International Mortality and Smoking Statistics System (IMASS)

I. Characterizing and comparing
mortality trends in 30 developed countries

IC. Chronic obstructive pulmonary disease (COPD)
and
Respiratory diseases, non-acute (RDNA)

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EXECUTIVE SUMMARY

Mortality rates for chronic obstructive pulmonary disease (COPD) and the broader classification of respiratory disease, non-acute (RDNA) by sex, age and period of death for 30 developed countries are summarized in a variety of tables and figures.

Preliminary comparison of data for COPD and RDNA demonstrated that trends over time in COPD rates were affected by changes in the definition of the disease, particularly due to differences between the 8th and 9th revisions of the ICD, the 9th revision being introduced in or around 1979 in most countries. It was concluded that it was more reliable to restrict attention to studying trends in RDNA, so further investigation was restricted to this disease grouping.

It was clearly evident that RDNA rates rose markedly with age in all the countries considered and were generally substantially higher in men than in women.

The highest rates ever recorded in both sexes were in Romania, the peak rate in females (151.1 per 100,000 per year for age 30-84) being over twice as high as that seen in any other country.

There was considerable variation by country and sex in the trend in RDNA rates over time. In a number of country/sex combinations overall rates for age 30 to 84 (age adjusted) rose, then fell, with the peak occurring earliest in males in the UK and females in Czechoslovakia. In some cases, including USA and Canada in both sexes, there was an increase over the whole or virtually the whole period. In others, rates stayed relatively constant over the whole period studied, or most of it. In many countries, the trend in RDNA rates over time was not the same in each age group as it was for the overall age adjusted rate.

The variability in patterns by country, sex and age is not readily summarized in a convenient form, as was the case for ischaemic heart disease. The rank order of the countries varies by time, sex and age and also cannot be summarized very easily. Some features of the data are, however, worth noting:

- In USA and Denmark particularly, and also in Canada, Iceland, Australia and New Zealand, an increase in the overall RDNA rate (age 30-84, age adjusted) in females has led to these countries now having rates that are among the highest of any countries studied when previously their rates were not exceptionally high.

- Overall rates in the UK and Ireland have always been relatively high in both sexes. However rates have been declining and in younger age groups the relative position of these countries has improved dramatically.

- Relative to other countries, rates in Scandinavian countries, particularly Sweden, have tended to be low for many years. However, since rates have not declined in recent years (and have increased in some countries, notably in females in Denmark), and rates in other countries have declined, their relative position is not now so markedly low.

- Rates in Spain, Portugal, France and Italy used to be among the highest in both sexes, but a continuing decline (except in males in Spain) has led to their relative position improving.

- Rates in males in Belgium are generally high, but otherwise males or females in other mainland West European countries (including also Netherlands, Germany, Austria and Switzerland) tend to be around average for the countries considered.

- Rates in Romania were extremely high in both sexes, but have declined markedly since 1970.

- Rates in USSR were very high in both sexes where data were available, in the 1980s. At that time they had the highest overall rates in males.

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R1. RDNA mortality rates (per 100,000 per year) by age, period and sex
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Table C1 is available in file IMASSTABLECITABS.DOC
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1. Introduction

Part IA 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 I and is not repeated in full here.

Part IC characterises and compares mortality trends in the same 30 countries for chronic obstructive pulmonary disease (COPD) and for respiratory diseases, non-acute (RDNA), including a less detailed materials and methods section more specific to this part. Part IB has similarly considered trends for IHD mortality.

2. Materials and methods

2.1 Countries included

The 30 countries for which data are available are listed in section 2.1 of part IA 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 and IHD, 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 IA of this report shows the actual periods for which data are available for each country.

2.3 Definitions of cause of death

As discussed in section 2.3 of part IA of this report, there are a number of general problems about defining cause of death. The data recorded on the database are based on cause of death coded according to successive revisions of the International Classification of Diseases (ICD). Countries vary as to when (and if) they introduce the various revisions (see Appendix 1 of part IA of this report). In the UK, USA and Japan the 6th revision was introduced in 1950, the 7th revision in 1958, the 8th revision in 1968 and the 9th revision in 1979, and many countries follow approximately this schedule. The latest, 10th, revision is not used in data for many of the countries considered here, including UK and USA, but was introduced in Japan in 1995 and in a number of other countries between 1994 and 1999.

While for some diseases, such as lung cancer, there is no real difficulty in obtaining a comparable disease definition from the data available for the various ICD revisions, the problem here is much more complex. Ideally, for comparison with smoking data, one would have liked a disease definition which included only the terms chronic bronchitis (CB), emphysema and COPD. However there are a number of problems with this:

(i) asthma, as well as bronchitis unqualified as to whether it is acute or chronic, is combined with CB and emphysema in the same WHO

broad summary code in the 8th and 9th revisions;

(ii) COPD is classified with "other respiratory disease" in the 6th, 7th and 8th revisions, it being a term only commonly used in the last 20 years or so;

(iii) emphysema is classified with "other respiratory disease" in the 6th and 7th revisions; and

(iv) asthma is included under allergic disorders (and not as a respiratory disease at all) in the 6th and 7th revisions and cannot be separately identified from the available data.

