Healthy life expectancy: comparison of OECD countries in 2001

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The epidemiological transition, characterised by a progressive rise in the average age of death in virtually all populations across the globe, has necessitated a serious reconsideration of how the health of populations is measured, with increased attention on non-fatal as well as fatal health outcomes. At the same time, there is considerable uncertainty in many populations as to whether – and to what extent – gains in life expectancy have been accompanied by improvements in health status.\(^1\)\(^-\)\(^3\) Without being able to measure health, the most important outcome of the health system, in a way that is comparable across populations and across time within specific populations, it is not possible to know if health policies are working – if levels of health are improving and inequalities are being reduced.\(^4\)

Since 2000, the World Health Organization (WHO) has been reporting annually in its World Health Report on average levels of population health for its 191 member states using healthy life expectancy (HALE), a summary measure that combines information on mortality and morbidity.\(^5\)\(^-\)\(^7\) It is important to capture both fatal and non-fatal health outcomes in any summary measure of population health since health policy is not aimed only at reducing mortality.\(^8\) Substantial resources are devoted to reducing the incidence of conditions that cause ill-health but not death and to reducing their impact on people’s lives.\(^9\) To better reflect the inclusion of all states of health in the calculation of healthy life expectancy, the name of the indicator used to measure healthy life expectancy was changed from disability-adjusted life expectancy (DALE) to health-adjusted life expectancy (HALE) in the World Health Report 2001.

Murray and Lopez\(^10\) published disability-adjusted life expectancy (DALE) estimates for the eight regions of the world based on the estimates of severity-weighted disability prevalence developed in the Global Burden of Disease study.\(^11\) DALE has also been calculated for Australia\(^12\) based on a national burden of disease study. It has also been calculated for Canada and Australia using population survey data on disability at four levels of severity.\(^13\)\(^-\)\(^15\) More recently, Canada has produced estimates of health-adjusted life expectancy across OECD countries, although causal inferences require more sophisticated analyses of the health system and non-health system determinants of levels of health.

Conclusions: The new methods used in the WHO Multi-Country Household Survey Study have increased the comparability of self-report data across OECD countries, a major step forward in the use of self-reported data on health. Building on this experience, WHO is developing improved health status measurement techniques for a World Health Survey to be carried out in 2002/03.

Abstract

Objectives: To compare average levels of population health for Australia and other OECD countries in 2001.

Methods: Healthy life expectancies (HALE) for OECD countries for 2001 are based on analysis of mortality data for OECD countries, country-specific estimates of health state prevalences for 135 causes from the Global Burden of Disease 2000 study, and an analysis of 34 health surveys in 28 OECD countries, using novel methods to improve the comparability of self-report data.

Results: HALE at birth ranges from a low of 59.8 years for Turkey to a high of 73.6 years in Japan in 2001. Australia ranks fourth among OECD countries at 71.6 years with a 95% uncertainty interval of 70.9 to 72.8 years, ahead of New Zealand in 13th place at 70.3 years. The equivalent ‘lost’ healthy years at birth range from around 10 years in OECD countries with lowest life expectancies to around eight years in those with high life expectancies at birth. There is a statistically significant association between higher levels of health expenditure and higher healthy life expectancy across OECD countries, although causal inferences require more sophisticated analyses of the health system and non-health system determinants of levels of health.

Conclusions: The new methods used in the WHO Multi-Country Household Survey Study have increased the comparability of self-report data across OECD countries, a major step forward in the use of self-reported data on health. Building on this experience, WHO is developing improved health status measurement techniques for a World Health Survey to be carried out in 2002/03.

expectancy based on population prevalence data for health states together with measured utility weights.\textsuperscript{16}

In calculating HALE for the World Health Report 2000, we carried out an analysis of 60 representative population health surveys, which revealed substantial problems with comparability of self-report health status and disability data.\textsuperscript{17} It has long been known that health expectancy estimates based on self-reported health status information are not comparable across countries due to differences in survey instruments and cultural differences in reporting of health.\textsuperscript{18} Despite substantial efforts to try to standardise questionnaire instruments and methods across countries,\textsuperscript{19-21} standardised instruments alone do not solve comparability problems.\textsuperscript{17} These relate more fundamentally to unmeasured differences in expectations and norms for health, so that the meaning different populations attach to the labels used for response categories in self-reported questions, such as mild, moderate or severe, can vary greatly.\textsuperscript{22}

