noted that Scotland's relative mortality disadvantage compared to the rest of the UK, after allowing for deprivation, worsened between 1981 and 2001 and that by 1991 deprivation no longer explained most of the excess mortality. It was also reported that the excess mortality in Scotland compared to England and Wales had increased most among males aged <65 years in the period 1981-2001.

Our analysis of mortality among the younger working age population has demonstrated that the decline in mortality in this age group stalled in mid 1980s and since then there has been no net reduction in mortality among men or women. As a consequence there is an even greater excess of mortality in Scotland's young working age population (15-44 years) compared to Western Europe and to England and Wales, and this gap has appeared relatively recently.

Scottish male mortality in the younger working age population was close to, and often below, the Western European mean in the period from 1955-1995, but by 2007[xx] was 55% higher; for women the Scottish mortality rate was mostly 10-20% above the Western European mean in the period from 1955-1995, but rose rapidly after this point and was 44% higher in 2007. In comparison to England and Wales, Scottish mortality in this age group has been historically higher but the excess has increased more recently: in 1950 Scottish male mortality among the young working ages was 24% higher than in England and Wales and by 2009 this excess had increased to 54%; among younger working age women, the equivalent excess Scottish mortality was relatively unchanged (49% in 1950 vs. 46% in 2009), although this gap narrowed in the intervening years before widening again from the mid 1990s.

The rise in mortality among young adults was noted by McLoone[11] in his study of Scottish mortality between 1981 and 1999. Among men aged 15-44, suicide was the main cause of rising death rates, but this cause only accounted for around 50% of the overall increase. Other causes contributing to the rise were drug use, chronic diseases of the liver (mainly alcoholic liver damage) and, to a smaller extent, violent deaths. With the exception of murder, similar patterns were observed among young women.

A more recent study has pointed to an excess of mortality in Glasgow compared to Liverpool and Manchester, that cannot be explained by deprivation alone and that the excess is most pronounced for premature mortality (deaths under 65 years)[12]. Another recent study has found that male premature mortality rates rose by over 14% in Scotland over a ten year period between the early 1990s and 2000s in persistently deprived areas and that this rise was not replicated elsewhere in the UK[13]. This study also noted that the rise among men in Scotland was driven by Glasgow where mortality rates rose by over 15% during the decade.

[xx] 2007was selected as the last year of comparison because there were data for 15 of the 16 comparison countries. After this year mortality data were not available for several countries.

Inequalities in mortality across Scotland have also been reported at a regional level, with the Clydeside region being noted as having an excess mortality which could mostly be attributed to the poorer experience of socially disadvantaged populations[14]. The region also had a smaller reduction in premature mortality (between 1980-82 and 2000-02) than other regions in Scotland, contributing to an increasing excess of premature mortality in this region, with Clydeside being 30% above the Scottish average in 2000-02 having been only 17% higher in 1980–82. This divergence was explained by changing death rates for ischaemic heart disease (IHD), chronic liver disease in males, and behavioural disorders due to the use of drugs.

Post-industrial decline has been frequently cited as one of the major underlying reasons behind the poor health profile of Scotland and mortality in West Central Scotland has been compared to other post-industrial regions of Europe[15] – Leon et al's original report suggested comparing Scotland (and parts of Scotland) with more comparable places such as ex-industrial areas. The findings of this study showed that the mortality trends of West Central Scotland compared poorly with other post-industrial regions of Europe and this suggested that post-industrial decline alone cannot explain West Central Scotland's poor health. A more recent analysis of geographical inequalities in health at a regional level within 19 European countries identified a rise in geographic inequalities across these regions in the period 1991-2008 and noted that South West Scotland[xxi] was among the tenth of these areas with the lowest life expectancy – the only region in Western Europe that fell into this decile[16].

Overall, trends in working age mortality show that Scotland's relative position has not improved and, for younger working age mortality specifically, Scotland's position has worsened as mortality trends have flattened off. The flat trend in Scottish younger working age mortality, with no real reductions over the last 20-25 years among men or women, should be a cause of great concern.

Elderly (75 years and over) mortality has decreased by around 50% over the last 60 years for both men and women. However, the reduction in Scottish female mortality in this age group has not kept pace with the reduction in other Western European countries: Scotland's relative position has deteriorated to the extent that female elderly mortality has been the highest in Western Europe since 2002. This is a disturbing trend and may in part be due to the transition of an unhealthy working age cohort into an unhealthy elderly cohort. Given Scotland's aging demographic trends and how little is known comparatively about elderly mortality in Europe and Scotland, further comparative study of the causes of elderly mortality in a European context would be helpful.

Turning to cause specific mortality, it is apparent that for many, but not all, of the cancers investigated in this study mortality in the Scottish working age population has been falling; the exceptions are the rising trends in oesophageal cancer mortality among men and flat trends in oesophageal and lung cancer mortality among women. This is within a context of general increases in cancer incidence among Scotland's working age men and women[xxii].

