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Original Article

Trends in Asthma Mortality in Spain from 1960 to 2005

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ABSTRACT

Background and objective: No data have been published on trends in asthma mortality in Spain between 1960 and 2005. The aim of this study was to trace these trends for both the general population and the 5- to 34-year age group in Spain.

Material and methods: The data on asthma mortality for the general population and by age and sex were obtained from the Spanish National Institute of Statistics and used to calculate the asthma mortality rates per 100 000 inhabitants.

Results: The overall asthma mortality rate per 100 000 inhabitants was 9.36 in 1960 and 2.22 in 2005, showing a reduction from 12.26 to 0.96 in males and from 6.58 to 3.44 in females. In the 5- to 34-year age group, the mortality rate for both sexes ranged from 0.4 to 0.1, showing great variability over time.

Conclusions: Asthma mortality decreased in the period analyzed, but less in women than in men. The trend and rates in Spain are similar to those of most countries for which data are available.

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Evolución de la mortalidad por asma en España, 1960-2005

RESUMEN

Introducción y objetivo: No hay datos publicados sobre la evolución de la mortalidad por asma en España en el período 1960-2005. El objetivo de este estudio ha sido describir la evolución de la tasa de mortalidad debida al asma en España entre 1960 y 2005, tanto en el total de la población como en el grupo de edad de 5 a 34 años.

Material y métodos: Los datos necesarios para calcular la tasa de mortalidad, esto es, número de defunciones debidas al asma y población, proceden del Instituto Nacional de Estadística. En cada caso se obtuvieron los valores totales, por grupo de edad y sexo. A partir de estos datos se calculó la tasa de mortalidad por asma, por 100.000 habitantes.

Resultados: La tasa de mortalidad por asma para todas las edades era en 1960 de 9,36, y en 2005 de 2,22, con una reducción en los varones de 12,26 a 0,96 y en las mujeres de 6,58 a 3,44. En el grupo de edad de 5 a 34 años, los valores de la tasa de mortalidad para ambos sexos oscilan entre 0,4 y 0,1, y se observa una gran variabilidad en su evolución a lo largo de los años.

Conclusiones: La mortalidad por asma ha disminuido a lo largo del período analizado, si bien de forma diferente en varones y mujeres, entre las que el descenso es mucho menor. La tendencia y las tasas de España son similares a las de la mayoría de los países de los que se dispone de datos.

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Introduction

Though the prevalence of asthma has increased in most countries in recent years, a decrease in cases of life-threatening asthma has been reported in Spain.¹ According to a study carried out in 7 European countries, the asthma prevalence in Western Europe has doubled in the last 10 years; it is now 8.6% overall, with the highest rate of 15.2% reported in the United Kingdom.² However, asthma prevalence and mortality do not seem to be closely correlated.³ In Spain the prevalence of asthma increased annually by 0.26% between 1991 and 2001, rising from 4.5% to 7.3% in nonsmokers. The increase is probably the result of the rise in the rate of diagnosis in recent years, and past underestimation of the number of cases could also partly explain the lack of correlation between prevalence and mortality.⁴

Another factor that shows the importance of asthma for public health is that 38% of children and 16% of adults in Europe have lost school or work days; the figure is higher in Spain, where asthma is second only to chronic obstructive pulmonary disease (COPD) as the reason for absence from work due to respiratory diseases.² The World Health Organization (WHO) has estimated that 15 million disability-adjusted life years are lost each year due to asthma.³

Although the Spanish National Institute of Statistics (INE) publishes figures for deaths due to asthma annually, until 1999 it did not publish the asthma-related mortality rate. Nor does it present the trend of asthma mortality over time. Furthermore, between 1981 and 1998 it did not publish figures for deaths due exclusively to asthma by age groups, but included them in the same group as deaths due to chronic bronchitis and emphysema. Finally, although the INE has published mortality rates by 5-year age groups since 1999, it does not give the rate for the 5- to 34-year age group. It is important to know the mortality rates and trend for this age group because it is the one that best reflects true cases of asthma, avoiding confusion with other diseases. In children younger than 5 years, asthma may be confused with other respiratory diseases—generally infectious ones. In the population aged over 34 years, deaths due to asthma are more likely to be attributed to other diseases, such as COPD.