To address this issue, WHO has recently undertaken a Multi-Country Survey Study involving 66 surveys in collaboration with 57 member states using a standardised health status survey instrument together with new statistical methods for adjusting biases in self-reported health.\textsuperscript{23,24} These new data, together with comprehensive analyses of epidemiological data for all regions of the world, and new life tables for all WHO member states, have enabled us to calculate healthy life expectancy for 191 countries for 2001 in a way that is comparable across countries.

The World Health Report 2000 also carried out an assessment of the performance of health systems of member states in achieving three main (intrinsic) goals for the health system: health, responsiveness and fairness in financing, and used healthy life expectancy as the measure of goal attainment for level of health.

In the Australian debate about the WHO analysis of health systems, a number of commentators argued that what was of more interest to Australia was a comparison of its performance with other OECD countries, rather than with all 191 WHO member states.\textsuperscript{25,26} In this paper, we examine more closely the analysis of healthy life expectancy for 2001 for OECD countries, compare the results for Australia with those of other OECD countries, and discuss their implications for the monitoring of trends in population health.

**Methods**

Calculation of healthy life expectancy requires three inputs: life expectancy at each age, estimates of the prevalence of various states of health at each age, and valuations of time spent in these health states compared with full health. Because comparable health state prevalence data are not yet available for all countries, two sources of information were used: the Global Burden of Disease 2000 study and the WHO Multi-Country Survey Study. In this section, we provide a brief overview of the data sources and methods used for OECD countries. These methods are described in more detail elsewhere\textsuperscript{27,28} and have been reviewed by an independent scientific peer review group.\textsuperscript{23}

**Life tables**

New life tables and detailed cause of death distributions were developed for OECD countries for 2001, based on analysis of available time series of vital registration data.\textsuperscript{7} Vital registration data were available up to and including 2000 for 20 OECD countries, to 1999 for six countries and to 1998 for the remaining four OECD countries. Regression methods were used to project key life table parameters for all OECD countries to 2001, and a modified logit life table system used to construct the 2001 life table for each OECD country with the most recent country-specific life table as the standard.\textsuperscript{29} In the two OECD countries with incomplete registration systems (Republic of Korea, Turkey), demographic techniques were used to estimate the level of completeness of death recording and to adjust the data accordingly.\textsuperscript{29}

**WHO multi-country health survey data**

The WHO Multi-Country Survey Study included 34 surveys carried out in 28 of the 30 OECD countries. The sampled populations were adults aged 18 years and over. Surveys were carried out in all OECD countries except Japan and Norway. Surveys in the European countries were carried out as part of the Eurobarometer survey program and a postal survey was carried out in Australia under the auspices of the Commonwealth Department of Health and Human Services. Just under one-half of the surveys in OECD countries were household interview surveys, two were telephone surveys, and the remainder postal surveys. Postal surveys as well as household surveys were carried out in five OECD countries (Czech Republic, Finland, France, Netherlands, Turkey) and postal plus telephone surveys in one OECD country (Canada) in order to allow different survey modes to be compared.

Based on an extensive review of existing health state measurement instruments and health measurement literature, and on WHO technical consultations,\textsuperscript{30,31} six domains were selected from the International Classification of Functioning, Disability and Health (ICF)\textsuperscript{32} as core domains for inclusion in the health status module for the surveys. These domains were mobility, cognition (concentration and memory), pain, affect (anxiety and depression), self-care and usual activities.

For each of these six core health domains, respondents reported their status on a five-category scale. For example, for the affect domain respondents were asked how much distress, sadness or worry they experienced in the past 30 days. Response categories were: None, Mild, Moderate, Severe, Extreme. To address the problem of differences across and within populations in the use of such response categories, the WHO survey instrument included short descriptions (‘vignettes’) that marked fixed levels of ability (e.g. people with different levels of mobility such as a paraplegic person or an athlete who runs four kilometres each day) and some measured tests for selected health domains. Each respondent was asked to rate the vignettes for a health domain using the same question and response categories as for their self-report on their own level of health.