[xxi] South West Scotland is a NUTS 2 classification and includes the following areas: Dumfries & Galloway, East Dunbartonshire, West Dunbartonshire and Helensburgh & Lomond, East Ayrshire and North Ayrshire mainland, Glasgow City Inverclyde, East Renfrewshire and Renfrewshire, North Lanarkshire, South Ayrshire, South Lanarkshire.

[xxii] ISD Scotland - http://www.isdscotland.org/Health-Topics/Cancer/Cancer-Statistics/Oesophagal/

Oesophageal cancer among men provides an example of rising incidence and mortality. In the last 25 years incidence rates of oesophageal cancer across the whole population have increased for males (+ 43%) and females (+25%) . Male oesophageal cancer mortality rose through the 1970s and 1980s and in 2010 male mortality from this cause was 62% higher than in 1950. In contrast, the female mortality rate, which is lower, has remained relatively stable. There have been modest improvements in survival at one, three and five years for men and women in the last 20 years . Oesophageal cancer has been primarily associated with alcohol and tobacco consumption, both being independent risk factors[17,18] but also having a multiplicative combined effect[19].

In counterpoint to oesophageal cancer, there has been a downward trend in **stomach cancer** incidence and mortality in Scotland over a long period – the contrasting trends in incidence and mortality for these tumours has been reported previously[20]. Mortality rates have been steadily decreasing throughout Europe over the last 60 years and Scottish mortality has closely followed the Western European country mean rate for both men and women. There have been improvements in survival at one, three and five years for men and women in Scotland in the last 20 years[xxiii].

Colorectal cancer mortality rate has reduced by over 50% since 1955 and Scotland's relative mortality ranking for this cause among Western European countries has improved for both sexes. Over the last 25 years (1986-2010) there have been increases in incidence among men (particularly those aged 55-74 years) and women (particularly those aged 65-74 years). Given this, it is likely that improvements in early detection and treatment have been important in the reduction in mortality that has been observed. The Scottish Bowel Screening Programme – in which adults aged 50-74 years are invited to participate and which involves a screening every two years – commenced in June 2007 and by December 2009 all NHS Boards in Scotland were participating in the programme. Survival has improved for men and women in the last 20 years and is above 80% at one year and above 50% at five years[xxiv].

In relation to **pancreatic cancer**, Scotland's relative position has improved despite little overall change in mortality, partly due to increases in mortality in Southern European countries. There has been very little change in incidence rates over the last 25 years[xxv]. Survival rates are low, particularly beyond one year and have not improved notably in the last 20 years . In 1977, there was a single-year peak in male pancreatic cancer mortality. There is no obvious reason for this but misdiagnosis is a possible cause. It is known that the diagnosis of pancreatic cancer is probably far more reliable now than it was back in the 1970s due to advances in imaging, ERCP[xxvi].

Leon et al predicted (in 2003) that **lung cancer** mortality had passed its peak and that mortality would be expected to fall in future years. While this has been the case for male lung cancer mortality (which has decreased steadily from a peak level in 1979), there has been no sign of a reduction in female mortality from this disease.

[xxiii] ISD Scotland - http://www.isdscotland.org/Health-Topics/Cancer/Cancer-Statistics/Stomach/
[xxiv] ISD Scotland http://www.isdscotland.org/Health-Topics/Cancer/Cancer-Statistics/Colorectal/
[xxv] ISD Scotland http://www.isdscotland.org/Health-Topics/Cancer/Cancer-Statistics/Pancreatic/
[xxvi] Personal correspondence from Dr David Brewster, Director, Scottish Cancer Registry

The female lung cancer mortality rate in 2010 was more than three times the rate in 1950. Incidence among men at all ages reduced by 50% in a 25 year period (1985-2010)[xxvii], but increased by 13% for women over the same period, with the increase concentrated among women over 65 years of age. Survival rates have improved modestly for both men and women but are only just over 30% at one year .