After studying coding systems in some detail it became clear that there was no entirely satisfactory solution. The definition of COPD finally selected (as detailed in Appendix 1) is comparable enough for the 9th and 10th revisions, but may lead to some discontinuities earlier, which may vary by country. As an alternative, data for RDNA are also considered. This broader disease grouping has fewer continuity problems, but includes various diseases that are not associated with smoking.

It should also be noted that there are numerous 'rules' used when carrying out the coding, and that these may vary between countries and from time to time. For instance, the death coded is the underlying cause, but between 1985 and 1992 England and Wales adopted its own version of the rule to determine the underlying cause, resulting in a substantial drop in the death rate from pneumonia in that period. A discussion of other aspects of the validity of mortality data is given by Alderson.[1]

Section 3 of this report presents some further information concerning the difference between COPD and RDNA, justifying the decision to restrict attention to the latter disease category for later analyses.

2.4 Individual country tables (Tables C1 and R1)

Tables C1 (C for COPD) and R1 (R for respiratory diseases non-acute) give 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 rather than the two used for lung cancer.

2.5 Individual country plots (Figure R1)

Plots were generated for each country for RDNA 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 as useful as for lung cancer, because cohort patterns were much less marked than was the case for lung cancer, and they are not included in this report, though they are available on request. Instead, Figure R1 for RDNA presents RDNA rates for each country showing how mortality rates varied by period for each age group, with age groups shown as separate lines. There are no plots for COPD.

2.6 Between country comparison tables (Table R2)

Table R2 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 R2)

Figure R2 plots the ranks shown in part b of Table R2, 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 R2. 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. Comparisons between COPD and RDNA

Tables C1 (COPD) and R1 (Respiratory Disease, non-acute) show mortality rates for each country by age, period and sex. Below we compare age-adjusted mortality rates (per 100,000 per year) by period for USA, Japan and UK for the two diseases for males.

	USA			Japan			UK		
Period	COPD	RDNA*	Ratio**	COPD	RDNA*	Ratio**	COPD	RDNA*	Ratio**
1946-1950	18.2	20.3	0.89	56.8	74.8	0.76	156.7	158.7	0.99
1951-1955	22.1	23.8	0.93	37.4	48.6	0.77	168.8	170.5	0.99
1956-1960	34.3	36.0	0.95	26.1	33.9	0.77	173.3	174.6	0.99
1961-1965	50.2	51.8	0.97	23.5	29.4	0.80	189.2	190.4	0.99
1966-1970	68.9	70.6	0.98	43.0	47.1	0.91	182.8	183.6	1.00
1971-1975	74.5	76.1	0.98	46.2	49.4	0.94	153.2	153.8	1.00
1976-1980	69.1	76.5	0.90	36.1	42.5	0.85	126.0	130.3	0.97
1981-1985	66.3	82.3	0.81	29.7	44.2	0.67	106.0	116.1	0.91
1986-1990	66.3	82.9	0.80	25.7	43.3	0.59	96.6	108.1	0.89
1991-1995	64.6	80.2	0.81	24.4	45.4	0.54	80.5	93.4	0.86
1996-2000	62.1	78.1	0.80	21.3	44.6	0.48	69.4	84.6	0.82

* Respiratory disease – non-acute
** COPD/RDNA

It can be seen that in the UK, mortality rates of COPD and RDNA were virtually identical up to 1971-1975, but over the remaining period COPD as a percentage of RDNA fell from almost 100% to just over 80%. In the USA, COPD and RDNA rates were also very similar in 1971-1975, and the subsequent decline in COPD as a percentage of RDNA was also very similar. However, in earlier years COPD did not form such a high proportion of RDNA as in the UK. In Japan, COPD and RDNA rates were again at their closest in 1971-1975. However the preceding increase and subsequent decline in the COPD/RDNA ratio were much more marked than in the USA. Trends in the COPD/RDNA ratio were, in all three countries, quite similar for females.

In Table 1 we present the COPD/RDNA ratio as a percentage for males for each country for three time points, 1951-1955, 1971-1975 and 1991-1995. A number of conclusions can be drawn from these data.

First, COPD and RDNA rates are quite similar in 1971-1975 in all the countries, with the lowest percentages being 93% in Austria and 94% in Japan.

At that time ICD 8th revision would have been in force and, as shown in Appendix 1, the only difference between the two disease definitions is that RDNA included, but COPD excluded, deaths from hypertrophy of tonsils and adenoids, and from empyema and abscess of lung. Further examination of the data for Austria and Japan revealed that deaths from hypertrophy of tonsils and adenoids were extremely rare and that the discrepancy was due to deaths from empyema and abscess of lung (not available separately), a cause of death code rarely used in most of the other countries considered.