The asthma mortality rate per 100 000 adults in Europe ranges from 0.54 in the Netherlands to 8.7 in Portugal.² In the 5- to 34-year age group the rate has been consistently under 1 death per 100 000 population in the United States, Canada, Japan, and most European countries, though there was a slight upward trend in the late 1970s and early 1980s. The only exception is New Zealand, which had an asthma epidemic in the late 1970s, when mortality reached 4.1 deaths per 100 000 population in 1979.^{5,6}

The aim of the present study was to offer the most complete figures to date on asthma mortality in Spain for all ages and for the 5- to 34-year age group.

Material and Methods

Calculation of Rates

The number of deaths due to asthma and the population estimates on July 1 were obtained from the INE⁷ for each year analyzed. These data were obtained by sex and 5-year age groups and used to calculate the mortality rate per 100 000 inhabitants. The following formulas were used:

$$\text{Asthma mortality rate} = (\text{deaths due to asthma} / \text{general population}) \times 100\,000.$$

$$\text{Asthma mortality rate from 5 to 34 years} = (\text{deaths due to asthma from 5 to 34 years} / \text{population aged from 5 to 34 years}) \times 100\,000.$$

We decided not to standardize the rates for 3 reasons: *a*) asthma mortality is age-dependent, so the reference population chosen (that of a given year) affects the trend⁸; *b*) the crude rates (the real number of deaths per year) offer a more exact picture of the asthma burden; and *c*) most mortality rates of other countries reported in the literature are crude rates.

Deaths

The data for the period 1960 to 1998 were taken from the INE publication on “Deaths by Cause,” which is included in the “Natural Population Movement” statistics for each year. The data obtained were disaggregated by age group and sex. For the period 1981 to 1998 the INE did not publish detailed data, so we had to request them from the INE’s user attention service. The data for the period 1999 to 2005 were obtained online from the “Health” section of INEbase, which is on the INE’s website (www.ine.es).

Definitions

During the study period the WHO’s International Classification of Diseases (ICD) changed several times. In particular, the classification of asthma underwent major changes, moving from “allergic, endocrine system, metabolic and nutritional diseases” to “diseases of the respiratory system.” The ICD codes referring to asthma are code 241 from 1960 to 1967 (ICD-7); code 493 from 1968 to 1998 (ICD-8 and 9), and codes J45 + J46 from 1999 to 2005 (ICD-10). In addition to these changes in coding, changes in the criteria defining asthma were introduced in the ninth revision of the ICD in 1980.⁹

Population

The data for 1960 to 1970 were obtained from the Spanish Statistical Yearbook (*Anuario Estadístico de España*), which states the total population of Spain and the proportions by sex and age. These data were used to estimate the population of males and females and of the 5- to 34-year age group.

The population figures for the period 1971 to 2005 were obtained from INEbase. For the period 1971 to 2001 the intercensal population estimate was used and for the period 2002 to 2005 the current population estimate was used because the intercensal one had not yet been published. In both cases the population estimates on July 1 of each year were used.

Sources for the Mortality Rates in Other Countries

In order to compare the Spanish rates with those of other countries, we used information from Neffen et al,¹⁰ Baluga et al,¹¹ Kuo et al,¹² Iwai et al,¹³ Eurostat,¹⁴ Akinbami,¹⁵ and the Australian Bureau of Statistics.¹⁶

Results

As shown in Figure 1, between 1960 and 2005 asthma mortality per 100 000 population decreased both for the general population (from 9.36 to 2.22) and for each sex separately (from 12.26 to 0.96 in