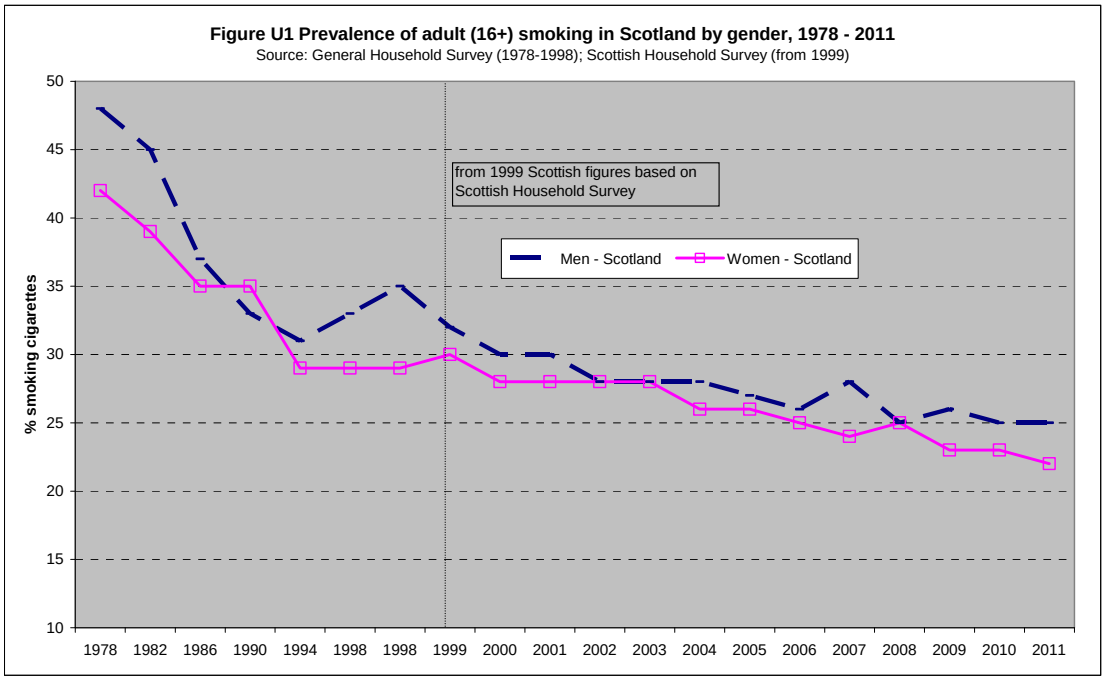
It is notable that lung cancer mortality reductions in each five year age band from 35-39 up to 60-64 years are much more modest among women compared to men, and mortality has increased among women aged 70-74 years (Table 3).

Table 3 Lung Cancer mortality by gender and age, Scotland

	Crude mortality rate (per 100,000 person-years at risk)					
	Men			Women		
Age Group	1985	2010	% change	1985	2010	% change
35-39	6.7	1.9	-72%	3.9	1.2	-69%
40-44	17.6	6.4	-64%	7.3	5.9	-19%
45-49	39.6	11.9	-70%	13.5	15.3	13%
50-54	107.5	48.5	-55%	38.9	34.4	-12%
55-59	219.0	74.6	-66%	96.9	73.6	-24%
60-64	357.7	150.4	-58%	133.6	116.7	-13%
65-69	504.0	260.8	-48%	207.5	206.9	0%
70-74	646.8	379.1	-41%	205.1	295.7	44%

Smoking, the primary cause of lung cancer (and implicated in many other cancers), has reduced as a result of progressively more stringent tobacco control policy over the last 50 years and changes in public attitudes to smoking. Smoking prevalence trends over last 30 years, estimated from the General Household Survey and latterly from the Scottish Household Survey (Figure U1), have been downward.

Figure U1 Prevalence of adult (16+) smoking in Scotland by gender, 1978 - 2011
Source: General Household Survey (1978-1998); Scottish Household Survey (from 1999)



While there appears to have been more of a reduction in smoking among men, it is still the case that more men than women in Scotland are smokers. These trends appear slightly at odds with the lung cancer incidence and mortality trends in Scotland. However, given the lag time between smoking and developing lung cancer, it is likely that part of the difference in lung cancer incidence and mortality between

[xxvii] ISD Scotland http://www.isdscotland.org/Health-Topics/Cancer/Cancer-Statistics/Lung-Cancer-and-Mesothelioma/

men and women is due to a cohort effect. Women took up smoking later than men – in the UK there was a 20-30 year time lag between smoking becoming a widespread habit in men and women[21] – and this is reflected in a later peak in mortality.

A different dose response relationship between smoking and likelihood of lung cancer between the sexes may also be important. It has been reported that women have a higher risk of developing lung cancer than men at every level of exposure to cigarette smoke and that this cannot be explained by differences in base-line exposure, smoking history, or body size, but is likely due to a higher susceptibility to tobacco carcinogens[22]**.** Nevertheless, the peak in lung cancer mortality among working age Scottish women has already been ten years longer than for men and shows no sign of an imminent reduction. This is worthy of further detailed study.

There has been a sustained reduction in female **breast cancer** mortality over the last 30 years (reduced by 46% since 1980) despite substantial increases in incidence over the last 25 years (41% increase in age standardised incidence rate for all ages, 1986-2010)[xxviii]. Improvements in early detection, treatment and survival are all likely to have contributed to this improvement. For example, survival at one to ten years after a breast cancer diagnosis in Scotland has increased notably in the last 20 years . In relation to earlier detection, the Scottish breast screening programme was initiated in 1988 and reached full national coverage in 1991[xxix]. A recent Europe-wide review of the effectiveness of breast cancer screening on breast cancer mortality suggests that there is a reduction in mortality of 25–31% for women invited for screening, and 38–48% for women actually screened[23].

