

# International Mortality and Smoking Statistics System (IMASS)

- I. Characterizing and comparing mortality trends in 30 developed countries
- IB. Ischaemic Heart Disease

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## EXECUTIVE SUMMARY

Ischaemic heart disease (IHD) mortality rates by sex, age and period of death for 30 developed countries are summarized in a variety of tables and figures. From the data presented, a number of conclusions are drawn, including the following:

1. IHD mortality rates are generally substantially higher in men than women.
2. In both sexes and in all periods considered (1946-50 to 1996-2000), IHD mortality rates rise markedly with age in all the countries considered.
3. Over the period since 1971-75 (which avoids problems in comparability due to discontinuity of definition of IHD between the 7<sup>th</sup> and 8<sup>th</sup> revisions of the International Classification of Diseases) there have been striking declines in the IHD mortality rate in many countries. These declines are particularly marked in USA and Canada, in Australia and in Israel, and are also clearly evident in New Zealand, in Japan, in Denmark, Finland, Norway and Sweden, in France, in Italy and in Belgium and the Netherlands. They are also seen to a somewhat lesser extent in UK and Ireland and in most of the rest of Western Europe, but are generally not evident in Eastern Europe, with marked rises seen in Poland and particularly Romania.
4. The extent of the decline has been broadly similar in both sexes and, with some exceptions, in all age groups.
5. Whereas birth cohort is a strong determinant of risk of death from lung cancer, it does not seem to be a strong determinant of risk of death from IHD. IHD appears to be much more affected by changes that affect the whole population at the same time.
6. Based on levels of, and time trends in, the IHD mortality rate, the 30 countries can be divided into a number of groups:

Countries that used to have relatively high IHD mortality rates (relative to other countries at the same time) but now do not do so These include USA, Canada, Australia and, to a lesser extent, New Zealand and Israel.

Countries that used not to have relatively high IHD mortality rates but now do so These include Bulgaria, Czechoslovakia, Hungary and Romania, and also Poland except for the oldest age groups. Although a rise in the absolute mortality rate has been seen in some of these countries (particularly Romania), the worsening position of these countries relative to the others is mainly because mortality rates in other countries have declined. IHD mortality rates in these former Communist countries in recent years still remain lower than those seen in western countries 30 years earlier. USSR also had very high rates in 1981-1990, but earlier data are not available.

Countries that have always had relatively high IHD mortality rates These include Finland (except recently in younger females), UK and Ireland.

Countries that have generally had relatively low IHD mortality rates For many years France and Japan have had very low rates. Low rates are also generally seen in Spain, Portugal, Italy, Greece and Yugoslavia.

Countries with IHD mortality rates that are around mid-table These include Belgium, Netherlands, Austria, Germany, Switzerland (where some declines are seen), Denmark, Iceland, Norway and Sweden.

Levels of, and time trends in, IHD mortality rates show a clear tendency to be more similar in neighbouring countries than would be expected by chance.

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Table I1 and Figure I1 are available in file IMASSTABLEI1a.DOC

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1. Introduction

Part 1A of this report characterizes and compares lung cancer mortality trends in 30 developed countries based on data recorded in our “International Mortality and Smoking Statistics System” (IMASS). It also includes a detailed materials and methods section, much of which is relevant to the whole of Part 1 and is not repeated in full here.

Part 1B characterizes and compares ischaemic heart disease (IHD) mortality trends in the same 30 countries, including a less detailed materials and methods section more specific to this part.

## 2. Materials and methods

### 2.1 Countries included

The 30 countries for which data are available are listed in section 2.1 of part 1A of this report, and shown in the tables in this report. The country names relate to political boundaries as they existed pre-1990.

### 2.2 Scope of the mortality data

As for lung cancer, results are shown for 5-year periods from 1946-50 to 1996-2000 and for 5-year age groups from 30-34 to 80-84. Appendix 1 of part 1A of this report shows the actual periods for which data are available for each country.

### 2.3 Definitions of causes of death

See section 2.3 and Appendix 1 of part 1A of this report for details of when successive revisions of the International Classification of Diseases (ICD) came into use in each country and some general remarks about the problems of defining cause of death.

