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Changes in life expectancy and disability in Australia 1998 to 2009

Summary

Life expectancy is an indication of how many years a person can expect to live, assuming death rates do not change. The term 'health expectancy' is used to describe, within a person's life expectancy, the expected years spent in various health states from birth to death, such as years with disability.

However, disability does not necessarily equate to poor health or illness. Expected years with disability should not be considered as being of less value than 'health' years (without disability).

Life expectancy in Australia has risen markedly since the beginning of the twentieth century. For policy development, service planning, and population health and wellbeing, it is important to know whether the extra years in life expectancy at birth and at older ages are healthy or are marked by increasing disability and dependence.

In short, older Australians are living longer and, on average, getting more years of life without severe or profound limitation in basic daily activities than with it. On the other hand, the ageing of the Australian population and the increasing longevity of people are leading to a greater number of older people with disability and severe or profound activity limitation.

Australians are living longer and getting more disability-free years

Between 1998 and 2009, almost all of the increase in life expectancy at birth, for both males and females, was disability-free years. The expected years of life with disability and severe or profound limitation in activities of self-care, mobility and communication remained stable for both sexes. Overall life expectancy at birth rose from 75.9 years to 79.3 years for males and from 81.5 years to 83.9 years for females.

Females could expect to live longer and live more years both with and without disability compared to males. Australian boys born in 2009 could expect to live an average 61.6 years without disability and another 17.7 years with disability, including 5.5 years with severe or profound activity limitation. Girls born in 2009 could expect to live an average 64.3 years without disability and another 19.6 years with disability, including 7.5 years with severe or profound activity limitation.

A large part of the recent increase in the disability-free life expectancy occurred between 2003 and 2009. It reflected a decline in the disability prevalence rates reported by the Australian Bureau of Statistics (ABS) 2009 Survey of Disability, Ageing and Carers (SDAC). This was the first time a decline was reported in almost three decades. The result of the 2012 SDAC may help confirm whether evidence is accumulating to indicate a new trend in disability prevalence.

Older Australians are living longer and getting more years of life without severe or profound activity limitation

During 1998–2009, around half of the gains in life expectancy for older Australians at age 65 were disability-free years. They gained more years without severe or profound activity limitation than with this limitation: 2.1 years versus 0.5 years for males and 1.8 years versus 0.1 years for females. Overall life expectancy at age 65 rose from 16.1 years to 18.7 years for males and from 19.8 years to 21.8 years for females.

For older Australians at age 65 in 2009, males could expect to live an average 8.2 years without disability and another 10.5 years with disability, including 3.5 years with severe or profound activity limitation. Females could expect to live an average 9.7 years without disability and another 12.1 years with disability, including 5.6 years with severe or profound activity limitation.

The greater number of expected years of life with severe or profound activity limitation for older females than for males was related to the greater longevity and higher prevalence rates of severe or profound activity limitation of older females.

Mixed/uncertain evidence of compression of disability

Has the number of years lived with disability fallen (compressed) or risen (expanded) as overall life expectancy has lengthened? This study found no consistent evidence of compression or expansion of disability among older Australians. Increases in the disability-free life expectancy were not greater than the gains in the overall life expectancy at age 65. Gains in life expectancy at age 65 were accompanied by increases in expected years lived both with and without disability.

There might be some emerging evidence of relative compression of disability among older Australian women, since the proportions of expected years with disability and severe or profound activity limitation for females at age 65 declined between 2003 and 2009. However, we suggest that no firm conclusion should be made before the results of the 2012 SDAC are available.

Contents

Introduction

Life expectancy has risen markedly since the beginning of the twentieth century in Australia. Between 1970 and 2004, reductions in mortality of people aged 50 or over contributed about 70% to the increase in life expectancy at birth (ABS 2006; 2011). For policy development, service planning, and population health and wellbeing, it is important to know whether the extra years in life expectancy are healthy or marked by increasing disability and dependence. This bulletin explores this question and updates key analyses published previously in the report *Life expectancy and disability in Australia 1988 to 2003* (AIHW 2006). It also examines the changes between 1998 and 2009.

Life expectancy is an indication of how many years a person can expect to live. Technically it is the average number of years of life remaining to a person at a particular age, assuming age-specific death rates do not change. While life expectancy is an important indicator of population health, people's health is increasingly being conceptualised in terms of their quality of life and functional status (AIHW 2004).

The term 'health expectancy' is used to extend the concept of life expectancy to include morbidity and disability. Life expectancy is composed of lengths of time spent in various states of health until death. Health expectancy refers to the number of years that a person could expect to live in a defined state of health. The expected years of life free of disability, or the expected years of life with disability, is one of the most common measures of health expectancy. It has been estimated for more than 50 countries, including Australia (Robine & Michel 2004). As this indicator is adjusted for the size and age structure of populations, it allows direct comparison of different population subgroups and analyses of changes over time.

Analysis of the trends in health expectancy in Australia may shed light on a wide-ranging debate on the impact of greater longevity on trends in morbidity and disability. There are opposing views on whether morbidity has 'compressed' or 'expanded' with increasing life expectancy; that is, has the number of years lived with morbidity or disability fallen or risen as overall life expectancy has lengthened? This bulletin focuses on years lived with disability.

Disability does not necessarily equate to poor health or illness. For example, in the early stages of disability associated with paraplegia, the affected persons may be considered in poor health, but once their condition is stable they may enjoy good health particularly in the sense that they do not require medical services and may participate in many life areas. Therefore, discussion of 'health expectancy' should not be interpreted as considering years with disability to be of less value than 'health' years (without disability) for any policy purposes.

Some results of this analysis were first published in *Australia's welfare 2011* (AIHW 2011) and then reported in *Australia's health 2012* (AIHW 2012).

Methods and data sources

Estimates of health expectancies in this bulletin use the Sullivan method (Sullivan 1971). The Sullivan method is the most commonly used method for calculating health expectancies because of its simplicity, relative accuracy and ease of interpretation, and because the data sources it requires are more readily available. It requires only mortality data taken from period life tables and data on the prevalence of disability or other health states (Jagger 2001; Robine et al. 2000). Appendix A provides detailed information about the method.

Health expectancies may be expressed in terms such as 'disability-free life expectancy' or 'active life expectancy'. These terms are often used to indicate someone's expected remaining years of life where they do not require help with daily activities. Health expectancies may also be expressed in terms of expected years of life with disability or with daily activity limitations.

In this bulletin, health expectancies have been estimated using the following main measures:

- expected years of life lived with disability
- expected years of life lived with a severe or profound core activity limitation
- expected years of life free of disability
- expected years of life free of a severe or profound core activity limitation
- estimates of each of the above as a proportion of total life expectancy.

Unpublished ABS abridged life tables for 1996–1998, 2001–2003 and 2007–2009 are used together with the age- and sex-specific disability prevalence rates in the calculation of health expectancies. Data on prevalence of disability and severe or profound core activity limitation are from the Australian Bureau of Statistics (ABS) 1998, 2003 and 2009 Survey of Disability, Ageing and Carers (SDAC).

ABS disability surveys generally follow the conceptual framework and major concepts of the International Classification of Functioning, Disability and Health (ICF). For details of the survey operational definitions of disability and severe or profound core activity limitation, see Appendix B. Data about Indigenous status are not available from the SDAC.

A summary of the ABS 2009 SDAC data quality declaration can be viewed via the link: <http://www.abs.gov.au/AUSSTATS/abs@.nsf/Latestproducts/4430.0Quality%20Declaration02009?opendocument&tabname=Notes&prodno=4430.0&issue=2009&num=&view=>.

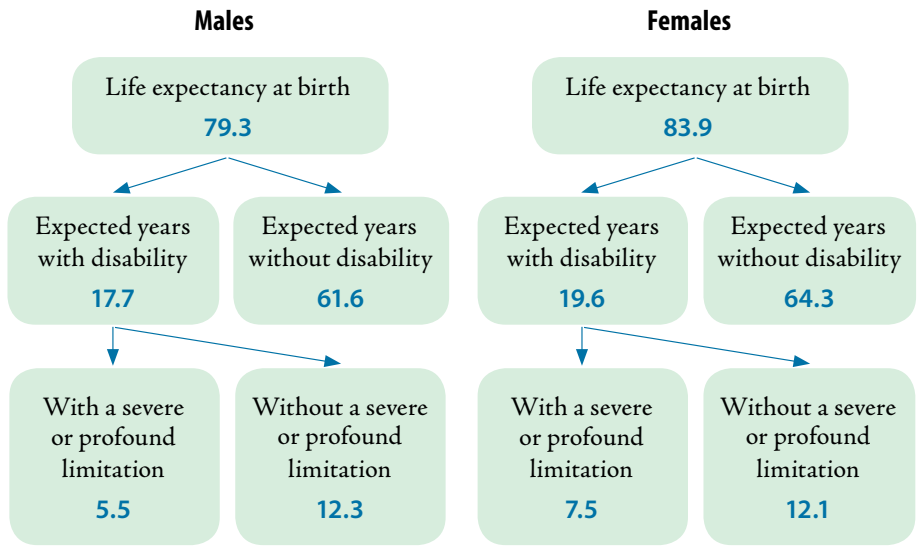
Estimates of health expectancies in 2009

Health expectancies at birth

In 2009, total life expectancy at birth was 79.3 years for Australian males and 83.9 years for females (Figure 1), a difference of 4.6 years.

