

# Mortality from benign prostatic hyperplasia: worldwide trends 1950-92

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## Abstract

**Study objective** - To provide a systematic overview of worldwide trends in mortality from benign prostatic hyperplasia (BPH) over the past four decades.

**Design** - This was a descriptive analysis based on age adjusted mortality rates for BPH between 1950 and 1992 for 41 countries from five continents.

**Setting** - Official death certifications from the World Health Organization database.

**Main results** - In the 1950s, the highest age adjusted (on the world standard population) mortality rates for BPH in Europe were in Denmark (22.8/100 000) and Germany (18.1), followed by Scandinavian countries, the UK, and Switzerland. Italy had rates around 10/100 000, and rates were lower in eastern and southern Europe (5-8/100 000). Between 1950 and 1990, a fall of over 90%, or even 95%, was observed in most western European countries. Thus, in the early 1980s, overall mortality from BPH ranged between 0.5 and 1.5/100 000 in most western European countries. In proportional terms, similar reductions were registered in other developed countries of North America, Asia (that is, Japan or Singapore), and Oceania. A fall in rates was also observed in eastern Europe and in Latin America, particularly from the late 1970s onwards, although these reductions were generally much smaller. Thus, in the early 1990s, most countries in these areas had BPH rates between 1 and 5/100 000. The pattern of trends was, at least qualitatively, similar at younger ages, although most falls were proportionally greater.

**Conclusions** - The most probable interpretation of these trends is that therapeutic improvements - including more widespread and timely surgery, introduction of less invasive techniques, such as transurethral prostatectomy, and possibly the development of medical treatments - have had a favourable and substantial impact on BPH mortality. There are, however, areas of the world, including several countries of western Europe and South America, where rates are still very high.

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Benign prostatic hyperplasia (BPH) is a common condition in elderly men. While it is almost absent below age 45 years, its pathological

prevalence is around 30% at age 50, and over 50% above age 70.<sup>1,2</sup> The clinical prevalence of symptoms is much lower, however, and has been estimated at around a half to a third of the pathological one.<sup>3</sup>

Certified mortality data on BPH over the past few decades may have been influenced by substantial changes in both the certification and treatment of the disease. Improved diagnosis would, at least in principle, have introduced spurious trends in BPH rates. Improved treatment - including surgical advancements such as transurethral prostatectomy, with its subsequent developments, and new drug therapies - should, however, have reduced mortality from the disease.<sup>4-9</sup>

There are substantial temporal variations in the adoption of any such procedure in various countries and areas of the world.<sup>5,7,10-12</sup> To provide a systematic overview of trends in mortality from BPH over the past few decades, we systematically analysed data from 41 countries available through the World Health Organization (WHO) mortality database. This overview has potential therefore to allow priorities to be defined for intervention on a clinical and public health level.

## Methods

Numbers of deaths certified as being caused by BPH between 1950 and 1992 and estimates of the resident population, stratified by sex and five year age group, were derived from copies of the original computer tapes of the WHO mortality database.

### COUNTRIES IN THE DATABASE

#### Europe

Data were available for the 23 major European countries (United Kingdom was subdivided into England and Wales, Scotland and Northern Ireland), excluding the former Soviet Union, Albania, and a few small countries such as Andorra, Liechtenstein, and Malta.

#### Americas

The WHO database contains some data on mortality and population for 49 American countries or territories. All countries with a population of less than 2 million were excluded. Of the 24 countries remaining, only those with age stratified mortality and population figures of sufficient detail were retained: 14 countries were excluded at this stage. The analysis is based on data from Canada, the United States, and the remaining eight Latin American coun-

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tries – Argentina, Chile, Costa Rica, Cuba, Mexico, Puerto Rico, Uruguay, and Venezuela.

### Africa

Useful data were available only for Egypt.

### Asia

Five countries provided useful data on BPH mortality over at least part of the calendar period considered: Hong Kong (not an independent country, but a self governing commonwealth), Japan, Singapore, Sri Lanka, and Thailand.

### Oceania

Data were available for Australia and New Zealand.