There have been large reductions in **ischaemic heart disease (IHD)** and **cerebro-vascular disease** mortality among working age men and women and, although Scottish rates are still relatively high for both, they appear to be converging toward the Western European mean. Successive devolved Scottish governments have given a high priority to cardiovascular disease through initiatives aimed at prevention, early detection and better treatment. For example through the Have a Heart Paisley health demonstration project (2001-2008)[xxx], Keep Well health checks[xxxi] and the current HEAT target for inequalities targeted cardiovascular health checks[xxxii].

A modelling study focussed on coronary heart disease (CHD) mortality in the Scottish population over the period 1975-1994 attributed 40% of the total reduction in CHD mortality in the study period to improvements in treatments and just over 50% to reductions in risk factors such as reductions in smoking, cholesterol and blood pressure[xxxiii 24]. Findings from a Finnish study of CHD mortality in the period 1982 to 1997 suggested that improved treatments explained approximately 23% of the mortality reduction, and risk factors explained some 53-72% of the reduction[25].

It is likely that a combination of early detection, improved treatment and reductions in risk factors have all played their part in the improvements seen in Scotland. It is notable – as Leon and colleagues pointed out – that trends in ischaemic heart disease mortality in Finland in working age males are identical to those in Scotland,

[xxviii] ISD Scotland - http://www.isdscotland.org/health-topics/cancer/cancer-statistics/breast/
[xxix] ISD Scotland - http://www.isdscotland.org/Health-Topics/Cancer/Breast-Screening/
[xxx] http://www.healthscotland.com/keep-well/programmes/hahp.aspx
[xxxi] http://www.keepwellscotland.org.uk/index.aspx
[xxxii] http://www.scotland.gov.uk/About/Performance/scotPerforms/partnerstories/NHSScotlandperformance/cardiovascularhealthcheck
[xxxiii] Other, unquantified factors accounted for the remaining 9%.

particularly given Finland's focus on cardiovascular disease prevention built around the framework of the North Karelia project[26].

While male working age mortality from **chronic obstructive pulmonary disease** (COPD) in Scotland has fallen substantially (down by 82% since 1950), female mortality has remained stable. However, Scottish mortality rates have remained consistently among the highest in Western Europe for men and for women. It is estimated that over 100,000 Scots are currently affected. Smoking is a leading cause, along with poor air quality, exposure to dust, chronic asthma and genetic factors[xxxiv]. The current burden of COPD in Scotland may, in part, be due to the high smoking rates seen 30-40 years ago[xxxv].

Trends in **chronic liver disease** in Scotland's working age population are clearly concerning, notwithstanding the modest reduction in mortality in recent years. Since the 1970s, liver disease mortality has increased greatly: by the year 2000, male mortality was six times, and female mortality five times, the rate in 1950.

Given the increasing political focus on Scotland's problems with alcohol, exemplified by the Scottish Government's plans to introduce an Alcohol Minimum Pricing Bill in 2012/13[xxxvi], it is of interest to note that chronic liver disease mortality among working age Finnish males rose above the Scottish rate in 2007. This is the result of two contrasting trends: a slight reduction in Scottish male mortality from chronic liver disease since 2002 and a sharp rise in Finnish mortality, which began between 2003 and 2004. Finnish male mortality for this condition has continued to rise and in 2009 was more than 50% higher than the rate in 2003.

There were several changes to Finnish alcohol policy in 2004 which have contributed to the rise in Finnish mortality. Quotas for travellers' tax free imports of alcoholic beverages from other European Union (EU) countries were abolished and later in the year Estonia, a neighbouring country with low alcohol prices, joined the EU. Related excise duties on alcoholic beverages were reduced in the same year by one-third on average. It is reported that alcohol consumption in Finland increased by 10% as a result and alcohol-related harm, including alcohol-induced liver disease deaths[27], also increased significantly.

Mortality in Scotland from **external causes** – injuries, poisonings, accidents, suicide and homicide – has reduced modestly since the 1950s but, due to greater reductions in other European countries, Scotland's ranking has deteriorated. Among men, the Scottish and Western European rates are now very similar, while the Scottish female rate rose above the Western European mean in 2006. The increasing importance of this disparate group of causes has been apparent in recent studies. Our own findings show that, among the 11 causes of deaths we have compared in the working age population, the contribution of mortality from external causes has doubled in 50 years. External causes now account for 17% of the total burden of mortality for men among these 11 selected causes and 11% of the total for women. In comparisons of mortality in the three cities of Glasgow, Liverpool and Manchester (in the period 2003-2007), external causes contributed to 14% of the excess deaths in Glasgow across all ages and 30% of the excess deaths in the younger working age group (15-44 years). There are a range of causes collected under this grouping, some of which

[xxxiv] http://www.chss.org.uk/chest/chest_conditions/chronic_obstructive_pulmonary_disease/index.php
[xxxv] http://www.scotpho.org.uk/health-wellbeing-and-disease/chronic-obstructive-pulmonary-disease-copd/key-points
[xxxvi] http://www.scottish.parliament.uk/help/43354.aspx

have differing trends (cf. trends in motor vehicle accident (MVA) mortality versus suicide). Further research on specific individual causes within the 'external causes' grouping could assist in understanding the overall trends better.