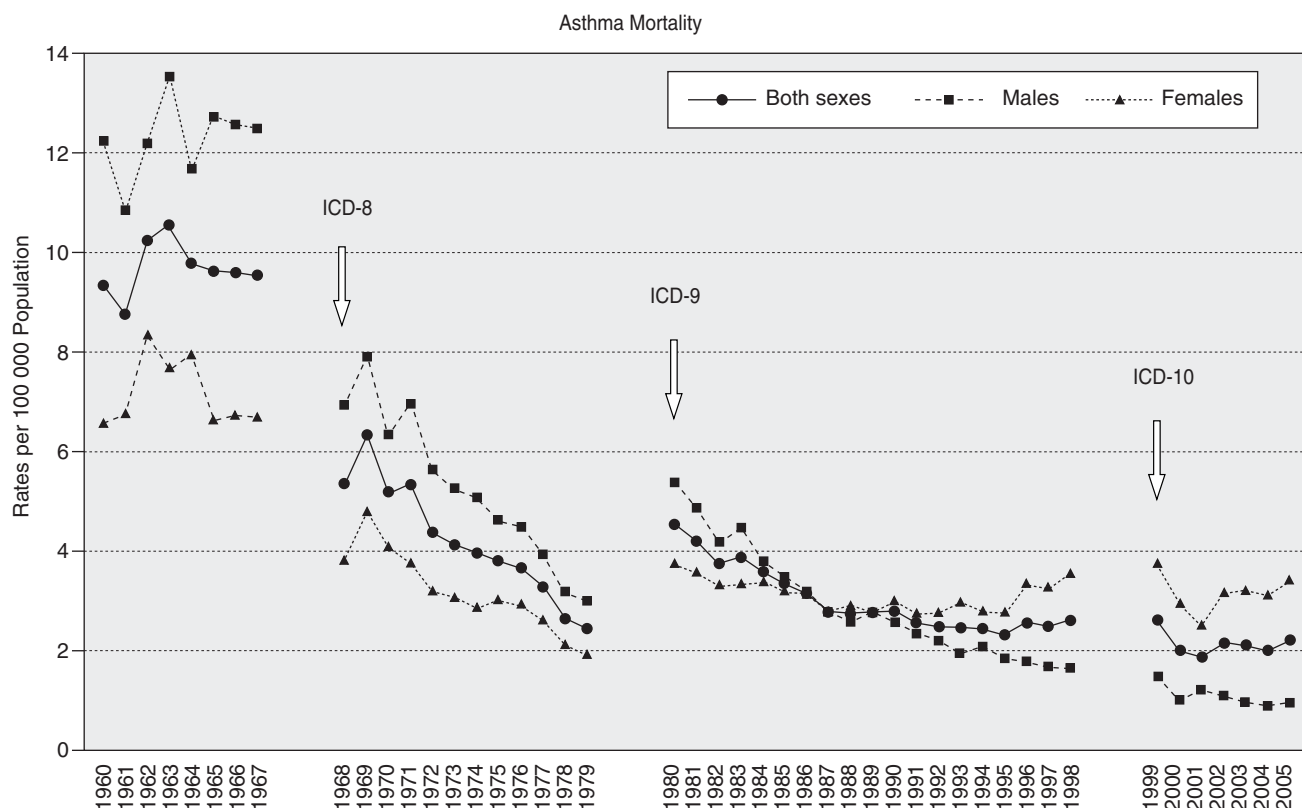


Figure 1. Asthma Mortality Rate per 100 000 population. International Classification of Diseases (ICD) codes: 241 according to the ICD-7 (up to 1967), 493 according to the ICD-8 (up to 1979) and the ICD-9 (up to 1998), and categories J45 and J46 of the ICD-10.

males and from 6.58 to 3.44 in females). In the 1960s the male mortality rate was double the female rate (12.74 and 6.65 per 100 000 population, respectively, in 1965), but in the late 1980s the situation reversed. This difference increased over the rest of the study period, as male mortality fell gradually until a few years ago and has remained fairly constant since then. For example, between 1987 and 2005 male mortality fell from 2.79 to 0.96, whereas female mortality rose from 2.79 to 3.44. Figure 1 shows how each change in the ICD has affected the mortality rates: the points of inflection were probably due more to the change of method than to changing trends in mortality.

Figure 2 shows asthma mortality for the 5- to 34-year age group. As can be seen, it is far lower than the rate for all ages. As the values are lower and the scale is different, the curve appears to be more erratic because small variations are more evident. In most years the mortality rates for this group are between 0.1 and 0.3 per 100 000, whereas for all ages they are between 2 and 6 per 100 000. Despite this erratic behavior, 3 trends can be observed:

- Until 1979, the last year in which the ICD-8 was applied, there was a continual decrease in mortality and 1979 showed the lowest value of the entire study period. The decrease was similar for both sexes, but female mortality was slightly higher.
- After the ICD-9 introduced a coding change in 1980,⁹ mortality increased, reaching a peak of 0.30 in 1989 and taking the rate close to the values of the early 1960s (0.3-0.4), which were the highest in the study period.
- In 1989 mortality began to decrease again, but in the following 10 years the curve shows a great deal of variability. In the last few years there was a downward trend but the low value of 1979 was not

reached again. During this period, mortality in this age group showed a change in the distribution by sex: mortality was lower in women than in men, exactly the opposite of the situation for all ages.