### DATA

Between 1950 and 1992, four different revisions of the *International Classification of Dis-*

*eases* (ICD) were in operation (from the 6th to the 9th).<sup>13-16</sup> The ICD codes for BPH under these revisions were, 610 in the 6th and 7th and 600 in the 8th and 9th. No major change was introduced, however, in the coding of deaths from BPH. Certified deaths from BPH were thus recorded, for all calendar periods and countries considered, according to the 9th revision of the ICD.<sup>16</sup>

Age specific rates for each 5 year age group and calendar period were computed from the matrices of certified deaths and resident populations. In addition to overall age standardised rates, based on the world standard population,<sup>17</sup> truncated ones at age 45–64 years were chosen for presentation. The age range 45–64 years was chosen instead of that of 35–64, since there was no information of material relevance to BPH mortality below age 45. Truncated rates are of interest for at least two reasons: firstly, they provide specific information on trends in middle age, which have major public health and social relevance, and secondly, death certification in the elderly is generally less re-

Trends in death certification age-standardised (world) rates/100 000 population from benign prostatic hyperplasia in selected countries, 1950–92

Country	Total, all ages					Age 45–64 y				
	1950–54	1970–74	1985–89	1990–92	% of change 1990–92 v 1950–54	1950–54	1970–74	1985–89	1990–92	% of change 1990–92 v 1950–54
<b>Europe:</b>										
Austria	12.22*	8.53	1.20	0.58	–95	4.46*	1.78	0.23	0.00	–100
Belgium	8.28*	3.67	0.45§	—	–95	2.53*	1.09	0.09§	—	–96
Bulgaria	9.26†§	6.20	1.96	1.29	–86	3.80†§	2.59	0.69	0.38	–90
Czechoslovakia	8.59§	8.01	4.88	2.95‡	–66	3.59§	2.87	1.51	0.91‡	–75
Denmark	22.85§	5.31	1.49	1.16	–95	7.37§	1.08	0.21	0.12	–98
Finland	12.72§	4.86	1.25	1.03	–92	3.64§	1.12	0.15	0.24	–93
France	5.63	4.56	0.88	0.45‡	–92	1.80	1.17	0.21	0.09‡	–95
Germany, FRG (combined since 1990–91)	18.10§	10.41	0.90	0.87‡	–95	5.90§	2.22	0.13	0.18‡	–97
Greece	5.74†§	4.30	0.59	0.08‡	–99	1.65†§	1.36	0.04	0.00‡	–100