Scotland's **suicide** ranking has worsened within Europe over the last 40 years and rates for both sexes have been higher than the Western European mean since 1993. However, it should be noted that issues of under-reporting, misclassification and different practices and recording systems may be particularly pronounced in relation to suicide, and can hinder accurate cross-country comparisons[28,29]. The definition of suicide we have applied is almost identical to that used by Office for National Statistics (ONS), including deaths given an underlying cause of intentional self-harm or an injury/poisoning of undetermined intent[xxxvii]. Mok et al[30] have noted that Scottish suicide rates have increased relative to England and Wales in the last 40 years and that much of the divergence is due to suicide among young men. In a related study, covering the period 2001-2006, the authors reported that younger male and female Scots (aged 15–44 years) had double the risk of suicide compared with their English peers[31].

Within Scotland, we know that suicide is strongly socially patterned with men and women from the most deprived areas (SIMD[xxxviii] decile 1) at least four times more likely to commit suicide than their counterparts in the least deprived areas (SIMD decile 10)[32]. Recent studies of suicide trends suggest that rises in suicide can be linked to increased unemployment associated with the global recession[33] and in English regions this is a particularly notable association for men[34]. Taken together, these findings show that suicide remains higher in Scotland than in many other European countries, despite high profile and well-funded suicide prevention strategies, such as Choose Life[xxxix], and that there is also a very real risk that a prolonged recession could lead to further increases in suicide rates in Scotland.

Mortality as a result of **motor vehicle accidents** (MVAs) peaked in Scotland in the mid 1970s and has since dropped by over 75% for both sexes. Scotland's relative position in relation to other European countries has worsened, but this may partly be explained by coding changes in some countries. There are notable discontinuities (sharp reductions) in the MVA mortality trends for a number of countries – France in 2000, Portugal in 2002 and Italy in 2003 – which coincide with the introduction of the ICD10 classification. It is not easy to distinguish motor vehicle accidents via ICD10 and it is possible that in these countries codes other than those we have applied (V02-V04, V09, V12-V14, V19- V79, V86-V89) have been used to identify motor vehicle accidents, from among the range of other codes used for transport accidents (V01-V99).

[xxxvii] The ICD10 codes Y87.0 / Y87.2 (Sequelae of intentional self-harm/injury/poisoning of undetermined intent) are excluded from the definition we have used. See ONS website for their full definition: http://www.ons.gov.uk/ons/rel/subnational-health4/suicides-in-the-united-kingdom/2010/stb-statistical-bulletin.html#tab-Definition-of-suicide

[xxxviii] SIMD, denotes the Scottish Index of Multiple Deprivation, an index which defines relative deprivation for small areas across Scotland in a consistent way. For more information - www.scotland.gov.uk/Topics/Statistics/SIMD

[xxxix] Choose Life : A National Strategy and Action Plan to Prevent Suicide in Scotland was launched in 2002, by the then Scottish Executive. This policy was developed alongside the National Programme for the Improvement of Mental Health and Well-Being in Scotland.

4.1 Policy context

Linking policy to 60 years of mortality trends in any country would be a challenge and in this brief discussion of the Scottish context there is no attempt to be comprehensive. Rather, we touch on some issues that are pertinent to consider and give examples of recent policy.

There is a time-lag between policy development and implementation, and between changes in a risk factor and the health benefits of those changes. Good policy also needs to be implemented well. The health impacts of lifestyle and environment run through the life-course and there can also be specific cohort effects as a new culture and behaviours take hold on each new generation.

With the growing recognition that health in Scotland was (and is) significantly worse than in other parts of the UK, successive devolved governments in Scotland have introduced strategies, policy initiatives and legislation to address a variety of health-related issues. Some policy and action aims to influence wider environmental, social and cultural factors, while there are also issue-specific policies to address major risk factors and specific causes of death.

Scottish policy on tobacco control is an example of the latter. In March 2006, Scotland followed the Republic of Ireland's lead by banning smoking in enclosed public places[xl]. This has been followed by further initiatives aimed at making Scotland tobacco free. On 1 October 2007, the minimum purchase age for tobacco was increased from 16 to 18 in Scotland, England and Wales; and in January 2010 a bill was passed[xli] which, among other measures, introduced a ban on the display of cigarettes and other smoking related products and on the sale of cigarettes from vending machines.

