Understanding the Health of Scotland’s Population in an International Context

A review of current approaches, knowledge and recommendations for new research directions

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PART II – Comparative Mortality Analysis

A report by the London School of Hygiene & Tropical Medicine

Commissioned and funded by the Public Health Institute of Scotland

March 2003
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INTRODUCTION

The purpose of this report is to improve our understanding of the health of Scotland in an international context. In the absence of any existing systematic description of how mortality rates in Scotland compare with those in other European countries we have undertaken such an analysis. The results of this descriptive analysis are presented here in Part II of the report.

Data directly available from WHO was used to examine mortality trends from 1950 to 2000 in 20 European countries. We started by considering all cause mortality in four different age groups (infancy, childhood, working and adult age). We then moved on to focus on working ages for specific causes of death. Scottish trends were studied and compared with those for other countries and against the mean, minimum and maximum Western European rates.
Mortality data
Mortality data were obtained from the World Health Organization Statistical Information System (WHOSIS) website (http://www.who.int/whosis). This WHO Mortality Database contains counts of deaths by country, 5-year age group, sex, individual year and cause-of-death, coded according to the ICD (see below) in use at the time of death. In addition, corresponding mid-year population estimates were also available from the same source. 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.

Countries and time period
These data were analysed for 20 European countries (see table 1) for the period 1950-2000, where available. 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 Eastern Europe, Poland and Hungary were included but only for country-specific comparison. For Germany, the rates from former Western 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 curve for Germany around 1990. Nevertheless, considering that Germany only acts as a comparison country for Scotland and is not a focus of interest per se, we felt that this approach was adequate to the task in hand.

Causes of death
Choice of age groups and causes
Mortality was studied for all causes by age group (infant mortality, child mortality (1-14 year olds), adult 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 as it is in this age group that Scotland’s mortality is worst in the context of Western Europe (see part I of this report). The causes selected for analysis were the major ones together with several of particular interest such as liver cirrhosis. The 13 causes are listed in table 2. Between them these causes accounted for 84% of all deaths in men and 82% of those in women aged 15-74 years.

International Classification of Diseases (ICD)
Causes of death have been coded according to the International Classification of Diseases since the beginning of the 20th century. This has been revised approximately every 10 years. The ICD revisions that have been used after 1950 are IDC6 to ICD10. Table 2 indicates the codes used in Switzerland in 1996-7 (table 3 indicates the range of years in which each ICD revision was used by country).

Coding
As four 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 of all, coding practices may change when a new ICD revision is introduced, and secondly there will be differences between countries in any particular period/ICD revision, in certification and coding. This may lead to ‘step effects’ in the curve at the time when a new ICD-version was introduced, for some countries. We have chosen to use the codes that best represented the practice in Scotland, in other
words, to minimise any inflections in the Scottish curves, even though this might occasionally go with sudden discontinuities in the trends for other countries. Analysis of these discontinuities is beyond the scope of this report.

There are several causes of death for which specific problems are known to exist:

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.

Chronic obstructive lung disease: This is a relatively recent term which has been described as well 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 it was given a category of its own.

Statistical aspects

Age-standardised rates
To take account of differences in age composition of populations between countries or over time when comparing rates for different populations, it is necessary to adjust the rates using direct standardisation. This method averages age-specific rates in a study population using as weights the population distribution of a specified population. For this report, the European standard population was used.

Western European country means, minimums and maximums
For each year considered, we have calculated the Western European country mean as a simple average of all the rates. In addition, for each year we have identified the minimum and maximum rate among the comparison countries. For each cause of death, these rates were displayed in a graph for the period 1955 to 1995. These cut-off points were chosen because the rates were not available for all countries before and after these years. Information on Greece was available only from 1961, so this country was excluded from this analysis altogether. Poland and Hungary were also excluded, which left 17 countries for this analysis. In each graph, mortality rates for Scotland were superimposed, to illustrate Scotland’s position in Europe.

Rank position
To quantify Scotland’s position in Europe, we calculated every country’s rank position for each year. Subsequently the mean rank position for every five-year period from 1956 was determined, to take account of random variation. This analysis was carried out again for all countries except Greece, Poland and Hungary (17 countries in total). 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 17.

RESULTS

A note on reporting of mortality rates: these will, with the exception of infant mortality rates, be reported per 100,000/year unless indicated otherwise.