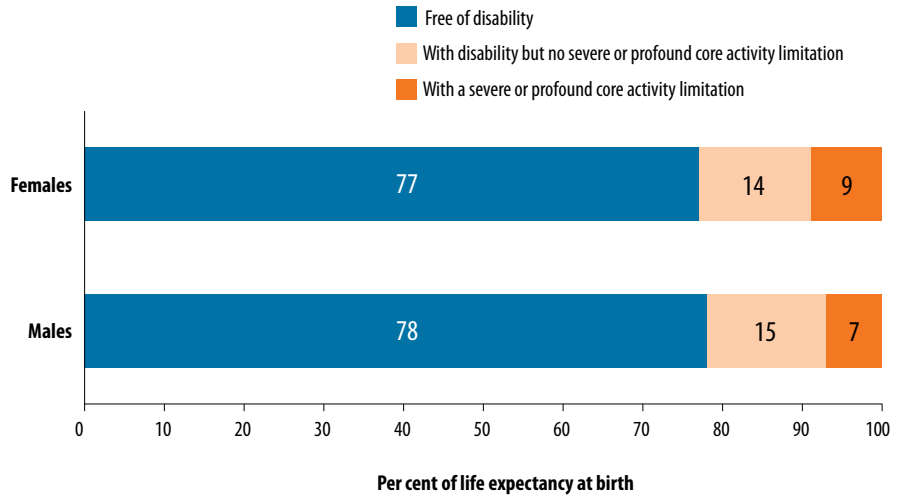
Males born in 2009 could expect to live an average 61.6 years without disability and another 17.7 years with different severity levels of disability. Females born in 2009 could expect to live an average 64.3 years without disability and another 19.6 years with disability. Years lived with disability account for 22% of total life expectancy for males and 23% of total life expectancy for females (Figure 2; Table C1).

Of the expected years with disability, on average, males could expect to experience 5.5 years with severe or profound core activity limitation (6.9% of total male life expectancy), compared to 7.5 years for females (9% of total female life expectancy).



Sources: Table C1; ABS unpublished data table of 2009 Survey of Disability, Ageing and Carers; ABS unpublished abridged Australian life tables 2007–2009.

Figure 1: Life expectancy and expected years of life with disability or with severe or profound core activity limitation, by sex, 2009



Sources: Table C1; ABS unpublished data table of 2009 Survey of Disability, Ageing and Carers; ABS unpublished abridged Australian life tables 2007–2009.

Figure 2: Expected years of life with disability or severe or profound core activity limitation at birth, as a proportion of total life expectancy at birth, by sex, 2009

Health expectancies at age 65

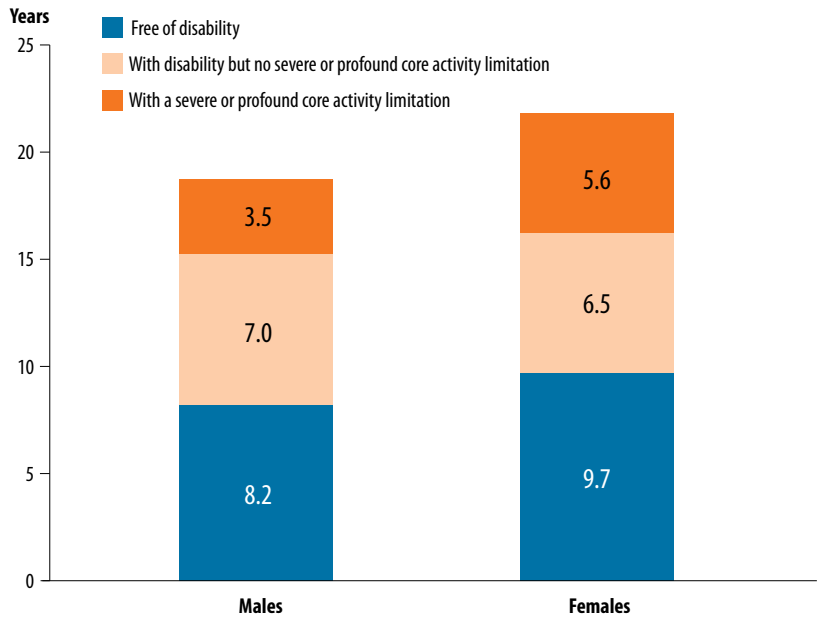
Life and health expectancies at birth are influenced by mortality in early life, while life and health expectancies at age 65 are more useful for monitoring healthy ageing and discussing issues relating to long-term care for the older population.

In 2009, life expectancy at age 65 (that is, the number of additional years a person aged 65 could expect to live) was 18.7 years (to 83.7) for males and 21.8 years (to 86.8) for females.

Males at age 65 in 2009 could expect to live an average 10.5 years with disability, including 3.5 years with severe or profound core activity limitation. Females at age 65 could expect to live an average 12.1 years with disability, including 5.6 years with severe or profound core activity limitation (Figure 3; Table C2).

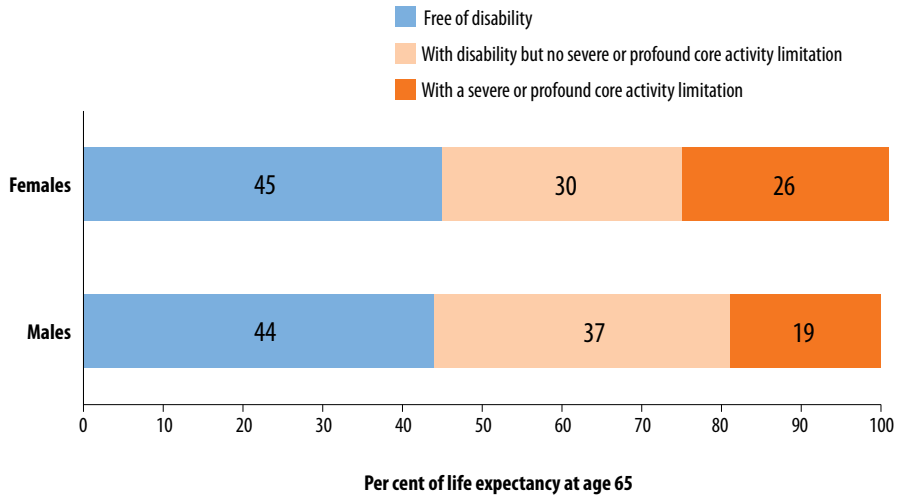
At age 65, the proportion of remaining years lived with disability was much higher than at birth: 56.1% for males and 55.5% for females. The proportion of years with severe or profound core activity limitation was also higher: 18.8% for males and 25.8% for females (Figure 4).

It should be noted that health expectancies at any given age are average estimates for the total population of that age group, including persons who already have a disability at the given age. Hence the expected years of life with disability at age 65 for a person who does not have a disability at age 65 would be fewer than the estimates in Table C2, which average the experience of person without a disability at 65 and those with a disability at 65.



Sources: Table C2; ABS unpublished data table of 2009 Survey of Disability, Ageing and Carers; ABS unpublished abridged Australian life tables 2007–2009.

Figure 3: Expected years of life with disability and severe or profound core activity limitation at age 65, by sex, 2009



Sources: Table C2; ABS unpublished data table of 2009 Survey of Disability, Ageing and Carers; ABS unpublished abridged Australian life tables 2007–2009.

Figure 4: Expected years of life with disability and severe or profound core activity limitation at age 65, as a proportion of life expectancy at age 65, by sex, 2009

Age and sex differences in health expectancies

Overall, females had longer life expectancy and also greater number of expected years both with and without disability compared to males (Figure 1).

