Projection of Australian health care expenditure by disease, 2003 to 2033

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HEALTH AND WELFARE EXPENDITURE SERIES
Number 36

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December 2008

Australian Institute of Health and Welfare
Canberra
Cat. no. HWE 43

This publication is part of the Australian Institute of Health and Welfare's Health and Welfare Expenditure Series. A complete list of the Institute's publications is available from the Institute's website <www.aihw.gov.au>.

ISSN 1323-5850

ISBN 978 1 74024 862 4

Suggested citation

Goss J 2008. Projection of Australian health care expenditure by disease, 2003 to 2033. Cat. no. HWE 43.Canberra: AIHW.

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Published by the Australian Institute of Health and Welfare

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Acknowledgments

This report was commissioned and funded by the National Health and Hospitals Reform Commission.

This report is based on a projection model which was first reported in *Projection of health care expenditure by disease: a case study from Australia,* prepared for the United Nations for their UN World Economic and Social Survey 2007 report (posted on the United Nations website in June 2007 (www.un.org/esa/policy/wess/wess2007files/backgroundpapers/australia.pdf) (Vos et al. 2007), and also reported in an Australian Health Review article (Begg et al. 2008).

Within the AIHW the projection modelling was done by, and the report prepared by John Goss. Brett Rogers, Suzie Cong and Rebecca Bennetts provided assistance with data extraction and the production of tables and graphs. Gail Brien and Jenny Hargreaves provided analytical and editorial comment. Jen Badham provided statistical advice.

The report represents the views of the author, Mr John Goss, and does not necessarily represent the views of the Australian Institute of Health and Welfare, the National Health and Hospitals Reform Commission or the Australian Government.

Abbreviations

ABS	Australian Bureau of Statistics
AIHW	Australian Institute of Health and Welfare
AusDiab	Australian Diabetes, Obesity and Lifestyle Study
BMI	Body Mass Index
GDP	Gross Domestic Product
HIV/AIDS	Human immunodeficiency virus/Acquired immune deficiency syndrome
NHHRC	National Health and Hospitals Reform Commission
RR	relative risk
UN	United Nations
WHO	World Health Organization

Symbols

n.a.	not available
..	not applicable
n.e.c.	not elsewhere classified
–	nil or rounded down to zero

Executive summary

This report provides projections of expenditure by disease for Australia for the period 2003 to 2033. The projections revise and update those in an earlier report prepared for the United Nations (Vos et al. 2007).

The projection model used here combines demographic factors of population ageing and population growth, and non-demographic factors of changes in disease rates, volume of services per treated case, treatment proportions (the proportion of cases that receive treatment) and excess health price inflation (i.e. the difference between health inflation and general inflation). Changes in these factors are applied to current health and high-care residential aged care expenditure (hereafter referred to as 'health and residential aged care expenditure') to project health and residential aged care expenditure for each disease and by the different areas of expenditure, such as hospitals, out-of-hospital medical services and pharmaceuticals. In most cases, disease trends are based on what has happened with a particular disease in the past. In some instances, this has been supplemented with expert judgement about likely changes in future treatment practices and the impact this may have on disease trends.

Under the central set of assumptions used in this study, total health and residential aged care expenditure is projected to increase by 189% in the period 2003 to 2033 from $85 billion to $246 billion—an increase of $161 billion (Table 3). This is an increase from 9.3% of gross domestic product (GDP) in 2002–03 to 12.4% in 2032–33. Increases in volume of services per treated case are projected to account for half of this increase (50%) (Table 4).

The two demographic growth factors—population ageing (23%) and the absolute increase in population (21%)—are projected to contribute almost a quarter each.

Other non-demographic factors contributing to the increase include excess health price inflation (5% of the increase). Changes in disease rates overall reduce expenditure projections by about 1.5% or $2.3 billion (Table 4).

The projection model shows that the causes of increased health and residential aged care expenditure vary greatly depending on the disease being considered.

Diabetes has the greatest projected increase (436%) between 2003 and 2033, followed by dementia (364%) (Table 3). The projected increase in expenditure for injuries (116%), neonatal and maternal services (88% and 84%) is low in comparison, these last two because changes in the age structure of the population mean those giving birth will be a smaller proportion of the population. The projected growth in diabetes expenditure of 436% is due to multiple reasons, particularly the projected impact on diabetes prevalence rates of expected increases in obesity.

Given the difficulties in making predictions about what non-demographic factors will be in 30 years time, these projections of health and residential aged care expenditure in 2033 may differ significantly from what actually transpires. To gain some insight into the levels of uncertainty around some of the variables, the report includes some sensitivity analyses which was conducted by varying the estimated growth in volume of services per treated case and excess health price inflation to 20% lower than the central case, and 20% higher than the central case. These analyses show that the 20% lower assumptions for the volume per case and excess health price inflation variables gave a projection in 2032–33 for health and residential aged care expenditure of 10.8% of GDP (Table 15). The 20% higher assumptions

gave an estimate of 14.4% of GDP. In other words, the uncertainty around the central estimate of 12.4% of GDP or $246 billion is about 15% (tables 14 and 15). Despite these uncertainties, projection work is important, not so much for the accuracy of the numbers produced, but because it assists us to understand the drivers of health and residential aged care expenditure, and to anticipate changes.

1 Introduction

In February 2008, the Australian Government established the National Health and Hospitals Reform Commission (NHHRC). The NHHRC is to report by June 2009 on a long-term health reform plan to provide sustainable improvements in the performance of the health system. <http://www.nhhrc.org.au/internet/nhhrc/publishing.nsf/Content/termsof-reference> accessed on 15 October 2008. The NHHRC commissioned the Australian Institute of Health and Welfare (AIHW) to prepare this report on projections of Australian health and residential aged care expenditure by disease for the period between 2003 and 2033 to inform their work on health reforms.

This report is based on a projection model, results from which were first published in a report for the UN prepared by the University of Queensland and the AIHW (Vos et al. 2007). That report noted that further work should be done with this projection model, particularly in assessing the impact on projected health and residential aged care expenditures of varying the key assumptions of growth in 'excess health price inflation' and 'volume per case of disease'.

The UN report was based on 2000–01 disease expenditure data and the projection model that was used applied only one excess health price inflation factor. The modelling at that time used a set of assumptions which primarily focussed on estimating what health and residential aged care expenditure was necessary to meet the needs of changing disease and demography. Past trends in the growth of health and residential aged care expenditure informed these estimates but were not a dominant factor in the choice of parameters used to project expenditure. Thus, for example, the growth in expenditure per cancer case between 1993–94 and 2000-01 was analysed, but part of this growth was considered to be not in accord with best practice guidelines. Thus the UN report projected a lower growth in expenditure per cancer case than had occurred from 1993–94 to 2000–01 (Vos et al. 2007). As a result of the different assumptions used, the UN report projects significantly lower expenditure than appears in this report.

The projection model used in this report is based on changes in health and residential aged care expenditure from 1993-94 to 2004–05 and uses separate excess heath price inflation parameters for each area of expenditure. The model assumes that new technologies and changes in treatment practices will have a similar impact on the growth in the volume of services per case of disease as occurred in the last decade. The estimates for changes in disease rates are the same as for the UN report.

It should be kept in mind that projections are not destiny. It is unlikely that the increased expenditure reported in the following projections will be realised. There are many unknowns that simply cannot be modelled and diseases that are expected to increase dramatically may be more likely to attract attention, which in turn may reduce the growth of those diseases and the expenditure related to them.

Why do we do expenditure projections?

If projecting health and residential aged care expenditure for 30 years into the future is considered problematic, and the final result will invariably be different to what is projected, what benefit does this work add?

Projection work is worth doing not so much for the final numbers it produces, but because:

- it analyses what drives health and residential aged care expenditure growth
- the models can be used for 'what if?' analyses to test the impact of different policies and changes in the external environment.

Some of the reasons commonly put forward to explain 'exploding' health and residential aged care expenditure include the ageing population, technological change, expenditure in the last year of life, health prices growing out of control, and the obesity 'epidemic'. While each of these factors do play a role, in order to understand what is actually happening, and what can be changed, it is useful to bring together all of these potential drivers into the one picture. One of the key lessons to be learnt from modelling expenditure by disease is how different the drivers are for each disease, and that broad generalisations about growth in health and residential aged care expenditure do not apply across all diseases or across all areas of health expenditure.

2 Methods

Health and residential aged care expenditure projections reported here are based on population projections from the Australian Bureau of Statistics (ABS) and an analysis of past trends in disease rates and shifts in expenditure. The central assumptions used in this projection model are that the non-demographic drivers of health and residential aged care expenditure will grow at similar rates to previous years, and that the levels of efficiencies and inefficiencies in the health system in the last 10 years will continue. The projection model also assumes that the proportion of total health and residential aged care expenditure that the Australian government, state and territory governments and the private sector funds for each type of service remains the same throughout the whole period. Expenditure and GDP for all years are reported in 2006–07 dollars.

Projection model

The AIHW's report, *Health system expenditure on disease and injury in Australia, 2000–01*, reports estimated health care costs by area of expenditure. As part of this projections work, the per person health care costs for each disease and injury group estimated by the disease expenditure projection has been projected into the future. The projection model works by combining expected changes in various demographic and non-demographic factors.

The demographic factors are:

- population ageing
- population growth.

The non-demographic factors are:

- disease rate change
- change in volume of services provided per treated case
- treatment proportion change (proportion of cases who receive treatment)
- excess health price inflation (i.e. difference between health inflation and general inflation).

The model is set up for maximum flexibility. For each of the diseases modelled there are 16 areas of expenditure and 20 age-sex profile cells, five time period cells and four non-demographic factors, giving a total of 6,400 separate parameters that can be changed (Vos et al. 2007 and Begg et al. 2008).

Due to the time consuming nature of estimating 6,400 parameters for each of the diseases, most diseases have only been set up with 110 parameters. In particular, the volume of services per treated case has only been estimated for four of the 16 areas of expenditure (admitted patient services, out-of-hospital medical services, pharmaceuticals and residential aged care services).

Disease incidence and prevalence for 2003 were used as the baseline for the projections. Expected increases in the cost per case of disease in the future were estimated using trends observed between 1993–94 and 2004–05. More detail is provided below on parameters used in the model.

Population projections

Australian Bureau of Statistics 'Series 8' population projections based on the 2001 census have been used (ABS 2003). This series assumes a high net overseas migration, a constant improvement in life expectancy, and a fertility rate declining to 1.6 in 2011 when it becomes constant.

Disease rate changes

One of the key model inputs is the change in age-standardised disease rates between 2003 and 2033 (Appendix B). These are derived from a model which projects disease rates based on changes that have been observed over the last decade, and on evidence regarding the likely future occurrence of potentially preventable conditions (Vos et al. 2007 and Begg et al. 2008). For projecting health expenditure, for some disease groups, such as cancer, incidence rates are used, because expenditure on cancer is more related to incidence than prevalence. For other diseases, for example mental disorders, expenditure relates more to prevalence than incidence, so expenditure is projected according to expected changes in prevalence rates.

Incidence and prevalence

Incidence in relation to disease refers to the number of new cases of a disease in a given year. Prevalence is the number of existing cases of this disease. Each measure can be reported as a number or as a rate, for example per 1,000 of the population. In this report, rates were age-standardised to the Australian population as at 30 June 2001. Projected changes in incidence rates for each disease between 1994 and 2033 are available in Appendix B.

Note: these projections of incidence and prevalence relate directly to the disease and not to people, allowing increased expenditure on disease to be estimated regardless of the number of conditions an individual has.

Expenditure on residential aged care however, is only reported by main condition and therefore does not attribute expenditure across the many conditions a resident may have. This does have an impact on the projections when examined by disease. Other work done by the AIHW (AIHW 2006) indicates that the main condition method overestimates the proportion of residential aged care expenditure due to dementia and stroke and underestimates the expenditure that is due to other conditions such as hearing loss and immobility.

The following sections describe a number of diseases for which incidence and prevalence rates and counts are projected to increase or decrease between 2003 and 2033 (tables 1 and 2). These provide examples of a range of inputs into the model.

Cardiovascular disease

The incidence rate of cardiovascular disease (which includes cerebrovascular disease and ischaemic heart disease) is estimated to fall by 40.4% over 30 years. This has been estimated by projecting forward the dramatic decline in cardiovascular disease over time (Table 1).

Table 1: Estimated change in age-standardised incidence rates, 2003 to 2033

Cause group	Number (in 2003)	Per cent change in rate/1000
Acute respiratory infections	29,460,100	0
Congenital anomalies	2,400	0
Maternal conditions	72,000	0
Neonatal causes	11,600	0
Infectious & parasitic diseases	17,552,700	–0.1
Injuries	309,000	–15.6
Malignant neoplasms	469,000	–38.9
Cardiovascular disease	86,500	–40.4

Sources: University of Queensland and AIHW burden of disease database.

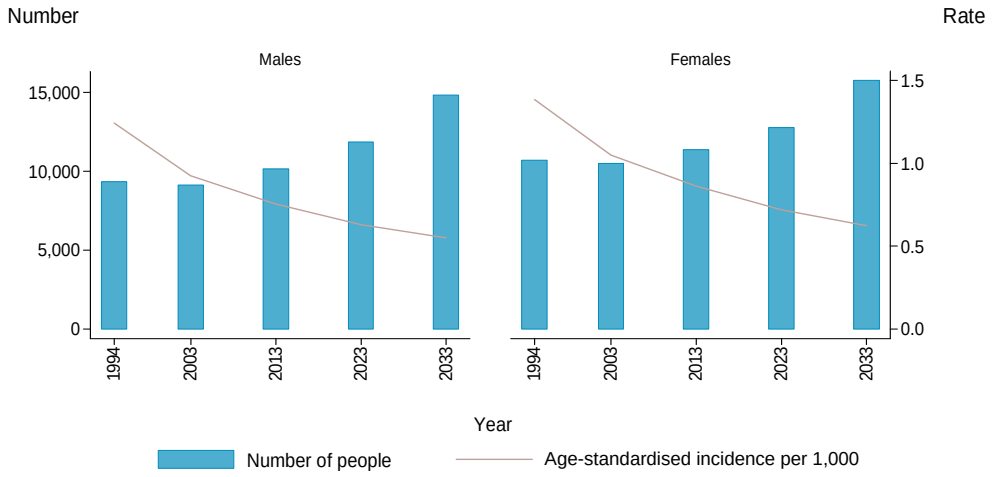
Table 2: Estimated change in age-standardised prevalence rates, 2003 to 2033

Cause group	Number (in 2003)	Per cent change in rate/1000
Diabetes mellitus	1,170,900	57.1
Genitourinary diseases	417,900	1.1
Nervous system/sense organs	3,998,200	0.8
Musculoskeletal diseases	1,770,800	0.4
Mental disorders	2,914,600	0
Oral conditions	2,970,500	–0.1
Digestive system diseases	251,000	–0.4
Chronic respiratory disease	1,743,800	–12.8

Sources: University of Queensland and AIHW burden of disease database.

Cerebrovascular disease (stroke)

Figure 1 shows the incidence and incidence rate for cerebrovascular disease (stroke). Although the number of new cases is projected to rise over time (because of an ageing and growing population), the age-standardised rate of disease actually decreases. The projected change for stroke between 2003 and 2033 is 10,962 incident cases. This represents an increase of 55.9% from 19,627 to 30,589 new cases per year. These changes are despite substantial declines in the age-standardised incidence rate of stroke (40.4% and 40.6% for males and females, respectively) expected over the projection period.

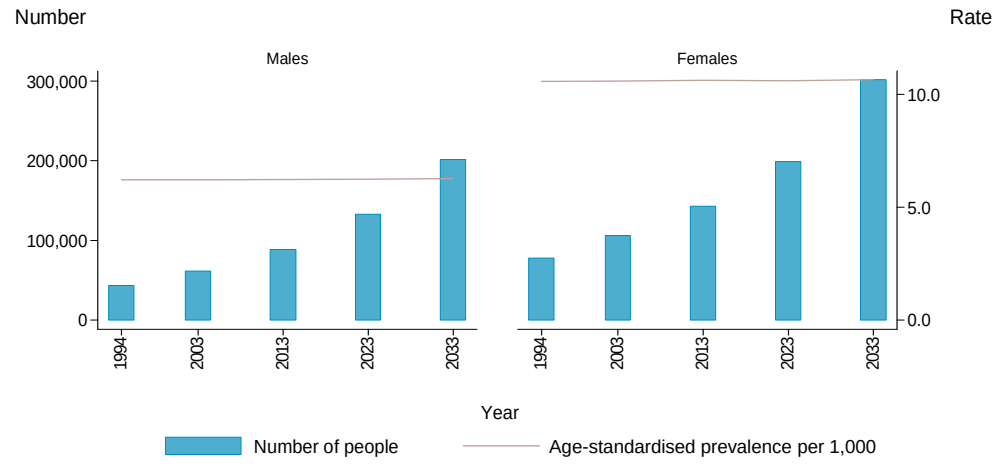


Source: Vos et al. 2007.