For the period 1951-1955, COPD rates tended to be a somewhat smaller proportion of RDNA rates than was the case for 1971-1975. This was because, at that time, the ICD 6th revision was generally in force and the list of diseases included in RDNA and not COPD was slightly greater, including pleurisy as well as the diseases noted in the previous paragraph. The discrepancy was greatest for Japan, where the ratio was 77%. Here the breakdown of deaths (in males) was as follows.

Disease	ICD code	Deaths
COPD	A093+A097	19446
Hypertrophy of tonsils and adenoids	A094	2
Empyema and abscess of lung	A095	5163
Pleurisy	A096	2081
RDNA	A093 to A097	26692

Deaths from pleurisy must explain why the percentages shown in Table 1 are lower in 1951-1955 than in 1971-1975.

For the period 1991-1995, it is clear that the COPD/RDNA ratio is lower than in 1971-1975, often being around 80%, but in some countries being much lower, 29% in Greece and 54% in Japan. The decline relates to the difference between the ICD 8th and 9th revisions (see Appendix 1). In the 8th revision COPD was only included as part of A096 (other respiratory disease), but in the 9th revision COPD was included in B325, which did not include various other respiratory diseases. Adding in these diseases, categorised under B313-B315, B319, B326, B327 and B329, clearly leads to better

comparability. Of these diseases B326 (pneumoconiosis etc) and more so B329 (other diseases of respiratory system) are the most common. Interestingly, the declining COPD/RDNA ratio in Greece is due to a sharp decrease in the number of deaths from COPD (B323-B325) over the period from when the ICD 9th revision was introduced, and a sharp increase in the numbers of deaths from B329. Between 1979 and 1990, deaths in males from B323-B325 went down from 1125 to 417, while those from B329 went up from 596 to 1092. Why this should be is not clear, and it seems unlikely that the massive decline in COPD rates shown in Table C1.11 represents a real finding.

Based on the data considered, it seems much more reliable to restrict attention to studying trends in RDNA, so in the rest of this report only data for this disease grouping will be considered.

4. RDNA

4.1 Table R1

In both sexes and in all periods, there is a large increase in the RDNA mortality rate with increasing age. With one minor exception (Israel, females, 1946-1950) the highest rates are always in the highest age group studied.

Looking at mortality rates for age 30-84, age standardised to the European Standard Population (see also Table R2.6a for males and R2-12a for females), various observations can be made.

Firstly, peak rates are always higher in men than in women, and usually substantially higher. In men, the highest mortality rates recorded are in Romania (225.2, in 1966-1970), UK (190.4, in 1961-1965), USSR (184.3, in 1981-1985), Czechoslovakia (168.6, in 1966-1970) and Ireland (160.2, in 1966-1970), with rates between 120 and 150 in Australia, Belgium, Bulgaria, Hungary, New Zealand and Spain. The lowest peak rates in men are in Iceland (35.0, in 1991-1995), Sweden (38.6, in 1976-1980), Norway (54.6, in 1996-2000) and Israel (59.4, in 1981-1985). In women, Romania has by far the highest peak rate (151.1, in 1966-1970), with the next highest in Denmark (68.6, in 1996-2000). Other peak rates over 50 are seen in Bulgaria, Czechoslovakia, Ireland, New Zealand, Spain, UK, USA and USSR. The lowest peak rates in women are for Finland (16.4, in 1966-1970), Switzerland (16.8, in 1996-2000), Sweden (21.8, in 1996-2000), and Germany (25.1, in 1951-1955). Iceland is the only country to have similar peak rates in men (35.0) and women (34.8).

Second, trends vary considerably by country and sex. The most commonly seen pattern, particularly in men, was for rates to rise and then fall. For those cases where the rise and fall was relatively marked, the peak occurred earliest, in 1961-1965, in UK (males) and Czechoslovakia (females). Cases where the peak occurred in 1966-1970 or 1971-1975 were Australia (males), Austria (males), Bulgaria (both sexes), Czechoslovakia (males), Finland (males), France (males), Germany (males), Greece (both sexes), Ireland (males), Italy (males), Poland (both sexes), Portugal (males), Romania

(both sexes) and Switzerland (males). Cases where it occurred somewhat later, in 1976-1980 or 1981-1985, were Hungary (both sexes), Israel (males) and New Zealand (males).

Another relatively common pattern was an increase over the whole, or virtually the whole period. This was seen in Australia (females), Canada (both sexes), Denmark (both sexes), Iceland (females), Israel (females), Netherlands (males), New Zealand (females), Norway (both sexes), Sweden (females) and USA (both sexes).

Cases where rates have been about constant for a fairly long period include Austria (females), Belgium (both sexes), Finland (females), Germany (females), Iceland (males), Ireland (females), Japan (both sexes – though higher just post-war), Portugal (females), Spain (males), Sweden (males), Switzerland (both sexes) and UK (females). In the case of Finland, Iceland and Sweden the flat period followed a rise in the 1950s and 1960s. No very clear trend is evident in Yugoslavia (both sexes) either, the pattern being more of some upward shift between 1966-1970 and 1971-1975 but no trend otherwise.