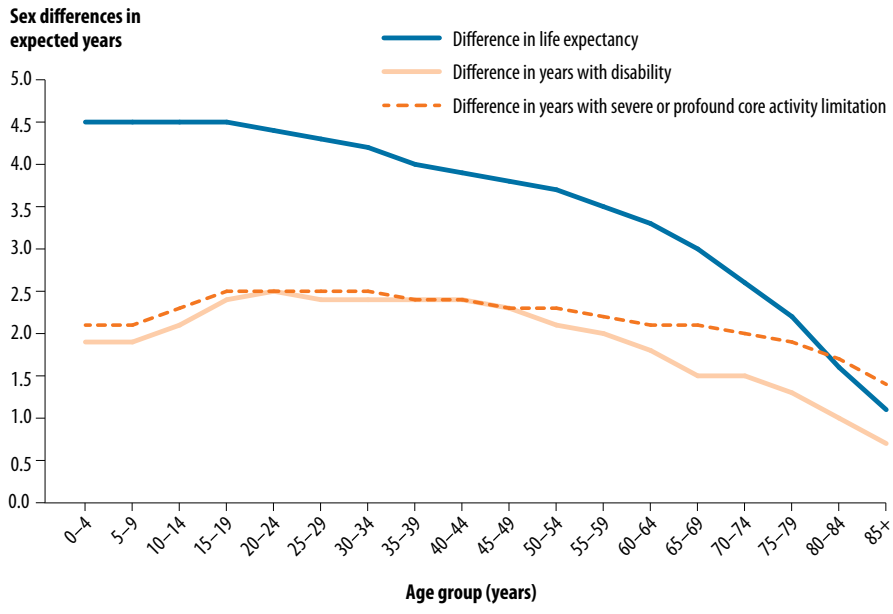
The difference in life expectancy narrowed with age, from 4.5 years at birth to 3 years at age 65, and to 1.1 years at age 85 or over (Figure 5).

Females had higher expected years with disability than males across all ages. The sex difference was larger for the population aged 15 to 44 and then gradually reduced among the older population, with a minor difference of 0.7 years for the population at age 85 or over (figures 5 and 6).

The sex difference in the expected years with severe or profound core activity limitation was proportionally larger than that for years with any disability across all ages (figures 6 and 7) and was more marked among the older population (Figure 5).

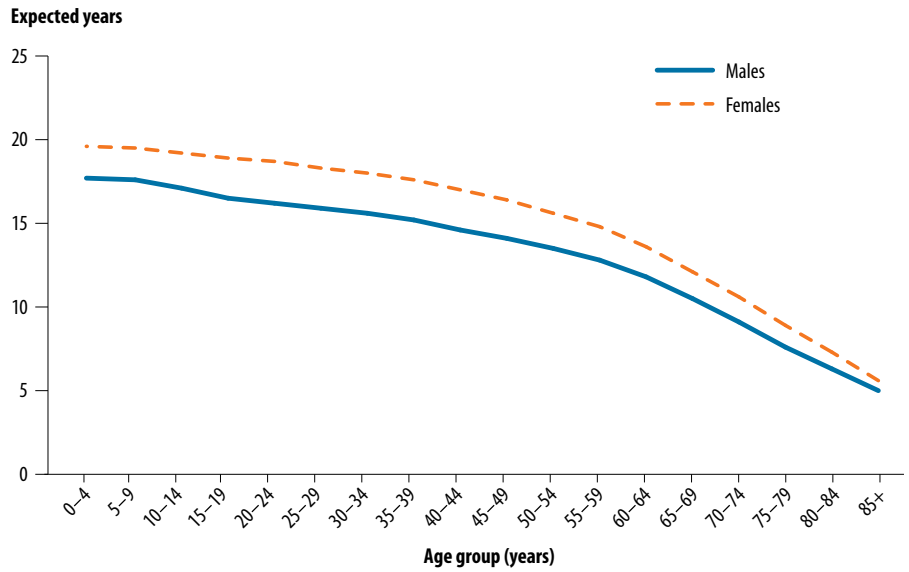
Over the age of 80, the sex difference in the expected years with severe or profound core activity limitation was even larger than the difference in life expectancy (Figure 5).

Although total life expectancy was higher for females than for males, the sex difference in disability-free years was smaller compared to that for total life expectancy. The difference almost disappeared at very older ages (figures 8 and 5).



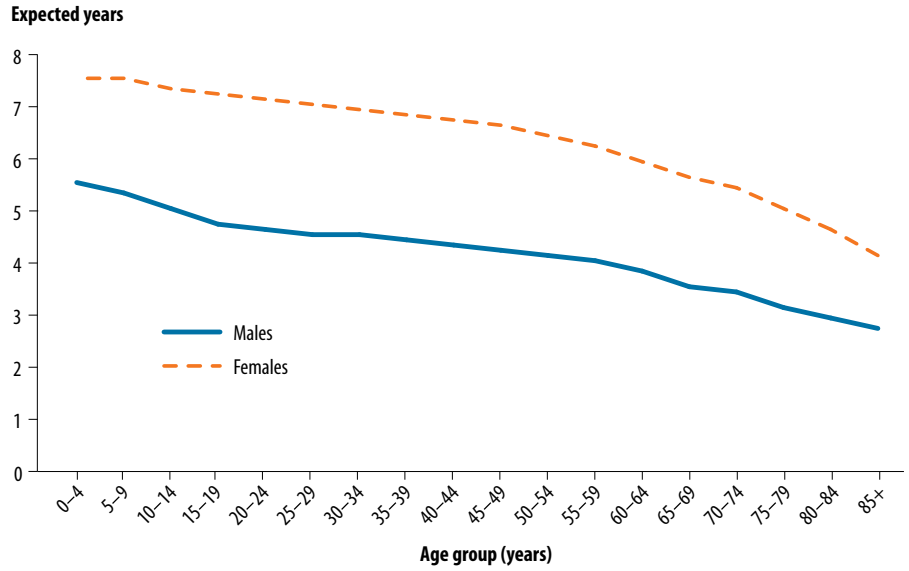
Sources: Table C2; ABS unpublished data table of 2009 Survey of Disability, Ageing and Carers; ABS unpublished abridged Australian life tables 2007–2009.

Figure 5: Differences between females and males in life expectancy and expected years of life with disability and severe or profound core activity limitation, by age, 2009



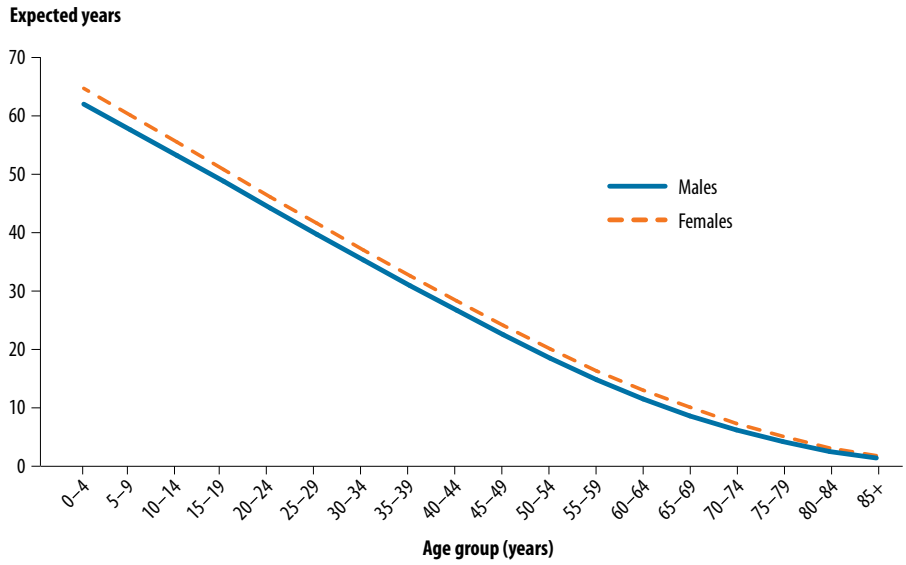
Sources: Table C3; ABS unpublished data table of 2009 Survey of Disability, Ageing and Carers; ABS unpublished abridged Australian life tables 2007–2009.

Figure 6: Expected years of life with disability, by sex and age, 2009



Sources: Table C3; ABS unpublished data table of 2009 Survey of Disability, Ageing and Carers; ABS unpublished abridged Australian life tables 2007–2009.