Survey respondent responses on vignettes for each health domain enabled differences in the use of the response categories...
to be identified and new statistical methods were used to adjust for these differences across population groups according to age, sex, education level and country. The resulting health state profiles on the six core domains of health can then be validly compared across countries, as well as across groups differing in sex, age or education level.

Detailed reviews were carried out of the sample representativeness and of the health status results for all the surveys. We found no systematic relationship between the measured health state prevalences and survey response rates across countries. Australia was alone among OECD countries in having higher male than female severity-weighted prevalences. This suggested that the low response rate in Australia may have been associated with non-response bias, and further investigation revealed that the Australian survey sample had substantially higher rates of private health insurance than the general population. As a result of these analyses, one survey in the OECD (Australia), one survey in Africa and one survey in South America were excluded from the analyses contributing to HALE calculations for the World Health Report 2002.

Health state valuations

A key step in the construction of healthy life expectancy is comparing time lived in a health state worse than full health with time lived in full health. Health state valuations constitute scalar index values for the overall levels of health associated with different states (defined as multidimensional profiles), measured on a cardinal scale that ranges from zero (for a state equivalent to death) to unity (for a state of full health). Health state valuations quantify departures from perfect health, i.e. the reductions in health associated with particular health states. It is important to emphasise that these weights do not measure the quality of life of people with disabilities and do not measure the value of different people to society.

The WHO Multi-Country Survey Study included full household surveys in 10 countries where all individuals were asked to provide descriptions for a series of hypothetical health states described in terms of the six core domains of health, followed by valuations of these states using a simple thermometer-type (visual analog) scale (VAS). This is the only appropriate available valuation tool for respondents across a wide range of levels of educational attainment and diverse cultural settings, and has been demonstrated consistently to have higher reliability than other methods.

However, it is well known that VAS ratings do not provide interval-scaled valuations of health states. More cognitively demanding choice-based methods were used to calibrate the VAS ratings using more detailed surveys among sub-samples of respondents in eight developing and two developed countries.

A health state valuation function based on the global average usage. For example, in Australia, 27% of survey respondents gave self-report responses of moderate or greater on domains in a country may be quite different to the prevalence of definitions using more severe response categories.

Results

The survey data collected in the 28 OECD countries identified considerable variability in the use of question response categories to describe the same health state and a systematic tendency for people in richer OECD countries (higher GDP per capita) to rate the same fixed level in health domains such as affect or cognition using more severe response categories.

As a result, the self-reported prevalence of problems for a health domain in a country may be quite different to the prevalence of problems where the domain categories are defined in terms of global average usage. For example, in Australia, 27% of survey respondents gave self-report responses of moderate or greater on
the affect question, whereas the 'standardised' prevalence of affect problems using the global average threshold for the mild/moderate boundary was only 5%. In comparison, only 20% of respondents in Slovakia reported affect problems of moderate or greater level, but when responses were reclassified using the global average threshold, the prevalence of moderate or greater affect problems was double that in Australia at 10%. These and other results provide further evidence of systematic variation in the use of response categories and the non comparability of self-report data across populations.

Figure 1 compares the average GBD 2000-based prevalences and the survey prevalences for OECD countries. Differences between these at the oldest ages probably result from undersampling of older people in poorer health in the surveys, and incomplete adjustment for co-morbidity at older ages in the GBD 2000. Further analyses are under way to address these potential sources of bias at older ages. The final severity-weighted prevalences used for the calculation of HALE are a weighted average of these two sets of prevalences, with weights based on the relative uncertainty ranges for each set.28

Japan leads the OECD with an estimated average healthy life expectancy of 73.6 years at birth in 2001 (see Table 1). Female healthy life expectancy in Japan was 75.8 years compared with 71.4 years for males. After Japan, in second to fourth places, are Switzerland (72.8 years), Sweden (71.8 years) and Australia (71.6 years), followed by a number of other European countries then New Zealand in 13th place with an average HALE at birth 1.3 years lower than Australia. Canada is in 18th place (69.9 years) with an uncertainty range of 10-21 in ranking and the USA in 22nd place (67.6 years with a ranking range of 22-25). Note that there is a considerable range of uncertainty in the ranks for many OECD countries, so that for Australia the 95% uncertainty range is ranks 2 to 10.