Figure 1: Incidence and age-standardised incidence rate of cerebrovascular disease, 1994 to 2033

Dementia

Figure 2 shows the prevalence and prevalence rates for dementia. It is estimated that age-standardised rates of dementia will not increase or decrease, because no change in rates of dementia has been observed in recent years. However, it is interesting to note the implications of a constant rate of dementia. Although the rate of disease is constant, a 200% increase in the numbers of people with dementia is projected over the next 30 years. This increase is entirely due to population ageing and population growth.

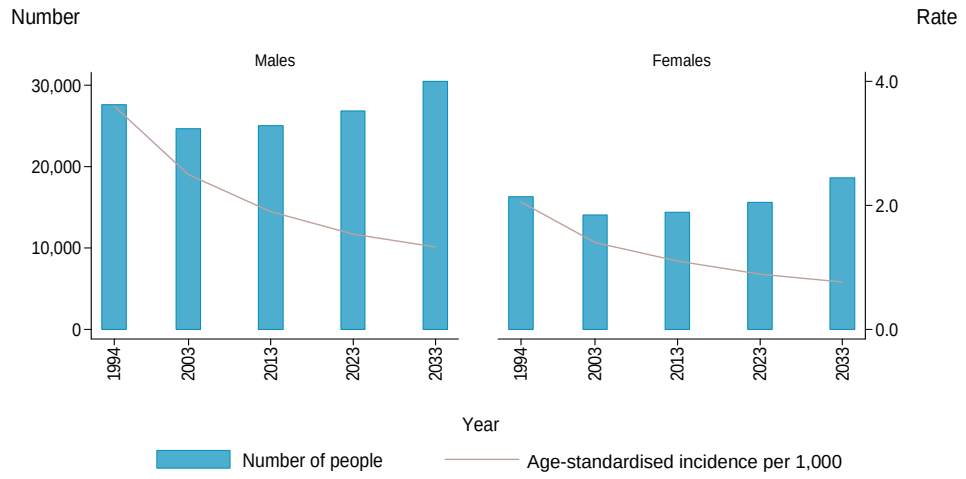


Source: Vos et al. 2007.

Figure 2: Prevalence and age-standardised prevalence rate of dementia, 1994 to 2033

Ischaemic heart disease

The projected change for ischaemic (coronary) heart disease between 2003 and 2033 is 10,359 incident cases. This represents an increase of 26.8% from 38,675 to 49,034 new cases per year. Like stroke, these changes are despite the substantial declines in the incidence of coronary heart disease (46.8% and 45.6% for males and females, respectively) that are projected to occur over the projection period (Figure 3).

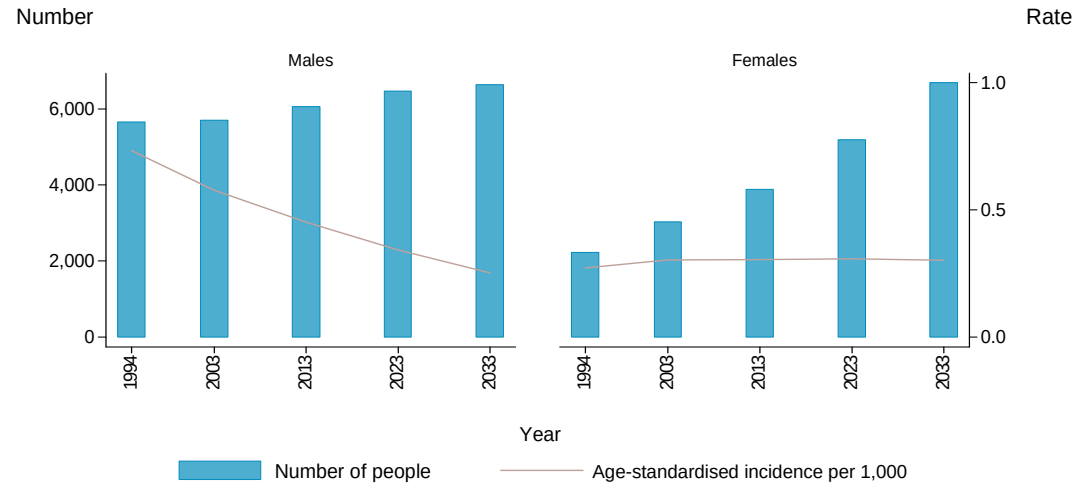


Source: Vos et al. 2007.

Figure 3: Incidence and age-standardised incidence rate of coronary heart disease, 1994 to 2033

Lung cancer

The projected change for lung cancer between 2003 and 2033 is 4,599 incident cases. This represents an increase of 52.7% from 8,734 to 13,333 new cases per year. For females, these changes will mostly be driven by demographic factors until 2023, after which time lung cancer incidence will begin to stabilise as the effects of the smoking epidemic moves through this population. For males, the increases are due to demographic factors alone as lung cancer rates are projected to decline by 56.4% over the projection period, continuing the decline that has been observed over the last decade (Figure 4).

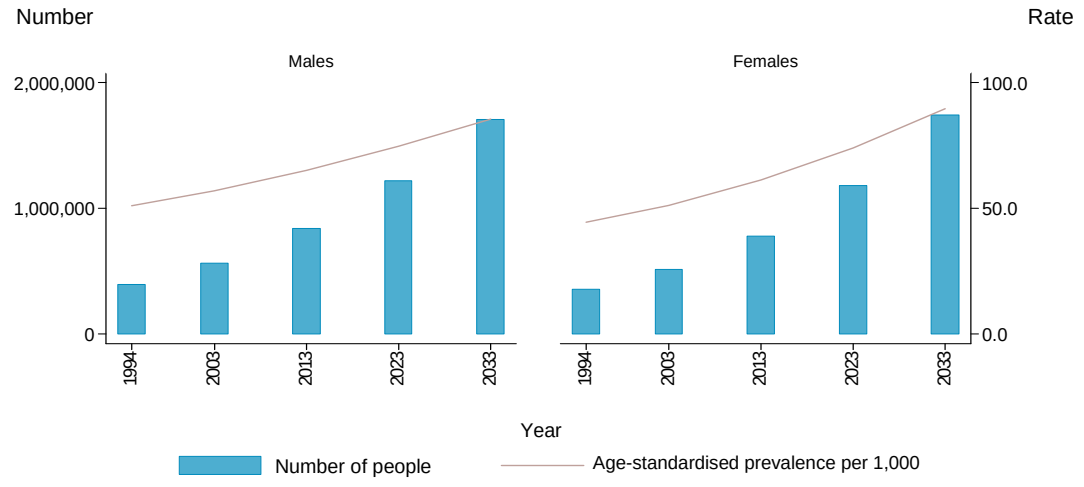


Source: Vos et al. 2007.

Figure 4: Incidence and age-standardised incidence rate of lung cancer, 1994 to 2033

Diabetes

The projected change for type 1 and type 2 diabetes between 2003 and 2033 is 2.419 million prevalent cases. This represents an increase of 207% from 1.171 million to 3.590 million existing cases per year. The projected change for type 2 diabetes during this period is 2.376 million prevalent cases—an increase of 221% from 1.073 million to 3.449 million. These changes will be driven by both demographic factors and increasing age-standardised prevalence rates due to expected increases in the prevalence of obesity over the projection period (Figure 5).

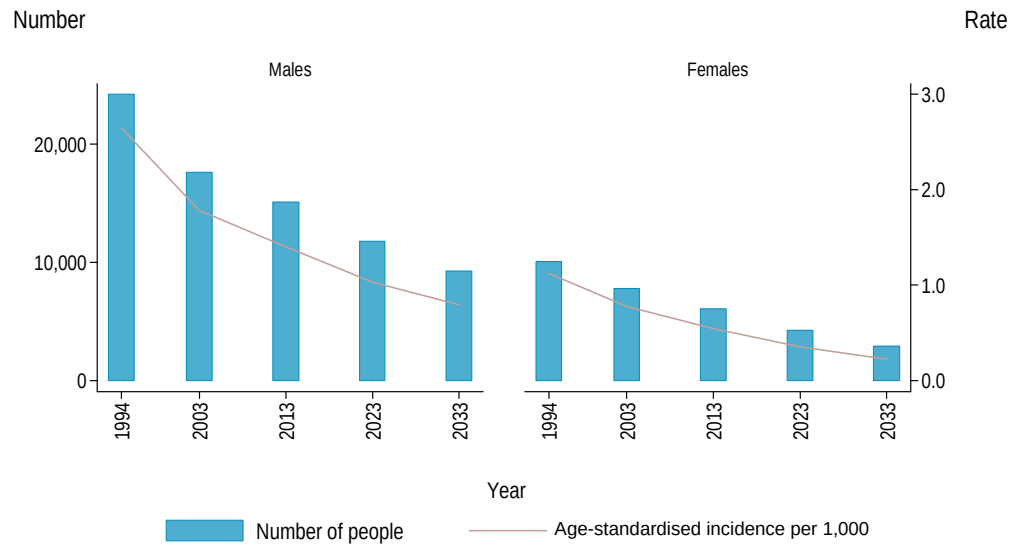


Source: Vos et al. 2007.

Figure 5: Prevalence and age-standardised prevalence rate of diabetes, 1994 to 2033

Road traffic injuries

The projected change for road traffic injuries between 2003 and 2033 is 13,215 fewer incident cases. This represents a decrease of 52.1% from 25,381 to 12,166 new cases per year. These changes are driven by the projected decline in the age-standardised rate of road traffic injuries (55.6% and 71.1% for males and females, respectively) occurring over the projection period (Figure 6).



Source: Vos et al. 2007.

Figure 6: Incidence and age-standardised incidence rate of road traffic accidents, 1994 to 2033

Volume of services per treated case

A crucial parameter on the non-demographic side is growth in volume of services per treated case, and in this area there is substantial uncertainty.

The projections in this model are mostly based on historical trends in expenditure by age and sex group and area of expenditure plus epidemiological estimates of incident or prevalent cases over the last decade or so.

The estimates of change in volume of services per treated case aim to capture the combination of factors influencing treatment practices, by quantifying changes in health and residential aged care expenditure over time. Introduction of new technologies and changes in treatment practices have been the main contributors to changes in volume per case in the past and this is expected to continue.

Treatment proportion changes

Changes in the proportion of the population with diseases being treated has only been estimated for diabetes, hypertension and hyperlipidemia; where evidence suggests there are a significant number of people with the disease who are not treated and who could be treated in the future.

Excess health price inflation

Excess health price inflation has been calculated separately for each sector (Appendix Table C2) (i.e. for hospital services, out-of-hospital medical services, pharmaceuticals, dental services, residential aged care services, and other services. The excess health price inflation is generally based on what happened in each sector in the period 1995–96 to 2005–06.

This is a significant difference from the UN report (Vos et al. 2007) which assumed 0.7% per year for all areas of expenditure except dental which had a higher rate of 2.0% per year.

Source of funds

Source of funds was calculated based on the assumption that the proportion of total health and residential aged care expenditure as at 2004–05 funded by the Australian government, state and territory governments and the private sector, for each type of service remains the same over the period 2003 to 2033.

Sensitivity analysis

Sensitivity analysis was used to gain insight into the levels of uncertainty around two variables used in the model—volume of services per treated case and excess health price inflation. For each of these variables there were low, medium and high assumptions. The medium assumption refers to the central assumptions used in the model. Under the low assumption scenario, both the estimated volume of services per treated case and excess health price inflation were reduced by 20%, and under the high assumption scenario, both variables were increased by 20%.

The results are presented as projections of health and residential aged care expenditure as a percent of GDP and the projected amount of expenditure on these services in billions of dollars for each of the three assumptions. In addition, the results include the percentage of uncertainty around each of the central estimates for the combined effect of volume of services per treated case and excess health price inflation.

3 Results

Projected expenditure

Under the central set of assumptions used in this study (see Chapter 2), total health and residential aged care expenditure is projected to increase by 189% in the period 2003 to 2033 from $85 billion to $246 billion (an increase of $161 billion). This is an increase in health expenditure as a proportion of GDP from 9.3% to 12.4% (Table 3). Note: expenditure and GDP for all years is expressed in 2006–07 dollars to enable comparisons to be made across the period.

Table 3: Projected health and residential aged care expenditure[a] by disease group, 2002–03 to 2032–33

	Expenditure (millions of 2006–07 dollars)[b]				Change 2002–03 to 2032–33
	2002–03[c]	2012–13	2022–23	2032–33	
Cardiovascular	9,329	12,535	16,781	22,559	142%
Respiratory	7,188	9,679	14,483	21,947	205%
Injuries	6,650	8,134	10,555	14,353	116%
Dental	5,888	7,705	10,766	14,925	153%
Mental	5,147	6,670	8,998	12,109	135%
Digestive	4,877	6,916	10,612	16,488	238%
Neurological	4,727	7,358	12,095	21,560	356%
Dementia	3,847	6,033	9,889	17,837	364%
Parkinson's disease	323	488	825	1,399	334%
Other neurological	557	837	1,380	2,325	317%
Sense disorders	2,636	3,642	5,640	8,859	236%
Musculoskeletal	4,411	6,289	9,567	14,234	223%
Genitourinary	3,678	4,966	7,272	10,857	195%
Cancer	3,487	5,128	7,807	10,112	190%
Endocrine, nutritional & metabolic	2,584	3,322	4,602	6,395	147%
Skin	2,373	3,309	5,012	7,767	227%
Maternal	2,150	2,427	3,167	3,953	84%
Infectious	1,890	2,427	3,359	4,673	147%
Diabetes	1,607	2,831	5,007	8,610	436%
Type 2 diabetes	1,296	2,427	4,495	8,041	520%
Neonatal	631	724	952	1,185	88%
Congenital	310	369	492	633	104%
Other[d]	15,500	21,041	30,564	44,837	189%
Total health & residential aged care expenditure ($m)	**85,063**	**115,471**	**167,729**	**246,056**	**189%**
GDP[e] ($b)	**919**	**1,235**	**1,582**	**1,981**	
Total as per cent of GDP	**9.3%**	**9.3%**	**10.6%**	**12.4%**	

(a) Expenditure in this report refers to health care expenditure and expenditure on the high care portion of residential aged care expenditure. This is the definition of health expenditure that was used in the national health accounts up until 2004–05. Since then health expenditure has excluded residential aged care expenditure as that is now counted as part of welfare expenditure.

(b) Expenditure and GDP for all years are reported in 2006–07 dollars.

(c) 2002–03 estimates are projected from 2000-01 actual data. Actual 2002-03 health and residential aged care expenditure in 2006-07 dollars was $84.7 billion.

(d) 'Other' includes expenditures which cannot be allocated by disease. It includes 'Signs, symptoms and ill-defined conditions' which covers diagnostic and other services for signs, symptoms and ill-defined conditions where the cause of the problem is unknown, and includes 'Other contact with the health system' such as fertility control, reproduction and development; elective plastic surgery; general prevention, screening and health examination; and treatment and aftercare for unspecified disease. Expenditure for aids & appliances, ambulances, community health services and capital goods which could not be allocated by disease is allocated proportionally across all categories.

(e) Calculated from Intergenerational Report (Treasury, 2007, p.29) which is the source for GDP growth rates and ABS national accounts data which is the source for the baseline GDP data).

Source: AIHW Disease expenditure projection model.

Diabetes is projected to have the largest percentage increase in expenditure (436%) between 2003 and 2033, followed by dementia (364%), Parkinson's disease (334%), digestive disorders (238%) and sense disorders (236%) (Table 3). The projected growth in diabetes expenditure (436%) is due to multiple reasons, with expected increases in obesity as a major factor for a projected large increase in the prevalence rate of diabetes.