Hungary	9.18*	7.74	3.23	1.79	–81	3.34*	2.09	1.04	0.49	–85
Iceland	19.35§	5.89	0.87§	—	–96	4.97§	2.26	0.00§	—	–100
Ireland	11.11	4.92	1.60	1.37‡	–88	6.09	1.56	0.44	0.00‡	–100
Italy	10.01§	7.19	1.42	0.99‡	–90	3.87§	2.02	0.32	0.33‡	–91
Netherlands	15.26	6.32	1.54	0.99‡	–94	4.90	0.98	0.20	0.03‡	–99
Norway	17.56§	5.02	1.78	1.31‡	–93	4.83§	0.73	0.24	0.00‡	–100
Poland	1.15*§	4.20	2.10	1.32	+15	0.71*§	1.53	0.63	0.47	–34
Portugal	5.22*§	3.22	0.76	0.42	–92	2.03*	1.49	0.19	0.16	–92
Romania	9.73†§	8.76	6.84	5.05	–48	3.92†§	3.89	2.65	2.50	–36
Spain	5.10§	3.77	0.89	0.69¶	–86	2.17§	1.12	0.17	0.14¶	–94
Sweden	12.35§	3.91	0.84	0.67¶	–95	4.53§	0.77	0.08	0.10¶	–98
Switzerland	16.02§	8.06	1.12	0.78	–95	6.17§	1.76	0.13	0.12	–98
UK, England and Wales	16.60	3.65	1.23	0.92¶	–94	6.53	0.91	0.38§	0.41¶	–94
UK, Northern Ireland	17.85	3.79	0.68	0.31¶	–98	5.44	0.73	0.00§	0.00¶	–100
UK, Scotland	15.42	3.18	0.79	0.24¶	–98	4.89	0.44	0.17	0.00¶	–100
Yugoslavia	5.97†§	4.69	4.08	2.85¶	–52	2.85†§	2.08	1.09	0.89¶	–69
<b>America:</b>										
Canada	8.42	1.74	0.38	0.24‡	–97	3.53	0.49	0.08	0.04‡	–99
United States	6.95	1.28	0.24	0.21¶	–97	4.21	0.46	0.08	0.07¶	–98
Argentina	4.27††§	3.42§	0.43	0.41¶	–90	2.65††§	1.93§	0.26	0.23¶	–91
Chile	8.36*	8.53	3.35	—	–60	6.35*	5.01	1.26	—	–80
Costa Rica	7.88†§	2.34	2.78	0.81‡	–90	3.49†§	2.03	1.02	0.00‡	–100
Cuba	5.92†§	2.85	1.91	2.12¶	–64	2.15†§	1.42	1.16	0.83¶	–61
Mexico	2.14*§	1.54	2.04	1.62‡	–24	1.62*§	0.97	0.83	0.49‡	–70
Puerto Rico	2.08†§	0.77	0.20	0.29‡	–86	1.21†§	0.30	0.08	0.39‡	–68
Uruguay	8.62*	5.01	1.19	1.75¶	–80	6.50*	3.13	0.42	0.35¶	–95
Venezuela	5.16*	3.32	1.75	—	–66	4.26*	3.54	1.01	—	–76
<b>Africa:</b>										
Egypt	7.47*	3.08	1.11**	—	–85	8.11*	3.85	0.99**	—	–88
<b>Asia:</b>										
Hong Kong	3.59†	1.83	0.33§	—	–91	0.87†	0.43	0.08§	—	–91
Japan	1.16	1.78	0.35	0.21	–82	0.50	0.32	0.02	0.01	–98
Singapore	1.68†§	2.89	0.23§	—	–86	0.54†§	1.04	0.00§	—	–100
Sri Lanka	1.67	0.71††§	0.04§	—	–98	2.64	0.84††§	0.09§	—	–97
Thailand	0.12*§	0.06	0.02§	—	–83	0.09*§	0.01	0.03§	—	–67
<b>Oceania:</b>										
Australia	15.17	3.54	0.79	0.54	–96	5.97	0.90	0.19	0.10	–98
New Zealand	12.64	3.97	1.17	0.68‡	–95	4.84	1.23	0.12	0.30‡	–94