Figure 7: Expected years of life with severe or profound core activity limitation, by sex and age, 2009



Sources: Table C3; ABS unpublished data table of 2009 Survey of Disability, Ageing and Carers; ABS unpublished abridged Australian life tables 2007–2009.

Figure 8: Expected years of life free of disability, by sex and age, 2009

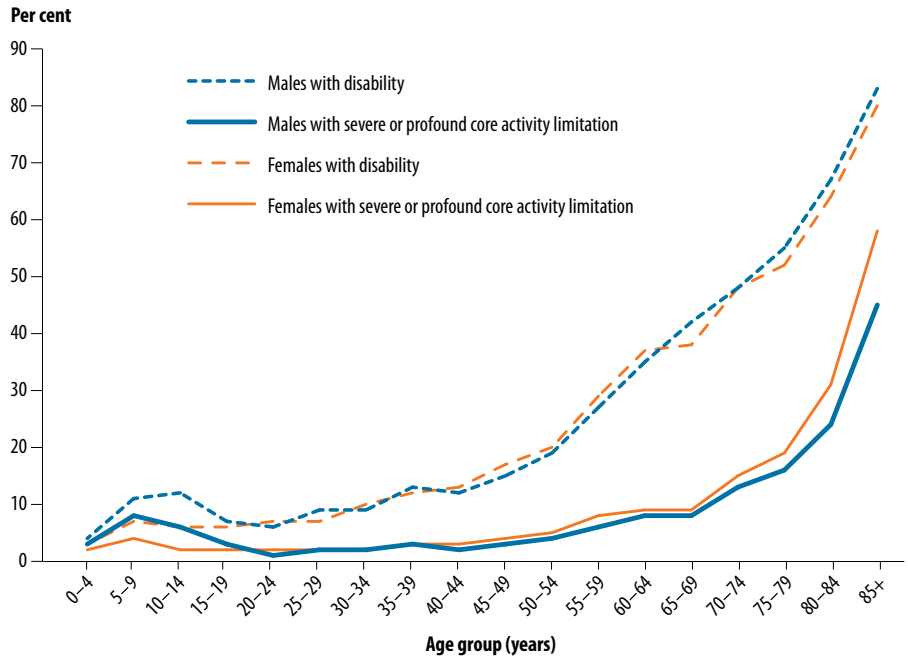
The proportion of years free of disability to total life expectancy was similar for males (78%) and females (77%) at birth and at age 65 (44% versus 45%) (figures 2 and 4).

The sex difference in the proportion of years free of severe or profound core activity limitation was marked among the population at age 65: 81% for males compared to 74% for females (Figure 4; Table C2).

The relatively high expected years with disability for females was most likely related to their higher life expectancy, as there were no substantial sex differences in age-specific prevalence rates of disability in most age groups except for children aged 5 to 14 (Figure 9).

The large sex differences in the expected years with severe or profound core activity limitation were related to both higher life expectancy and higher prevalence rates of severe or profound core activity limitation for females than for males, especially those aged 80 or over (Figure 9).

Overseas analyses of longitudinal survey data have suggested that the greater proportion of years lived with disability or daily activity limitations by women may be explained by the longer survival of women after the development of these problems (Robine et al. 1999). It is also possible that for any morbidity level, males are more active, displaying less disability (for example, less likely to report disability) as well as engaging in risky behaviours that shorten their life (Robine & Jagger 2005).



Sources: Table C4; ABS unpublished data table of 2009 Survey of Disability, Ageing and Carers.

Figure 9: Age-and sex specific rates of disability and severe or profound core activity limitation, 2009

Trends in health expectancies from 1998 to 2009

Changes in health expectancies at birth

Between 1998 and 2009, life expectancy at birth rose from 75.9 years to 79.3 years (an additional 3.4 years) for males and from 81.5 years to 83.9 years (an additional 2.4 years) for females (Figure 10).

The increase in life expectancy slowed down for both sexes over the past decade to 2009 (Figure 11).

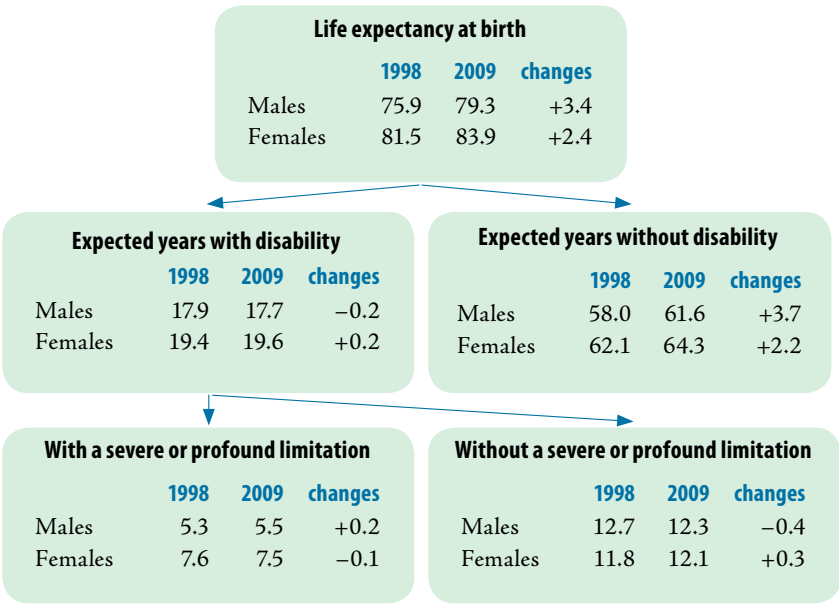
Males gained more in life expectancy than females at most ages, while the sex differences in these gains reduced with age and almost disappeared among people at age 85 or over (Figure 12).

Overall, between 1998 and 2009, almost all of the increase in life expectancy at birth, for both sexes, was years free of disability and severe or profound core activity limitation (Figure 10).

A large part of the growth in the expected disability-free years occurred during 2003–2009 (Figure 13). This reflected the decline in the disability prevalence rates reported by the 2009 Survey of Disability, Ageing and Carers—the first decline in almost three decades—and a relatively slow growth in life expectancy during this period. The reported overall age-standardised rate of disability declined by 2.1 percentage points between 2003 and 2009, and the overall rate of severe or profound core activity limitation dropped by 0.5 percentage points (ABS 2010).

The expected years of life with disability and with severe or profound core activity limitation remained almost constant between 1998 and 2009 for both sexes (Figure 10).

- The disability-free life expectancy for males rose by 1.1 years (63% of the gains in male life expectancy) in 1998–2003 and a further 2.5 years (1.6 times the gains in male life expectancy) in 2003–2009 (Table C1).
- The disability-free life expectancy for females remained almost constant over 1998–2003, but rose by 2.1 years (2 times the gains in female life expectancy) in 2003–2009.
- The expected years with disability for males rose by 0.7 years in 1998–2003 but dropped by 0.9 years in 2003–2009. The expected years for females rose by 1.3 years during 1998–2003 but fell by 1.1 years in 2003–2009.
- The expected years with severe or profound core activity limitation for males rose slightly (0.2 years) in 1998–2009. For females, the expected years rose slightly (0.6 years) in 1998–2003, followed by a slight decline (0.7 years) during 2003–2009.
- The proportion of disability-free life expectancy for males declined slightly (0.4 percentage points) in 1998–2003 but rose by 1.7 percentage points in 2003–2009. For females, the proportion dropped by 1.1 percentage points in 1998–2003 but rose by 1.5 percentage points during 2003–2009.
- The proportion of expected years free from severe or profound core activity limitation for males remained quite stable at about 93% over 1998–2009. The proportion for females declined slightly by 0.6 percentage points in 1998–2003 but rose by 1 percentage point in 2003–2009.