In dollar terms, expenditure on respiratory diseases is projected to increase the most ($14.8 billion) between 2003 and 2033, followed by dementia ($14.0 billion) and cardiovascular disease ($13.2 billion). Although diabetes has the largest projected percentage increase, expenditure in dollar terms is projected to increase by less than half that for respiratory disease or dementia ($7.0 billion) (Table 3).

The projected increase in expenditure for maternal services (84% or $1.8 billion) and neonatal services (88% or $0.6 billion) is low in comparison. Maternal conditions and neonatal conditions expenditure are projected to grow more slowly because changes in the age structure of the population mean women of childbearing age will be a smaller proportion of the total population.

Figures like these have implications for workforce planning. Based on these results, one would not increase the number of obstetricians faster than the number of geriatricians or endocrinologists.

Decomposition of expenditure

The following table (Table 4) and figures (figures 7 to 14) decompose the growth in expenditure over the period into the following six demographic and non-demographic factors: population ageing; population growth; disease rate change; change in volume of services provided per treated case; treatment proportion change; and excess health price inflation.

The decompositions for the different diseases are very different, which emphasises that generalising about the reasons for overall increases in health and residential aged care expenditure can be problematic.

The projected change in volume of health services provided per case of disease ($81.3 billion) is the biggest contributor to the overall increase of $161.0 billion (Table 4). Population ageing ($37.8 billion) and overall population growth ($34.4 billion) are major contributors to the overall increase projected for the period. Excess health price inflation ($8.8 billion) is another contributor.

The projected change in health and residential aged care expenditure in Australia between 2003 and 2033 of $161 billion would have been higher by $2.3 billion if net disease trends were ignored (Table 4). Favourable trends in disease rates lead to savings in expenditure for cardiovascular disease ($3.2 billion), cancers ($1.2 billion), injuries ($1.7 billion) and other diseases over the period which leads to lower overall expenditure of $7.4 billion. However, this is countered by the steep increase in costs due to projected higher rates of diabetes ($1.8 billion) and increases for other diseases giving a projected expenditure increase due to worsening disease rates of $5.1 billion. This is a net impact from disease rate changes of $2.3 billion.

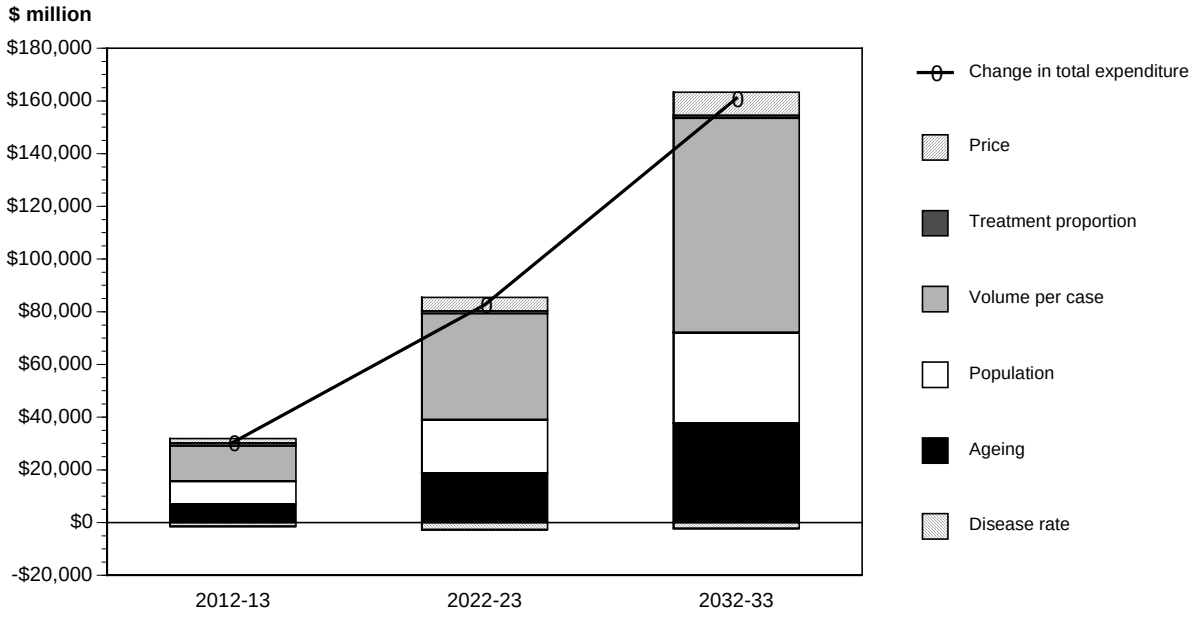
Table 4: Change in total health and residential aged care expenditure due to different factors, 2002–03 to 2032–33 ($ billion)

	Total health and residential aged care expenditure (billions of 2006–07 dollars)[a]			Components of change (billions of 2006–07 dollars)[a]					
	2002–03	2032–33	Expend-iture change	Ageing	Population	Disease rate	Volume per case	Treatment proportion	Price
Cardiovascular	9.33	22.56	13.23	6.39	3.71	–3.18	4.15	0.68	1.49
Respiratory	7.19	21.95	14.76	0.49	–0.03	0.58	12.42	0.00	1.30
Injuries	6.65	14.35	7.70	1.19	2.46	–1.66	4.69	0.00	1.03
Dental	5.89	14.93	9.04	–0.14	2.79	–0.11	6.05	0.00	0.44
Mental	5.15	12.11	6.96	–0.06	2.20	0.18	4.39	0.00	0.26
Digestive	4.88	16.49	11.61	1.55	2.75	0.36	6.75	0.00	0.19
Neurological	4.73	21.56	16.83	8.09	2.98	0.63	4.28	0.00	0.86
Dementia	3.85	17.84	13.99	7.71	2.40	0.50	2.79	0.00	0.60
Parkinson's disease	0.03	1.40	1.10	0.50	0.18	0.02	0.39	0.00	–0.02
Other neurological	0.56	2.33	1.77	–0.12	0.40	0.11	1.10	0.00	0.27
Musculoskeletal	4.41	14.23	9.82	3.54	2.07	0.26	3.29	0.00	0.67
Genitourinary	3.68	10.86	7.18	2.40	1.33	0.20	3.14	0.00	0.11
Cancer	3.49	10.11	6.63	2.43	1.43	–1.20	3.68	0.01	0.27
Sense disorders	2.64	8.86	6.22	3.24	0.81	–0.03	2.28	0.00	–0.07
Endocrine, nutritional & metabolic	2.58	6.40	3.81	–0.20	1.11	0.12	3.18	0.00	–0.41
Skin	2.37	7.77	5.39	0.32	1.46	0.28	2.73	0.00	0.61
Maternal	2.15	3.95	1.80	–0.54	0.72	0.00	1.42	0.00	0.20
Infectious	1.89	4.67	2.78	0.07	0.82	0.07	1.61	0.00	0.23
Diabetes	1.61	8.61	7.00	1.47	1.07	1.80	2.55	0.12	0.01
Type 2 diabetes	1.30	8.04	6.74	1.44	0.96	1.77	2.52	0.12	–0.07
Neonatal	0.63	1.19	0.55	–0.18	0.22	0.00	0.45	0.00	0.06
Congenital	0.31	0.63	0.32	–0.06	0.12	0.00	0.23	0.00	0.04
Other[b]	15.50	44.84	29.34	7.76	6.36	–0.60	14.01	0.23	1.58
Total	**85.06**	**246.06**	**161.00**	**37.75**	**34.38**	**–2.29**	**81.30**	**1.03**	**8.84**

(a) Expenditure for all years is reported in 2006–07 dollars.

(b) 'Other' includes expenditures which cannot be allocated by disease. It includes 'Signs, symptoms and ill-defined conditions' which covers diagnostic and other services for signs, symptoms and ill-defined conditions where the cause of the problem is unknown, and includes 'Other contact with the health system' such as fertility control, reproduction and development; elective plastic surgery; general prevention, screening and health examination; and treatment and aftercare for unspecified disease.
Expenditure for aids & appliances, ambulances, community health services and capital goods which could not be allocated by disease is allocated proportionally across all categories.

Source: AIHW Disease expenditure projection model.



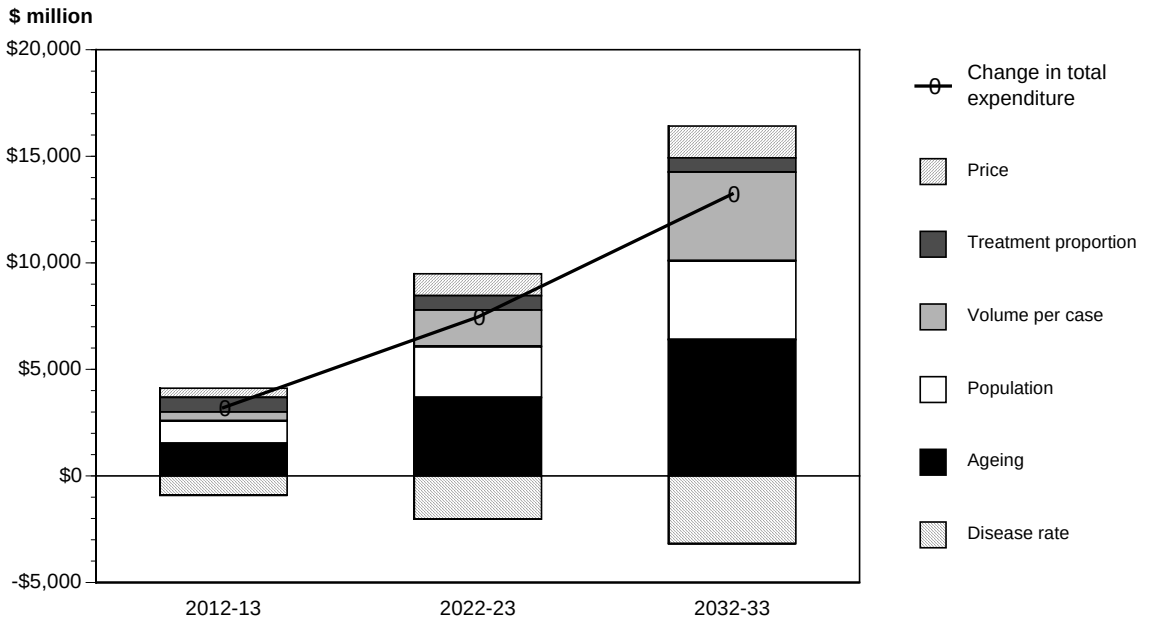
Source: AIHW Disease expenditure projection model.

Figure 7: Decomposition of projected change in total health and residential aged care expenditure

Cardiovascular disease

The projected change in expenditure for the period 2003 to 2033 for cardiovascular disease (both treatment and preventive) is $13.2 billion (142%), from $9.3 billion in 2003 to $22.6 billion in 2033 (Table 3; Figure 8).

The decline in the cardiovascular disease incidence rate projected in this period means the expenditure increase is $3.2 billion lower than it would be had the disease rate been constant. Factors that are projected to increase expenditure are ageing ($6.4 billion), overall population growth ($3.7 billion), extra volume of services per case of disease ($4.2 billion), extra proportion of those with hypertension and hyperlipidemia treated ($0.7 billion) and excess health price inflation ($1.5 billion) (Table 4).

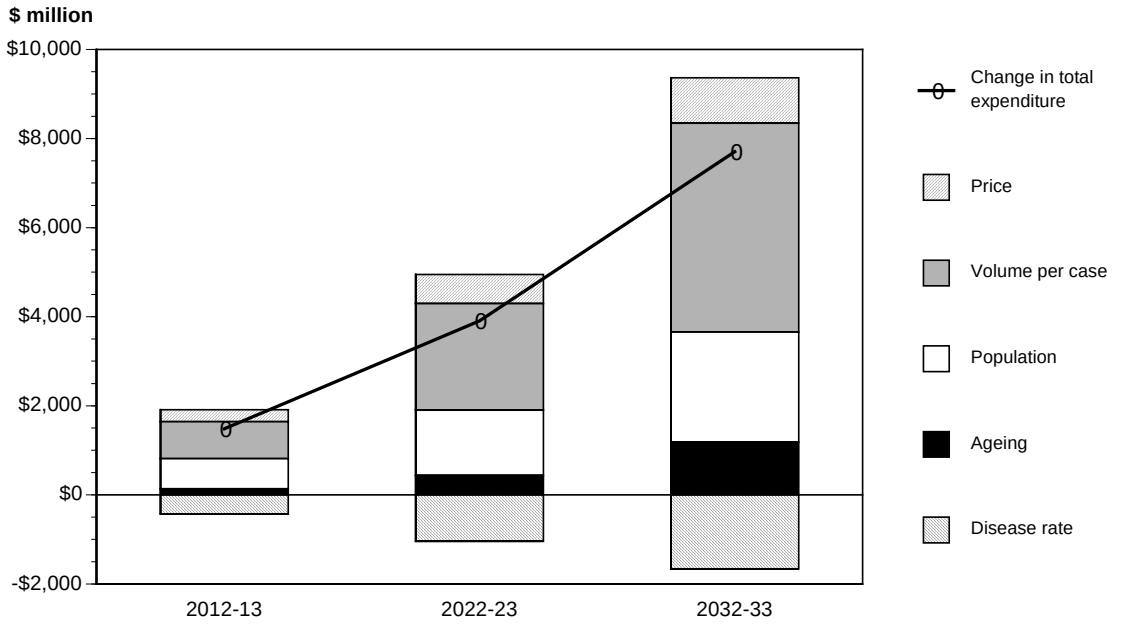


Source: AIHW Disease expenditure projection model.

Figure 8: Decomposition of projected change in expenditure for cardiovascular disease

Injuries

Expenditure on injuries is projected to increase by 116% ($7.7 billion) in the period 2003 to 2033 (Table 3; Figure 9). The change is a result of projected increases in expenditure due to general population growth ($2.5 billion), an expected increase in the volume of services per case ($4.7 billion), excess health price inflation ($1.0 billion), an ageing population ($1.2 billion) and a predicted decrease in the age-standardised incidence rate of injuries ($1.7 billion) (Table 4). There is no expected change in the proportion of injuries treated.

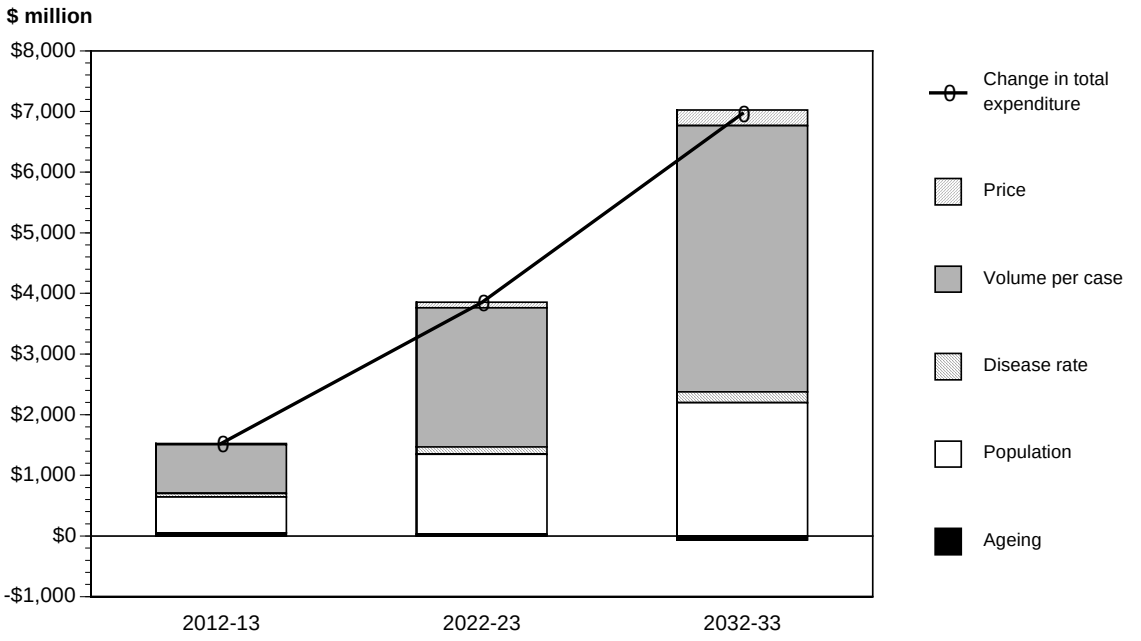


Source: AIHW Disease expenditure projection model.