For IHD, the definitions used in the 8<sup>th</sup>, 9<sup>th</sup> and 10<sup>th</sup> revisions are quite comparable. However, the definitions used in the 6<sup>th</sup> and 7<sup>th</sup> revisions are somewhat broader. It has been suggested<sup>1</sup> that comparability might be obtained by using codes 420 + 422.1 in the 6<sup>th</sup> and 7<sup>th</sup> revisions, but data are not available from WHO for such detailed codes. Examination of 1965 data for England and Wales showed that deaths for summary code A081 (as used in the database) were about 11% higher for men and 25% higher for women than deaths for 420 + 422.1, so the discontinuity is not a minor one. Given that the alternative was not to have any IHD data before about 1968 (when the ICD 8<sup>th</sup> revision came in), it seemed better to include earlier data using a somewhat different definition, but making it clear that there was a problem of non-comparability when studying time trends.

There was in fact little difference between the countries in when ICD 8<sup>th</sup> revision was introduced, Portugal and Iceland starting to use it for the 1971 data and all other countries starting to use it in 1968 or 1969. Because of the change in definition, some artificial decline in the rates would be expected over the periods 1961-1965 (all old definition), 1966-1970 (usually partly the new definition) and 1971-1975 (all or nearly all the new definition).

#### 2.4 Individual country tables (Table I1)

Table I1 (I for IHD) gives mortality rates by age, period and sex for each country. The layout is identical to that detailed in section 2.4 of part 1A of this report. As mortality rates are higher than for lung cancer, the rates are only given to one decimal place for IHD rather than the two used for lung cancer.

#### 2.5 Individual country plots (Figure I1)

Plots were generated for each country for IHD similar to those generated for lung cancer, showing how mortality rates varied by age for given birth cohorts. In practice, they proved not to be very useful, as cohort patterns were much less marked than was the case for lung cancer, and are not included in this report, though are available on request. Instead, Figure I1 for IHD presents IHD rates for each country showing how mortality rates varied by period for each age group, with age groups shown as separate lines.

#### 2.6 Between country comparison tables (Table I2)

Table I2 compares mortality rates in the 30 countries for various periods for men or women of a given age. It is divided into 12 pages, the first six pages (2.1 to 2.6) relating to males aged 35-39, 45-49, 55-59, 65-69, 75-79 and 30-84 (standardized) and the other six pages (2.7 to 2.12) giving similar data for females.

Each page of Table 2 is divided into 2 parts. Part a, at the top of the page, gives the mortality rates by period for each country. Part b, at the bottom of the

page, converts the rates within each period to ranks (1 = highest, 2 = next highest, etc.).

### 2.7 Between country comparison plots (Figure I2)

Figure I2 plots the ranks shown in part b of Table I2, but only for periods 1951-55, 1961-65, 1971-75, 1981-85 and 1991-95. Where data are available for all 30 countries, the ranks plotted are exactly those given in part b of Table I2. Where data are available for less than 30 countries for a given period, adjusted ranks, as described in section 2.8 of Part 1A of this report, are plotted.

### 3. IHD

#### 3.1 Table 11

In both sexes and in all periods, there is a large increase in the IHD mortality rate with increasing age, with the highest rates in the highest age group studied for each country.

Looking at mortality rates for age 30-84, age standardized to the European Standard Population (see also Tables I2.6a for males and I2.12a for females), various observations can be made.

Firstly, peak rates are always higher in men than in women. In men, the highest mortality rates recorded were in Finland (811, in 1966-1970), Australia (781, in 1966-1970), USA (775, in 1966-1970) and USSR (757, in 1981-1985), with rates between 600 and 750 in Canada, Ireland, New Zealand, and the UK. The lowest peak rates were in Japan (167), France (182), Spain (185), and Greece (208). In women, the highest rates recorded were in Ireland (446, in 1946-1950), USSR (407, in 1981-1985), USA (382, in 1946-1950), UK (370, in 1946-1950), Finland (365, in 1961-1965) and Israel (360, in 1971-1975), with rates between 300 and 350 in Australia, Canada, Czechoslovakia, Hungary, New Zealand and Switzerland. The lowest peak rates were in France (74), Greece (113), Japan (113), Spain (130), and Poland (138). It is clearly evident that countries with high (or low) rates in men also tended to have high (or low) rates in women.