\* 1955–59 only available; † 1960–64 only available; ‡ 1990–91 only available; § one or more years were missing; ¶ 1990 only available; \*\* 1980–84 only available; †† 1965–69 only available.

liable, and may, therefore, introduce spurious trends in rates.

Data were missing for part of one or more calendar periods in a few countries. When a single year was missing within a quinquennium, numerators and denominators were interpolated linearly from the previous and subsequent calendar year. No extrapolation was made for missing data at the beginning or the end of the calendar period considered, or when data on one or more quinquennia were not available.

**Results**

Table 1 gives the age standardised death certification rates from BPH at all ages and trun-

dated rates from 45 to 64 years in the 41 countries considered, together with the percentage changes in mortality from 1950–54 to 1990–92 (or the last calendar period available). To provide more comprehensive information on a few specific patterns of trends, Figure 1 gives trends in BPH rates for eight selected countries. Further, to offer a summary picture of the range of variations in BPH mortality over the last few years, age standardised rates for the period 1990–92 for various countries are given in histogram form in Figure 2.

**EUROPE**

In the 1950s, the highest age standardised mor-

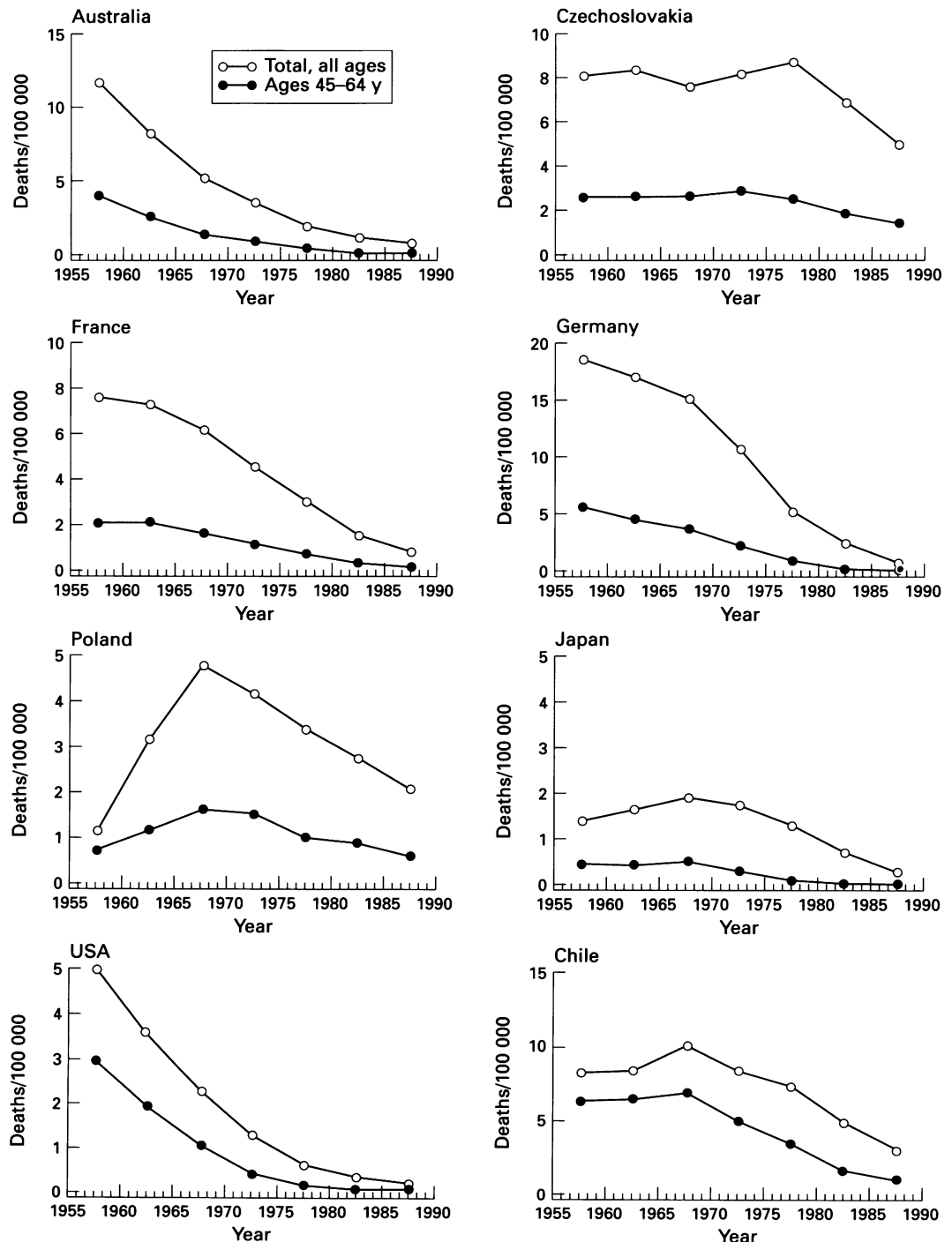


Figure 1 Trends in overall mortality and 45–64 years age standardised (world) mortality from benign prostatic hyperplasia in selected countries, 1955–89.