Figure 9: Decomposition of projected change in health and residential aged care expenditure for injuries

Mental disorders

The projected change in expenditure for mental disorders is $7.0 billion (135%) for the period 2003 to 2033 from $5.1 billion to $12.1 billion (Table 3; Figure 10). The change is due to general population growth ($2.2 billion); an expected increase in the volume of services per case ($4.4 billion); excess health price inflation ($0.3 billion); and a predicted increase in the incidence rate of disease ($0.2 billion). The change also predicts a slight decrease in expenditure as a result of an ageing population ($62 million) (Table 4). This modelling does not include any change in the proportion of mental disorders treated.

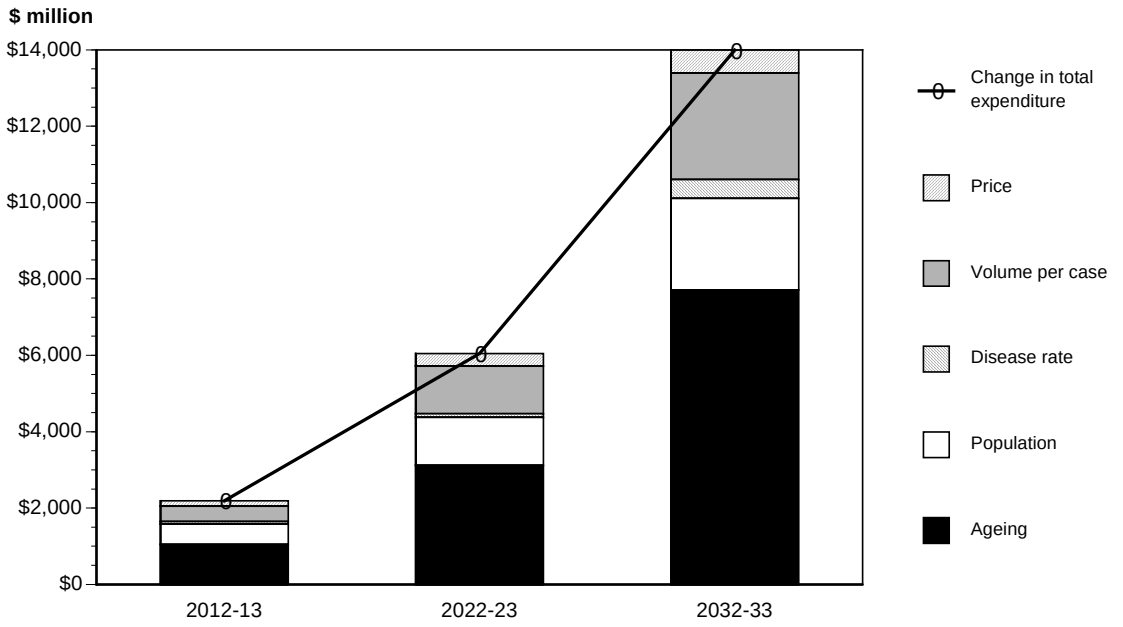


Source: AIHW Disease expenditure projection model.

Figure 10: Decomposition of projected change in health and residential aged care expenditure for mental disorders

Dementia

The projected change in health and residential aged care expenditure for people with dementia for the period 2003 to 2033 is $14.0 billion (364%), from $3.8 billion in 2003 to $17.8 billion in 2033 (Table 3; Figure 11). Over half of the increase in total expenditure is projected to be due to ageing ($7.7 billion). Additional factors that contribute to the projected increase are excess health price inflation ($0.6 billion), volume per case ($2.8 billion) and population growth ($2.4 billion) (Table 4). There is no expected change in the proportion of dementia treated.

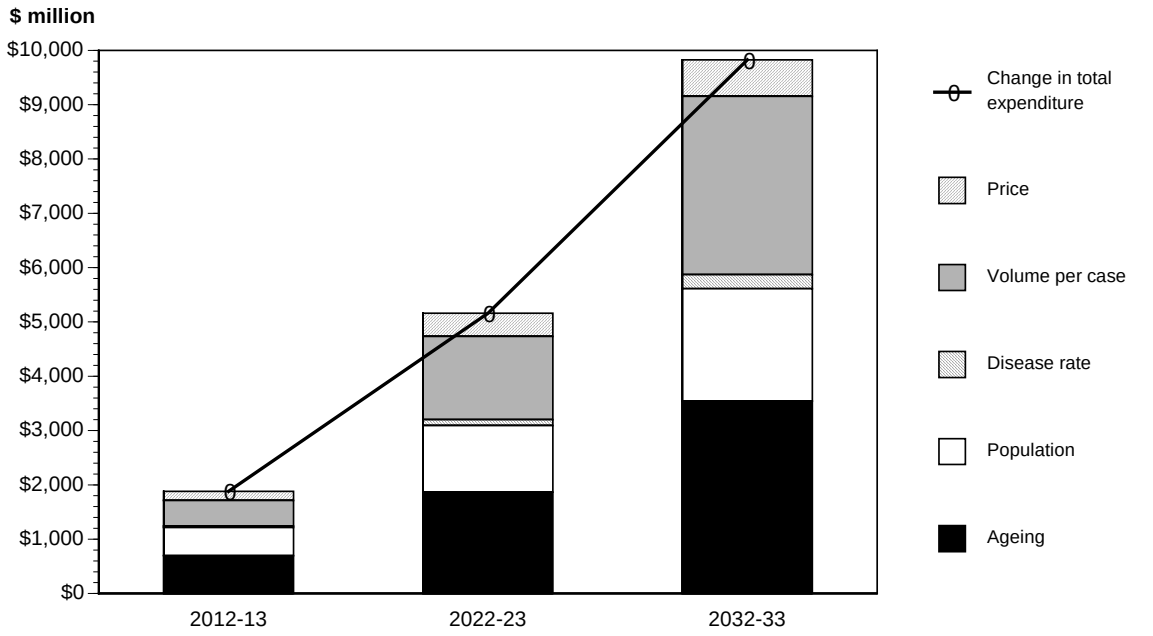


Source: AIHW Disease expenditure projection model.

Figure 11: Decomposition of projected change in health and residential aged care expenditure for dementia

Musculoskeletal disorders

Expenditure on selected musculoskeletal disorders is projected to increase by 223% ($9.8 billion) in the period 2003 to 2033 (Table 3; Figure 12). Factors that contribute to the projected increase are ageing ($3.5 billion), general population increase ($2.1 billion), an increase in volume of treatment per case ($3.3 billion), a predicted increase in the incidence rate of disease ($0.3 billion) and excess health price inflation ($0.7 billion) (Table 4). There is no expected change in the proportion of musculoskeletal disorders treated.

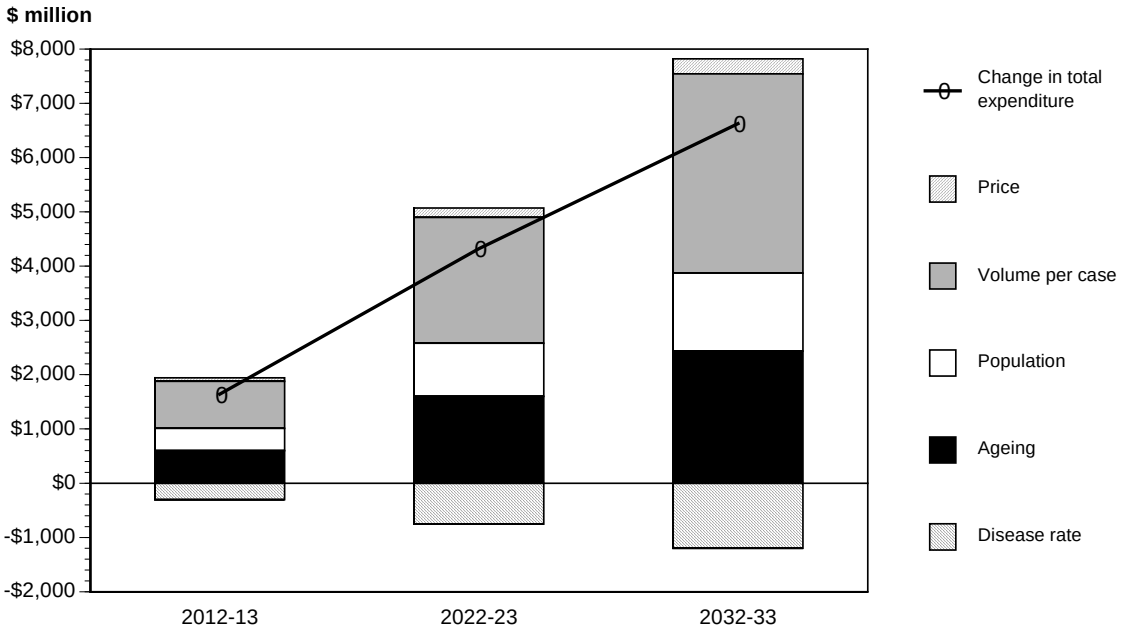


Source: AIHW Disease expenditure projection model.

Figure 12: Decomposition of projected change in health and residential aged care expenditure for musculoskeletal disorders

Cancer

The projected expenditure on cancer in the period 2003 to 2033 shows an increase of $6.6 billion, from $3.5 billion to $10.1 billion (190%) (Table 3; Figure 13). This expenditure increase would have been $1.2 billion higher had cancer disease rates not been projected to decrease. Increases in volumes of services per case of disease ($3.7 billion), population growth ($1.4 billion) and the ageing of the population ($2.4 billion) are the main factors projected to affect the growth of total expenditure for cancer. The other factor that produces an increase in this projection is excess health price inflation ($0.3 billion) (Table 4). There is no expected change in the proportion of cancers treated.

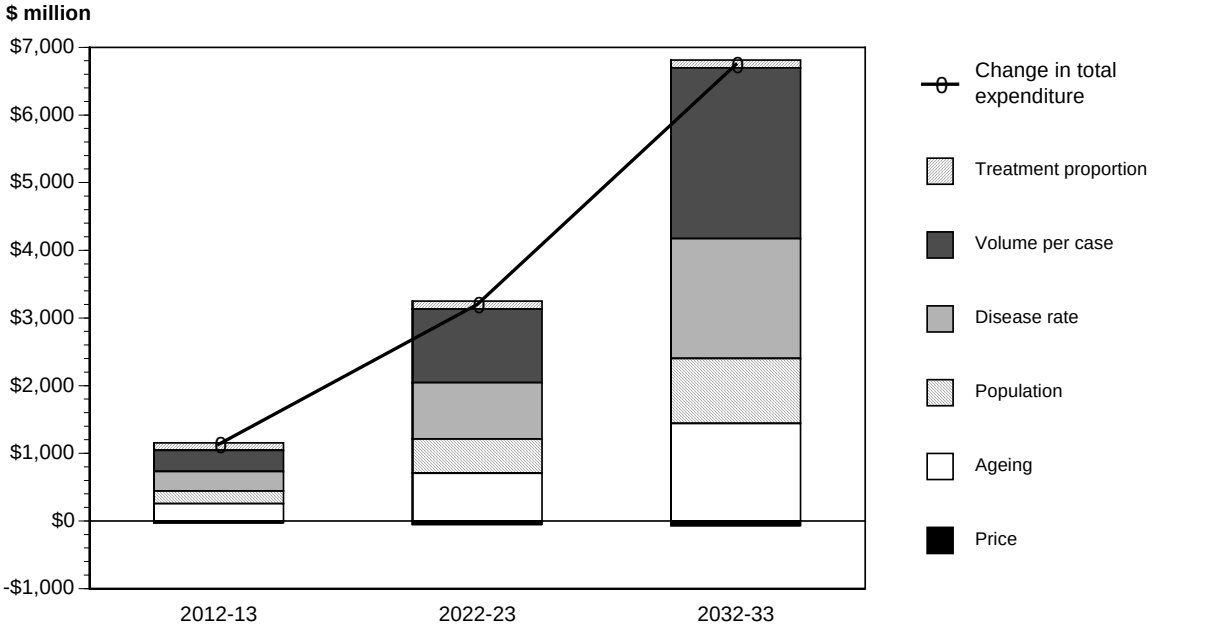


Source: AIHW Disease expenditure projection model.

Figure 13: Decomposition of projected change in health and residential aged care expenditure for cancer

Diabetes

Overall, in the period 2003 to 2033 it is projected that the cost of treatment of diabetes (type 1 and type 2) will increase by 436% ($7 billion) from $1.6 billion to $8.6 billion (Table 3). Most of the increase will be in type 2 diabetes where the increase is projected to be $6.7 billion (Figure 14). It is projected that type 2 diabetes will increase by 520% from $1.3 billion to $8.0 billion. Factors that are projected to increase expenditure for type 2 diabetes are ageing ($1.4 billion), overall population growth ($1.0 billion), an increase in the prevalence rate of diabetes (largely driven by an expected increase in obesity) ($1.8 billion), extra volume of services per case of disease ($2.5 billion) and treatment of diabetics currently untreated ($0.1 billion) (Table 4).



Source: AIHW Disease expenditure projection model.

Figure 14: Decomposition of projected change in health and residential aged care expenditure for type 2 diabetes

Sources of funds

Both government and the private sectors fund health and residential aged care services. The government sector comprises the Australian Government and state, territory and local governments. The private sector comprises private health insurance funds, individuals or households who provide funds through their out-of-pocket payments to service providers and other private sources. These out-of-pocket payments cover the difference between the total cost of the service and any refunds from Medicare and private health insurance; the co-contributions required for residential aged care services and for medications; and any other health services for which the full cost is paid. The private sector also includes funding by injury compensation insurers such as workers' compensation and third party motor vehicle insurers.

Note: the following tables and figure in this section assume that the proportion of total health and residential aged care expenditure that the government and private sectors fund, for each type of service, remains the same throughout the whole period, i.e., at 2004–05 levels.

There were some differences in the rate of growth of health and residential aged care expenditure projected to be funded by the different sectors. Government funding is projected to increase by 194% between 2003 and 2033 compared to an increase of 189% for all sources of funding (Table 5). Health insurance funded expenditure is projected to grow at 188% and individuals' out-of-pocket funded expenditure at 172%.

Table 5: Total health and residential aged care expenditure by source of funds[(a)], 2002–03 to 2032–33, ($ billion)

	Expenditure (billions of 2006–07 dollars)[(b)]							
	2002–03	2007–08	2012–13	2017–18	2022–23	2027–28	2032–33	Change from 2002–03 to 2032–33
Australian Government	42.0	48.0	57.7	69.4	84.2	104.2	124.2	196%
State, territory and local governments	16.3	18.4	22.0	26.6	32.4	40.1	47.9	193%
Individual out-of-pocket	17.4	19.7	23.4	27.7	33.0	40.3	47.5	172%
Health insurance funds	6.1	6.8	8.1	9.8	11.9	14.7	17.5	188%
Other private[(c)]	3.2	3.6	4.3	5.2	6.2	7.6	9.0	181%
Total	**85.1**	**96.5**	**115.5**	**138.6**	**167.7**	**206.9**	**246.1**	**189%**

(a) Source of fund proportions for each area of expenditure as of 2004–05 was assumed to apply across the period.

(b) Expenditure for all years is reported in 2006–07 dollars.

(c) 'Other private' includes expenditure on health goods and services by workers' compensation and compulsory motor vehicle third-party insurers as well as other sources of income of service providers.

Source: AIHW Disease expenditure projection model.