Second, trends over time vary considerably by country. For the period 1971-1975 to 1991-1995, where discontinuity of definition and completeness of data are not a problem, trends clearly varied by country but were strikingly similar in the two sexes, as illustrated in the table below (where USSR is excluded due to limited available data).

<u>Ratio of rates 1991-1995/1971-1975</u>	<u>Males</u>	<u>Females</u>
0.40-0.49	Australia, Canada, Israel, USA	Australia, Canada, Israel, USA
0.50-0.59	Belgium, Netherlands, New Zealand	Belgium, Denmark, France, Italy, Japan, Netherlands, New Zealand, Sweden
0.60-0.69	Denmark, Finland, France, Iceland, Italy, Japan, Norway, Sweden, UK	Austria, Finland, Ireland, Norway, Portugal
0.70-0.79	Austria, Germany, Ireland, Portugal	Bulgaria, Iceland, UK
0.80-0.89	Spain, Switzerland	Germany, Spain, Switzerland, Yugoslavia*
0.90-1.09	Bulgaria, Czechoslovakia*	Czechoslovakia*, Greece, Hungary
1.10-1.29	Greece, Hungary, Yugoslavia*	-
1.30-1.60	Poland	Poland
1.61-1.99	-	Romania
2.00+	Romania	

\* Ratio for 1986-1990/1971-1975

In both sexes, it can be seen that there has been a clear decline in the IHD mortality rate in many countries, with at least a 50% decline in both sexes in USA and Canada, in Australia and in Israel, and at least a 30% decline in both sexes also in New Zealand, in Japan, in Denmark, Finland, Norway and Sweden, in France, in Italy, and in Belgium and the Netherlands, with smaller declines seen in UK and Ireland and in most of the rest of Western Europe. Marked declines have not been seen in Greece and Spain where rates were low in the first place or in Eastern European countries, with marked rises seen in both sexes in Poland and particularly in Romania where about a doubling of the rate has been seen over the 20 year period, and smaller rises seen in men in Bulgaria, Czechoslovakia, Hungary and Yugoslavia.

There is also some variation by country in trends for the earlier periods. For countries which show no clear evidence of any discontinuity in the mortality rates over the period (1961-1975) associated with the change in definition of IHD, and which shows a decline in the table above, the trend often shows some rise preceding the decline, particularly in males. Thus, for example, mortality rates in Australian men rose steadily from 647 for 1946-1950 to a peak of 781 for 1966-1970 and then declined to 241 in 1996-2000. In females, however, where peaks tended to be earlier for such countries, the decline was sometimes evident over essentially the whole period studied (e.g. Australia, Canada, Ireland, UK).

It was not always possible, in the presence of existing trends, to identify whether a discontinuity had occurred, but there were some countries where this seemed to be a problem. Thus note:

- (i) the large rise in rate over the period in question (1961-1975) in both sexes in Belgium, Bulgaria and Czechoslovakia,
- (ii) the marked fall in both sexes in Italy, Japan, Portugal, Romania and Switzerland, and
- (iii) the marked fall in females in Germany, Greece and Poland.

Note that trends in mortality rates may occur, not only as a result of changes in the definition of the disease, or of changes in exposure to environmental factors causing the disease (not considered in this report), but as a result of changes in the ability of the medical profession to prevent death or prolong life in those with the disease. Comparable data on incidence of IHD are unfortunately not available and a part of the declining trend in mortality seen in many countries is doubtless due to improved treatment.

### 3.2 Figure I1

The data in Figure I1 are the same as those given in Table I1 but plotted so that rates for the same age group are on the same line on the figure.

Looking first at those 14 countries (USA and Canada, Australia and New Zealand, Israel, Japan, Belgium and Netherlands, France, Italy, Denmark, Finland, Norway and Sweden) for which a relatively large decline in the IHD rate (by 30% or more) for age 30-84 has been seen in both sexes over the period 1971-1975 to 1991-1995, various patterns are evident. In males, the decline is generally seen in all age groups. However, there is some indication of a flattening off in the very youngest age groups in some countries (e.g. Australia, Israel, Netherlands and Norway), while in Japan the decline stopped around 1990, with some subsequent increase in IHD rates in all but the oldest age groups. In females in Japan, the decline seems to be reversing in recent years, but in the other 13 countries, rates are continuing to fall except in the youngest two or three age groups where rates appear to have levelled off. In some countries, such as Denmark, Finland, Norway, UK and Ireland, the decline in IHD mortality rates in both sexes has tended to be concentrated more in the second half of the period 1971-1975 to 1991-1995 and the rapid decline has continued up to 1999-2000.