In females in France, Italy and Spain the pattern has been of a period of relative constancy, then a decline, while in females in Netherlands a long constant period has been followed by a recent increase. Trends in USSR are not clear due to the limited number of years for which data are available.

4.2 Figure R1

The data in Figure R1 are the same as those given in Table R1 but plotted so that rates for the same age group are on the same line on the figure.

It is clear that, in many countries, but not all, the trend in the RDNA rate over time is not the same in each age group as was described in the previous section for the overall (age 30-84) age adjusted rate. This is illustrated by a number of examples below.

US males Between 1951-1955 and 1996-2000, the overall age adjusted rate rose by a factor of 3.85 from 20.3 to 78.1, peaking at 82.9 in 1986-1990. As shown below, the pattern was very different by age, with the rise less and the peak earlier at younger age groups. The data for the older age groups (60+) are consistent with the highest rates being in the cohorts born around 1910, but this pattern is not seen in the younger age groups.

	Rate		Ratio	Peak rate	
Age group	1951-1955	1996-2000	1996-2000/ 1951-1955	Value	Period
40-44	4.3	4.3	1.00	6.8	1966-1970
50-54	15.1	17.8	1.18	28.8	1966-1970
60-64	44.9	90.4	2.01	116.1	1966-1970
70-74	69.9	317.2	4.54	335.4	1981-1985
80-84	102.9	779.1	7.57	781.3	1991-1995

UK males Between 1951-1955 and 1961-1965, the overall age adjusted rate rose by a factor of 1.12 from 170.5 to a peak of 190.4. It subsequently declined continuously, by a further factor of 0.44, to 84.6 in 1996-2000. In the oldest age group considered, 80-84, the peak occurred at 1966-1970, and the rise and decline were similar so that the rate in 1996-2000 of 971.7 was similar to that in 1951-1955 of 992.9. However, as the age group declined, the peak rate tended to get earlier, so that at ages <60, the peak was in the earliest periods considered and the rate in 1996-2000 was only about 20% of the peak rate.

Belgium males Apart from 1966-1970, when the rate was 141.8, overall age adjusted mortality was quite constant at between 112.2 and 122.9 in all the periods studied. This concealed different patterns in the different age groups. The ratio of rates for 1991-1995 (the latest period studied) to 1951-1955 (the earliest period) was 0.25 at age 40-44, 0.21 at age 50-54, 0.50 at age 60-64, 1.44 at age 70-74 and 2.14 at age 80-84.

In each of the three examples above, the trend in RDNA has been much more favourable in the younger age groups than in the older age groups. Table 2 presents the 1991-1995 to 1951-1955 ratio of rates (as a percentage)

for men and women aged 40-44, 60-64 and 80-84 for all the countries. It can be seen that, for men, in nearly all cases, the decline has been greater (or the increase less) at age 40-44 than at age 80-84, with the ratio usually intermediate at age 60-64. Hungary and Romania do not show the general tendency for the ratio to increase with increasing age. For women, however, such a pattern is not seen so consistently, and in about a quarter of the countries, the ratio is higher at age 40-44 than at age 80-84, and in about a half the ratio is highest at age 60-64.

Table 2 also helps to illustrate the contrasting trends by country and sex. Thus, while in males in Belgium, Italy and the UK RDNA rates for age 40-44 in 1991-1995 are only 20-25% of what they were in 1951-1955, in females in Denmark and the USA RDNA rates for age 60-64 in 1991-1995 are around 10 times what they were. 5-fold increases or greater are also seen in Canada, Sweden and the USA for males aged 80-84 and in the USA for females aged 80-84.

4.3 Table R2 and Figure R2

The data laid out in Table R2 and Figure R2 allow easier comparison of the countries. Detailed inspection of the way the rank order of the countries has changed over time revealed that the pattern was relatively complex and did not show the consistency over sex and age group that was evident for ischaemic heart disease. Below the patterns in each of the 30 countries are summarized briefly in turn. In order to try to detect regional similarities (or differences) the countries are considered in geographical groupings. In the text below, the word “average” is used to describe the median (average rank) of the countries considered for a given sex and age group. “Above average” describes countries with relatively high rates – actually low rank numbers as 1 = highest, 2 = next highest, etc – and “below average” describes countries with relatively low rates. “Overall rates” always refers to the rates for age 30-84 standardized to the European Standard Population.

North America

USA — In all age groups in males, USA has moved from a country with below average rates to one with above average rates. This increase was even more evident in females. Thus, while in 1951-1955 US females had overall rates for age 30 to 84 that were second lowest of the countries studied, in 1991-1995 it had rates that were third highest.

Canada — In males, rates in Canada have tended to be somewhat below average, except in the 1990s where in older age groups rates have been about mid-table. In females, rates have stayed around mid-table at younger ages. At older ages, however, rates have moved from below average to above average for the countries considered.

United Kingdom and Northern Ireland

UK — Overall rates used to be the highest of any country in UK males in the 1950s and 1960s and have always been relatively high in both sexes. In younger age groups UK's position has been more mid-table in the last 20 years considered.