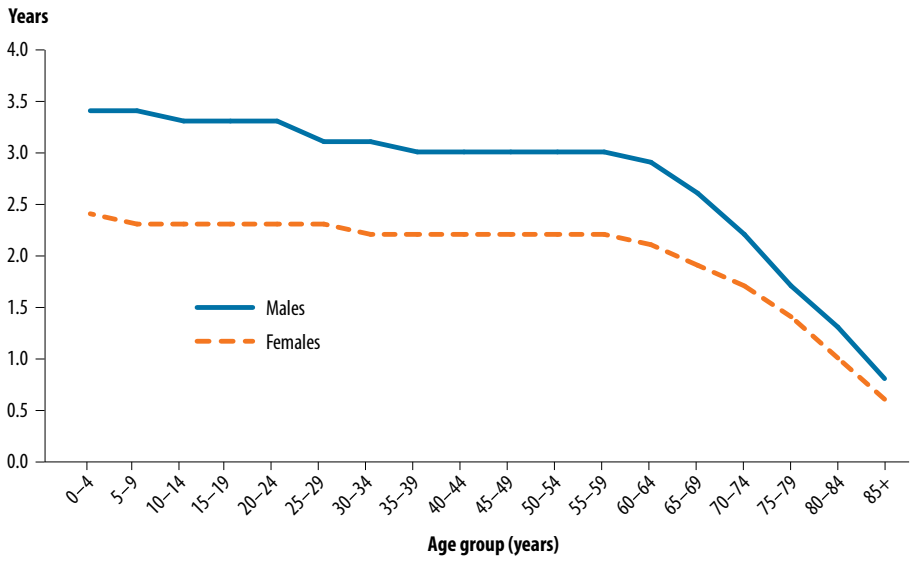


Sources: Table C1; AIHW analysis of ABS 1998 Survey of Disability, Ageing and Carers confidentialised unit record files; ABS unpublished data table of 2009 Survey of Disability, Ageing and Carers; ABS unpublished abridged Australian life tables 1996–1998; 2007–2009.

Figure 10: Life expectancy and expected years with disability at birth, by sex, 1998 and 2009

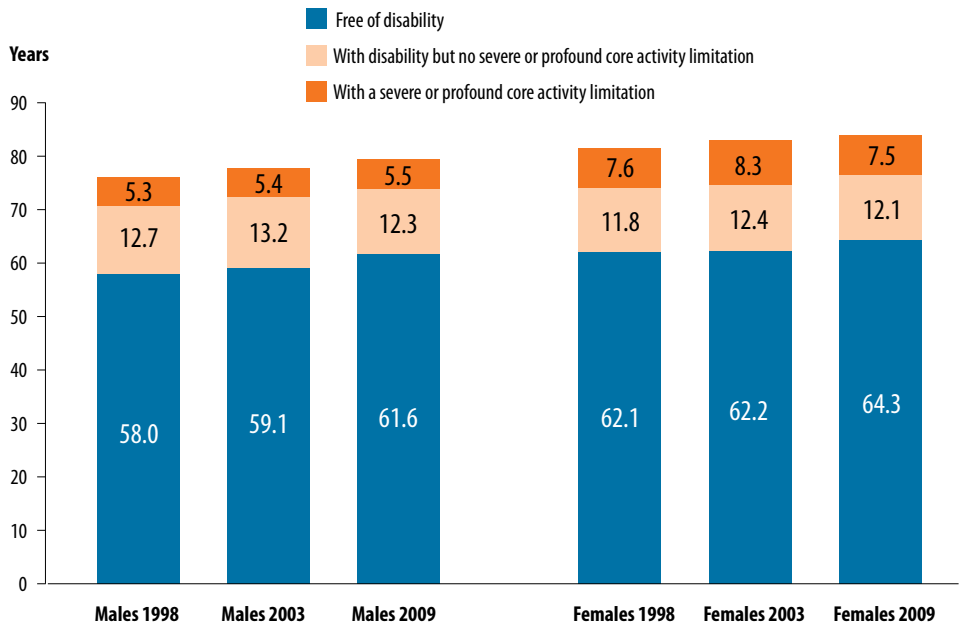
Sources: Table C1; ABS unpublished abridged Australian life tables 1996–1998, 2001–2003, 2007–2009.

Figure 11: Increase in life expectancy at birth, by sex, 1998 to 2009



Sources: Table C5; Table A7; AIHW analysis of ABS 1998 Survey of Disability, Ageing and Carers confidentialised unit record files; ABS unpublished tables of 2009 Survey of Disability, Ageing and Carer; ABS unpublished abridged Australian life tables 1996–1998, 2007–2009.

Figure 12: Increases in life expectancy, by sex and age, between 1998 and 2009



Sources: Table C1; AIHW analysis of ABS 1998 Survey of Disability, Ageing and Carers confidentialised unit record files; ABS unpublished tables of 2009 Survey of Disability, Ageing and Carer; ABS unpublished abridged Australian life tables 1996–1998, 2001–2003, 2007–2009.

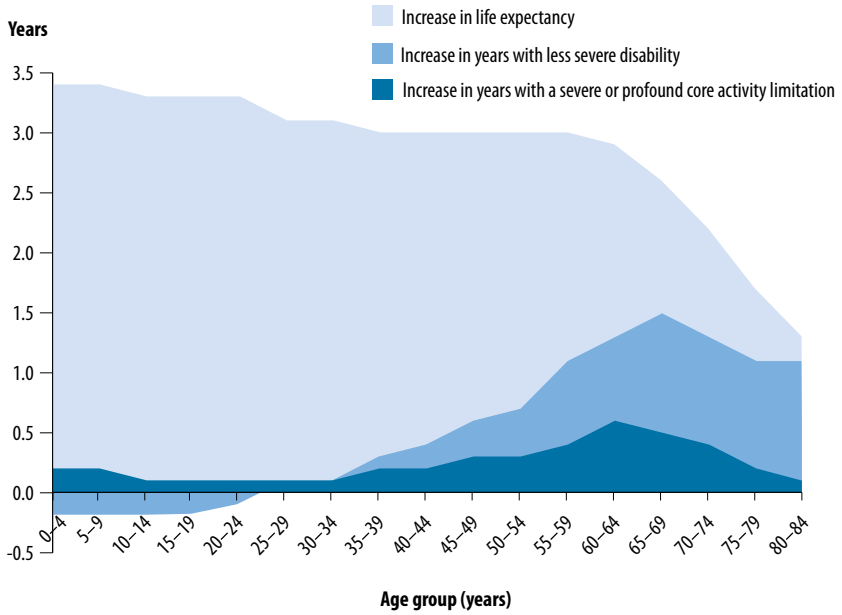
Figure 13: Expected years of life with disability and severe or profound core activity limitation at birth, by sex, 1998 to 2009

Age and sex patterns of changes in health expectancies

The increases in expected years with disability between 1998 and 2009 were mainly evident among the older population. Among males at age 65 or over, between 57% and 85% of the gains in life expectancy were expected years with disability. Among females at age 55 to 84, between 38% and 53% of gains in life expectancy were expected years with disability (figures 14 and 15; tables C5 and C6).

The expected years with disability declined slightly among males at age 25 or less (Figure 14).

There was a slight increase in the expected years with severe or profound core activity limitation for males, especially among those at age 55 to 74, while there was a slight decline among females across most ages except for those at age 50 to 74 (figures 14 and 15; tables C5 and C6).



Sources: Table C5; AIHW analysis of ABS 1998 Survey of Disability, Ageing and Carers confidentialised unit record files; ABS unpublished tables of 2009 Survey of Disability, Ageing and Carer; ABS unpublished abridged Australian life tables 1996–1998, 2007–2009.

Figure 14: Changes in life expectancy, expected years of disability and severe or profound core activity limitation, by age, males, between 1998 and 2009

Sources: Table C6; AIHW analysis of ABS 1998 Survey of Disability, Ageing and Carers confidentialised unit record files; ABS unpublished tables of 2009 Survey of Disability, Ageing and Carer; ABS unpublished abridged Australian life tables 1996–1998, 2007–2009.

Figure 15: Changes in life expectancy, expected years of disability and severe or profound core activity limitation, by age, females, between 1998 and 2009

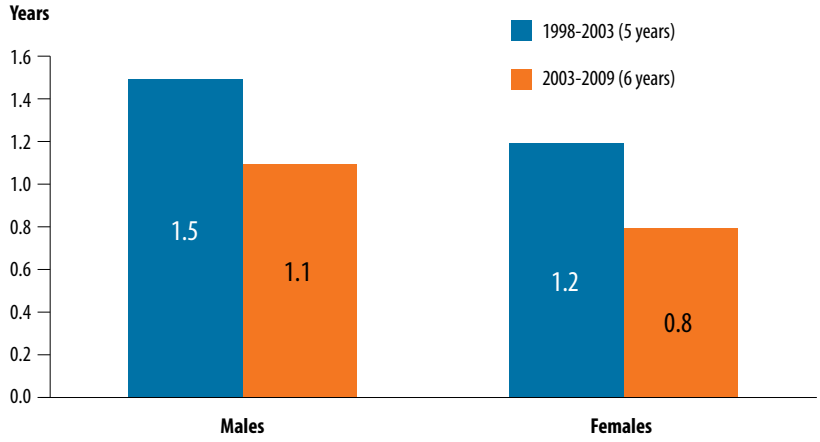
Changes in health expectancies at age 65

Life and health expectancies at birth are influenced by mortality in early life. Focusing on life and health expectancies at age 65 is more appropriate for monitoring healthy ageing and discussing the issues relating to 'compression or expansion of morbidity'.