The data described below relates to the years 1950 to 2000.

All cause mortality

Infants (0-1 years old) (fig A1M – A6F)

Scottish trends
Mortality rates for both boys and girls steadily declined: from 43 to 6 and from 34 to 5 per 1000/year respectively.

Comparison of trend with Western European country mean
Since the early 1960s, Scottish rates for both boys and girls quite closely followed the Western European country mean. Before that time they were slightly lower.

Position in Europe
In the 1950s, there were huge differences between European infant mortality rates with very high rates in Southern Europe and Portugal in particular. Despite these differences, infant mortality rates have since decreased in all countries and current differences between countries are very small: minimum and maximum rates are 4 and 8 per 1000/year and 3 and 7 per 1000/year for boys and girls respectively. Determination of rank position is therefore not very meaningful within this age group.

Children (1-14 years old) (fig B1M – B7F)

Scottish trends
Since 1950, mortality rates in children have decreased considerably, dropping from 114 to 19 for boys and from 86 to 12 for girls.

Comparison of trend with Western European country mean
Rates in Scotland in the 1950s were close to the minimum, and have remained low since that time. The subsequent decrease in the Western European country mean has meant that Scottish rates have been close to this mean since 1975.

Position in Europe
In the 1950s, huge differences existed between mortality rates of Western European countries. In Southern Europe, mortality was very high, with an extreme of 4 times Scotland’s rate occurring in Portugal. Rates in all countries have since decreased and converged on the Western European country mean, and recent European rates are actually very similar to Scottish rates (with the exception of Portugal, Hungary and Poland, where they remain slightly higher). For this reason, rank position is not particularly informative in this context.

Adults (15-74 years old) (fig C1M – C7F)

Scottish trends
Following a period of reasonable stability since the 1950s, male mortality rates have been decreasing since the 1970s. The mortality rates in 1950 and 2000 were 1250 and
740 respectively. The female trend has been somewhat different, whereby there has been a constant slow decrease since the 1950s. Female mortality has declined from 880 in 1950 to 430 in 2000.

Comparison of trend with Western European country mean
In men, Scottish mortality rates have been falling at a similar pace to the Western European country mean and have accordingly remained around 180 higher than this mean. In women however, the Western European country mean is falling at a faster pace and, consequently, the difference between these rates is slowly increasing.

Position in Europe
The decline in mortality has been greater in other European countries than Scotland. Therefore, apart from a few exceptions between 1965-75 when rates were slightly higher in Ireland, Scotland has had the highest mortality rates for men in Western Europe since 1978 and for women since 1958.

The mortality rate patterns in most Western European countries were parallel, although lower. Finland had very high mortality rates for men up until 1970, since which time there has been a steep decline, and it is currently ranked third. Other countries that have had high mortality rates at some point during the past 50 years are Northern Ireland, Denmark, Ireland, Austria, Germany and Portugal. Trends in Hungary and Poland are generally rather different from the rest of Europe, although the most recent mortality rates in Poland are very similar to those in Scotland.

A number of countries have actually made a ‘step-change’ in rank position over the past 50 years: the positions of Ireland and Denmark deteriorated and those of Austria and France improved for men; the positions of England & Wales, Denmark, the Netherlands and Norway deteriorated whilst those of Finland and Spain improved for women.

Elderly (over 75 years old) (fig D1M – D7F)

Scottish trends
Mortality rates decreased slightly in men until 1980 (from 17000 to 15500), following which there was a steadier decline, to 11000 in 2000. For women, the opposite is true: mortality rate declined fairly fast until 1985, falling from 14000 in 1950 to 9500. Subsequently there has not been much further decrease: mortality rate reached 8500 in 2000.

Comparison of trend with Western European country mean
The maximum, minimum and mean Western European rates follow an approximately parallel pattern, with a decline in men since 1975 and a steady decline in women since 1955. The Scottish mortality rate for men in this age group has consistently fallen between the Western European country mean and maximum rates. In women, the Scottish rate used to lie close to the mean but has recently fallen at a slower rate than the Western European country mean, and is consequently lagging behind.