Life expectancy at birth for New Zealanders in 2001 is estimated to be 76.1 years for males and 80.9 years for females (see Table 1), 1.3 years and 1.7 years lower than life expectancies at birth for Australian males and females respectively. The corresponding trans-Tasman gap in healthy life expectancy is 1.0 years and 1.6 years for males and females respectively. The somewhat greater average loss of healthy life expectancy for Australian males compared with New Zealand males is in large part due to substantially higher estimated levels of illicit drug dependence and harmful use in Australia. This is somewhat offset by higher levels of disability in New Zealand males resulting from higher incidence of motor vehicle accidents and other unintentional injuries.

Healthy life expectancy is lower in the Eastern European OECD countries than in those of Western Europe (see Table 1), reflecting both lower life expectancies and worse health status. Adult mortality, particularly for men, has increased during the 1990s in many of the former socialist economies of Eastern Europe. In addition, survey data for these countries gave high severity-weighted prevalences of health states less than full health, higher even than prevalences for some developing regions. High levels of anxiety and depression are a major factor in this, particularly for men, even after adjustment for cross-population differences in the use of response categories.

The difference between HALE and total life expectancy is LHE (‘lost’ healthy life expectancy). The equivalent ‘lost’ healthy years range from around seven years in Japan to 10 years in the OECD countries with lowest life expectancies at birth (see Figure 2). The proportion of total life expectancy at birth ‘lost’ due to ill-health ranges from 9% in countries like Japan and Australia up to 14% in the OECD countries with lowest healthy life expectancies (Poland, Hungary and Turkey). As shown in Figure 2, healthy years lost due to ill-health decrease both in absolute and relative terms as life expectancy increases across OECD countries.

Figure 3 shows deviations in average healthy life expectancy at birth from the OECD average (with 95% uncertainty intervals), plotted against deviations from the OECD average health expenditure per capita (Gross Domestic Product measured in international dollars using purchasing power parity conversion rates). Full details of these estimates for OECD and other countries are provided in the Annex Tables to the World Health Report 2002.7 The US has the highest per capita health expenditure of OECD countries, but this is associated with a HALE at birth 0.8 years below the OECD average. Japan is also an exception, with the highest
Figure 2: Lost health expectancy (LHE = LE – HALE) at birth versus life expectancy (LE) at birth, OECD countries, 2001.

Table 1: Healthy life expectancy and total life expectancy at birth, by sex, OECD member states ranked by HALE, with 95% uncertainty ranges, 2001.

<table>
<thead>
<tr>
<th>Rank</th>
<th>95% range</th>
<th>OECD country</th>
<th>Healthy life expectancy (HALE) at birth</th>
<th>Life expectancy at birth</th>
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<td></td>
<td>Persons</td>
<td>Males</td>
<td>Females</td>
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<td>5</td>
<td>3-11</td>
<td>France</td>
<td>71.3</td>
<td>69.0 (68.7-69.7)</td>
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<tr>
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<td>69.2 (68.8-70.2)</td>
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<td>69.3 (68.8-70.4)</td>
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OECD average 68.4 66.6 70.2 74.0 80.2

Discussion and conclusions

Previous comparisons of health attainment in Australia and other OECD countries have focused on life expectancy and found that Australia had a higher-than-average life expectancy at birth and only slightly higher-than-average health expenditure per capita. The analysis of healthy life expectancy for 2001 has confirmed...
Australia's higher-than-average level of population health, using an indicator that incorporates population prevalences of health states as well as mortality risks. Australia ranks fourth in terms of level of health in 2001 among OECD countries with a 95% uncertainty range in ranks of 2 to 10. In other words, we can say with 95% certainty that Australia is among the top 10 OECD countries for level of health, but is not the first (which is either Japan or Switzerland).