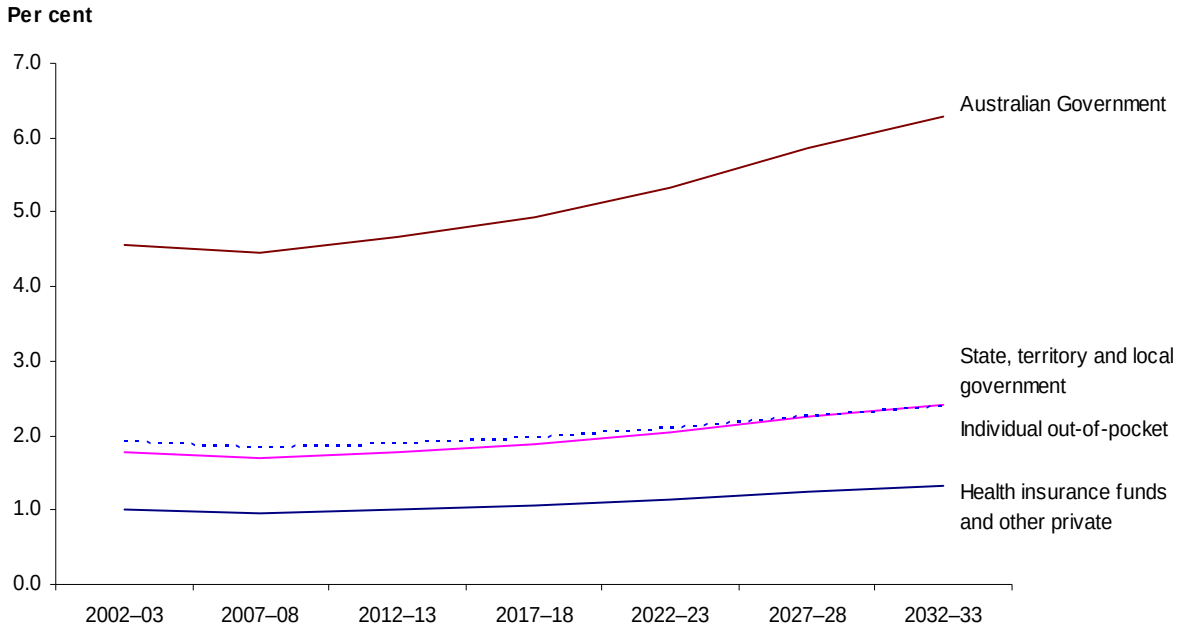
Australian Government funding of health and residential aged care expenditure is projected to increase from 49.4% at the beginning of the period to 50.5% in 2033 (Table 6). This increase is due to the high proportion of funding for residential aged care borne by the Australian Government, and the fact that residential aged care expenditure is projected to increase by much more (295%) than total health and residential aged care expenditure (189%) (Table 8). So although the other areas of Australian Government funding responsibility—out-of-hospital medical services and pharmaceuticals—are projected to grow at lower rates than total expenditure (157% and 163% respectively), the very large increases for residential aged care more than outweigh the areas with lower growth. State, territory and local governments also are projected to show an increase in their funding share from 19.2% at the beginning of the period to 19.5% in 2033 (Table 6). This increase is due to admitted patient hospital expenditure being projected to grow at a somewhat faster rate (214%) than total health and residential aged care expenditure (189%) (Table 8).

Table 6: Proportion of total health and residential aged care expenditure, by source of funds, 2002–03 to 2032–33 (per cent)

	2002–03	2007–08	2012–13	2017–18	2022–23	2027–28	2032–33
Australian Government	49.4	49.8	50.0	50.1	50.2	50.4	50.5
State, territory and local governments	19.2	19.0	19.0	19.2	19.3	19.4	19.5
Individual out-of-pocket	20.5	20.4	20.2	20.0	19.7	19.5	19.3
Health insurance funds	7.1	7.0	7.0	7.1	7.1	7.1	7.1
Other private[(a)]	3.8	3.7	3.7	3.7	3.7	3.7	3.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) 'Other private' includes expenditure on health goods and services by workers' compensation and compulsory motor vehicle third-party insurers as well as other sources of income of service providers.

Source: AIHW Disease expenditure projection model.



Source: AIHW Disease expenditure projection model.

Figure 15: Total health and residential aged care expenditure as a proportion of GDP, by source of funds, 2002–03 to 2032–33 (per cent)

The Australian government, state and territory governments and the private sector are all projected to increase their funding of health and residential aged care services as a proportion of GDP over the 30 years from 2003 to 2033. This is because overall costs for health and residential aged care services are projected to increase faster than expenditure for the economy as a whole (Figure 15; tables 4 and 7). Total health and residential aged care expenditure as a proportion of GDP is projected to increase from 9.3% to 12.4%, with the Australian Government share of GDP increasing from 4.6% to 6.3% (Table 7).

Table 7: Total health and residential aged care expenditure as a proportion of GDP, by source of funds, 2002–03 to 2032–33 (per cent)

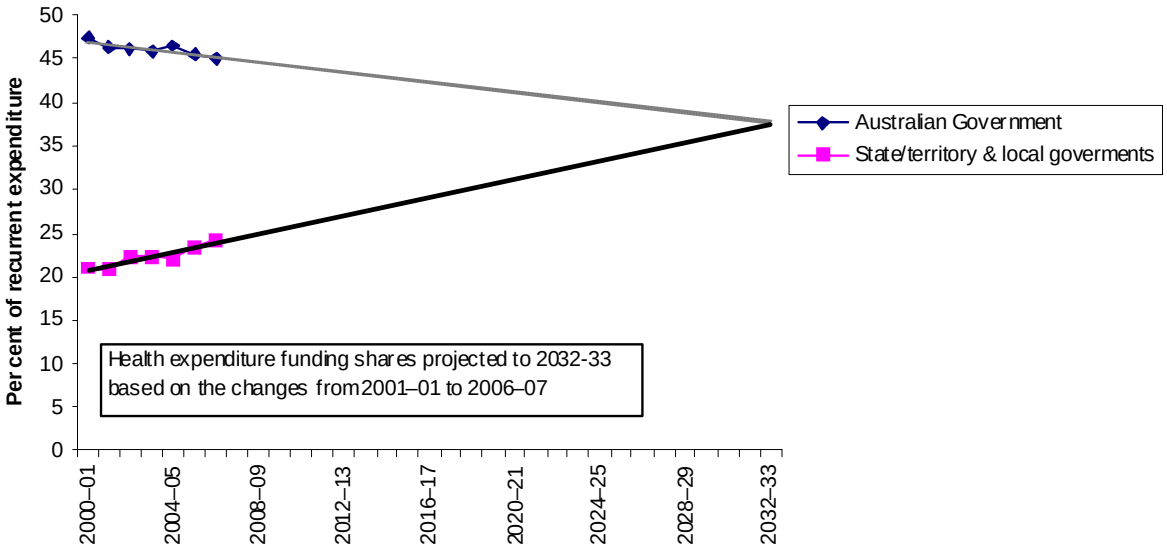
	2002–03	2007–08	2012–13	2017–18	2022–23	2027–28	2032–33
Australian Government	4.6	4.5	4.7	4.9	5.3	5.8	6.3
State, territory and local governments	1.8	1.7	1.8	1.9	2.0	2.3	2.4
Individual out-of-pocket	1.9	1.8	1.9	2.0	2.1	2.3	2.4
Health insurance funds and other private[(a)]	1.0	1.0	1.0	1.1	1.1	1.3	1.3
Total	**9.3**	**9.0**	**9.3**	**9.9**	**10.6**	**11.6**	**12.4**

(a) 'Other private' includes expenditure on health goods and services by workers' compensation and compulsory motor vehicle third-party insurers as well as other sources of income of service providers.

Source: AIHW Disease expenditure projection model.

The numbers in the source of funds tables and figures (tables 5 to 7; figures 15 and 16) assume that the proportion of total health and residential aged care expenditure funded by the government and private sectors for each type of service remains the same from 2003 to 2033. For example, for pharmaceuticals it assumes that the proportion funded by the Australian Government remains at 54% and by individuals' out-of-pocket payments at 45%. Similarly, it assumes that the proportion of admitted patient services (public and private hospitals) funded by the Australian Government remains at 44% and that funded by state, territory and local governments remains at 35%.

If there are structural changes in how various services are funded due to policy changes, then this can significantly change the proportion of services funded by each sector. For example, in recent years the state, territory and local governments have been funding a greater proportion of public hospital services and overall health services, and the Australian Government a lesser proportion. If this trend were to continue there would be projected increases in state, territory and local government funding and corresponding decreases in Australian Government funding. Thus, projections based on trends for the period 2000–01 to 2006–07 when structural changes in funding were occurring, show that the state, territory and local governments funding share would move from 21% in 2001 to 37% in 2033, while the Australian Government funding share would fall from 47% to 38% (Figure 16). It is important to keep in mind the potential or otherwise for these types of changes in funding arrangements when developing projections based on past trends, otherwise they are unlikely to be either realistic or useful.



Source: AIHW health expenditure database.

Figure 16: Government funding shares of recurrent health and residential aged care expenditure—actual 2000–01 to 2006–07 and projected 2007–08 to 2032–33

Area of expenditure

This report analyses four areas of expenditure: admitted patient services, out-of-hospital medical services, pharmaceuticals and residential aged care services (high-level care only). Expenditure on the other health care services, which represented approximately a third of health and residential aged care expenditure in 2002–03, are not disaggregated.

Projected growth in expenditure between 2003 and 2033 is reported as a percentage increase. For each area, diseases can have a high percentage increase but a low cost increase if they had a low cost base in 2003. Similarly, diseases with a low percentage increase but a high cost increase are generally those that started out with a higher level of expenditure than the average for all diseases.

Expenditure on high care services in residential aged care is projected to have the highest percentage increase between 2003 and 2033 of the four areas analysed (295% or $22.2 billion), whereas admitted patient services is projected to have the largest cost increase ($55.5 billion) even though its percentage increase is lower (214%) (Table 8).

Increases in expenditure on out-of-hospital medical services and pharmaceuticals are projected to be similar in both cost and percentage increases (around $17 billion each and around 160%).

Table 8: Projected change in health and residential aged care expenditure by area of expenditure, 2002–03 to 2032–33

	Expenditure (millions of 2006–07 dollars)[a]				
	2002–03	2012–13	2022–23	2032–33	Change 2002–03 to 2032–33)
Admitted patient services	25,926	35,678	54,157	81,425	214%
Out-of-hospital medical services	10,859	14,652	20,421	27,952	157%
Pharmaceuticals	10,865	14,871	20,701	28,544	163%
Residential aged care (high-care) services	7,528	11,191	17,538	29,725	295%
Other health[b]	29,885	39,079	54,912	78,410	162%
Total	**85,063**	**115,471**	**167,729**	**246,056**	**189%**

(a) Expenditure for all years is reported in 2006–07 dollars.

(b) Other health comprises non-admitted patient services, dental services, other health practitioners, community and public health, patient transport services, aids and appliances, administration and research.

Source: AIHW Disease expenditure projection model.

Admitted patient services expenditure

Between 2003 and 2033, expenditure on admitted patient services is projected to increase by 613% for type 2 diabetes, 465% for Parkinson's disease, 433% for dementia and 334% for sense disorders. Lower increases are projected for maternal, neonatal and congenital conditions (87%, 88% and 103% respectively) (tables 9 and 13).

The cost of increases in admitted patient services expenditure over the period is projected to be greatest for cardiovascular disease—an increase of $4.6 billion from $2.5 billion in 2003 to $7.1 billion in 2033, followed by injuries ($2.5 billion to $6.9 billion) and cancer ($2.2 billion to $6.8 billion) (Table 9).

Table 9: Projected admitted patient services expenditure by disease group, 2002–03 to 2032–33

	Expenditure (millions of 2006–07 dollars)[a]				Change 2002–03 to 2032–33
	2002–03	2012–13	2022–23	2032–33	
Cardiovascular	2,481	3,142	4,562	7,083	185%
Respiratory	2,083	2,943	4,698	7,574	264%
Injuries	2,478	3,251	4,619	6,909	179%
Dental	201	255	339	449	124%
Mental	1,414	1,900	2,686	3,721	163%
Digestive	2,145	3,122	4,918	7,733	261%
Neurological	407	635	1,101	1,967	383%
Dementia	252	405	724	1,340	433%
Parkinson's disease	45	72	135	253	465%
Other neurological	111	157	242	374	237%
Sense disorders	693	1,029	1,770	3,010	334%
Musculoskeletal	1,185	1,723	2,726	4,102	246%
Genitourinary	1,694	2,357	3,593	5,547	227%
Cancer	2,210	3,387	5,302	6,791	207%
Endocrine, nutritional & metabolic	431	564	814	1,202	179%
Skin	477	699	1,119	1,840	285%
Maternal	1,586	1,800	2,366	2,971	87%
Infectious	529	723	1,086	1,641	210%
Diabetes	424	762	1,421	2,578	508%
Type 2 diabetes	340	655	1,286	2,427	613%
Neonatal	530	609	802	999	88%
Congenital	232	276	367	472	103%
Contact with health system etc.	4,724	6,501	9,868	14,837	214%
Total	**25,926**	**35,678**	**54,157**	**81,425**	**214%**

(a) Expenditure for all years is reported in 2006–07 dollars.

Source: AIHW Disease expenditure projection model.

Out-of-hospital medical services expenditure

Between 2003 and 2033, expenditure on out-of-hospital medical services is projected to increase by 483% for type 2 diabetes, 433% for dementia, 365% for Parkinson's disease and 228% for sense disorders (Table 10). Lower increases are projected for neonatal conditions, maternal conditions and injuries (74%, 76% and 86% respectively) (tables 10 and 13).

The cost of increases in out-of-hospital medical services expenditure over the period is projected to be greatest for respiratory disease—an increase of $1.9 billion, from $1.3 billion in 2003 to $3.2 billion in 2033, followed by cardiovascular disease ($1.3 billion to $3.0 billion) and injuries ($0.9 billion to $1.7 billion) (Table 10).

Table 10: Projected out-of-hospital medical expenditure by disease group, 2002–03 to 2032–33

	Expenditure (millions of 2006–07 dollars)[a]				Change 2002–03 to 2032–33
	2002–03	2012–13	2022–23	2032–33	
Cardiovascular	1,264	1,905	2,551	3,016	139%
Respiratory	1,314	1,693	2,335	3,179	142%
Injuries	899	1,071	1,331	1,673	86%
Dental	21	27	35	45	114%
Mental	694	921	1,254	1,727	149%
Digestive	525	726	1,050	1,510	187%
Neurological	78	112	174	287	270%
Dementia	29	47	82	153	433%
Parkinson's disease	10	15	27	46	365%
Other neurological	39	50	66	88	126%
Sense disorders	575	799	1,224	1,888	228%
Musculoskeletal	432	590	835	1,138	163%
Genitourinary	726	954	1,333	1,891	160%
Cancer	244	313	418	527	116%
Endocrine, nutritional & metabolic	506	648	878	1,173	132%
Skin	515	696	993	1,417	175%
Maternal	153	171	220	270	76%
Infectious	554	692	912	1,186	114%
Diabetes	334	611	1,086	1,842	451%
Type 2 diabetes	309	579	1,047	1,800	483%
Neonatal	20	22	28	34	74%
Congenital	27	32	43	55	104%
Contact with health system etc.	1,979	2,670	3,721	5,093	157%
Total	**10,859**	**14,652**	**20,421**	**27,952**	**157%**

(a) Expenditure for all years is reported in 2006–07 dollars.

Source: AIHW Disease expenditure projection model.

Pharmaceutical expenditure

Between 2003 and 2033, expenditure on pharmaceuticals is projected to increase by 473% for type 2 diabetes, 414% for other neurological conditions, 388% for Parkinson's disease and 297% for dementia (Table 11). Lower increases are projected for neonatal conditions, maternal conditions and cardiovascular disease (48%, 53% and 86% respectively) (tables 11 and 13).

The cost of increases in pharmaceutical expenditure over the period is projected to be greatest for cardiovascular disease—an increase of $2.4 billion from $2.8 billion in 2003 to $5.2 billion in 2033, followed by respiratory disease ($1.1 billion to $2.9 billion) and endocrine, nutritional & metabolic disorders ($1.0 billion to $2.3 billion) (Table 11).

Table 11: Projected pharmaceutical expenditure by disease group, 2002–03 to 2032–33

	Expenditure (millions of 2006–07 dollars)[a]				Change 2002–03 to 2032–33
	2002–03	2012–13	2022–23	2032–33	
Cardiovascular	2,785	3,807	4,597	5,182	86%
Respiratory	1,135	1,453	2,028	2,852	151%
Injuries	155	184	230	297	91%
Dental	11	14	18	23	108%
Mental	769	998	1,336	1,784	132%
Digestive	752	1,057	1,603	2,458	227%
Neurological	298	470	833	1,474	394%
Dementia	40	58	93	157	297%
Parkinson's disease	46	71	127	225	388%
Other neurological	213	341	613	1,092	414%
Sense disorders	242	347	575	984	307%
Musculoskeletal	406	639	1,050	1,491	267%
Genitourinary	267	354	493	702	163%
Cancer	252	354	558	867	244%
Endocrine, nutritional & metabolic	977	1,256	1,720	2,336	139%
Skin	187	245	343	497	166%
Maternal	3	3	4	5	53%
Infectious	250	311	405	530	112%
Diabetes	390	665	1,127	1,855	376%
Type 2 diabetes	293	538	968	1,679	473%
Neonatal	1	2	2	2	48%
Congenital	2	3	4	6	140%
Contact with health system etc.	1,980	2,710	3,772	5,201	163%
Total	**10,865**	**14,871**	**20,701**	**28,544**	**163%**

(a) Expenditure for all years is reported in 2006–07 dollars.