Position in Europe
Trends are quite varied between the European countries: some rates have declined, others have remained stable or display peaks in mortality rates. Scotland has been ranked third for much of the time since 1955 and currently among Western European countries, only Ireland and Portugal have higher rates than Scotland in both men and
women. Countries that have had higher rates than Scotland in the past are Northern Ireland, Finland, Ireland, Austria, Germany and Portugal. Rates in Hungary and Poland have changed little and are also currently higher than the Scottish rates.

**Cause specific mortality (15-74 year olds)**

**Oesophageal cancer** *(fig E1M – E7F)*

**Scottish trends**
Mortality rate has been steadily increasing in men since the beginning of the 1970s. Mortality rates in women have also risen, but to a much lesser extent, and now appear to be stable.

**Comparison of trend with Western European country mean**
Until 1970, Scottish rates in men were close to the Western European country mean. Since then Scottish rates have drifted away from the mean and are now the highest in Western Europe. In women, the mean rate also remained stable thus resulting in a divergence with the Scottish rate.

**Position in Europe**
In men, a wide variety of trends are observed: England and Wales and Northern Ireland follow a similar pattern to Scotland, but at a lower level; in Northern Europe rates are decreasing in Finland but increasing in Denmark; France and Switzerland previously had very high rates which subsequently fell and are now clearly lower than in Scotland. Rates in Ireland, Netherlands and Belgium are also increasing but at a lower level. In the other countries, mortality has remained reasonably stable, with the exception of Hungary, where mortality has increased sharply since 1980 and is now at the same level as Scotland.

In women, mortality rates in most countries have remained low and stable. Exceptions are Northern Ireland and Ireland where the mortality rates have been very similar to the Scottish rate. In Finland, mortality has decreased sharply from the highest rate to one of the lowest.

In both men and women, the Scottish rank position has deteriorated several positions to be 2nd for men and 1st for women in the first half of the 1990s.

**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.

**Comparison of trend with Western European country mean**
Rates have been steadily decreasing throughout Europe, and the rate in Scotland has followed the Western European country mean rate in both men and women, albeit at a slightly higher level.

**Position in Europe**
Countries with higher rates than Scotland include Finland - which had very high rates up until 1980 - and Portugal and Italy, in both men and women. In Hungary and Poland, mortality from stomach cancer has always been higher, and is declining at a
Colored rate to Scotland in men, whereas in women it is almost equal to the Scottish rate.

**Colorectal cancer** *(fig G1M – G7F)*

**Scottish trends**
Colorectal cancer mortality rates in men fell between 1955 and the early 1980s. However, since then it has been relatively stable. In women, however, the rate has fallen steadily since 1955.

**Comparison of trend with Western European country mean**
The Western European country mean has risen slightly for men over the period and has fallen since the mid-1970s for women. For both men and women the Scottish rate has gradually converged with the mean.

**Position in Europe**
Up until the early 1970s, Scottish rates were the highest in Western Europe for men and women. In the most recent period Ireland, Denmark and Austria have rates that are as high or higher than those in Scotland.

**Pancreatic cancer** *(fig H1M – H7F)*

**Scottish trends**
Mortality due to cancer of the pancreas in men rose from 1955 until the early 1970s, since when it has declined. There is a suggestion of a similar, but less pronounced pattern among women.

**Comparison of trend with Western European country mean**
The Western European country mean has also shown a pattern of increase followed by slight decrease among men, while for women an initial slight increase has given way to a stable mean rate. Rates among Scottish men and women have both converged downwards towards the Western European country mean, and are now fluctuating around it.

**Position in Europe**
For both men and women Scottish rates have improved their rank position relative to other Western European countries since 1955. This has partly been a consequence of sharp increases in Southern European countries and less pronounced increases in countries such as Austria and Germany.

**Lung cancer** *(fig I1M – I7F)*

**Scottish trends**
Mortality from lung cancer in men declined after having reached a peak around 1975. The trend in women is very different to that observed in men: mortality rates steadily rose from the 1950s, stabilising at the beginning of the 1990s. In the most recent years there is a suggestion of a slight decline.

**Comparison of trend with Western European country mean**
The Western European country mean for men also shows a pattern of increase followed by decrease. However, the timing and extent of these trends is later and less
marked than for Scotland, resulting in a pronounced downward convergence of the Scottish rates towards the mean. In women, the Western European country mean has been increasing, but at a much slower pace, resulting in a very marked divergence of the Scottish rate away from the mean.