In relation to Scotland's increasingly recognised problems with alcohol, there have been various action plans which have placed an emphasis on changing the culture of drinking in Scotland[xlii]. The Licensing (Scotland) Act 2005 came into force on 1 September 2009. The Act places a direct obligation on local licensing boards to consider the protection and improvement of public health when granting or reviewing licences. In November 2011, the Scottish Government introduced the Alcohol (Minimum Pricing) (Scotland) Bill. This demonstrates a strong commitment to a legislative approach to reducing alcohol consumption, although this bill has been challenged in the European Union.

Similarly, a range of initiatives have been introduced to increase physical activity[35], improve the Scottish diet[36] and tackle obesity[37]. It is too early to say what impact these initiatives and strategies have had on mortality. Many, if successful, might be expected to reduce mortality across more than one cause.

It is clear from the trends presented in this report and the discussion above about their wider context, that it is a combination of primary prevention, better care and improved treatment outcomes that has had a positive impact on Scottish mortality from chronic diseases such as heart disease, cerebrovascular disease, breast cancer and colorectal cancer. However, this study also shows that as the burden of mortality from these chronic diseases has reduced, mortality in younger age groups and from causes related to alcohol and from external causes – injuries, poisonings, accidents,

[xl] Smoking, Health and Social Care (Scotland) Act, 2005
[xli] Tobacco and Primary Medical Services (Scotland) Bill, 2010
[xlii] Plan for Action on Alcohol Problems, 2002 (and updated in 2007)

suicide and homicide – have become increasingly prominent. Scottish Government policy has arguably already started to focus more on these issues, but given the worrying mortality trends among younger Scottish adults, further emphasis needs to be given to understanding and addressing the causes of mortality in this age group, many of which will be located within underlying social, economic and environmental factors. The role of further research in this context is set out in the next section.

4.2 Further research

A better understanding is needed of the concerning Scottish trends in mortality in younger working age, among elderly women and for female lung cancer. More detailed research of the factors underlying these trends could be of great value.

There is the possibility that some of the mortality trends observed are in part period effects and in part related to specific cohorts. Static trends in mortality among younger working age Scots may reflect some sort of cohort effect. It is also possible that the poor health profile of working age women may be being reflected at a later stage in life in the increasingly poor health profile of elderly Scottish women. This study has not undertaken cohort specific analyses, but a retrospective cohort study could help improve our understanding of historical mortality trends and provide an insight into likely future mortality trends in particular age/gender groups.

The causes included in the working age mortality analyses cover just less than 60% of all mortality in the age group. As an example, these analyses have not included drug related deaths (except those drug deaths classified as suicides), of which there were 584 in Scotland in 2011[xliii]. Widening the range of causes studied would provide a more comprehensive comparative analysis of mortality. Equally, the range of comparator countries could be extended to a wider range of European countries (for example, including more Eastern European countries and the smaller northern European countries). Leon and colleagues, in their original report, pointed to the importance of learning from other countries outside the UK – with different social, cultural and economic contexts – that have managed to improve their health position relative to others. This could be an illuminating focus for further research.

It has not been the purpose of this study to investigate in depth the emerging mortality trends in Scotland by age group or by cause. However, interesting questions arise. For example, are the improving trends for some conditions attributable to improved prevention, early detection and better treatment and care, or is their incidence in the Scottish population falling? Some of the more positive trends – reductions in mortality from ischaemic heart disease, cerebrovascular disease and female breast cancer, for example – arguably do reflect the success of screening, early intervention and improved treatment rather than a reduction in incidence of these diseases. Further more detailed analysis of incidence, treatment and mortality data for specific causes could help improve our understanding of these trends.

In a European context, there are differences in the timing of trends for different causes in different countries and these are worthy of further study. Questions to address might include:

- Why has cerebrovascular disease mortality risen, peaked and dropped at different points in time in different countries?

[xliii] National Records of Scotland Drug-related Deaths in Scotland in 2011, published in august 2012 - http://www.gro-scotland.gov.uk/statistics/theme/vital-events/deaths/drug-related/2011/index.html

- Similarly, why has the trend in oesophageal cancer mortality in Scotland and the rest of the UK been so different from other parts of Europe?
- How has policy and legislation affected liver cirrhosis trends in different European countries?
- In relation to heart disease, what can be learned from the different approaches to primary prevention and treatment in Scotland and Finland over the last 40 years?

5. Conclusions

This study, which compares Scottish mortality over a 60 year period within Europe, reveals a picture of mortality trends that vary by age, gender and cause.

Although there have been absolute reductions in mortality rates across all age groups in the last 60 years, mortality among Scottish men and women has deteriorated relative to our Western European neighbours. This is particularly clear for infants, children and the younger working age population of both sexes, and for elderly women.