Source: AIHW Disease expenditure projection model.

Residential aged care

Between 2003 and 2033, health and high-care residential aged care expenditure overall is projected to increase by 189%, whereas the high-care portion of residential aged care is projected to increase by 295%. Residential aged care is dominated by dementia, which is projected to have a large increase due to the ageing of the population.

Expenditure on high-level residential aged care is projected to increase by 519% for type 2 diabetes, 457% for other neurological conditions, 408% for sense disorders and 363% for dementia. Lower increases are projected for congenital disorders and injuries (131% and 158% respectively) (tables 12 and 13).

The cost of increases over the period are projected to be greatest for dementia—an increase of $10.5 billion, from $2.9 billion in 2003 to $13.4 billion in 2033, followed by cardiovascular diseases ($1.3 billion to $3.6 billion) and musculoskeletal disorders ($0.7 billion to $2.7 billion) (Table 12).

Table 12: Projected residential aged care[a] expenditure by disease group, 2002–03 to 2032–33

	Expenditure (millions of 2006–07 dollars)[b]				Change 2002–03 to 2032–33
	2002–03	2012–13	2022–23	2032–33	
Cardiovascular	1,324	1,736	2,428	3,600	172%
Respiratory	164	243	386	640	291%
Injuries	154	204	275	397	158%
Dental	—	—	—	—	—
Mental	465	655	993	1,446	211%
Digestive	51	75	115	194	282%
Neurological	3,116	4,883	7,971	14,343	360%
Dementia	2,892	4,540	7,407	13,381	363%
Parkinson's disease	168	248	401	650	286%
Other neurological	56	95	163	312	457%
Sense disorders	37	61	101	189	408%
Musculoskeletal	666	1,015	1,614	2,706	307%
Genitourinary	22	30	44	71	230%
Cancer	29	42	63	96	234%
Endocrine, nutritional & metabolic	21	27	37	56	172%
Skin	19	29	45	75	293%
Maternal	—	—	—	—	—
Infectious	12	18	28	45	277%
Diabetes	70	125	228	431	519%
Type 2 diabetes	70	125	228	431	519%
Neonatal	—	—	—	—	—
Congenital	8	10	14	19	131%
Contact with health system etc.	1,372	2,039	3,196	5,417	295%
Total	**7,528**	**11,191**	**17,538**	**29,725**	**295%**

(a) Refers to high-level residential aged care only.

(b) Expenditure for all years is reported in 2006–07 dollars.

Source: AIHW Disease expenditure projection model.

In percentage terms, diabetes is the leading cause of the projected increase in expenditure in three of the four areas of health and residential aged care expenditure covered in this analysis, and it is the second highest contributor to the increase in pharmaceutical expenditure behind neurological disorders. The cost of diabetes is expected to increase by over six-fold in both the areas of admitted patient services (508% increase) and residential aged care (519%) between 2002–03 and 2032–33 (Table 13).

Diabetes, neurological and sense disorders were the top three leading causes of projected change in all areas of health and aged care expenditure (Table 13).

Table 13: Leading causes[(a)] of projected change in health and residential aged care expenditure, by area of expenditure and disease, 2002–03 to 2032–33

Rank	Disease	Change in admitted patient services expenditure	Disease	Change in out-of-hospital medical expenditure	Disease	Change in pharmaceutical expenditure	Disease	Change in residential aged care expenditure
1	Diabetes	508%	Diabetes	451%	Neurological	394%	Diabetes	519%
2	Neurological	383%	Neurological	270%	Diabetes	376%	Sense disorders	408%
3	Sense disorders	334%	Sense disorders	228%	Sense disorders	307%	Neurological	360%
4	Skin	285%	Digestive	187%	Musculoskeletal	267%	Musculoskeletal	307%
5	Respiratory	264%	Skin	175%	Cancer	244%	Skin	293%
6	Digestive	261%	Musculoskeletal	163%	Digestive	227%	Respiratory	291%
7	Musculoskeletal	246%	Genitourinary	160%	Skin	166%	Digestive	282%
8	Genitourinary	227%	Mental	149%	Genitourinary	163%	Infectious	277%
9	Infectious	210%	Respiratory	142%	Respiratory	151%	Cancer	234%
10	Cancer	207%	Cardiovascular	139%	Congenital	140%	Genitourinary	230%

(a) Excludes 'Signs, symptoms and ill-defined conditions' and 'Other contact with the health system'.

Source: AIHW Disease expenditure projection model.

Sensitivity analysis

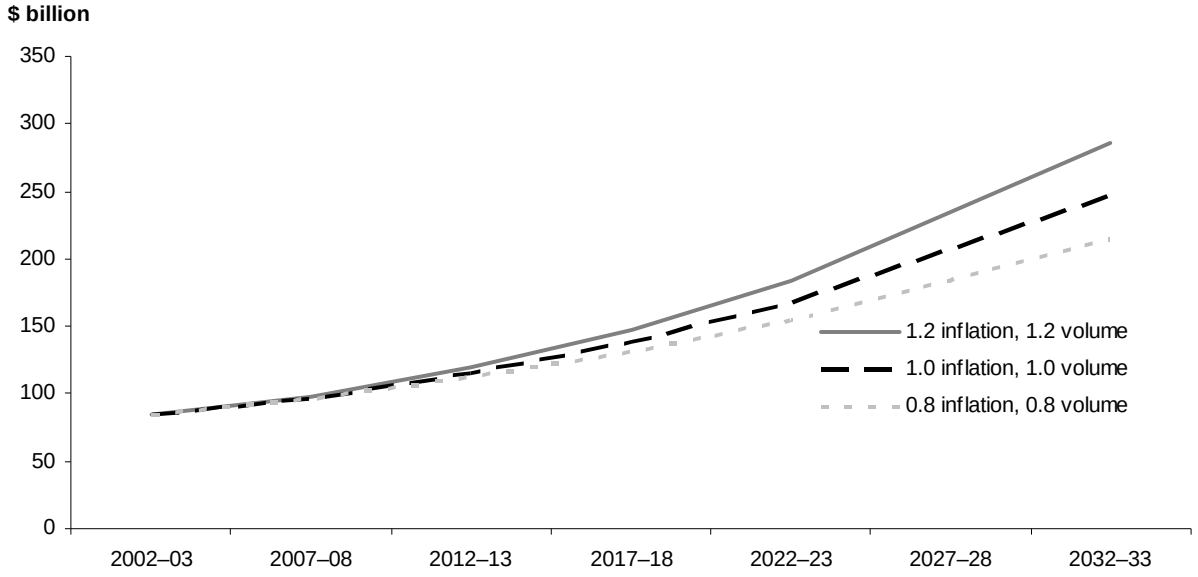
To gain some insight into the levels of uncertainty around two variables—volume of services per treated case and excess health price inflation—low, medium and high assumptions were used for each variable. The medium assumption refers to the central assumptions used in the model. Under the low assumption scenario, both the estimated volume of services per treated case and excess health price inflation were reduced by 20%, and under the high assumption scenario, both variables were assumed to be 20% greater.

The central assumptions project that total expenditure on health and residential aged care expenditure will increase from $85 billion in 2002–03 to $246 billion in 2032–33 (Table 8; Figure 17). Sensitivity analysis shows that the low assumptions for the volume per case and excess health price inflation variables project an increase from $85 billion in 2002–03 to $214 billion in 2032–33 (Table 14; Figure 17). The high assumptions project an increase to $286 billion. In other words, the uncertainty around the central estimate of $246 billion is around plus or minus 15%.

Table 14: Projections of health and residential aged care under different assumptions, 2002–03 to 2032–33, ($ billion in 2006–07 dollars)

	2002–03	2007–08	2012–13	2017–18	2022–23	2027–28	2032–33
Low assumption	85	96	112	131	154	184	214
Medium assumption	85	96	115	139	168	207	246
High assumption	85	97	120	147	183	235	286

Source: AIHW Disease expenditure projection model.



Source: AIHW Disease expenditure projection model.

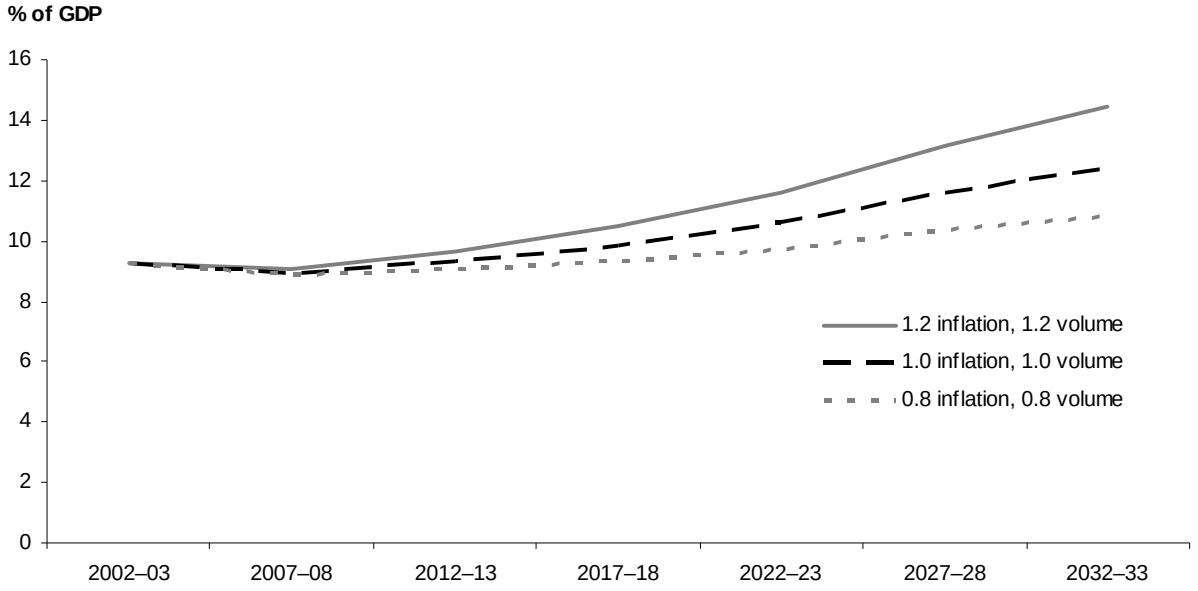
Figure 17: Projections of health and residential aged care expenditure under different assumptions, 2002–03 to 2032–33, ($ billion in 2006–07 dollars)

For projections of health and residential aged care expenditure as a proportion of GDP, the central assumptions project an increase from 9.3% in 2002–03 to 12.4% in 2032–33 (Table 7; Figure 18). Sensitivity analysis shows that the low assumptions for the volume per case and excess health price inflation variables project an increase from 9.3% in 2002–03 to 10.8% billion in 2032–33 (Table 15; Figure 18). The high assumptions project an increase to 14.4%. In other words, the uncertainty around the central estimate of 12.4% is around plus or minus 15%.

Table 15: Projections of health and aged care expenditure as per cent of GDP under different assumptions, 2002–03 to 2032–33

	2002–03	2007–08	2012–13	2017–18	2022–23	2027–28	2032–33
Low assumption	9.3	8.9	9.0	9.3	9.7	10.3	10.8
Medium assumption	9.3	9.0	9.4	9.9	10.6	11.6	12.4
High assumption	9.3	9.0	9.7	10.5	11.6	13.2	14.4

Source: AIHW Disease expenditure projection model.



Source: AIHW Disease expenditure projection model.

Figure 18: Projections of health and aged care expenditure as per cent of GDP under different assumptions, 2002–03 to 2032–33

4 Discussion

The AIHW projection model uses total health and aged care expenditure data and factors in the conclusions from a careful analysis of past trends in disease rates and shifts in health and residential aged care expenditure,. There is no inevitability about these scenarios. In most cases, the changes into the future have been estimated according to what has happened with a particular disease in the past. However, the future does not necessarily repeat the past. For instance, developments in health technologies and health service utilisation may drastically alter the outlook for some diseases. Advances in prevention and treatment, similar to those that precipitated the decline in cardiovascular disease rates over the last three decades may become possible in other disease areas and alter our patterns of health expenditure. Nevertheless, it is important for government to anticipate changes in health and residential aged care expenditure, as the cost of health care is rising faster than other sectors of the economy and is expected to continue for quite a while as the population ages.

A rich database of cost estimates has been generated by area of expenditure, disease, age and sex. This amount of detail is useful to government planning to resource health services in the future, as it indicates which parts of the health system, and for which specialty areas, expenditure is likely to grow most. As the factors driving the expenditures for each disease are different, the data can be used to inform policies for each disease that can be tailored to ensure appropriate levels of expenditure. The database is also a valuable resource for health economists who want to model the cost-effectiveness of health interventions, particularly preventive interventions. An important element in such studies is to estimate the cost of treating disease in scenarios with and without a preventive intervention in place.

Demographic factors

Demographic factors used in the projections model are changes in the age structure of the population (population ageing) and overall population increase. The ABS 'Series 8' population projection based on the 2001 census (ABS, 2003) is used in this modelling.

There is some uncertainty around the assumed changes in fertility, migration and mortality which drive the ABS population projections, but the impact on health expenditure growth of the uncertainties on the demographic side in the next 30 years are less significant than the uncertainties in non-demographic factors. For health expenditure projections in particular, it is mostly the uncertainty in the mortality assumption which is of relevance, particularly for the next 20 years. Changes in migration have most of their impact on health expenditure when migrants start to age, and changes in fertility have an impact on maternal health costs initially, but then do not have any significant impact on health costs for decades. The demographic factors used in the model contribute 44% of the projected increase in health care costs.

Population ageing (i.e. the change in the age structure of the population) accounts for almost a quarter of the growth in expenditure. For some diseases, population ageing accounts for around half or more of the growth in expenditure (for example neurological disorders, sense disorders and cardiovascular treatment) (derived from Table 4).

Much of the impact of ageing comes from a large increase in expenditure for long-term aged care services. For mental health services, ageing will have little impact, and in fact from 2013 to 2033 ageing will tend to reduce expenditure for mental illness. This is because mental disorders are most prevalent among young and middle aged adults and less so in the elderly.

Overall population growth accounts for around one fifth of the expected growth in expenditure, with considerable variation from disease to disease. The population projections used project a relatively high population growth of 34% in the next 30 years. (The population growth in the 18 available ABS population projection scenarios for this period vary from 17% to 38%). These population growth rates are generally higher than that projected for the USA (24% over the next 30 years) and are in contrast to a population decline in Europe (5% over the next 30 years). Therefore, Australian population growth will drive health and aged care expenditure growth to a greater extent than in most other countries.

Non-demographic factors

Changes in treatment and prevention practices include:

1. an increase in the proportion of population with disease who are treated
2. changes in the pattern of treatment with a shift in emphasis from hospital to out-of-hospital medical and pharmaceutical services
3. changes in the pattern of services delivery, especially the provision of more services to older people, who are increasingly receiving similar levels of health services as the middle aged with similar diseases
4. changes in technology such as new drugs, new procedures and application of old drugs in new ways, and
5. changes in prices paid for health industry inputs.

The change in treatment practices is reflected in the projection model in the assumptions about the increase in intensity of care (volume per case) and excess health price inflation.

The projected increases in expenditure vary significantly for each disease area. For example, maternal conditions expenditure is projected to grow by 84%, congenital diseases by 104%, cancer by 190%, cardiovascular by 142%, dementia by 364% and diabetes by 436% (Table 3). These different growths have implications for health services planning, especially workforce planning. For example, to increase the supply of obstetricians at the same rate as the supply of geriatricians and endocrinologists would be unwise.