**Position in Europe**
Scottish lung cancer mortality in women has consistently been the highest in Western Europe (and indeed the world) for women over the entire period. Until the early 1980s the same applied to men, since when it has been overtaken by Belgium. Among women, Denmark’s rate has been rapidly catching up that of Scotland and in the last few years it has been higher than that in Scotland.

**Breast cancer (fig J1M – J7F)**

**Scottish trends**
Breast cancer mortality rates in Scotland increased up until the mid-1980s. Since the mid-1990s they have been falling.

**Comparison of trend with Western European country mean**
The Western European country mean has followed a similar trajectory, although slightly less pronounced. However, most recently it appears that the fall in mortality in Scotland has been steeper than in many other countries, resulting in a degree of convergence.

**Position in Europe**
Scottish rates are not the highest in Western Europe, but do lie close to the maximum. The mortality rates of other parts of the UK, Denmark, Ireland and Belgium are very similar to those in Scotland.

**Ischaemic Heart Disease (IHD) (fig K1M – K7F)**

**Scottish trends**
Mortality rates for IHD in men increased from the 1950s, plateaued for a few years and then started declining at an increasingly steep rate from the early 1970s. The trend in women is very different, being one of intermittent decline that has become steadier and more marked from the early 1980s.

**Comparison of trend with Western European country mean**
In general, the Scottish rates for men have run parallel to the Western European country mean, which also had a peak around the 1970’s. Most recently, it appears that the curves are starting to converge.
For women, the Western European country mean slowly fell whilst the Scottish rate remained stable until the late 1980s, meaning the two curves diverged slightly. Since then, the Scottish rate has started to fall and is now clearly converging with the Western European rate.

**Position in Europe**
There are huge differences between the IHD mortality rates of European countries. Scottish rates in women have consistently been the highest in Western Europe since the 1950s. Among men, Scotland was displaced from the number 1 position by Finland in the 1960s and 1970s. Rates in Northern Ireland have been particularly
close to those of Scotland throughout the past 50 years. In Eastern Europe rates are steadily increasing, and rates in Hungary have recently overtaken Scottish rates in both men and women.

**Cerebrovascular disease** *(fig L1M – L7F)*

**Scottish trends**
The pattern of cerebrovascular disease is different to that of ischaemic heart disease: rates have been falling since 1950, the decline being particularly consistent among women.

**Comparison of trend with Western European country mean**
The Western European country mean and minimum have also declined, as has the maximum rate since 1980. As per IHD mortality, Scottish mortality appears to be converging with the Western European country mean in men. In women, there was slight convergence until 1975, since when the two rates have run parallel.

**Position in Europe**
Portugal has extremely high mortality rates, especially in men. However, after Portugal, Scotland has the highest mortality rates in Western Europe. Other Western European countries with high mortality are Northern Ireland, Finland and Ireland. Rates in the other countries follow a similar pattern to each other and lie more closely together than for IHD mortality rates.

**Chronic Obstructive Lung Disease** *(fig M1M – M7F)*

**Scottish trends**
Following a peak around 1960, mortality due to chronic obstructive lung disease in men started a long period of decline that has only recently levelled off. In women, the pattern is very different, with mortality slowly rising since 1955.

**Comparison of trend with Western European country mean**
In men, the Western European country mean rate has been falling since 1970, after which point the Scottish rate has been converging towards it. In women, the mean has remained relatively stable, so the Scottish rate has been diverging away from it since the early 1970s.

**Position in Europe**
In men and women Scotland has one of the highest mortality rates from this cause of any of the comparator countries in Western Europe. Rates among men are particularly similar to those in Northern Ireland and England and Wales from 1970. Ireland has also rates that are of the same order, which have often been higher than those in Scotland. Among women, rates in Denmark have increased very steeply since the early 1970s and are now appreciably greater than those in Scotland.

**Liver cirrhosis** *(fig N1M – N7F)*

**Scottish trends**
Scottish mortality rates from liver cirrhosis were essentially static between 1950 and the early 1970s. Since then in both sexes they have been increasing. This increase has been particularly steep since the early 1990s.
Comparison of trend with Western European country mean
The mean in men and women has shown a similar pattern – with a slight upward trend that peaked in the mid-1970s followed by a gradual decline. This has resulted in Scottish rates in both sexes first of all converging upwards towards the mean, crossing and then diverging away since the early 1990s.

