Life expectancies in the United Kingdom and Japan
Shigeyuki Nakaji, Domhnall MacAuley, Siobhan O’Neill, Oonagh McNally, David Baxter and Kazuo Sugawara

Abstract
Background Compared with other developed countries, the United Kingdom has exhibited less of an increase in life expectancy over the past 30 years.
Methods We compared the chronological changes in the age-adjusted mortality rates (AMRs) from all causes or major causes, and in life expectancy in the United Kingdom and Japan between 1970 and 1997.
Results In both 1970 and 1997 the AMRs for most major causes were higher in the United Kingdom than in Japan; the difference in the AMR between countries was smaller in 1970 than in 1997. The difference in the AMR from all causes between the United Kingdom and Japan in 1997 was mainly due to differences in the AMR for heart diseases. The trend for an increasing difference over time between the United Kingdom and Japan in the AMR from all causes was due to the decreased rate of AMR from heart diseases from 1970 to 1997 in the United Kingdom being lower than those from cerebrovascular diseases in same period in Japan.
Conclusions These data suggest that mortality rates could be reduced by a change in focus of the National Health Service toward an emphasis on primary rather than secondary prevention and associated clinical interventions. The greatest priority should be placed on reducing the incidence of heart disease by aggressively improving primary prevention.
Key words: age-adjusted mortality rate, life expectancy, United Kingdom, primary prevention

Introduction
There is a variety of models for the provision of medical and health services in developed countries. Established in 1948, the National Health Service (NHS) in the United Kingdom incorporates medical and health care services, and is probably the best-known example of a ‘social medicine’ service in the world. However, despite the provision of an essentially free-to-user service, over the past 30 years the United Kingdom has exhibited less of an increase in life expectancy compared with other developed countries (the so-called ‘G7 countries’). Among these seven countries, female life expectancy in the United Kingdom is the lowest, and male life expectancy ranks sixth (Table 1).1 Japan, in contrast, has the longest life span in the G7,2–16 although there are no clear scientific explanations for this observation.
(2) the mortality rate integrates the fine effects of changes in the three primary determinants of the burden of disease: occurrence, stage of detection, and treatment;

(3) when the mortality rate is evaluated chronologically and geographically, the effects of changes in age distribution are removed by the AMR.

Thus, comparing these two measures between countries allows a comparison of the relative efficacy of the two health care systems.

In this study, we compiled data separately for England and Wales, Scotland, and Northern Ireland. Although all the UK countries are under the same NHS service, there are differences in some factors, such as racial origin, culture and medical facilities, that may influence the incidence of disease and causes of death.

Materials and methods

Data source

Mortality data

We used data from vital statistics of the four countries of the United Kingdom (Northern Ireland, England and Wales, and Scotland) and Japan collected in 1970 and 1997.17–21 The International Classification of Diseases (ICD) 822 was used in 1970 in all countries. In 1997 Japan used ICD 10,23 whereas three of the UK countries used ICD 9. Moreover, only England and Wales used the classification of ‘000.0’ in 1997, that of death within 28 days after birth, and this category was not included in other classifications.

We classified diseases by ICD number in each country and in each year as follows:

- Malignant neoplasms (140–239, 140–239, 02100).
- Endocrine, nutritional and metabolic diseases and immunity disorders (240–279, 240–279, 04000).
- Mental disorders (290–315, 290–319, 05000); diseases of the nervous system and sense organs (320–358, 320–359, 06000, 07000 and 08000).
- Diseases of the respiratory system (460–519, 460–519, 10000).
- Diseases of the digestive system (520–572, 520–577, 520–579, 11000).
- Diseases of the genitourinary system (580–629, 580–629, 4000).
- Complications of pregnancy, childbirth and the puerperium (630–678, 630–678, 15000).
- Diseases of the musculoskeletal system and connective tissue (710–738, 710–738, 13000).
- Certain conditions originating in the perinatal period (760–779, 760–779, 16000).
- Symptoms, signs and ill-defined conditions (780–796, 780–799, 18000).
- Suicide and self-inflicted injury (E950–E959, E950–E959, 20200).
- Homicide and injury purposely inflicted by other persons (E960–E969, E960–E969, 20300).
- Other causes (E970–E999, E970–E999, 20400).

We selected the first time point as the year 1970 because it was thought that by this time there would be little residual influence of World War II.

Population data

For the United Kingdom we used the estimated populations of each country in 1970 and 1997,17–21 and for Japan we used population census data in 197024 and estimated population data in 1997.25

Calculation of mortality rate and life expectancy

For England and Wales, we included the number of deaths under the ‘000.0’ classification when the total life expectancy and AMRs from all causes (total AMRs) were calculated. However, these were not included in other calculations.

Life expectancy

We used Chiang’s method26,27 to estimate life expectancy. The rate of survival period (nax) was extracted from life tables for each year in each country.