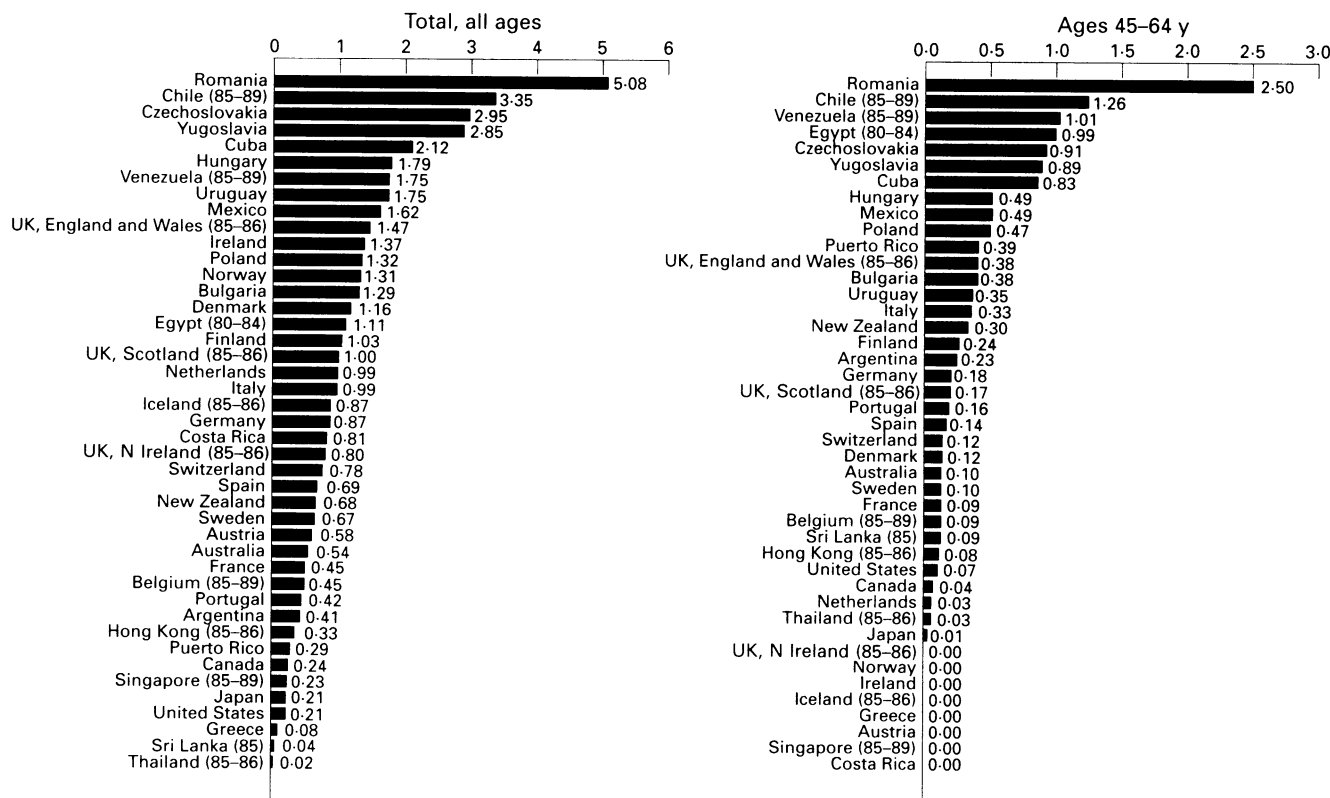


Figure 2 Overall and truncated age standardised (world) mortality from benign prostatic hyperplasia 1990-92 (unless mentioned in parentheses).

tality rates from BPH were in Denmark (22.9/100 000) and Germany (18.1), followed by Norway (17.6), the UK (15 to 18), Switzerland (16.0), The Netherlands (15.3), other Scandinavian countries (12-13), and Austria (12.2). Italy had rates around 10/100 000, while those in eastern Europe, Belgium, France, Spain, Portugal and Greece were lower (between 5 and 9/100 000). Inspection of the age specific rates indicates that there were substantial differences between various countries across subsequent age groups, although these were often and apparently larger at elderly ages. Still, a noticeable heterogeneity of BPH rates was evident even at younger ages. For instance, BPH mortality rates in 1950-54 for the age group 45 to 64 years were 7.4 in Denmark and 5.9 in Germany, but only 1.8/100 000 in France.

Over the four decades considered, there were steady and substantial downward trends in BPH mortality in all western European countries. In the late 1980s or early 1990s, overall mortality ranged between 0.5 and 0.9/100 000 in France, Belgium, Germany, Greece or Portugal, and 1.2 and 1.5 in Denmark, Italy, and Ireland. The downward trends were observed consistently across various age groups, but tended to be greater at younger ages.

Some decline in rates was also observed in eastern European countries, particularly from the late 1970s onwards. However, the reduction was much smaller than in western countries. Thus, BPH mortality fell from 8.6/100 000 in 1953-54 to 3.0 in 1990 in Czechoslovakia, from 12.9 to 4.3 in the former German Democratic Republic, from 9.2 to 2.0 in Hungary, from 9.7 to 5.1 in Romania, and from 6.0 to

2.9 in the former Yugoslavia. Only in Bulgaria was the fall appreciable (from 9.3 to 1.3), and in Poland mortality declined from 4.8 in 1965-69 to 1.3/100 000 in 1990. Consequently, Romania, former Yugoslavia, Czechoslovakia, and Hungary had some of the highest BPH mortality rates in the world (fig 2). In addition, the decline in Eastern Europe was somewhat larger at a younger age.

#### AMERICAS

Mortality from BPH in the early 1950s in Canada and the United States was relatively low (7-8.4/100 000). Moreover, in both countries a substantial and steady decline was observed over the past few decades. Thus, in 1985-89, the age standardised mortality rates were 0.38/100 000 males in Canada, and 0.24 in the USA - two of the lowest rates in the world. In both countries, the fall in rates was substantial in all subsequent age groups, including the elderly one. The decline was appreciable also in Puerto Rico and Argentina, whose rates were 0.2 and 0.4/100 000 in the late 1980s.