Position in Europe
Currently, the Scottish mortality rates among men and women appear to be the highest in Western Europe, although they remain low in comparison with those in Hungary. The trends described above have resulted in Scotland’s rank position deteriorating gradually, although the full extent of this is not evident in the rank order statistics shown in the Figures because the major shift occurs in the latest 5-year period for which the rank order data are not available.

The change in Scotland’s rates relative to the Western European country mean is partly driven by the increase in Scotland. However, it is also influenced by the steep declines over the past 20 years in the extremely high mortality rates suffered by countries such as France, Austria and the countries of Southern Europe. In this way, Scotland is going in the opposite direction to most of Western Europe.

**External causes (fig O1M – O7F)**

**Scottish trends**
Scottish rates have not changed much over the past 50 years with respect to external causes of mortality in men. The rate rose slightly until the 1970s but has decreased since and is now back at the 1950 level. The trend in women is quite similar: the mortality rate is at the same level now as in 1950, although higher levels were observed during the 1970s.

Comparison of trend with Western European country mean
In men, mortality from external causes has always remained below the Western European country mean, although these rates are now converging, due to the slow decline of the mean. Mortality in women is slightly higher than in other countries and follows the mean rate quite closely, although it currently appears to be falling below the mean.

Position in Europe
Many countries have much higher mortality rates than Scotland, with Finland displaying the highest male rate. In men, rates that are most comparable to Scotland are seen in the rest of the UK, Norway, Ireland, Italy, Greece and Spain. In women, different trends are observed, but Scotland seems to be most similar to Norway, Sweden, Ireland and Germany.

**Suicide (fig P1M – P7F)**

**Scottish trends**
Mortality due to suicide in men remained low and stable until about 1975. Since then it has slowly risen to a level that is now twice as high as it was in 1955. In women, mortality from suicide has remained more stable and it is currently still at the same rate as it was in 1955.
Comparison of trend with Western European country mean
There has been a steady convergence of suicide rates in men with the mean since the mid-1970s. Today the Scottish rate is the same as the mean. In women, the mean rate has remained stable, and the Scottish rate runs parallel to, although below, this mean.

Position in Europe
Suicide rates vary considerably between countries. In men, the highest rates are currently in Finland, France and Belgium, Austria and Switzerland, Hungary and Poland, although in some of these countries rates are falling. The only other countries where increases in mortality are observed, as per in Scotland, are Ireland and Poland. In women, rates for most countries are either stable or falling. The highest rates are found in the same countries as for men. The most similar patterns to Scotland are in Northern Ireland, Norway, Ireland, the Netherlands and Poland.

Motor vehicle accidents (fig Q1M – Q7F)
Scottish trends
Mortality from motor vehicle accidents is currently below the level it was at in 1950. During the interim it has been about twice as high, peaking in the 1970s. Absolute rates are much lower in women, but the pattern is similar to men with a peak in the 1970s.

Comparison of trend with to Western European country mean
The mean mortality rate due to road accidents has followed the same pattern is in Scotland with a peak in the 1970s. However, the Scottish rate has always been lower than the Western European country mean rate and is most recently approaching the minimum for both men and women.

Position in Europe
Mortality due to road accidents is much lower in Scotland than in many European countries but is falling in most. Countries following a trend most similar to Scotland are England and Wales, Northern Ireland, the Nordic countries, Ireland and the Netherlands.
Table 1: Countries included by region

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Table 2: Codes used for each ICD revision as specified in the WHOSIS database

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*: Pancreatic cancer was not coded separately in the Swiss coding system
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Note: These years may vary for some specific diseases
*: These countries never used ICD9
**: Switzerland used its own coding system from 1995
TABLE OF FIGURES

Infant mortality…………………………………………………………………..…….. A1M – A6F
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Chronic obstructive lung disease mortality in adults aged 15-74…………………..…….. M1M – M7F
Liver cirrhosis mortality in adults aged 15-74…………………………………………….. N1M – N7F
External causes mortality in adults aged 15-74…………………………………………….. O1M – O7F
Suicide mortality in adults aged 15-74…………………………………………………….. P1M – P7F
Motor vehicle accidents mortality in adults aged 15-74………………………………….. Q1M – Q7F

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 5 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.