Life expectancy at age 65 rose by 2.6 years for males and 1.9 years for females between 1998 and 2009. The rate of growth in life expectancy was slower in 2003–2009 than in 1998–2003 for both males and females (Figure 16).

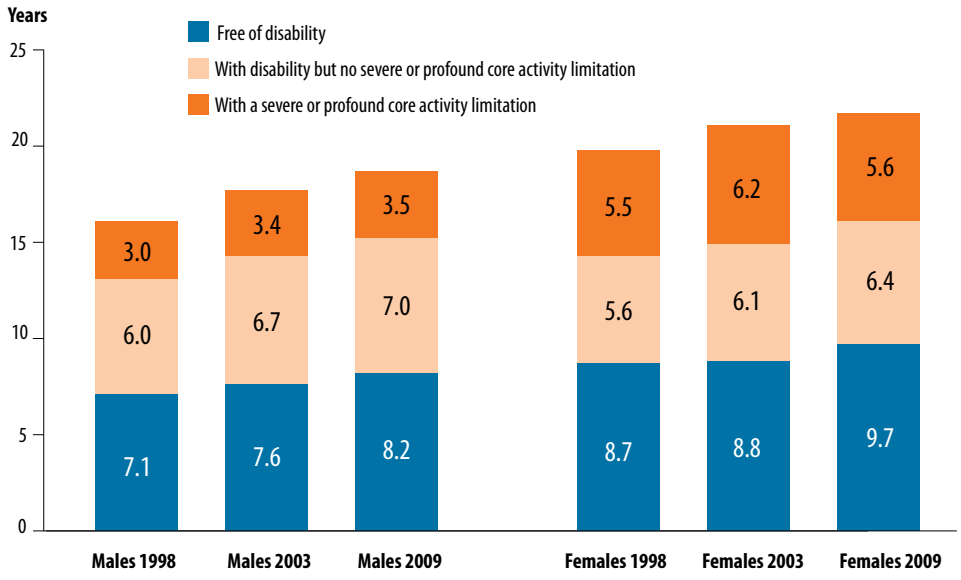
Overall, the recent changes in health expectancy during 1998–2009 suggested an improvement relating to the expected years with severe or profound core activity limitation. Along with the increase in life expectancy, the gains in the years without severe or profound core activity limitation were greater than the extra years with this limitation for both sexes: 2.1 years versus 0.5 years for males and 1.8 years versus 0.1 years for females.

- During 1998–2009, around half of the gains in life expectancy for each sex was years free of disability with all levels of severity combined, and between 80% (males) and 95% (females) of the gains were years without severe or profound core activity limitation (tables C5 and C6).
- Between 1998 and 2009, males at age 65 gained slightly more (2.1 years) in the expected years free of severe or profound core activity limitation than females (1.8 years), while the expected years free of disability rose by about 1 year for both sexes (Figure 17).
- The expected years with disability at age 65 rose by 1.5 years for males and 1 year for females, while there was a small increase in the expected years with severe or profound core activity limitation (0.5 years) for males (Figure 17).
- The proportion of expected years with disability and severe or profound core activity limitation remained about the same for males between 1998 and 2009, while the proportion of severe or profound core activity limitation for females fell from 27.9% to 25.8%.



Sources: Table C2; ABS unpublished abridged Australian life tables 1996–1998, 2001–2003, 2007–2009.

Figure 16: Increase in life expectancy at age 65, by sex, 1998 to 2009



Sources: Table C2; AIHW analysis of ABS 1998 Survey of Disability, Ageing and Carers confidentialised unit record files; ABS unpublished tables of 2009 Survey of Disability, Ageing and Carer; ABS unpublished abridged Australian life tables 1996–1998, 2001–2003, 2007–2009.

Figure 17: Expected years of life with disability and severe or profound core activity limitation at age 65, by sex, 1998 to 2009

Is morbidity compressing?

Proposed health scenarios and related measures of health expectancies

The relationships among mortality, morbidity and disability are complex. The bulk of the literature on health expectancies has assumed a connection between morbidity and disability (for example, Fries 2000). Three broad health scenarios have been proposed to describe the evolution of mortality, morbidity and disability and thus the health consequences of increasing life expectancy at older ages.

The three scenarios have been expressed in terms of changes in various relationships between life expectancy and expected years of life with disability. Any particular situation may be classified as a combination of absolute compression or expansion of morbidity (according to the change in the number of years lived with or without disability), combined with relative compression or expansion of morbidity (according to changes in the proportion of expected life lived with or without disability) (Box 1).

Box 1: Health scenarios and related measures of health expectancies

Compression of morbidity

- In this scenario, the period living with ill-health and disability before death is shortened because of a delay in onset of chronic disease/disability and a slowdown in the rate of increase in life expectancy.
- If the number of expected years of life with disability falls, there is an absolute compression of morbidity.
- If the proportion of expected years of life with disability falls without the number of expected years of disability decreasing (it may even rise), there is a relative compression of morbidity.

Expansion of morbidity

- In this scenario, increasing longevity is accompanied by more survivors who are frail and suffer from chronic conditions, resulting in a longer period living with disability before death.
- If the number of expected years of life free of disability falls, there is an absolute expansion of morbidity.
- If the proportion of expected years free of disability falls without the number of expected disability-free years decreasing (it may even rise) there is a relative expansion of morbidity.

Dynamic equilibrium

- In this scenario, the overall level of diseases/disability increases largely due to the increase of less severe diseases/disability, while the prevalence of severe diseases/disability falls or remains stable, due to the rate of progression of diseases/disability slowing down.
- If the ratio of disability-free life expectancy to total life expectancy is constant there is an equilibrium.
- Considering severity of disability, if the number of years with disabilities—all levels combined—increases, while the number of years with severe disability remains constant or even falls within life expectancy, there is said to be 'dynamic equilibrium'.

Sources: Robine et al. 2000; Howse 2006.

The three health scenarios focus on a delay in different stages of the progress of diseases in their theories (Howse 2006):

- 'Compression of morbidity' highlights the delay in onset of chronic disease that may be accomplished by the effectiveness of primary prevention of diseases.
- 'Expansion of morbidity' highlights the delay in the final stage of the progression of chronic disease—the delay in the progression from severe disease to death that may be achieved by life-sustaining medical technologies.
- 'Dynamic equilibrium' highlights the significance of delay in the intermediate stage of the disease process—the delay in the progression from less severe to more severe (and more disabling) disease states that may be realised by medical advances.

It has been recently suggested that the three scenarios might be considered as parts of the four 'circling back' transition stages: (1) an increase in the survival of sick persons—expansion of morbidity; (2) a control of the progression of chronic disease—dynamic equilibrium; (3) an improvement of health status and health behaviours of the new cohorts of older people—compression of morbidity; and (4) an eventual emergence of very old and frail populations, leading to a new expansion of morbidity (Robine & Michel 2004; Robine & Jagger 2005). Among low mortality countries, the fast growth of centenarians seems to be accompanied by a parallel decline in their functional health status (Robine et al. 2009).

Evidence and conclusions in the international literature are contradictory about trends in the relationships between the longevity, morbidity and disability among the older population (for example, Robine et al. 2009). The following aspects may in part explain the conflicting evidence about these health scenarios:

- Although the three scenarios are generally considered as mutually exclusive alternatives, in reality, the three 'delay' factors often operate together to improve the longevity of the older population. It is the balance of the interplay of these coexisting factors that determines the outcome for the health of the older population (Howse 2006), and the balance may change over time.
- The three broad scenarios do not necessarily imply progression from one to another. There were reported changes from one scenario to another in both directions within the same population at different time periods (for example, Yong & Saito 2009).
- The impact of these 'delay' factors on the health of the older population varies from one country to another and across different subgroups and cohorts within the population (for example, Robine & Jagger 2005).

The conflicting evidence of the literature also indicates that measuring the relationship between longevity and morbidity and disability is much more complicated than each of the basic scenarios and individual studies might suggest. Apart from variations in the definitions and data sources, various studies often attempt to fit the data into one of the proposed health scenarios and do not reflect a full picture of the relationships. It may be necessary to consider a framework that allows a comprehensive description of both positive and negative changes in the relationship between longevity and health status.