Comparisons with other projection models

The non-demographic factors used by the Treasury in its second Intergenerational Report (IGR2) (2007) and the Productivity Commission (2005) in their modelling are less detailed than those used in this model. This report's estimates are a summation of estimates made of excess health price inflation, volume per case, increased treatment proportion and disease rate increases. In contrast, the Treasury's non-demographic growth rates are derived from trends in the historical data. The latest IGR also models hospital expenditure due to proximity to death. The Productivity Commission non-demographic factors estimate the

impact of technology and demand on per capita costs for each area of expenditure and data on estimated hospital costs in the last year of life.

Treasury estimates

The Treasury estimates cover the period from 2006–07 to 2046–47 and cover only health expenditure funded by the Australian Government. Health expenditure includes data from the MBS, PBS and RPBS, public hospital funding data, the private health insurance rebate and some other health spending such as for population health and safety programs, health workforce programs, health and medical research and spending on veterans where this is additional to that spent on other Australians.

Productivity Commission estimates

The Productivity Commission estimates cover the period from 2002–03 to 2044–45 and project for health expenditure funded by the Australian Government and state and territory governments. Health expenditure data include Australian government funding of the AHCAs, MBS, PBS, RPBS and the private health insurance rebate, and state and territory government funding of hospitals, community and public health, dental services, aids and appliances, research and administration.

Results from the different models

Because of the differences in projection periods and types of expenditure covered, the projections developed from these three models are not directly comparable. We can achieve some comparability, however, by restricting the analysis to the projections of health and aged care expenditure funded only by the Australian Government and by estimating what the projected expenditure from the Productivity Commission and the Treasury models would be for the specific years used by the AIHW in its model.

For each model, this analysis estimated the health to GDP ratios from the available published time periods by interpolation, e.g. for the Treasury model the ratios for 2006–07 and 2011–12 were used to calculate what the ratios would be at the AIHW time periods, for example for 2007–08.

A comparison of the ratio of Australian Government health expenditure to GDP projections for the period 2008 to 2033 showed that, in 2008, the ratio projected for the AIHW was 4.5%, the Productivity Commission was 4.3% and the Treasury was 4.4%. By 2033, the projected health to GDP ratios (expenditure by the Australian Government only) were 6.3%, 6.7% and 7.0% respectively (Table 16; Figure 19).

The growth rates (calculated from data in Table 16) show that for the period 2008 to 2033 the AIHW projected the smallest increase in the Australian Government health expenditure to GDP ratio (40.8%), compared to 54.2% projected by the Productivity Commission (2005) and the largest growth (57.2%) projected by the Treasury in its IGR2 (2007).

Somewhat different demographic assumptions account for some of the difference, but the non-demographic growth factors are the main explanation for the differences. The AIHW annual average growth for the non-demographic factors is 2.0% which is somewhat lower than those of the Treasury (2.2% for the whole period 2007 to 2047) and the Productivity Commission (2.1% for the period 2003 to 2033). (This estimate of the Treasury non-demographic factor is calculated by the AIHW from Table 2.2, Table A3 and p.51 of Treasury

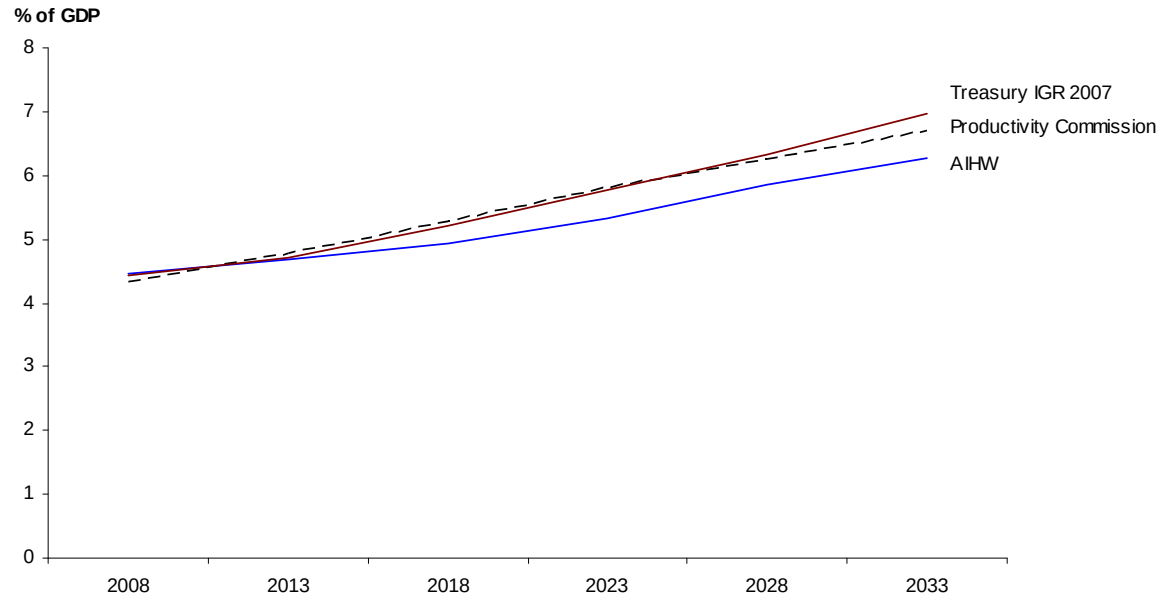
2007. The estimate of the non-demographic factor for the Productivity Commission projections is from Figure 6.11 and Table 5.1 of Productivity Commission 2005). The inclusion of disease trends in the AIHW model is only a partial explanation for the differences, as changes in disease rates account for only 1.5% of expenditure growth. It is the estimates of increases in volume of services per case of disease that explains much of the difference in expenditure projections. The non-demographic growth factor in the UN report (Vos et al. 2007) was 1.2% per year.

Although there are differences in the central assumption results for the three projections, all three models give results that are within the bounds of the sensitivity analysis (p. 33-35). So, the sensitivity results from p.33 applied to the AIHW Australian Government funding numbers give a range of 5.5% of GDP to 7.3% of GDP for 2032–33. The 7.3% is greater than the Treasury estimate of 7.0% (Table 16). Similarly, if the Treasury sensitivity analyses are applied to the Treasury numbers (Table B2 of Treasury 2007 indicates a variation in health and aged care expenditure in 2046–47 of -13% and +11%), the variation for 2032–33 is from 6.1% of GDP to the base assumption of 7.0% of GDP (Table 16) to an upper estimate of 7.8% of GDP. This overlaps the AIHW central estimate of 6.3% of GDP (Table 16).

Table 16: Projections of Australian Government health and aged care expenditure as a proportion of GDP by AIHW, the Productivity Commission and the Treasury, 2007–08 to 2032–33 (per cent)

	2007–08	2012–13	2017–18	2022–23	2027–28	2032–33	Ratio of 2032–33 to 2007–08
AIHW	4.5	4.7	4.9	5.3	5.8	6.3	1.41
Productivity Commission	4.3	4.8	5.3	5.8	6.3	6.7	1.54
Treasury	4.4	4.7	5.2	5.8	6.3	7.0	1.57

Sources: Calculated by the AIHW from Table 6.2 (Productivity Commission 2005) and Appendix Table A1 (Treasury 2007).



Source: Table 16.

Figure 19: Projections of Australian Government health and aged care expenditure as a proportion of GDP by AIHW, the Productivity Commission and the Treasury, 2002–03 to 2032–33

Appendix A: Principal data sources for disease incidence and prevalence estimates

Table A1: Principal data sources for epidemiological modelling

Principal data source	Prevalence/ Incidence	Reference Period		Disease and injury categories
A. Disease registers, surveillance and notification systems				
National Notifiable Diseases Surveillance System: includes Notifications; and Reports: Annual report & Communicable Diseases Intelligence	Incidence	2003	A1	Tuberculosis
	Incidence	2003	A2a	Syphilis
	Incidence	2003	A2b	Chlamydia
	Incidence	2003	A2c	Gonorrhoea
	Incidence	2003	A5a	Diptheria
	Incidence	2000–03	A5b	Pertussis
	Incidence	2003	A5c	Tetanus
	Incidence	2003	A5d	Poliomyelitis
	Incidence	2003	A5e	Measles
	Incidence	2003	A5f	Rubella
	Incidence	2003	A5g	Haemophilus influenza type B
	Incidence	1993–96	A5g	Hib B sequela
	Incidence	2003	A8	Arbovirus infections
	Incidence	2003	A9a	Hepatitis A
	Incidence	2003	A9b	Hepatitis B
	Incidence	2003	A10	Malaria
HIV/AIDS National Registry	Incidence	2003	A3	HIV/AIDS
National Perinatal Data Collection	Incidence	2003	D2	Low birth weight
VIC Perinatal Data Collection Unit	Incidence	2001–02	D2	Low birth weight
QLD Perinatal Data Collection	Incidence	2002	D2	Low birth weight
National Cancer Statistics Clearinghouse	Incidence	2001	F	Malignant neoplasms
State and Territory cancer registries	Incidence	1997	F12	Breast cancer
Breast Screen Australia	Incidence	2001–02,1997	F12	Breast cancer
National Diabetes Register	Incidence	2001	H	Diabetes mellitus
Australian and New Zealand Register of Dialysis and Transplant Patients	Incidence	2002	H	Diabetes mellitus sequela
	Incidence	2002	O1	Nephritis and nephrosis
Victorian Cystic Fibrosis Screening program	Incidence	1989–1998	I2	Cystic Fibrosis
ABS Causes of death dataset	Incidence	2003	K5	Motor Neurone disease
	Incidence	2003	R1	Anencephaly
WA Intellectual Disability Exploring Answers	Incidence	1983–1996	K9	Intellectual disability
Victorian Perinatal Data Collection Unit Birth Defects Register	Incidence	2001–02	R2	Spina Bifida
	Incidence	2001–02	R5	Digestive system malformation
	Incidence	2001–02	R6a	Renal Agenesis

(continued)

Table A1 (continued): Principal data sources for epidemiological modelling

Principal data source	Prevalence/ Incidence	Reference Period		Disease and injury categories
Congenital malformations, Australia	Incidence	2001–02	K9	Intellectual disability
	Incidence	1997	R3	Congenital heart disease
	Incidence	1997	R5	Digestive system malformation
	Incidence	1997	R6b	Other urogenital tract malformations
	Incidence	2001	R7	Abdominal wall defect
Western Australian Birth Defects Registry	Incidence	2003	R6b	Other urogenital tract malformations
B. Health service utilisation data				
National Hospital Morbidity Database (diagnoses or procedures)	Incidence	2002–03	A2b	Chlamydia sequale
	Incidence		A2c	Gonorrhoea sequale
	Incidence		A4	Diarrhoea
	Incidence		A5e	Measles sequela
	Incidence		A6	Meningitis
	Incidence		A7	Septicaemia
	Incidence		A8c	Dengue fever sequela
	Incidence		A9a	Hepatitis A
	Incidence		A9c	Hepatitis B sequela (D)[(a)]
	Incidence		A9c	Hepatitis C sequela (D)
	Incidence		C1	Maternal haemorrhage (P)[(b)]
	Incidence		C3	Hypertension in pregnancy (P)
	Incidence		C4	Obstructed labour (P)
	Incidence		C5	Abortion (P)
	Incidence		C6	Other maternal conditions (P)
	Incidence		D1	Birth trauma & asphyxia
	Incidence		D3	Neonatal infections
	Incidence		G	Benign neoplasms (P)
	Incidence		H	Diabetes sequela (P)
	Incidence		I1a	Haemolytic anaemia
	Prevalence		I1b	Other non-deficiency anaemia
	Incidence		K8b	Cataract related blindness (P)
	Incidence		L2	Ischaemic heart disease – AMI
	Incidence		L3	Stroke
	Incidence		L7	Aortic aneurysm
	Prevalence		L8	Peripheral vascular disease (P)
	Incidence		L8	Peripheral vascular disease sequela
	Prevalence		N2	Cirrhosis of the liver (D)
	Incidence		N3	Appendicitis (P)
	Incidence		N4	Intestinal obstruction (P)
	Incidence		N5	Diverticulitis (P)
	Incidence		N6	Gall bladder and bile duct disease (P)
	Incidence		N7	Pancreatitis
	Incidence		N8	Inflammatory bowel disease (P)
	Incidence		N9	Vascular insufficiency of intestine (P)
	Incidence		O2	Benign prostatic hypertrophy (P)
	Incidence		Ooth	Other genitourinary diseases (P)
	Incidence		Q4	Slipped disc (P)

(continued)

Table A1 (continued): Principal data sources for epidemiological modelling

Principal data source	Prevalence/ Incidence	Reference Period		Disease and injury categories
National Hospital Morbidity Database (diagnoses or procedures) cont.	Incidence		R3	Congenital heart disease (P)
	Incidence		R4	Cleft lip and or palate (P)
	Incidence		T	Unintentional injuries
	Incidence		U	Intentional injuries
Bettering the Evaluation And Care of Health	Incidence	2000–01	B1	Lower respiratory tract infections
	Incidence	2000–01	B2	Upper respiratory tract infections
	Incidence	2000–01	B3	Otitis media
	Incidence	2000–01	N1	Peptic ulcer disease
	Incidence	2003–04	P4	Skin ulcers
Alcohol and Other Drug Treatment Services National Minimum Data Set	Prevalence	2002–03	J1c	Stimulant dependence
WA Data Linkage System	Incidence	1990–2003	L1	Heart Failure
	Incidence	1990–2003	L2	Ischaemic heart disease
	Incidence	1990–2003	L3	Stroke
Victorian Linked Admitted Episodes Database	Incidence	1996–2002	L	Heart failure
	Incidence	1996–2002	N9	Vascular insufficiency of intestine
C. Population health surveys				
2001-02 National Gastroenteritis Survey	Incidence	2001–02	A4	Diarrhoea
1980 National Trachoma and Eye Health Program	Prevalence	1976–78	A11	Trachoma sequela
	Incidence		B3	Otitis media
National Health Survey	Incidence	1995	B2	Upper respiratory tract infections
	Incidence	2001	B3	Otitis media
	Prevalence	2001	K10	Migraine
	Prevalence	2001	P1	Eczema
	Prevalence	2001	Poth	Other skin diseases
	Prevalence	1995	Q3	Chronic back pain (U)[(d)]
	Incidence	2001	Q7	Gout
	Prev. & Inc.	2001	Qoth	Other musculoskeletal disorders
	Prev. & Inc.	1995	Qoth	Other musculoskeletal disorders
Australian Diabetes, Obesity and Lifestyle Study (AusDiab)	Incidence	1999–2000	E2	Deficiency anaemia
	Prevalence	1999–2000	H	Diabetes mellitus
Risk Factor Prevalence Study, 1989	Incidence	1989	E2	Deficiency anaemia
2002 National non-melanoma skin cancer survey	Incidence	2002	F11	Non-melanoma skin cancer
National Mental Health and Well-being Survey, 1997 - adult component, Low prevalence (psychotic) disorders component & child and adolescent component	Prevalence	1997	J1a	Alcohol dependence
	Prevalence	1997	J1c	Benzodiazepine dependence
	Prevalence	1997	J1d	Cannabis dependence
	Prevalence	1997	J2	Psychotic disorders
	Prevalence	1997	J3	Anxiety and depression
	Prevalence	1997	J4	Bipolar disorder
	Prevalence	1997	J5	Personality disorders (isolated)
	Prevalence	1997	J7a	ADHD
Australian Child to Adult Development Study	Incidence	1990–96	K9	Intellectual disability
Australian Longitudinal Study on Women's Health[(d)]	Prevalence	1996–2002	O3	Urinary incontinence
	Prevalence	1996–2002	Ooth	Menstrual problems

(continued)