Mortality rates among younger working age adults (age 15-44) in Scotland are of particular concern. There has been no reduction in mortality among younger working age men or women since the mid to late 1980s, and among men the mortality rate rose by 19% from 1991-2002. Scotland now has the highest mortality among this age group in Western Europe. In 2009, among younger working age Scots, mortality was 46% higher for women and 54% higher for men than it was in England and Wales.

Mortality among working age people (age 15-74) as a whole in Scotland has fallen for many causes over the last 50 years, in line with trends across the rest of Western Europe. Moreover, Scotland's relative position has improved for a number of conditions. For example, among the working age population there have been sustained long-term reductions in Scottish mortality for colorectal cancer, female breast cancer, male lung cancer, male ischaemic heart disease and cerebrovascular disease.

However, there are still reasons for concern in relation to a range of causes: Scottish mortality rates for oesophageal cancer are now the highest in Western Europe; the suicide rate among Scottish men is 50% higher than in 1968; and rates of mortality from chronic liver disease (including cirrhosis) among men and women, despite reductions in recent years, remain at historically high levels and are among the highest in Western Europe.

The relative contributions of different causes of death within Scotland have shifted over the last 60 years. Among men, as the burden of mortality from heart disease and cerebrovascular disease has reduced, the relative contribution of mortality from external causes, chronic liver disease (including cirrhosis), lung cancer and oesophageal cancer has increased. Among women there has been a similar pattern, with the relative contribution of mortality from external causes, chronic liver disease, lung cancer and chronic obstructive pulmonary disease (COPD) increasing. Moreover, the contribution of lung cancer mortality among women has increased both in absolute terms and relatively.

Female lung cancer mortality is a key issue. Unlike male lung cancer mortality, which peaked over a 15 year period between the mid 1960s and the end of the 1970s and has since dropped substantially, the female lung cancer mortality rate rose to its present level in the early 1990s and shows no sign of a decline. This represents a 25 year peak and a quite different pattern to that observed for male lung cancer mortality.

Taking a broader societal view, we live in a globalised and consumer-driven society in which our economic, social and demographic environments are rapidly changing. It has been argued that the 'modernist' world we live in is in transition; in a 'change of age' rather than merely an 'age of change'[38]. Scotland, and much of Europe, is predicted to remain in a prolonged economic depression. This prevailing economic context, which began with the financial crisis of 2008 and has led to rises in

unemployment, job insecurity and widespread financial difficulties, makes it more likely than not that mental health problems, suicide incidence and poverty rates will increase. In relation to other aspects of health in Scotland, there are long-standing trends that precede the financial crisis: smoking prevalence has been decreasing steadily but rising levels of obesity, high levels of alcohol related harm and low levels of physical activity are continuing concerns. What is clear is that a range of existing and emerging issues are likely to impact directly and indirectly on future mortality trends.

This type of comparative epidemiological study provides an insight into how these global, economic and cultural trends may be affecting population health. The findings of this study importantly provide quantifiable evidence for policy debate. Given the relative speed of change in many of these mortality trends, these analyses should be updated regularly in order to monitor and understand how patterns of mortality are changing in Scotland and within a European context.

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Appendix

Appendix Table 1 Countries included by region

Region	Countries
UK	Scotland
	England and Wales
	Northern Ireland
Northern Europe	Denmark
	Finland
	Norway
	Sweden
Western Europe	Belgium
	France
	Ireland
	The Netherlands
Central Europe	Austria
	Germany
	Switzerland
Southern Europe	Greece
	Italy
	Portugal
	Spain
Eastern Europe	Hungary
	Poland

Appendix Table 2 Years in period 1950-2010 where mortality data are missing by country

Countries	Missing years
UK	
Scotland	–
England and Wales	2010
Northern Ireland	2010
Northern Europe	
Denmark	1950 - 1951, 2007 – 2010
Finland	1950 – 1951
Norway	1950, 2010
Sweden	1950
Western Europe	
Belgium	1950 – 53; 2000 – 2003, 2006 – 2010
France	1951, 2009 – 2010
Ireland	2010
The Netherlands	–
Central Europe	
Austria	1950 – 1954
Germany	1950 – 1951
Switzerland **	1950, 2008 – 2010 (for Cirrhosis, COPD, MVA: 1995 – 2010)
Southern Europe	
Greece	1950 - 1960, 2010
Italy	1950, 2004 – 2005, 2009 – 2010
Portugal	1950 – 1954; 2004 – 2006, 2010
Spain	1950, 1970, 2009 – 2010
Eastern Europe	
Hungary	1950 – 1954, 2010
Poland	1950 – 1958, 1997 – 1998, 2010 (for MVA: 1972 – 1982; for suicide: 1980 – 1982)

**: Switzerland has used an aggregated ICD10 coding system from 1995

Appendix Table 3 Codes used for each ICD revision as specified in the WHOSIS database