BPH death rates in the 1950s were also comparatively low in most other American countries that provided data for the WHO dataset, but the falls in rates were appreciably smaller. The declines in the overall age standardised rates were from 8.4 to 3.4 in Chile, 7.9 to 2.8 in Costa Rica, 2.1 to 1.9 in Mexico, 8.6 to 1.2 in Uruguay, and 5.2 to 1.8 in Venezuela. Chile, Cuba, and a few other Latin American countries therefore had some of the highest death rates from BPH.

## AFRICA

Useful data on BPH mortality were available only from Egypt. These showed a substantial decline (from 7.5 to 1.1/100 000 males, all ages), which was also reproduced in age specific rates for various age groups.

## ASIA

In the 1950s, death rates from BPH in the few Asian countries that provided data were low on a worldwide scale (3.6/100 000 in Hong Kong, 1.2 in Japan, and 1.7 in Singapore). Substantial reductions were observed nonetheless over the last few decades, and rates in the late 1980s or early 1990s were around 0.2/100 000 in these countries (three of the lowest rates in the world). The reductions were observed in various age groups, but were larger at younger ages.

## OCEANIA

In the early 1950s, the overall age adjusted BPH rates were 15.2/100 000 in Australia and 12.6 in New Zealand. These fell in the late 1980s to 0.8 and 1.2 respectively. In New Zealand, but less clearly in Australia, the fall in rates was smaller in the elderly, that is, those above the age of 75.

## Discussion

This overview of trends in mortality from BPH in various areas of the world shows a fall of over 90% – and often over 95% – in death rates in developed countries. In recent years, therefore, death from BPH has become a rare event, particularly in countries like Canada, the United States, or Japan. In contrast, however, and despite some reduction in rates, mortality from BPH was persistently and substantially higher in several countries of eastern Europe and South America.

BPH is practically absent below age 40, but has a prevalence in pathology series of over 50% above age 70 years.<sup>218</sup> Besides a major role of age and of normal testicular function, since the disease does not develop in men castrated before puberty,<sup>19</sup> there is no other defined and strong risk factor for the disease. Associations have been reported with liver cirrhosis, hypertension, vasectomy, indicators of sexual activity, race, and religious group,<sup>1 2 20 21</sup> but none can be clearly and consistently related to changes and trends in death rates observed in various countries over the past four decades.

Part of the observed variation is attributable to the variable degree of accuracy of certification in various countries and areas of the world. Thus, several countries of southern and eastern Europe, Latin America, and Asia probably have a lower quality of death certification data than countries of northern Europe, America, and Japan. This can hardly explain the consistent pattern registered over time, however, or the observation of similar trends in middle age men, in whom death certification is more reliable.<sup>222 23</sup> There are limited data on the incidence or pathological prevalence of

BPH. Necropsy studies on BPH in various areas of the world have not found major differences in age specific prevalences,<sup>24 25</sup> and in studies from North America and Europe no substantial patterns in incidence have been observed.<sup>1</sup>

Changed diagnostic approaches and increased attention to prostate disease should, it anything, have increased the diagnosis and certification of BPH. Mortality from BPH may be due to renal failure, urological infections that cause pyelonephritis and sepsis, acute urinary retention, but is essentially a result of complications of therapy.<sup>1 26 27</sup> Thus, the most likely interpretation of the favourable trends observed is that therapeutic improvements have had a favourable and substantial impact on death rates from the disease. In most North American and northern European countries and in Oceania, these therapeutic improvements (and the subsequent falls in rates) have been observed since the 1950s, whereas in southern Europe or Japan they have started in the late 1960s or early 1970s. The therapeutic advancements include more widespread and timely application of surgery, the introduction of less invasive techniques, such as transurethral prostatectomy, and its subsequent developments (with laser or microwave technology), and possibly the development of more effective medical treatments.<sup>3-5</sup> Thus, in the United States, the age adjusted rate of radical prostatectomy in 1990 was over fivefold that of 1984.<sup>7</sup>

Although more widespread and timely surgery seems to have had a major impact on BPH rates worldwide, whether the persisting wide variation in prostatectomy rates in various developed countries has had any substantial impact on BPH mortality is still debatable.<sup>10</sup>

These uncertainties and any other limitation of the data notwithstanding, the results of this study clearly indicate that there are areas of the world – including several countries of eastern Europe and South America – where the management of BPH is far from optimal, and where death rates from such an avoidable disease are still high. In these areas, the introduction of modern management techniques would be important on a public health scale.

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