Figures 1 and 2 show a decrease in the mortality rate in 2000. Though sharp variations are also observed in other years, they coincided with changes in the ICD. The decrease in 2000, however, came a year after the ICD-10 revision of 1999. The mortality rates for other countries^{5,9-17} are shown in Tables 1 to 3.

Discussion

In order to interpret the results of this study, we must first consider how far the data obtained reflect trends in asthma mortality. We must take into account the modifications in how diseases were classified in the various ICD updates. Major changes in asthma mortality can be observed with each update, though they are less pronounced in the 5- to 34-year age group.

Another important—and fairly controversial—factor is how far death certificates reporting asthma as the cause of death reliably reflect the truth, given that COPD or cardiovascular diseases may be confused with asthma.¹⁸ The possibility of confusion arises above all in the later years of life. A study carried out in the United Kingdom showed that for the general population asthma mortality could be overestimated by 26%, but that in individuals under the age of 35 years, 97.8% of the death certificates showed a correct diagnosis.¹⁹ The 5- to 34-year age group is the most reliable one in terms of correct classification and the changes in ICD coding do not seem to have a great influence on it.²⁰

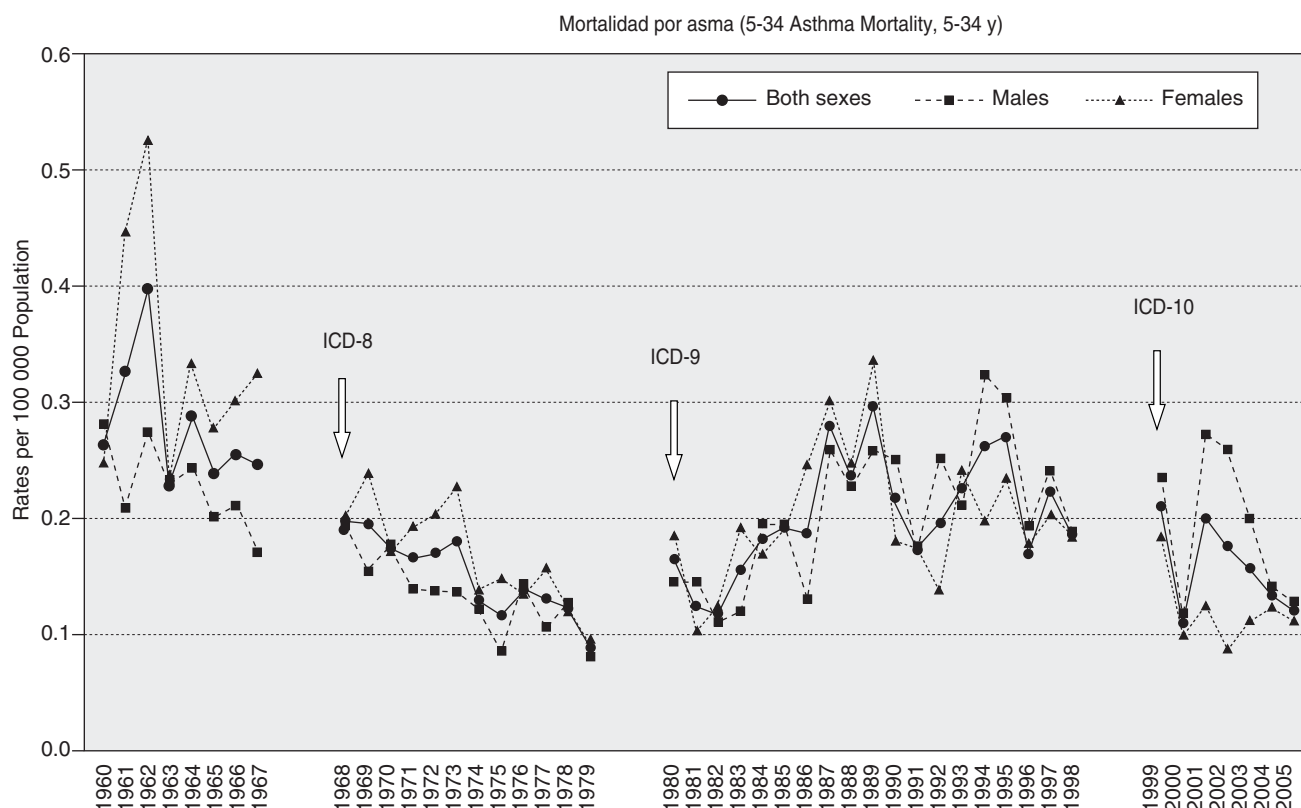


Figure 2. Asthma Mortality Rate per 100 000 population in the 5- to 34-year age group. International Classification of Diseases (ICD) codes: 241 according to the ICD-7 (up to 1967), 493 according to the ICD-8 (up to 1979) and the ICD-9 (up to 1998), and categories J45 and J46 of the ICD-10.

Figures 1 and 2 (general population and 5- to 34-year age group) show a similar downward trend in asthma mortality. This suggests that, though asthma mortality rates in a given year may be altered by artifacts, their behavior over 46 years is a faithful reflection of trends in Spain.

Asthma mortality in the 5- to 34-year age group shows a similar trend over the years, but with greater variability than in the general population. However, whereas the rate decreased in the general population in the period 1982 to 1989, it increased considerably in the 5- to 34-year age group and was always above the value of 1979, the lowest in the entire study period (0.086 deaths per 100 000). Japan's lowest values of 0.4 in males and 0.2 in females²¹ were also in 1979, although those rates were higher than Spain's rates of 0.08 and 0.09, respectively.