Age-adjusted mortality rate (AMR)

The direct method was used to estimate AMR. The standard population was taken as the average of the four countries (England and Wales, Scotland, Northern Ireland and Japan) by an equal weight in 1997. We used this method to concentrate the mortality in 1997 in for all four countries. AMRs from all causes and from 23 main causes were calculated. Furthermore, mortality rates were calculated for each 5-year age group from under 1 year to over 85 years.

Results

Life expectancy

The longest life expectancies among males and females in 1997 were found in Japan, followed by England and Wales, then
Northern Ireland and Scotland (Table 2). The greatest change in life expectancy from 1970 to 1997 was observed in Japan, followed by Northern Ireland, and then England and Wales, and Scotland.

AMRs (Table 3)

In 1997, mortality from all causes was lowest in Japan for both sexes: 972.4 per 100 000 for men, and 529.4 for women. England and Wales followed, with 1210.6 for men and 804.2 for women, followed by Northern Ireland and Scotland. In particular, the AMR for heart disease in Japan was less than 50 per cent of that in the other countries. Moreover, although the AMR for cerebrovascular disease in Japan was far higher than that of the other countries in 1970, there was little difference by 1997. Consequently, the difference in total AMR between Japan and the other countries increased from 1970 to 1997. In addition, changes in AMRs from 1970 to 1997 from nearly all causes were greater in Japan than in the other countries.

In nearly every age group, 1997 mortality rates by age group were lower in Japan than in the countries of the United Kingdom (Table 4). Moreover, the rate of decrease of AMR from 1970 to 1997 in almost every age group was greater in Japan than in the United Kingdom.

Discussion

To effectively evaluate health services in the United Kingdom, it is useful to compare outcomes with those in another country. We selected Japan as the country with which to make this comparison because it has the best record of prolongation of life expectancy from 1970 to 1997, and exhibited the longest life span in the world in 1997.11 We recognize that it may be difficult to directly compare the reasons underlying differences in life expectancy between UK countries and Japan because of differences in race or social structure. However, we note that infant mortality, neonatal mortality and perinatal mortality are also lower in Japan than in Western nations (see Table 4). These differences cannot be fully explained by racial differences alone.

We can draw two main conclusions from this study. The main finding is that the life expectancy of UK citizens was much shorter than that of Japanese citizens in 1997, despite the fact that the difference between the countries was relatively small.

Table 2 Life span in 1970 and 1997 in United Kingdom and Japan

<table>
<thead>
<tr>
<th></th>
<th>Northern Ireland</th>
<th>England &amp; Wales</th>
<th>Scotland</th>
<th>Japan</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Male</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1970</td>
<td>67.8</td>
<td>68.9</td>
<td>67.1</td>
<td>69.5</td>
</tr>
<tr>
<td>1997</td>
<td>74.1</td>
<td>75.0</td>
<td>72.7</td>
<td>77.5</td>
</tr>
<tr>
<td>Prolongation</td>
<td>6.3</td>
<td>6.1</td>
<td>5.6</td>
<td>8.0</td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1970</td>
<td>73.6</td>
<td>75.2</td>
<td>73.3</td>
<td>74.9</td>
</tr>
<tr>
<td>1997</td>
<td>79.4</td>
<td>80.0</td>
<td>78.1</td>
<td>84.7</td>
</tr>
<tr>
<td>Prolongation</td>
<td>5.8</td>
<td>4.8</td>
<td>4.8</td>
<td>9.8</td>
</tr>
</tbody>
</table>

Table 3 Age-adjusted mortality rate compared between countries in the United Kingdom and Japan in 1997 and the difference between 1970 and 1997