Ireland — Overall rates in Ireland are currently the highest of any country in both sexes, and have always been among the highest. At ages under 50, however, Ireland's relative position has improved markedly in the last 20 years.

Scandinavia

Iceland — In males, Iceland has generally tended to have relatively low rates, with overall rates the lowest of any country studied since 1976-1980. In females, rates also tended to be relatively low for many years, but the position has worsened in recent years.

Norway — In males, rates at all age groups in Norway have tended to be below average, particularly so in the earlier part of the period studied. In females, rates also used to be relatively very low, but in more recent years the position has worsened markedly. Thus, while overall rates were lowest of all the 29 countries studied in 1971-1975, Norway had a mid-table position in 1991-1995.

Sweden — In males, Sweden has tended to have relatively very low rates (except in recent years in the youngest age group). Overall rates for males have been lowest or second lowest throughout the period studied. Rates have also tended to be very low in females for many years, though more recently the position has worsened somewhat. Overall rates, however, rates remain below average.

Finland — In males, rates in Finland have tended to be relatively low in younger age groups and mid-table in older age groups. In females, rates at all ages have tended to be relatively low, with overall rates the lowest of any country studied in recent years.

Denmark — In males, rates in Denmark used to be relatively low, but their position has worsened markedly so that overall rates were markedly above average in the 1990s. In females, the worsening has been even more dramatic at all ages 50+. Overall, Denmark had the fourth lowest rates in 1951-1955, but had the second highest in 1991-1995 and the highest in 1996-2000.

Mediterranean countries

Spain — In males, rates in Spain have always tended to be above average. In the 1990s, rates have usually been in the top five at all ages. In 1951-1955 Spain had the highest rates at every age group in females. Since then their relative position has improved and rates in the 1990s have been about mid-table (except at age 35-39 where they are well above average).

Portugal — In males, rates in Portugal have tended to be above average in younger age groups and mid-table at higher ages. In females, Portugal had above average rates at all ages for most of the period. However, more recently, in older age groups, rates have tended to be mid-table.

France — Shortly post-war France tended to have relatively high rates in both sexes. Subsequently, their relative position has improved, particularly in older age groups where rates have been below average for some years.

Italy — In males, rates in Italy at older ages have stayed around mid-table. At younger ages they have gone from above average to below average over the period studied. In females, rates at all ages have tended to go from above average to below average.

Greece — In males, rates in Greece have tended to be relatively quite low, except in the more recent data in the youngest age groups. In females, rates are generally about average or somewhat below.

Non-Mediterranean Western Europe

Belgium — In males, rates in Belgium have tended to be relatively high, though its relative position varies by age and period. Overall rates for males in Belgium were the second highest of the countries studied for the first (1951-1955) and last (1991-1995) period with available data, but were less markedly high in the intervening period. In females, rates have generally been around mid-table.

Netherlands — In males, the relative position of Netherlands varies markedly by age. In the younger age groups, rates have tended to be relatively low, particularly in recent years. In the oldest age group for which data are shown (75-79) rates were mid-table until the mid 1980s but well above average subsequently, Netherlands being fourth in the 1990s. In females, overall rates were relatively low between 1971 and 1985, but around mid-table before and after, with no great variation in this pattern by age.

Germany — In both sexes, rates in Germany for older age groups tended to be relatively somewhat high up to 1960. Other rates have generally tended to be around mid-table in males and somewhat lower in females.

Austria — In both sexes, overall rates in Austria were mid-table up to 1970 and then below average. This pattern is not so clearly seen in younger age groups, particularly at age 35-39 where the relative position of Austria fluctuated considerably.

Switzerland — Rates in Switzerland have generally been relatively low in both sexes and all age groups, particularly since 1960. The relative position has tended to be somewhat lower in females than males.

Eastern bloc

Bulgaria — Over the period available for Bulgaria (1961 onwards) rates in males have tended to be above average, except at older ages where between 1976-1980 and 1981-1985 they switched to being relatively low. This switch is also evident in females. Thus for the overall rate Bulgaria had the third highest rates between 1961-1965 and 1976-1980 but subsequently had rates that were average or somewhat below.

Czechoslovakia — In males and in older females, Czechoslovakia tended to have relatively quite high rates between 1961-1965 and 1976-1980. Before and after this period, rates tended to be more mid-table.

Hungary — Up to 1971-1975, rates in males in Hungary tended to be about mid-table. Subsequently, rates tended to be markedly above average. The same change after 1971-1975 is also evident in females, more clearly in the younger age groups.

Poland — In males, rates in Poland have tended to be around mid-table. In females, rates have tended to be below average, particularly in more recent data at older age groups.

Romania — For many years, rates in males in Romania were the highest or nearly the highest in any country. However more recently in older age groups, Romania has moved down the rank order. In females rates were also high for many years, particularly so at age 50+. As for males, the relative position is improving in recent data.

Yugoslavia — Over the period available for Yugoslavia (1961-1965 to 1986-1990) rates have generally tended to be somewhat below average in males and about average in females.