Causes of Death	ICD Revision				
	ICD 6/7†	ICD 8†	ICD 9†	ICD 10	Swiss (ICD10 based) aggregated coding in use from 1995
All causes	A000	A000	B00	AAA	1000
Oesophageal cancer	A045	A046	B090	C15 – C159	1028
Stomach cancer	A046	A047	B091	C16 – C169	1029
Colorectal cancer	A048, 153	A049, 153	B093, B094	C18 – C219	1030
Pancreatic cancer	157	157	B096	C25 – C259	1032
Lung cancer	A050	A051	B101	C33 – C349	1034
Breast cancer	A051	A054	B113	C50 – C509	1036
Ischaemic heart disease	A081	A083	B27	I20 – I259	1067
Cerebrovascular disease	A070	A085	B29	I60 – I699	1069
Chronic obstructive pulmonary disease	A093, A097	A093, A096	B323, B325	J40 – J46	no equivalent code*
Chronic liver disease, incl. cirrhosis	A105	A102	B347	K70 – K709, K73 – K739, K74 – K749	no equivalent code*
External causes	A138 – A150	A138 – A150	B47 – B56	V01 – Y89	1095
Suicide	-	A147, A149	B54, B560	X60 – X84, Y10 – Y34	1101
Motor vehicle accidents	A138	A138	B471	V02 – V04, V09, V12 – V14, V19 – V79, V86 – V89	no equivalent code*

*The aggregated ICD10 coding used by the Swiss makes it impossible to compare the Swiss mortality data against equivalent data in other countries.
† The codes displayed are from condensed ICD lists used by WHO, derived in turn from actual ICD codes.

Appendix Table 4 Time periods with data available for each ICD revision by country (all causes)

	ICD revision			
Countries	**ICD 6/7**	**ICD 8**	**ICD 9**	**ICD 10**
UK				
Scotland	1950 – 1967	1968 – 1978	1979 – 1999	2000 – 2010
England & Wales	1950 – 1967	1968 – 1978	1979 – 2000	2001 – 2009
Northern Ireland	1950 – 1967	1968 – 1978	1979 – 2000	2001 – 2009
Northern Europe				
Denmark	1952 – 1968	1969 – 1993	*	1994 – 2006
Finland	1952 – 1968	1969 – 1986	1987 – 1995	1996 – 2009
Norway	1951 – 1968	1969 – 1985	1986 – 1995	1996 – 2009
Sweden	1951 – 1968	1969 – 1986	1987 – 1996	1997 – 2010
Western Europe				
Belgium	1954 – 1967	1968 – 1978	1979 – 1997	1998 – 99, 2004 – 2005
France	1950 – 1967	1968 – 1978	1979 – 1999	2000 – 2008
Ireland	1950 – 1967	1968 – 1978	1979 – 2001	2007 – 2009
The Netherlands	1950 – 1968	1969 – 1978	1979 – 1995	1996 – 2010
Central Europe				
Austria	1955 – 1968	1969 – 1979	1980 – 2001	2002
Germany	1952 – 1967	1968 – 1978	1979 – 1997	1998 – 2001
Switzerland ***	1951 – 1968	1969 – 1994	**	1995 – 2007
Southern Europe				
Greece	1961 – 1967	1968 – 1978	1979 – 2009	
Italy	1951 – 1967	1968 – 1978	1979 – 2002	2003 – 2008
Portugal	1955 – 1970	1971 – 1979	1980 – 2001	2002 – 2009
Spain	1951 – 1967	1968 – 1979	1980 – 1998	1999 – 2009
Eastern Europe				
Hungary	1955 – 1968	1969 – 1978	1979 – 1995	1996 – 2009
Poland	1959 – 1968	1969 – 1979	1980 – 1996	1999 – 2009

Note: These years may vary for some specific diseases
*: Some of the data and population files were recently updated on the WHO website (9th July, 2012). However, Table 4 indicates the ICD revisions by country and year available at the time of extraction and analysis in April 2012.
**: These countries never used ICD9
***: Switzerland has used an aggregated ICD10 coding system from 1995

Appendix Table 5 European Standard population

Age	Weight
0-1	1600
1-4	6400
5-9	7000
10-14	7000
15-20	7000
20-24	7000
25-29	7000
30-34	7000
35-39	7000
40-44	7000
45-49	7000
50-54	7000
55-59	6000
60-64	5000
65-69	4000
70-74	3000
75-79	2000
80-84	1000
85 & over	1000

Appendix Table 6 Table of Figures

Format of results

The age-standardised mortality rates that were calculated are presented in figures by age group, sex, cause of death and region. For each age group and cause of death summary graphs were produced that contained the minimum, maximum and mean rates for each year, with Scotland's rates added in a o—o—o format. These figures also contain information on the Scottish rank position for each five year period starting from 1956. The Scottish trends and its position in Europe are described in the 'Results' section and relate directly to these graphs.