Recent Australian evidence relating to the proposed health scenarios

The present AIHW analysis found no evidence of absolute expansion of morbidity for older Australians in 1998–2009, as the gains in life expectancy at age 65 years were accompanied by increases in expected years of life lived both with and without disability or a severe or profound core activity limitation. The expected years free of severe or profound core activity limitation rose more rapidly than the extra years with this limitation for both sexes: 2.1 versus 0.5 years for males and 1.8 versus 0.1 years for females.

There is also no consistent evidence suggesting the 'dynamic equilibrium' scenario for older Australians, because the expected years with a severe or profound core activity limitation continued to increase slightly during 1998–2009, along with the increase in the years with disability as a whole.

For the period 1998–2009, there is also no evidence of absolute compression of disability among older Australians, irrespective of level of disability. At age 65, gains in longevity were accompanied by increases in the years of disability as well as severe or profound core activity limitation (Figure 17; Table C2). Gains in the expected years free of disability and severe or profound core activity limitation were not greater than the gains in life expectancy.

There might be some emerging evidence of relative compression of disability among older Australian women. The proportion of expected years with disability for females at age 65 declined between 2003 and 2009, while the proportion rose between 1998 and 2003. During 1998–2009, the proportion of expected years with severe or profound core activity limitation for females at age 65 declined by about 2 percentage points. However, this decade included two contrasting trends. The proportion rose by 1.5 percentage points between 1998 and 2003 and then declined in the in 2003–2009 period, reflecting the decrease in the prevalence rates reported by the 2009 Survey of Disability, Ageing and Carers, the first decrease in the past three decades. The results of the 2012 survey may help confirm whether there is accumulating evidence indicating a new trend in the disability prevalence.

In short, older Australians are living longer and, on average, getting more years of life without severe or profound core activity limitation than with it. On the other hand, the ageing of the Australian population and the increasing longevity of people are leading to a greater number of older people with disability and severe or profound core activity limitation.

Appendix A: Methods for calculation of health expectancies

Estimates of health expectancies in this bulletin use the Sullivan method (Sullivan 1971). Health expectancies calculated by the Sullivan method are the average number of remaining years, at a particular age, that a population can expect to live, with different levels of disability or without a disability (Jagger 2001). In other words, just as with life expectancy, health expectancies are indicators of population health rather than predictions of any individual's experience.

The Sullivan method uses the observed age-specific prevalence of disability in a population at a given point time to calculate the years of life lived, with/without disability at each age, by a period life table cohort. It modifies the regular life table by applying the age-specific prevalence rate of disability to the number of person years in each age interval of the life table. Thus, the numbers of person years in each age interval of the life table are grouped into various categories of disability according to the age-specific rates of different levels of disability (Box 2).

Box 2: The Sullivan method for calculating health expectancies

I_i = the number of persons at exact age x_i

Li = the total number of person years lived within the age interval $(x_i – x_{i+1})$.

The years lived in the various age intervals $(x_i – x_{i+1})$ $(i=0, 1, 2, …., w)$ are divided into the years lived with disability and without disability as follows:

$(D_i\ L_i)$ = average years lived with disability in age interval $(x_i – x_{i+1})$

$(1\text{-}D_i)L_i$ = average years lived without disability in age interval $(x_i – x_{i+1})$

Where

D_i = observed prevalence rate of disability in the age interval $(x_i – x_{i+1})$

The average expected years of life free of disability at age xa is the total expected years of life lived free of disability from age xa onwards divided by the number of persons alive at age x_a:

$$DFLE_a = \sum_{i=a}^{w} (I\text{-}D_i)L_i/I_a \qquad a = 0,….,w$$

The average expected years of life with disability is similarly calculated as

$$DLE_a = \sum_{i=a}^{w} D_iL_i/I_a \qquad a= 0,….,w$$

Hence the total life expectance at agea, LEa, has been decomposed into a disability-free and a disability component:

$$LE_a = \sum_{i=a}^{w} L_i/I_a = DFLE_a + DLE_a \qquad a = 0,….,w$$

Sources: Robine et al. 2000; Mathers 1991.

Appendix B: ABS survey definitions of disability

Not all literature on health expectancy uses standard definitions of disability following the International Classification of Functioning, Disability and Health (ICF). A wide range of concepts and measures of disability has been used in the studies on health expectancies. The terms 'disease', 'morbidity' and 'disability' have been sometimes used interchangeably.

The ABS Survey of Disability, Ageing and Carers generally follows the conceptual framework and major concepts of the ICF (ABS 2010).

Disability

For ABS survey purposes, a person has disability if they have at least 1 of 17 limitations, restrictions or impairments that has lasted or is likely to last for at least 6 months and that restricts everyday activities. People with disability, so defined, are asked further questions about core activity limitations and schooling/employment restrictions. Those reporting a core activity limitation or schooling/employment restriction are the population with disability and a specific limitation or restriction. The remainder are the population with disability and no specific limitations.

Core activity

People who were identified as having disability were asked about their need for assistance with the core activities of self-care, mobility and communication.

Core activities comprise the following tasks:

- self-care—bathing or showering, dressing, eating, using the toilet, and bladder or bowel control
- mobility—getting into or out of a bed or chair, moving around at home and going to, or getting around, a place away from home
- communication—understanding and being understood by others: strangers, family and friends.

Core activity limitation

Four levels of core activity limitation were determined, based on whether a person needs personal assistance with, has difficulty with, or uses aids or equipment for, any of the core activities. A person's overall level of core activity limitation was determined by the highest level of limitation experienced in any of the core activity areas. The four levels of core activity limitation are:

- profound—always needs assistance from another person to perform a core activity
- severe—sometimes needs assistance from another person to perform a core activity; or has difficulty understanding or being understood by family or friends; or can communicate more easily using sign language or other non-spoken forms of communication
- moderate—does not need assistance, but has difficulty performing a core activity
- mild—has no difficulty performing a core activity but uses aids or equipment because of disability; or cannot easily walk 200 metres, walk up and down stairs without a handrail, easily bend to pick up an object from the floor, or use public transport; or has difficulty or needs help using public transport.

In this bulletin, a severe or profound core activity limitation is sometimes referred to as severe or profound activity limitation.

Appendix C: Appendix tables

Table C1: Expected years of life with disability and with severe or profound core activity limitation at birth, by sex, 1998 to 2009

	Number of expected years			Per cent of total life expectancy		
	1998	2003	2009	1998	2003	2009
Males						
Expected years of life:						
With disability (all severity levels)	17.9	18.6	17.7	23.6	24.0	22.3
With severe or profound core activity limitation	5.3	5.4	5.5	6.9	7.0	6.9
Free of disability	58.0	59.1	61.6	76.4	76.0	77.7
Free of severe or profound core activity limitation	70.7	72.3	73.9	93.1	93.0	93.1
Total life expectancy at birth	**75.9**	**77.8**	**79.3**	**100.0**	**100.0**	**100.0**
Females						
Expected years of life:						
With disability (all severity levels)	19.4	20.7	19.6	23.8	24.9	23.4
With a severe or profound core activity limitation	7.6	8.3	7.5	9.4	10.0	9.0
Free of disability	62.1	62.2	64.3	76.2	75.1	76.6
Free of severe or profound core activity limitation	73.9	74.6	76.4	90.6	90.0	91.0
Total life expectancy at birth	**81.5**	**82.8**	**83.9**	**100.0**	**100.0**	**100.0**

Sources: AIHW analysis of ABS 1998 and 2003 Survey of Disability, Ageing and Carers confidentialised unit record files; ABS unpublished abridged Australian life tables 1996–1998; 2001–2003; 2007–2009. ABS unpublished tables of 2009 Survey of Disability, Ageing and Carer.

Table C2: Expected years of life with disability and with severe or profound core activity limitation at age 65, by sex, 1998 to 2009

	Number of expected years			Per cent of total life expectancy		
	1998	2003	2009	1998	2003	2009
Males						
Expected years of life:						
With disability (all severity levels)	9.0	10.0	10.5	56.0	57.0	56.1
With severe or profound core activity limitation	3.0	3.4	3.5	18.6	19.0	18.8
Free of disability	7.1	7.6	8.2	44.0	43.0	43.9
Free of severe or profound core activity limitation	13.1	14.3	15.2	81.4	81.0	81.2
Total life expectancy at age 65	**16.1**	**17.6**	**18.7**	**100.0**	**100.0**	**100.0**
Females						
Expected years of life:						
With disability (all severity levels)	11.1	12.2	12.1	56.0	58.2	55.5
With a severe or profound core activity limitation	5.5	6.2	5.6	27.9	29.4	25.8
Free of disability	8.7	8.8	9.7	44.0	41.8	44.5
Free of severe or profound core activity limitation	14.3	14.8	16.1	72.1	70.6	74.2
Total life expectancy at age 65	**19.8**	**21.0**	**21.8**	**100.0**	**100.0**	**100.0**

Sources: AIHW analysis of ABS 1998 and 2003 Survey of Disability, Ageing and Carers confidentialised unit record files; ABS unpublished abridged Australian life tables 1996–1998; 2001–2003; 2007–2009. ABS unpublished tables of 2009 Survey of Disability, Ageing and Carer.