USSR — Where data are available for USSR (1981-1985 and 1986-1990) rates in all age groups have tended to be the highest or almost the highest in males and younger females, and well above average in older females.

Asia

Israel — Except just after the war, rates in males in Israel have tended to be relatively quite low. They have tended to be more mid-table in females.

Japan — Shortly after the war, Japan had relatively high rates in both sexes. However since 1960 Japan tended to have rates that are considerably below average, except in the youngest age groups studied. By 1991-1995 overall rates were, in both sexes, one of the lowest seen in any country.

Australasia

Australia — In males, rates have tended to be about average at younger age groups and somewhat above average at older age groups. In females, Australia's position has tended to worsen over time in all age groups from below average to above average.

New Zealand — In males, rates have tended to be above average, particularly in older age groups. Rates have also tended to be relatively high in females, particularly in younger age groups in the middle of the period, where New Zealand often had the highest rates.

Table 3 summarizes the ranks for the overall rate of RDNA for age 30 to 84 for 1951-1955, 1971-1975 and 1991-1995. Data are shown separately for the two sexes and the countries are placed in the same regional groupings as described above. This makes clear a number of features of the data, discussed to some extent already. These include:

(i) The massive worsening of the relative position in US females, also seen to a lesser extent in Canada and in Australia and New Zealand,

(ii) The generally low rates in Scandinavian countries, except in recent years for Denmark, particularly in females,

(iii) The tendency for the position to improve with time in both sexes in Mediterranean countries (except in Greece),

(iv) The relatively high rates in Belgian males compared to other non-Mediterranean Western countries,

(v) The variability of pattern seen in Eastern bloc countries, with rates very high in Romania over the whole period studied, very high in USSR over the limited period for which data are available (1980s), high in Bulgaria, Czechoslovakia and Hungary in some periods but not others, and around mid-table or lower in Poland and Yugoslavia,

(vi) The tendency for the position to improve with time in Japan.

5. Summary

Mortality rates for chronic obstructive pulmonary disease (COPD) and the broader classification of respiratory disease, non-acute (RDNA) by sex, age and period of death for 30 developed countries are summarized in a variety of tables and figures.

Preliminary comparison of data for COPD and RDNA demonstrated that trends over time in COPD rates were affected by changes in the definition of the disease, particularly due to differences between the 8th and 9th revisions of the ICD, the 9th revision being introduced in or around 1979 in most countries. It was concluded that it was more reliable to restrict attention to studying trends in RDNA, so further investigation was restricted to this disease grouping.

It was clearly evident that RDNA rates rose markedly with age in all the countries considered and were generally substantially higher in men than in women.

The highest rates ever recorded in both sexes were in Romania, the peak rate in females (151.1 per 100,000 per year for age 30-84) being over twice as high as that seen in any other country.

There was considerable variation by country and sex in the trend in RDNA rates over time. In a number of country/sex combinations overall rates for age 30 to 84 (age adjusted) rose, then fell, with the peak occurring earliest in males in the UK and females in Czechoslovakia. In some cases, including USA and Canada in both sexes, there was an increase over the whole or virtually the whole period. In others, rates stayed relatively constant over the whole period studied, or most of it. In many countries, the trend in RDNA rates over time was not the same in each age group as it was for the overall age adjusted rate.

The variability in patterns by country, sex and age is not readily summarized in a convenient form, as was the case for ischaemic heart disease.

The rank order of the countries varies by time, sex and age and also cannot be summarized very easily. Some features of the data are, however, worth noting:

- In USA and Denmark particularly, and also in Canada, Iceland, Australia and New Zealand, an increase in the overall RDNA rate (age 30-84, age adjusted) in females has led to these countries now having rates that are among the highest of any countries studied when previously their rates were not exceptionally high.

- Overall rates in the UK and Ireland have always been relatively high in both sexes. However rates have been declining and in younger age groups the relative position of these countries has improved dramatically.

- Relative to other countries, rates in Scandinavian countries, particularly Sweden, have tended to be low for many years. However, since rates have not declined in recent years (and have increased in some countries, notably in females in Denmark), and rates in other countries have declined, their relative position is not now so markedly low.

- Rates in Spain, Portugal, France and Italy used to be among the highest in both sexes, but a continuing decline (except in males in Spain) has led to their relative position improving.

- Rates in males in Belgium are generally high, but otherwise males or females in other mainland West European countries (including also Netherlands, Germany, Austria and Switzerland) tend to be around average for the countries considered.

- Rates in Romania were extremely high in both sexes, but have declined markedly since 1970.

- Rates in USSR were very high in both sexes where data were available, in the 1980s. At that time they had the highest overall rates in males.