For some other countries, patterns are very different. For example:

**Romania** The increase in rates continues in females at all ages, and in older males, but has flattened off in younger men.

**Poland and Hungary** While rates in older men and women continue to rise, quite sharp declines are seen at younger ages.

**Greece** Rates in both men and women show little trend in any age group.

### 3.3 Table I2 and Figure I2

The data laid out in Table I2 and Figure I2 allow easier comparison of the data between countries. Detailed inspection of the way the rank order of the countries has changed over time allows three general conclusions.

First, trends are very similar in males and in females. Second, trends are usually quite similar in different age groups. Third, trends are often similar in adjacent areas. It is possible to subdivide the countries into a limited number of groups where quite similar time trends have occurred.

1. North America (USA and Canada) Up until 1975 the USA had one of the highest IHD mortality rates ever recorded among the 30 countries studied, with Canada also having rates that were well above average. The marked subsequent decline seen in both countries has led to both countries occupying much more of a mid-table position, though US rates still remain quite high relative to the other countries in younger females.
2. Australasia (Australia and New Zealand) The pattern here is quite similar to that in North America, with IHD mortality rates in both countries formerly well up the rank order and then declining. Australia has dropped to a mid-table position, but the decline in New Zealand has been rather less marked.
3. Former Communist countries (Bulgaria, Czechoslovakia, Hungary, Romania, Poland and the USSR) The general pattern here is for the rank plots to show a large upward trend, so that, with the exception of Poland for the oldest age groups, the latest data put all six countries among those with the highest IHD mortality rates, whereas formerly they had had relatively low rates. This is emphasized in the table below for men and women aged 55-59.

Country	Rank order for age 55-59			
	Men		Women	
	1961-65	1991-95	1961-65	1991-95
Bulgaria	27	4	26	3
Czechoslovakia	18	1*	21	3*
Hungary	19	1	8	1
Romania	24	3	17	2
Poland	21	2	22	6
USSR	No data	3*	No data	1*

(\*Data for 1986-90)

Note that a major explanation of the worsening relative position of the former Communist countries is that their IHD mortality rates have not declined whereas rates in other countries have declined substantially. For example, for Hungary, European standardized rates for age 30-84 were, at 523, the highest recorded in 1991-1995 for any country. In 1971-1975 (when Hungary had a rate of 447) there were 11 countries that had a higher IHD mortality rate than 523, and 523 would not then have been regarded as unusually high.

Note also that, as data for USSR are only available for 1981-1985 and 1986-1990, we do not actually know whether the rank here has shown a large upward trend, but it seems plausible.

4. UK and Ireland In both countries, IHD mortality rates have generally been among the highest of the 30 countries, and they still remain so. Thus, for 1996-2000, rates for age 30-84 (standardized to the European population) were 4<sup>th</sup> for Ireland and 6<sup>th</sup> for UK for males and 4<sup>th</sup> for Ireland and 5<sup>th</sup> for UK for females among the 27 countries with data available. Rates have generally been in the top 10 in all age groups in both countries, except in younger females in some time periods.
5. Finland Up to 1980, IHD mortality rates in males were always in the top 3 of the countries in all age groups. In the last 20 years, especially in

the younger age groups, Finland has moved down the ranking order, being overtaken by a number of the Communist countries, but rates in males have remained relatively high. In females, however, IHD mortality rates have shown a rather different pattern. Although they have remained in the top 10 of the countries in the older age groups, in younger age groups they are more mid-table with their position tending to decline with time.

6. Israel In both sexes and all age groups, Israel has tended to show a decline in rank order. In males and younger females, Israel has moved from having above average IHD mortality rates to having below average rates. In older females, Israel has moved from having relatively very high rates to having rates that are about average.

Groups 1 to 6 include those countries that for all or part of the period studied have had IHD mortality rates that tended to be high compared to other countries.

There are two groups of countries that have tended to have relatively low rates.