Table C3: Life expectancy and disability, by age and sex, Australia, 2009 (years)

	Males					Females				
Age	Ex	DLE	SPLE	DFLE	SPFLE	Ex	DLE	SPLE	DFLE	SPFLE
0–4	79.3	17.7	5.5	61.6	73.9	83.9	19.6	7.5	64.3	76.4
5–9	74.8	17.6	5.3	57.2	69.5	79.3	19.5	7.5	59.7	71.8
10–14	69.8	17.1	5.0	52.8	64.9	74.3	19.2	7.3	55.1	67.0
15–19	64.9	16.5	4.7	48.4	60.2	69.3	18.9	7.2	50.4	62.2
20–24	60.0	16.2	4.6	43.8	55.4	64.4	18.7	7.1	45.7	57.3
25–29	55.2	15.9	4.5	39.3	50.7	59.5	18.3	7.0	41.2	52.5
30–34	50.4	15.6	4.5	34.9	46.0	54.6	18.0	6.9	36.6	47.7
35–39	45.7	15.2	4.4	30.5	41.3	49.7	17.6	6.8	32.2	42.9
40–44	41.0	14.6	4.3	26.3	36.7	44.9	17.0	6.7	27.9	38.2
45–49	36.3	14.1	4.2	22.1	32.0	40.1	16.4	6.6	23.7	33.5
50–54	31.7	13.5	4.1	18.1	27.6	35.3	15.6	6.4	19.7	28.9
55–59	27.2	12.8	4.0	14.4	23.2	30.7	14.8	6.2	15.9	24.5
60–64	22.9	11.8	3.8	11.1	19.1	26.1	13.6	5.9	12.6	20.2
65–69	18.7	10.5	3.5	8.2	15.2	21.8	12.1	5.6	9.7	16.1
70–74	14.9	9.1	3.4	5.8	11.6	17.5	10.6	5.4	6.9	12.2
75–79	11.4	7.6	3.1	3.8	8.3	13.6	8.9	5.0	4.7	8.6
80–84	8.4	6.3	2.9	2.1	5.5	10.0	7.3	4.6	2.7	5.4
85+	6.0	5.0	2.7	1.0	3.3	7.1	5.6	4.1	1.4	3.0

Ex Life expectancy at exact age x-x+.
DLE Expected years of life lived with disability.
SPLE Expected years of life lived with a severe or profound core activity limitation.
DFLE Expected years of life free of disability.
SPFLE Expected years of life free of severe or profound core activity limitation.

Sources: Table C4; ABS unpublished data table of 2009 Survey of Disability, Ageing and Carers; ABS unpublished Abridged Australian life tables 2007–2009.

Table C4: Age and sex prevalence rates of disability and severe or profound core activity limitation, 2009 (per cent)

	Total with disability			Severe or profound core activity limitation		
Age	Males	Females	Persons	Males	Females	Persons
0–4	3.9	2.8	3.4	2.9	1.5	2.2
5–9	11.2	6.7	9.0	7.7	3.8	5.8
10–14	11.5	5.5	8.6	5.5	2.2	3.9
15–19	7.3	5.8	6.6	2.5	1.8	2.2
20–24	6.1	7.3	6.7	1.3	1.6	1.5
25–29	8.7	7.5	8.1	1.7	2.1	1.9
30–34	8.8	9.5	9.2	1.9	2.3	2.1
35–39	13.0	12.4	12.7	2.5	3.0	2.8
40–44	12.5	13.4	13.0	2.0	3.5	2.8
45–49	15.2	17.4	16.3	3.5	4.4	3.9
50–54	19.3	20.5	19.9	3.8	5.1	4.5
55–59	26.7	28.7	27.7	5.9	7.7	6.8
60–64	35.0	36.9	35.9	8.2	8.8	8.5
65–69	42.2	38.0	40.1	8.4	9.4	8.9
70–74	48.5	47.7	48.1	12.8	15.1	14.0
75–79	55.2	51.8	53.4	16.2	19.0	17.7
80–84	66.6	64.1	65.2	23.5	31.4	28.0
85+	82.7	79.6	80.6	45.1	57.6	53.5
Total	*18.1*	*18.9*	*18.5*	*5.2*	*6.5*	*5.8*

Sources: ABS unpublished data table of 2009 Survey of Disability, Ageing and Carers.

Table C5: Increase in life expectancy, expected years of disability and severe or profound core activity limitation, by age, males, between 1998 and 2009

Age	Increases in life expectancy (years)	Increase in the expected years of		Proportion to changes in life expectancy (per cent)	
		Disability	Severe or profound	Disability	Severe or profound
0–4	3.4	-0.2	0.2	-7.0	5.8
5–9	3.4	-0.2	0.2	-6.7	6.0
10–14	3.3	-0.2	0.1	-6.5	4.3
15–19	3.3	-0.2	0.1	-5.0	3.4
20–24	3.3	-0.1	0.1	-2.8	3.4
25–29	3.1	0.1	0.1	2.2	3.8
30–34	3.1	0.1	0.1	3.9	4.1
35–39	3.0	0.3	0.2	9.8	5.9
40–44	3.0	0.4	0.2	11.9	5.9
45–49	3.0	0.6	0.3	19.2	8.4
50–54	3.0	0.7	0.3	24.2	10.9
55–59	3.0	1.1	0.4	35.6	14.4
60–64	2.9	1.3	0.6	43.8	19.7
65–69	2.6	1.5	0.5	56.8	20.3
70–74	2.2	1.3	0.4	58.9	19.0
75–79	1.7	1.1	0.2	64.5	13.0
80–84	1.3	1.1	0.1	85.5	10.4
85+	0.8	0.6	-0.2	71.3	-25.8

Sources: AIHW analysis of ABS 1998 Survey of Disability, Ageing and Carers confidentialised unit record files; ABS unpublished tables of 2009 Survey of Disability, Ageing and Carer; ABS unpublished Abridged Australian life tables 1996–1998, 2007–2009.

Table C6: Increase in life expectancy, expected years of disability and severe or profound core activity limitation, by age, females, between 1998 and 2009

Age	Increases in life expectancy (years)	Increase in the expected years of		Proportion to changes in life expectancy (per cent)	
		Disability	Severe or profound	Disability	Severe or profound
0–4	2.4	0.2	-0.1	6.5	-5.3
5–9	2.3	0.1	-0.2	5.9	-6.5
10–14	2.3	0.2	-0.2	7.3	-6.5
15–19	2.3	0.2	-0.1	8.2	-6.4
20–24	2.3	0.2	-0.1	10.9	-6.0
25–29	2.3	0.3	-0.1	12.8	-6.6
30–34	2.2	0.4	-0.1	16.2	-6.6
35–39	2.2	0.4	-0.1	18.9	-5.8
40–44	2.2	0.4	-0.1	19.3	-3.9
45–49	2.2	0.6	-0.1	26.4	-2.8
50–54	2.2	0.7	0.1	32.7	2.4
55–59	2.2	1.0	0.1	45.0	5.3
60–64	2.1	1.1	0.1	53.2	4.8
65–69	1.9	0.9	0.1	49.5	4.2
70–74	1.7	0.8	—	45.9	-1.7
75–79	1.4	0.5	-0.2	38.3	-13.8
80–84	1.0	0.5	-0.2	45.6	-16.2
85+	0.6	0.2	-0.4	33.6	-57.5

Sources: AIHW analysis of ABS 1998 Survey of Disability, Ageing and Carers confidentialised unit record files; ABS unpublished tables of 2009 Survey of Disability, Ageing and Carer; ABS unpublished Abridged Australian life tables 1996–1998, 2007–2009.

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Abbreviations

ABS	Australian Bureau of Statistics
AIHW	Australian Institute of Health and Welfare
SDAC	Survey of Disability, Ageing and Carers
ICF	International Classifications of Functioning, Disability and Health
WHO	World Health Organization

Symbols

— When used in a table: nil (including null cells)

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