6. Reference

1. Alderson M. *International Mortality Statistics*. London: The Macmillan Press; 1981.

TABLE 1 Ratio of COPD to respiratory disease (non-acute) mortality rates (as a percentage) in 30 countries for 1951-55, 1971-75 and 1991-95 (males). Based on rates for age 30-84 (adjusted to the European Standard Population)

Country	1951-55	1971-75	1991-95
Australia	96	99	87
Austria	79	93	91
Belgium	95	99	76
Bulgaria	-	99	82
Canada	91	99	84
Czechoslovakia	84	99	82 *
Denmark	83	98	95
Finland	91	99	89
France	89	98	73
Germany	91	99	88
Greece	-	99	29
Hungary	83	96	92
Iceland	98	97	88
Ireland	96	100	85
Israel	91	98	74
Italy	84	99	78
Japan	77	94	54
Netherlands	96	99	90
New Zealand	97	100	92
Norway	92	98	91
Poland	87 **	97	97
Portugal	87	97	66
Romania	93	97	88
Spain	93	99	71
Sweden	86	97	81
Switzerland	88	98	96
United Kingdom	99	100	86
United States	93	98	81
USSR	-	-	-
Yugoslavia	-	98	88 *

* Data for 1986-1990 - not available
** Data for 1956-1960

TABLE 2 1991-1995 mortality rates from respiratory disease (non-acute) as a percentage of those in 1951-1955 by age, sex and country

	Male			Female		
Country	40-44	60-64	80-84	40-44	60-64	80-84
Australia	63	108	212	121	468	154
Austria	38	90	112	136	81	58
Belgium	25	50	214	122	149	95
Bulgaria	NA					
Canada	51	147	514	66	344	298
Czechoslovakia*	123	140	195	176	125	94
Denmark	126	389	379	127	1155	297
Finland	96	70	229	94	231	223
France	31	52	126	49	46	73
Germany	65	82	141	125	135	61
Greece	NA					
Hungary	304	151	236	356	154	140
Iceland	49	∞ †	242	49	105	280
Ireland	43	86	226	59	137	122
Israel	74	128	189	69	230	277
Italy	23	69	163	41	44	59
Japan	47	66	161	44	50	88
Netherlands	31	115	340	68	162	126
New Zealand	94	81	175	205	376	157
Norway	71	276	346	169	407	142
Poland**	47	139	236	90	103	115
Portugal	49	80	173	74	67	149
Romania**	117	93	127	56	58	102
Spain	34	54	139	28	32	74
Sweden	91	241	511	115	363	383
Switzerland	45	136	193	44	150	74
United Kingdom	22	31	106	48	105	67
United States	102	214	759	215	958	816
USSR	NA					
Yugoslavia	NA					

*(1986-1990)/(1951-1955) **(1991-1995/(1956-1960) †No deaths in 1951-1955

TABLE 3 Rank of mortality rates from respiratory disease (non-acute) for age 30-84 (standardised to the European Standard Population)

Region/Country	Male 1951-1955	Male 1971-1975	Male 1991-1995	Female 1951-1955	Female 1971-1975	Female 1991-1995
North America						
USA	20	17	11	23	22	3
Canada	19	19	14	19	23	10
United Kingdom and Ireland						
UK	1	3	6	3	9	5
Ireland	4	4	1	2	2	1
Scandinavia						
Iceland	21	28	27	18	24	8
Norway	23	27	20	20	29	15
Sweden	24	29	26	22	28	19
Finland	15	14	18	24	27	27
Denmark	22	21	9	21	19	2
Mediterranean countries						
Spain	3	7	5	1	5	13
Portugal	7	13	12	6	8	16
France	8	15	22	5	16	22
Italy	10	12	15	4	10	21
Greece	(24) [a]	18	24	(12) [a]	6	14
Non-Mediterranean Western Europe						
Belgium	2	8	2	7	14	11
Netherlands	16	16	8	14	25	17
Germany	6	10	13	8	18	18
Austria	13	24	21	13	21	23
Switzerland	17	23	19	15	26	25
Eastern bloc						
Bulgaria	(7) [a]	9	17	(3) [a]	3	20
Czechoslovakia	12	2	(13) [b]	10	4	(17) [b]
Hungary	9	20	4	11	17	9
Poland	(17) [c]	11	16	(19) [c]	11	26
Romania	(4) [c]	1	3	(1) [c]	1	6
Yugoslavia	(20) [a]	22	(19) [b]	(14) [a]	13	(15) [b]
USSR	-	(1) [d]	(1) [b]	-	(3) [d]	(4) [b]
Asia						
Israel	18	25	25	17	12	12
Japan	14	26	23	9	20	24
Australasia						
Australia	11	5	10	16	15	7
New Zealand	5	6	7	12	7	4
Countries with data	24	29	27	24	29	27

[a] Data for 1961-1965 (29 countries with data)
[b] Data for 1986-1990 (30 countries with data)
[c] Data for 1956-1960 (26 countries with data)
[d] Data for 1981-1985 (30 countries with data)

Appendix 1 - Definitions of COPD and respiratory diseases (non-acute)