The last few years studied showed a slight increase in the mortality rate in the general population, which may be mainly due to the change in the demographic structure: asthma mortality is higher in older persons and the proportion of this group has increased in recent years. The difference in mortality due to demographic change is more evident because the rates were not standardized. The increase was not observed in the 5- to 34-year age group, supporting the idea that it is mainly due to the structural change in the population.

Female asthma mortality overtook male mortality during the study period. Female mortality due to asthma is also higher in both the black and white populations in Australia,¹⁶ Cuba,¹⁷ and the United States.²² This pattern may be related to the increase in asthma prevalence in adult women and to the increase in smoking in women.²³ However, in Spain, the inversion in the distribution of mortality by sex is due more to the decrease in male mortality, which

has been stable since 2000, than to the absolute increase in female deaths, which have also remained fairly stable. This change may be due to the larger number of smoking-related male deaths from cardiovascular and neoplastic diseases, for example, as these are more common among men and doctors may report them as the cause of death without taking into account the possibility of underlying asthma. The longer life expectancy of women could be another relevant factor, a hypothesis supported by the fact that in the 5- to 34-year age group mortality was lower in women than in men in the last period of the study. Furthermore, in this age group female mortality fell below male mortality in 1990. Also, though there seems to have been a decrease in cases of life-threatening asthma in Spain (possibly due to the introduction of inhaled corticosteroids), such cases are still more frequent among women (62%).¹ This greater prevalence of severe asthma in females may explain the sex difference in the mortality rate.

Other countries show similar trends: a downward trend in the general population, high values in the 1960s, an increase in the late 1970s and early 1980s and great variability in the 5- to 34-year age group.^{5,6,21,22} The values in Spain have been low since the 1990s and are similar to those in other countries. In the United Kingdom²⁴ and Japan²¹ the rates are higher. In the USA the rate is lower, but with differences by race: mortality is higher in the black (2.59) than in the white population (0.78).²² In the 5- to 34-year age group the rates in Spain are very low in comparison with other countries, though in recent years they have been even lower in the Netherlands. The Spanish rates are generally lower than those in New Zealand, Australia, Austria, Belgium, Germany, the United Kingdom, Japan, the USA, and Canada.