Uncertainty intervals for HALE estimates and ranks are based on quantifying the possible uncertainty in the components of the estimates, including measurement uncertainty and other sources of uncertainty, including potential non-random biases. A simulation-based approach to uncertainty propagation allows for an accurate representation of multiple sources of uncertainty, and also simplifies the process of accounting for correlations between the various sources of uncertainty. While the HALE uncertainty intervals reported here for OECD countries may appear relatively large, it should be remembered that they include sources of uncertainty that will vary little from year to year (e.g. for many epidemiological quantities and for health state valuations), so that when auto-correlation is taken into account, the uncertainty in change from year to year in healthy life expectancy will be much less than the total uncertainty intervals for the annual estimates themselves.

Across OECD countries, there is a statistically significant association between average per capita health expenditure and average level of population health. Population health is clearly the result of many factors besides health sector inputs, but health systems undoubtedly do affect premature mortality and the prevalence of states of less than ideal health through prevention and treatment interventions, both personal and non-personal. The proportion of HALE causally attributable to health system inputs requires a more detailed analysis taking other determinants of population health into account, and also taking appropriate account of the dependence of current levels of population health on past health system inputs.23,41

With the WHO Household Survey Program, WHO has measured health state valuations in a larger and more diverse group of people than in any previous study and has assembled the largest available empirical evidence base on variations in health state valuations. This will enable WHO (a) to quantify the actual range of variation in health state valuations and (b) to assess the impact of these variations on comparative judgements of levels of population health. Thus far, this work has indicated minimal cross-country differences, but we await further results from additional countries. Of far more importance for ensuring that population health measurements are comparable across populations is to address the range of issues involved in ensuring that health state prevalences are measured comparably across populations. For this reason, WHO methods used to calculate HALE have combined results from two separate approaches to the comparable estimation of severity-weighted health state prevalences.

Some commentators have argued that the data demands and complexity of the calculations make healthy life expectancy an impractical measure for use as a summary measure of population health.42 Although the concept of healthy life expectancy is relatively simple to understand, health encompasses multiple domains and mortality risks, and with the additional requirement to ensure comparability of estimates across countries, any acceptable methods used to compute healthy life expectancy will inevitably be complex. We have made careful attempts to quantify uncertainty ranges for the resulting HALE estimates, taking into account potential systematic errors and estimation uncertainty as well as sampling uncertainty in the surveys.38

Levels of uncertainty in HALE ranks are greater than levels of uncertainty in life expectancy among OECD countries. This reflects the much greater precision with which we are currently able to measure age- and sex-specific mortality rates and, where necessary, project them forward one or two years, compared with the measurement and valuation of health states in populations. This is not an argument to use life expectancy rather than HALE to compare the overall levels of health for OECD countries. Good science involves measuring the quantity of interest rather than using proxies with an additional error term that is unknown (until we measure the quantity of interest).

The regular assessment of levels of population health is a key input to the public policy process and comparable measurement of population health levels creates possibilities of investigating broad determinants at national and cross-national level. While it is possible to assess health progress purely with time comparisons within a country, relating this progress to health and other social interventions and trends is extremely difficult in the absence of comparison with other populations, simply because there is only one data point (the set of interventions that actually occurred in that country). Comparability is fundamental to the use of survey results for development of evidence for health policy but has been under-emphasised to date in instrument development. The new methods used in the WHO Multi-Country

![Figure 3: Healthy life expectancy (HALE) at birth in 2001 and health expenditure per capita in 2000 in international dollars (purchasing power parity conversion), deviations from OECD averages.](image-url)
Household Survey Study have increased the comparability of self-report data across countries. We consider these results as a major step forward in the use of self-reported data on health. Building on this experience, WHO is developing improved health status measurement techniques for a World Health Survey to be carried out in 2002-03.

Acknowledgements

The authors thank the many staff of the Global Program on Evidence for Health Policy who contributed to the development of life tables, burden of disease analysis and the development and conduct of the health surveys. In particular we thank Omar Ahmad, Brodie Ferguson, Mie Inoue, Doris Ma Fat, Matilde Leonardi, Jose Ayuso, Rafael Lozano, Cao Yang, Maria Villeneuve and Lydia Bendith. This study has been supported by a grant from the National Institute on Aging (1-P01-AG17625).

References

1. Mantong KG. Changing concepts of morbidity and mortality in the elderly population. Milbank Mem Fund Q Health Soc 1982;60:183-244.