ICD Revision	COPD		Respiratory Diseases (non-acute)	
	Summary	Full	Summary	Full
6th and 7th	A093	501 = bronchitis unqualified	As COPD +	
		502 = CB	A094	510 = hypertrophy of tonsils and adenoids
	A097	511 = peritonsillar abscess	A095	518, 521 = empyema and absess of lung
		512 = chronic pharyngitis and nasopharyngitis	A096	519 = pleurisy
		513 = chronic sinusitis		
		514 = deflected nasal septum		
		515 = nasal polyp		
		516 = chronic laryngitis		
		517 = other diseases of URT		
		520 = spontaneous pneumothorax		
		522 = pulmonary congestion and hypostasis		
		523 = pneumoconiosis due to silica and silicates (occupational)		
		524 = other specified pneumoconiosis and pulmonary fibrosis of occupational origin		
		525 = other chronic interstitial pneumonia		
		526 = bronchiectasis		
		527 = other diseases of lung and pleural cavity **(including emphysema)**		
8th	A093	490 = bronchitis, unqualified	As COPD +	
		491 = CB	A094	500 = hypertrophy of tonsils and adenoids
		492 = emphysema	A095	510 = empyema
		493 = asthma		513 = abscess of lung
	A096	501 = peritonsillar abscess		
		502 = chronic pharyngitis and nasopharyngitis		
		503 = chronic sinusitis		
		504 = deflected nasal septum		
		505 = nasal polyp		
		506 = chronic laryngitis		
		507 = hay fever		
		508 = other diseases of URT		
		511 = pleurisy		
		512 = spontaneous pneumothorax		
		514 = pulmonary congestion and hypostasis		
		515 = pneumoconiosis due to silica and silicates		
		516 = other pneumoconiosis and related diseases		
		517 = other chronic interstitial pneumonia		
		518 = bronchiectasis		
		519 = other diseases of respiratory system (**including COPD**)		

CB chronic bronchitis
COPD chronic obstructive pulmonary disease
URT upper respiratory tract

Appendix 1 - Definitions of COPD and respiratory diseases (non-acute) - continued

ICD Revision	COPD		Respiratory Diseases (non-acute)	
	Summary	Full	Summary	Full
9th (except USSR)	B323	490 = bronchitis, not specified as acute or chronic	As COPD +	
		491 = CB	B313	470,471 = deflected nasal septum and nasal polyps
		492 = emphysema	B314	472,473 = chronic pharyngitis, nasopharyngitis and sinusitis
		493 = asthma	B315	474 = chronic diseases of tonsils and adenoids
	B324	494 = bronchiectasis	B319	475-478 = peritonsillar abscess, chronic laryngitis, laryngotracheitis, allergic rhinitis, other diseases of URT
	B325	495 = extrinsic allergic alveolitis		
		496 = chronic airways obstruction NEC (**including COPD**)	B326	500-508 = pneumoconiosis and other lung disease due to external agents
			B327	511 = Pleurisy
			B329	510, 512-519 = empyema; pneumothorax; absess of lung and mediastinum; pulmonary congestions and hypostasis; post inflammatory pulmonary fibrosis; other alveolar and parietoalveolar pneumopathy; lung involvement in conditions classified elsewhere; other diseases of lung; other diseases of respiratory system
9th (USSR)	not possible		S329, B323	Same as other countries
10th (except Switzerland)	J40 = bronchitis, not specified as acute or chronic J41 = simple and mucopurulent CB J42 = unspecified CB J43 = emphysema J44 = other COPD J45 = asthma J46 = status asthmaticus J47 = bronchiectasis J67 = hypersensitivity pneumonitis due to organic dust (farmer's lung etc)		As COPD + J30-J39 = vasomotor and allergic rhinitis; chronic rhinitis, nasopharyngitis and pharyngitis; chronic sinusitis; nasal polyp; other disorders of nose and nasal sinuses; chronic disease of tonsils and adenoids; peritonsillar abscess; chronic laryngitis and laryngotracheitis; diseases of vocal chords and larynx NEC; other diseases of URT J60-J66 = pneumoconiosis (coalworker's; due to asbestos and other mineral fibres; due to dust containing silica; due to other inorganic dust; unspecified; associated with tuberculosis) J68-J70 = RC due to inhalation of chemicals, gases etc; pneumonitis due to solids and liquids; RC due to other external agents J80-J82 = adult respiratory distress syndrome; pulmonary oedema; pulmonary eosinophilis NEC J84-J86 = other interstitial pulmonary diseases; abscess of lung and mediastinum; pyothorax J90-J94 = other disease of pleura J95-J96 = postprocedural RD NEC; respiratory failure NEC J98-J99 = other RD; RD in DCE	
10th (Switzerland)	G063	J40-J46, i.e. same as other countries except excludes J47 = bronchiectasis and J67 = hypersensitivity pneumonitis due to organic dust (farmer's lung etc)	G063, G064	Same as other countries except includes J22 = unspecified acute lower respiratory infection and excludes J99 = RD in DCE

CB chronic bronchitis
COPD chronic obstructive pulmonary disease
DCE diseases classified elsewhere
NEC not elsewhere classified
RC respiratory conditions
RD respiratory disorders
URT upper respiratory tract