7. Japan Over at least the last 30 years of the period studied, Japan has had IHD mortality rates in both sexes and at all age groups that are the lowest or nearly the lowest of all the countries studied. Interestingly, for the immediate post war period this was not true, particularly in young females, where Japan had very high rates.
8. “Mediterranean countries” (Spain, Portugal, France, Italy, Greece, Yugoslavia) IHD mortality rates in France have always been among the lowest of the countries studied, in both sexes and all age groups. The same is true in Spain and Portugal (not strictly Mediterranean) except in the younger age groups, where a rise towards mid-table has occurred

recently. Greece too generally has low rates except in recent years in younger age groups. IHD mortality rates in Yugoslavia have also tended to be low, except in the younger age groups towards the end of the period (up to 1990) where data are available. For many years, Italy has tended to have rates that are below average, though not as low as in France.

Other countries tend to have had rates that are not particularly high or low. These countries can be divided into three groups.

9. Low countries (Belgium and Netherlands) In both countries IHD mortality rates have tended to be slightly below average.
10. Other West Europe (Austria, Germany, Switzerland) In Austria and Germany IHD mortality rates have tended to be around average, although they have risen somewhat up the rank order in the 1990s. Switzerland, on the other hand, has tended to move down the rank order, particularly in females, where rates have moved from above average to below average.
11. Other Scandinavia (Denmark, Iceland, Norway, Sweden) In Denmark, IHD mortality rates have tended to be slightly above average, but never markedly high. Rates have tended to be somewhat lower in Norway. In Sweden, rates have tended to be relatively low in the younger age groups, about average in the middle age groups (e.g. 55-59) but relatively high in the older age groups. Indeed among men aged 75-79 in 1976-1980 Sweden had the highest IHD mortality rates. In Iceland (where rates are more variable, especially in young females, due to the small numbers of deaths on which they are based) rates have generally been around average for the time among the various countries considered

#### 4. Summary

Ischaemic heart disease (IHD) mortality rates by sex, age and period of death for 30 developed countries are summarized in a variety of tables and figures. From the data presented, a number of conclusions are drawn, including the following:

1. IHD mortality rates are generally substantially higher in men than women.
2. In both sexes and in all periods considered (1946-50 to 1996-2000), IHD mortality rates rise markedly with age in all the countries considered.
3. Over the period since 1971-75 (which avoids problems in comparability due to discontinuity of definition of IHD between the 7<sup>th</sup> and 8<sup>th</sup> revisions of the International Classification of Diseases) there have been striking declines in the IHD mortality rate in many countries. These declines are particularly marked in USA and Canada, in Australia and in Israel, and are also clearly evident in New Zealand, in Japan, in Denmark, Finland, Norway and Sweden, in France, in Italy and in Belgium and the Netherlands. They are also seen to a somewhat lesser extent in UK and Ireland and in most of the rest of Western Europe, but are generally not evident in Eastern Europe, with marked rises seen in Poland and particularly Romania.
4. The extent of the decline has been broadly similar in both sexes and, with some exceptions, in all age groups.
5. Whereas birth cohort is a strong determinant of risk of death from lung cancer, it does not seem to be a strong determinant of risk of death from IHD. IHD appears to be much more affected by changes that affect the whole population at the same time.

6. Based on levels of, and time trends in, the IHD mortality rate, the 30 countries can be divided into a number of groups:

Countries that used to have relatively high IHD mortality rates (relative to other countries at the same time) but now do not do so These include USA, Canada, Australia and, to a lesser extent, New Zealand and Israel.

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Countries that have always had relatively high IHD mortality rates These include Finland (except recently in younger females), UK and Ireland.

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Countries with IHD mortality rates that are around mid-table These include Belgium, Netherlands, Austria, Germany, Switzerland (where some declines are seen), Denmark, Iceland, Norway and Sweden.

Levels of, and time trends in, IHD mortality rates show a clear tendency to be more similar in neighbouring countries than would be expected by chance.

5. Reference

1. Darby SC, Doll R, Stratton IM. Trends in mortality from smoking-related diseases in England and Wales. In: Wald N, Froggatt P, editors. *Nicotine, smoking, and the low tar programme, Proceedings of a symposium 'Nicotine, smoking, and the low tar programme'. London, 18-20 November 1986*. Oxford, New York, Tokyo: Oxford University Press, 1989;70-82.