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>Northern Ireland</th>
<th>England &amp; Wales</th>
<th>Scotland</th>
<th>Japan</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Males</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All causes</td>
<td>1348* (–5491)</td>
<td>1211 (–601)</td>
<td>1421 (–607)</td>
<td>972 (–774)</td>
</tr>
<tr>
<td>Diseases of the circulatory system</td>
<td>603 (–464)</td>
<td>503 (–417)</td>
<td>615 (–484)</td>
<td>296 (–500)</td>
</tr>
<tr>
<td>Heart disease (except hypertension)</td>
<td>434 (–282)</td>
<td>383 (–235)</td>
<td>428 (–275)</td>
<td>141 (–102)</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>281 (–127)</td>
<td>158 (–181)</td>
<td>236 (–210)</td>
<td>52 (–5)</td>
</tr>
<tr>
<td>Cerebrovascular disease</td>
<td>131 (–128)</td>
<td>103 (–119)</td>
<td>142 (–141)</td>
<td>137 (–348)</td>
</tr>
<tr>
<td>Malignant neoplasms</td>
<td>325 (21)</td>
<td>312 (–33)</td>
<td>365 (–14)</td>
<td>303 (51)</td>
</tr>
<tr>
<td>Diseases of the respiratory system</td>
<td>243 (–25)</td>
<td>201 (–125)</td>
<td>194 (–92)</td>
<td>155 (–11)</td>
</tr>
<tr>
<td>Diseases of the digestive system</td>
<td>33 (–8)</td>
<td>40 (1)</td>
<td>55 (9)</td>
<td>39 (–59)</td>
</tr>
<tr>
<td>Accidents</td>
<td>39 (–24)</td>
<td>26 (–23)</td>
<td>34 (–30)</td>
<td>45 (–37)</td>
</tr>
<tr>
<td>Others</td>
<td>106 (–49)</td>
<td>128 (–5)</td>
<td>159 (4)</td>
<td>135 (–217)</td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All causes</td>
<td>863 (–419)</td>
<td>804 (–330)</td>
<td>948 (–364)</td>
<td>529 (–685)</td>
</tr>
<tr>
<td>Diseases of the circulatory system</td>
<td>368 (–373)</td>
<td>317 (–294)</td>
<td>409 (–357)</td>
<td>191 (–379)</td>
</tr>
<tr>
<td>Heart disease (except hypertension)</td>
<td>233 (–189)</td>
<td>197 (–132)</td>
<td>255 (–149)</td>
<td>88 (–90)</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>139 (–50)</td>
<td>78 (–66)</td>
<td>128 (–74)</td>
<td>28 (–4)</td>
</tr>
<tr>
<td>Cerebrovascular disease</td>
<td>110 (–139)</td>
<td>94 (–105)</td>
<td>125 (–145)</td>
<td>91 (–244)</td>
</tr>
<tr>
<td>Malignant neoplasms</td>
<td>205 (–2)</td>
<td>206 (1)</td>
<td>240 (10)</td>
<td>141 (–15)</td>
</tr>
<tr>
<td>Diseases of the respiratory system</td>
<td>166 (14)</td>
<td>131 (–24)</td>
<td>127 (1)</td>
<td>67 (–31)</td>
</tr>
<tr>
<td>Diseases of the digestive system</td>
<td>30 (11)</td>
<td>33 (5)</td>
<td>40 (10)</td>
<td>20 (–41)</td>
</tr>
<tr>
<td>Accidents</td>
<td>18 (–19)</td>
<td>13 (–18)</td>
<td>21 (–19)</td>
<td>18 (–11)</td>
</tr>
<tr>
<td>Others</td>
<td>76 (–41)</td>
<td>105 (1)</td>
<td>112 (–9)</td>
<td>92 (–209)</td>
</tr>
</tbody>
</table>

*Per 100 000. 11970–1997.
small in 1970. This trend is mainly attributable to the difference in the decrease in AMR from cerebrovascular disease between the United Kingdom and Japan from 1970 to 1997. In 1997 the AMR of cerebrovascular disease in Japan was similar to that of the United Kingdom, whereas in 1970 the difference was large (e.g. the AMR for Japanese men was two times higher than United Kingdom values and 1.5 times higher for Japanese women).

The second key finding is that the difference in total AMR between the United Kingdom and Japan in 1997 was mainly due to the difference in the AMR for heart disease (more than 50 per cent from myocardial infarction in the United Kingdom and approximately 30 per cent in Japan), although these differences were smaller than in 1970.

In other words, the trend for an increasing difference over time between the United Kingdom and Japan in the AMR from all causes was a result of the decrease in rate of AMR from heart diseases from 1970 to 1997 in United Kingdom being lower than those from cerebrovascular diseases in same period in Japan.

The reasons behind these changes in AMR require urgent consideration so that appropriate measures may be taken in the future. It is clear that action should be taken to address the increase in heart disease. The current findings show that the United Kingdom did not sufficiently reduce the number of persons at high risk of heart disease from 1970 to 1997. It would appear from these data that the operation of the NHS might be reviewed to determine whether the focus of its...
activities should be shifted to primary rather than secondary prevention and associated clinical interventions.

In contrast, in 1997 the AMRs from most causes, and in most age groups, were lower in Japan than in the four countries of the United Kingdom, even among the younger age groups and for minor causes. Furthermore, the rates of decrease in AMR from 1970 to 1997 for almost all causes, and in nearly all age groups, were also greater in Japan than in the countries of the United Kingdom. These findings may be significant because they suggest that comprehensive levels, including medical and health fields, may be weaker in Japan than in the UK countries.

In addressing the differences reported in the current study, greater priority should be placed on reducing the incidence of heart disease by aggressively improving primary prevention, even at the expense of activity in other areas, because this malady exerts a greater influence on total AMR and life expectancy than the other minor causes.

On the other hand, more than one-quarter (217 of 774 for men and 209 of 685 for women) of the change in mortality rate is in the category ‘Other’. The reason for this may be that the procedures for coding the cause of death on death certificates changed in 1995. In earlier years, ‘heart failure’ was often reported as the cause of death when it was a final event in the course of some other illness, or when the course of illness was unknown. The change from using ‘heart failure’ to code more precisely the underlying causes of death resulted in a slight increase in the AMR from all malignant neoplasms since 1995, and possibly in 1994 as well, because the new codes tended to be used by some doctors before enforcement.

References


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