Table 1Crude Asthma Mortality Rates per 100 000 Population in the 5- to 34-Year Age Group in the 1980s^a

Country	Year	Rate
New Zealand	1982-1984	2.7
Australia	1982-1984	1.1
England	1982-1984	0.9
West Germany	1982-1984	0.8
Canada	1982-1984	0.5
France	1982-1984	0.3
United States	1982-1984	0.3
Sweden	1982-1984	0.5
Singapore	1982-1984	0.9
Japan	1982-1984	0.4
Switzerland	1982-1984	0.2
The Netherlands	1982-1984	0.3
Israel	1982-1984	0.4
Finland	1982-1984	0.2
Spain	1982-1984	0.2
Argentina	1980-1989	0.7
Brazil	1980-1991	0.5
Chile	1980-1990	0.3
Colombia	1986-1990	0.3
Costa Rica	1982-1991	1.4
Cuba ^b	1983-1992	1.8
Uruguay	1984-1990	0.6
Venezuela	1980-1999	0.8

^aData taken from Jackson et al,⁵ Bellido and Sunyer,⁹ and Neffen et al.¹⁰^b5-44 years.**Table 2**Asthma Mortality Rates per 100 000 Population in Europe and Latin America in the 1980s^a

Country	Year	Rate
Belgium	1994-1996	4.1
Bulgaria	1994-1996	0.8
Czech Republic	1994-1996	1.3
Denmark	1994-1996	4.9
Germany	1994-1996	6.7
Estonia	1994-1996	5.7
Ireland	1994-1996	2.8
Greece	1994-1996	0.9
Spain	1994-1996	2.5
Italy	1994-1996	1
Lithuania	1994-1996	3.3
Hungary	1994-1996	2.8
The Netherlands	1994-1996	0.3
Austria	1994-1996	4
Poland	1994-1996	2.6
Portugal	1994-1996	2.8
Finland	1994-1996	1.3
Sweden	1994-1996	3.5
United Kingdom	1994-1996	2.7
Iceland	1994-1996	2.7
Norway	1994-1996	7.2
Switzerland	1994-1996	2.5
Argentina	1980-1989	3.4
Brazil	1980-1991	2.0
Chile	1980-1990	1.6
Colombia	1986-1990	1.4
Costa Rica	1982-1991	3.8
Mexico	1980-1990	5.6
Paraguay	1991	0.8
Peru	1986-1991	3.7
Venezuela	1980-1989	3.1
Cuba	1993	5.9
Uruguay	1995-1998	4.1

^aData taken from Eurostat,¹⁴ Neffen et al,¹⁰ Fabr  Ortiz et al,¹⁷ and Baluga et al.¹¹

In summary, the overall asthma mortality rate in Spain showed a clear downward trend from the 1960s to 2000, since when it has remained fairly stable. Whereas mortality is higher in women in the general population, it is higher in men in the 5- to 34-year age group,

Table 3Recent Asthma Mortality Rates per 100 000 population in Developed Countries^a

Country	Year	Rate	Males	Females
European Union (27 countries)	2003-2005	2	1.7	2.3
Bulgaria	2003-2005	1.4	1.5	1.3
Czech Republic	2003-2005	1.1	0.9	1.2
Germany	2003-2005	2.6	2.5	2.7
Estonia	2003-2005	3.7	3.7	3.6
Ireland	2003-2005	1.6	1.5	1.8
Greece	2003-2005	0.2	0.2	0.1
Spain	2003-2005	2.1	0.9	3.3
France	2003-2005	2	1.5	2.5
Italy	2001-2003	1.5	1.4	1.6
Latvia	2003-2005	3	3	2.9
Lithuania	2003-2005	1.8	2	1.7
Hungary	2003-2005	2.4	2.4	2.4
The Netherlands	2003-2005	0.5	0.4	0.6
Austria	2003-2005	2.6	2.7	2.6
Poland	2003-2005	2	2.3	1.7
Portugal	2003-2005	1.1	0.9	1.2
Romania	2003-2005	2.2	2.4	2.1
Finland	2003-2005	1.7	1	2.3
Sweden	2003-2005	1.8	1.2	2.4
United Kingdom	2003-2005	2.3	1.63	
Croatia	2003-2005	2.4	2.9	1.8
Norway	2003-2005	2.6	2.1	3.1
Switzerland	2003-2005	1.6	1.4	1.9
Taiwan	2000	4.5	NA	NA
USA	2003	1.4	1.1	1.6
Japan	2000	NA	2.8	1.6
Australia	2004	1.5	1.2	1.7

^aData taken from Eurostat,¹⁴ Australian Bureau of Statistics,¹⁶ Kuo et al,¹² Akinbami¹⁵ and Iway et al.¹³

Abbreviation: NA, not available.

exactly the opposite of the situation in the 1960s. The situation was reversed in about 1990. The mortality rates for the general population and for the 5- to 34-year age group are comparable to those of other developed countries.

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