Table A1 (continued): Principal data sources for epidemiological modelling

Principal data source	Prevalence/ Incidence	Reference Period		Disease and injury categories
Survey of Disability, Ageing and Carers	Prevalence	1998	O3	Urinary incontinence
	Prevalence	2003	Q3	Chronic back pain
	Prevalence	2003	Q5	Occupational overuse syndrome
	Prevalence	1993	Qoth	Other musculoskeletal disorders
Child Dental Health Survey, Australia	Incidence	2000	S1	Dental caries
National Oral Health Survey of Australia	Prevalence	1987–88	S1	Dental caries
	Prevalence	1987–88	S2	Periodontal disease
South Australian Dental Longitudinal Study	Incidence	1991–1996	S1	Dental caries
The Adelaide Dental Study of Nursing Homes	Incidence	1998–1999	S1	Dental caries
	Prevalence	1998	S3	Edentulism
The Longitudinal Study of Dentists' Practice Activity	Incidence	1998–99	S4	Pulpal infection
National Dental Telephone Interview Survey	Prevalence	2002	S3	Edentulism
	Incidence	2002	S4	Pulpal infection
D. Epidemiological studies				
GBD study	Incidence		A2	STDs (apart from HIV/AIDS)
	Incidence		A5b	Pertussis sequela
	Incidence		A10	Malaria – sequela
	Incidence		B3	Otitis media – sequela
	Incidence		C2	Maternal sepsis – sequela
	Incidence		C3	Hypertensive disorders in pregnancy – sequela
Australian epidemiological studies	Incidence		A6	Meningitis sequela
	Prevalence		A9b	Hepatitis B
	Prevalence		A9c	Hepatitis C sequela
	Incidence		D4	Other neonatal causes
	Prevalence		E2	Deficiency anaemia
	Incidence		H	Diabetes Mellitus sequela
	Prevalence		I3	Haemophilia
	Prevalence		J1b	Heroin dependence
	Prevalence		J6b	Anorexia
	Incidence		J7b	Autism and Asperger's syndrome
	Prevalence		K4	Multiple sclerosis
	Incidence		K6	Huntington's disease
	Incidence		K7	Muscular dystrophy
	Prevalence		K8	Sense organ disorders
	Incidence		K9	Intellectual disability
	Prevalence		L3	Stroke
	Prevalence		M1	Chronic obstructive pulmonary disease
	Prevalence		M2	Asthma
	Prevalence		N2	Cirrhosis of the liver
	Prevalence		O4	Infertility
	Prevalence		P1	Eczema
	Prevalence		Poth	Other skin diseases

(continued)

Table A1 (continued): Principal data sources for epidemiological modelling

Principal data source	Prevalence/ Incidence	Reference Period		Disease and injury categories
International epidemiological studies	Incidence		A2b	Chlamydia sequela (i.e. child wish)
	Prevalence		A9b	Hepatitis B sequela
	Incidence		A9c	Hepatitis C sequela
	Incidence		D1	Birth trauma & asphyxia – sequela
	Incidence		D2	Low birth weight – sequela
	Incidence		J6a	Bulimia
	Incidence		K2	Epilepsy
	Incidence		K10	Migraine
	Prevalence		M2	Asthma
	Incidence		N8	Inflammatory bowel disease
	Prevalence		O3	Urinary incontinence
	Incidence		Q1	Rheumatoid arthritis
	Incidence		Q2	Osteoarthritis
	Incidence		Q4	Slipped disc
	Prevalence		Z2	Chronic fatigue syndrome
Meta-analyses of epidemiological studies	Prevalence		K1	Dementia
	Prevalence		K3	Parkinson's disease

Notes

(a) (D) refers to distributions which are used to estimate incidence to underlying causes.

(b) (P) refers to hospital data on procedures—may or may not be in addition to information on principal diagnosis.

(c) Proportion by underlying cause or type of problem (recent vs. long-term).

(d) The research on which this report is based was conducted as part of the Australian Longitudinal Study on Women's Health, The University of Newcastle and The University of Queensland. We are grateful to the Australian Government Department of Health and Ageing for funding and to the women who provided the survey data.

Source: Begg et al. 2007.

Appendix B: Change in age-standardised incidence rates by disease from reference year 2003, 1994–2031

Table B1: Change in age-standardised incidence rates (per 1,000 population) by disease from reference year 2003, 1994 to 2031

Cause	Reference year (2003)	% change from reference year			
		1994	2013	2023	2033
Communicable diseases, maternal and neonatal conditions					
Infectious and parasitic diseases					
Tuberculosis	—	–0.4	0.5	0.7	0.8
Sexually transmitted diseases (excluding HIV/AIDS)					
Syphilis	0.1	0.1	0.1	0.2	0.4
Chlamydia	2.0	0.1	0.1	0.2	0.3
Gonorrhoea	0.3	0.2	—	0.2	0.4
HIV/AIDS	—	0.5	0.1	0.4	0.7
Diarrhoeal diseases	878.1	—	—	–0.1	–0.1
Childhood immunisable diseases					
Diphtheria	—	—	—	—	—
Whooping cough	0.4	–0.1	—	—	–0.1
Tetanus	—	–3.4	5.7	10.6	14.2
Poliomyelitis	—	—	—	—	—
Measles	—	—	—	—	—
Rubella	—	–0.1	—	0.1	0.1
Haemophilus influenzae type b (Hib)	—	–0.4	0.2	0.1	—
Meningitis	0.1	–0.1	0.1	0.1	0.1
Septicaemia	1.0	–0.7	0.6	1.0	1.2
Arbovirus infection					
Ross River virus	0.4	–0.1	—	—	–0.1
Barmah Forest virus	0.1	–0.1	0.1	0.1	0.1
Dengue	—	—	—	0.1	0.1
Hepatitis					
Hepatitis A	0.1	–0.1	0.1	0.2	0.3
Malaria	—	0.1	—	0.1	0.2
Trachoma	—	—	—	—	—
Acute respiratory infections					
Lower respiratory tract infections	103.0	–0.1	0.1	0.2	0.2
Upper respiratory tract infections	1,319.7	—	—	—	—
Otitis media	59.1	—	—	0.1	—
Maternal conditions					
Maternal haemorrhage	2.2	—	—	—	—
Maternal sepsis	0.7	—	—	—	—
Hypertensive disorders of pregnancy	3.3	—	—	—	—
Obstructed labour	1.1	—	—	—	—

(continued)

Table B1 (continued): Change in age-standardised incidence rates (per 1,000 population) by disease from reference year 2003, 1994 to 2031

Cause	Reference year (2003)	% change from reference year			
		1994	2013	2023	2033
Neonatal causes					
Birth trauma and asphyxia	—	—	—	—	—
Low birth weight	0.1	—	—	—	—
Neonatal infections	0.5	—	—	—	—
Nutritional deficiencies					
Deficiency anaemia	47.3	–0.5	—	–0.1	–0.3
Non-communicable diseases					
Malignant neoplasms					
Mouth and oropharynx cancers	0.1	7.9	–12.5	–25.0	–37.5
Oesophagus cancer	0.1	3.2	–9.4	–19.5	–30.8
Stomach cancer	0.1	44.5	–27.5	–50.9	–67.7
Colorectal cancer	0.7	21.2	–19.0	–37.1	–52.8
Gallbladder cancer	—	31.1	–22.4	–42.5	–58.6
Pancreas cancer	0.1	4.1	–8.9	–19.3	–30.8
Lung cancer	0.4	11.8	–13.0	–25.1	–36.4
Bone and connective tissue cancer	—	8.1	–11.4	–23.0	–34.7
Melanoma	0.5	3.5	–8.9	–17.8	–26.8
Non-melanoma skin cancers	19.2	7.0	–13.0	–25.6	–38.4
Breast cancer	0.6	18.6	–19.5	–37.7	–53.6
Cervix cancer	—	44.5	–34.3	–57.3	–72.2
Corpus uteri cancer	0.1	15.2	–10.6	–20.8	–28.7
Ovary cancer	0.1	11.1	–14.6	–27.5	–39.2
Prostate cancer	0.6	9.3	–10.5	–24.4	–38.9
Testicular cancer	—	19.0	–4.0	–14.6	–24.1
Bladder cancer	0.2	17.3	–15.8	–31.5	–45.9
Kidney cancer	0.1	7.5	–11.3	–22.7	–34.3
Brain cancer	0.1	2.1	–7.6	–16.1	–25.7
Thyroid cancer	0.1	10.6	–13.8	–26.7	–38.7
Lymphoma	0.2	7.9	–10.2	–20.9	–31.7
Multiple myeloma	0.1	2.1	–8.2	–16.6	–26.3
Leukaemia	0.1	10.8	–13.7	–26.7	–39.4
Larynx cancer	—	5.8	–11.5	–23.6	–36.2
Eye cancer	—	6.8	–12.1	–23.8	–35.2
Other neoplasms					
Uterine myomas	1.9	—	—	—	—
Benign neoplasms of meninges and brain	0.1	0.1	–0.1	–0.1	–0.3
Cardiovascular disease					
Rheumatic heart disease	0.1	41.1	–25.1	–47.1	–63.6
Ischaemic heart disease	1.9	44.4	–22.6	–37.2	–45.7
Stroke	1.0	32.7	–17.9	–31.4	–40.2
Inflammatory heart disease	0.2	19.3	–13.7	–25.1	–33.8
Hypertensive heart disease	—	24.2	–14.9	–27.8	–37.3
Non-rheumatic valvular disease	0.2	–0.3	0.3	0.6	0.7
Congenital anomalies					
Anencephaly	—	–0.1	–0.1	–0.1	–0.1
Spina bifida	—	—	—	—	—

(*continued*)

Table B1 (continued): Change in age-standardised incidence rates (per 1,000 population) by disease from reference year 2003, 1994 to 2031

Cause	Reference year (2003)	% change from reference year			
		1994	2013	2023	2033
Congenital anomalies (continued)					
Congenital heart disease	0.1	—	—	—	—
Cleft lip and/or palate	—	—	—	—	—
Digestive system malformations					
Anorectal atresia	—	—	—	—	—
Oesophageal atresia	—	—	—	—	—
Urogenital tract malformations					
Abdominal wall defect	—	—	—	—	—
Down syndrome	—	—	—	—	—
Injuries					
Unintentional injuries					
Road traffic accidents	1.3	47.3	–24.0	–45.9	–60.1
Other transport accidents	0.8	0.1	0.1	0.2	0.3
Poisoning	0.6	—	—	—	—
Falls	6.3	28.4	–13.2	–26.0	–36.0
Fires, burns and scalds	0.3	0.1	—	0.1	0.1
Drowning	—	0.6	–0.1	–0.1	0.1
Sports injuries	0.5	0.2	—	—	0.1
Natural and environmental factors	0.4	0.1	—	0.1	0.1
Machinery accidents	0.5	0.1	0.1	0.4	0.7
Other unintentional injuries	2.7	0.2	—	0.1	0.2
Intentional injuries					
Suicide and self-inflicted injuries	1.2	9.0	–8.1	–18.8	–29.2
Homicide and violence	0.9	15.1	–9.0	–20.6	–30.7
Legal intervention and war	—	0.3	0.3	0.7	1.0

Note: Age-standardised to the Australian June 2001 population.

Source: Begg et al. 2007.

Appendix C: Methods

This section provides more detailed information on the projection methods for incident and prevalent cases and health care costs per case.

Population projections

Australian Bureau of Statistics (ABS) 'Series 8' population projections based on the 2001 census (ABS 2003) were used. These assume high net overseas migration of 125,000 annually; constant improvements in life expectancy (low mortality assumption); and total fertility rate declining to 1.6 by 2011 and then remaining constant.

Projections of incident and prevalent cases of disease and injury

Disease models based on recent epidemiological data were available from the Australian Burden of Disease and Injury Study for the year 2003 (Begg et al. 2007). Appendix A lists the input parameters and their data sources. Full details on methods are available in that report.

For the disease specific parameters, internally consistent disease models were first developed based on the best available data in the year 2003, and then trend data was applied to incidence and case fatality rate assumptions to estimate incidence and prevalence for the period 1994 to 2033.

Baseline models for 2003

DisMod2 software was used to derive a consistent set of epidemiological parameters for each disease. With population counts and all-cause mortality rates in the background, DisMod2 allows derivation of unknown disease parameters as long as three out of five are defined. The five parameters are incidence, prevalence, remission (i.e. cure), average duration and excess mortality (either entered as a population mortality rate, a case fatality rate or a relative risk of mortality). The calculated output values for incidence, remission and case fatality from the 2003 models were then used as inputs to disease models in future years.

Mortality trends and projections

The model extrapolated into the future observed all-cause mortality rates for the period 1979 to 2003 using simple log-linear Poisson regression and projected population figures. It then collapsed cause-specific mortality data for the same period into 51 clinically meaningful conditions, or groups of conditions. Multinomial logistic regression was used to model changes in the contribution of each group as a proportion of all cause mortality with changes in absolute levels of all-cause mortality expressed as rates per unit of population. These models were used to predict the future cause-specific structure of mortality, based on the projected all-cause mortality rates. Separate analyses were done for each age group (0,5,10…85) and sex.

Projected incidence and prevalence

The observed trends in cause-specific mortality rates can be due to a change in incidence and/or a change in case-fatality. Among the causes analysed, cardiovascular diseases, cancers, diabetes, alcohol-related conditions, road traffic accidents, falls, suicide and homicide showed significant mortality trends. The apparent trend in dementia mortality was ignored because: (a) there has been a shift in coding practices with more deaths being attributed to dementia; (b) prevalence data from international epidemiological studies show no clear change over time; (c) the case fatality is unlikely to have changed much over time as there are no effective life-saving interventions.

Mortality trends for cancers, diabetes, alcohol-related conditions, road traffic accidents, falls, suicide and homicide were assumed to be fully due to changes in incidence. Incidence trends for these causes were therefore adjusted to reflect changes in mortality over the projection period, with case-fatality being held constant. Findings from Unal et al. (2005) suggest that 58% of the drop in cardiovascular mortality observed in England and Wales was due to a drop in incidence, and the remaining 42% due to a reduction in case fatality. The same proportions were assumed to apply in this study to all cardiovascular diseases over the projection period.

Changes in the diagnostic criteria for type 2 diabetes in surveys, and a paucity of representative survey data, meant that there was no direct measurement of trends of type 2 diabetes in Australia from which to project the incidence of this disease. Body mass index (BMI, defined as body weight in kilograms divided by the square of a person's height in meters), overwhelmingly the main risk factor for type 2 diabetes, however, has been measured consistently at various points over recent time. The approach taken in this study, therefore, was to translate historical trends in BMI into expected changes in diabetes incidence following the risk attribution methods described in the WHO Comparative Risk Assessment Project (WHO, 2002).

Haby et al. (2006) analysed trends in BMI using data from five measurement surveys: the three National Heart Foundation Risk Factor Prevalence studies in the 1980s; the National Nutrition Survey of 1995; and the AusDiab study of 1999–2000. Projected mean BMI by age group and sex was derived from Haby et al.'s regression model of the mean of log-transformed BMI values on age, birth cohort and sex. Similar techniques were applied to the standard deviations of BMI values so as to fully describe the expected change in the distribution of this risk into the future (a change which can be characterised as a broadening of the distribution in the tail towards the highest BMI values rather than at the other end of the distribution with low values).

Using the relative risk (RR) for each unit increase in BMI from a meta-analysis of the Asia-Pacific Cohort Study collaboration and a lognormal transformation of the mean and standard deviation values, the model can integrate the area under the curve of the BMI distribution multiplied by the relevant RR values. The difference in this area under the curve at successive years into the future can be calculated. This proportion change over time is then applied to the incidence of diabetes.

There was no data to estimate a trend in case fatality for diabetes. Instead, it was assumed to reflect half the trend calculated for cardiovascular disease, on the basis that at least half of all mortality in diabetics is of vascular origin and would benefit from the same favourable trends observed for other cardiovascular disease. This resulted in considerable increasing trends in the incidence of type 2 diabetes, and even greater increases in future prevalence.

Mortality trend data are not relevant for conditions that are largely non-fatal. These include the mental, sense organ and musculoskeletal disorders. At the time of conducting this analysis, the only mental health survey in Australia was the ABS survey carried out in 1997 and hence there were no trend data. (The ABS 2007 mental health survey has since been released). In addition, internationally there is no clear evidence of secular trends due to a paucity of mental health survey data collected using comparable diagnostic tools and criteria. Therefore, no trends were assumed. Similarly, the model did not apply disease trends to hearing loss (only one community survey done), the various causes of vision loss and musculoskeletal disorders (no evidence for trends).

Based on the above considerations the model used the 2003 disease rates of incidence, case fatality and their trends to forecast and backcast the numbers of incident and prevalent cases by disease for the years 1994, 2001, 2003, 2013, 2023 and 2033.

Projected per case of disease health care costs

Current per case health care costs by type of expenditure (hospital care, out-of-hospital medical services, pharmaceuticals, residential aged care services and other health services) have been estimated for the AIHW disease expenditure project (AIHW 1998; AIHW 2005). The model used in this report projected the per case health care costs for a particular cause in the year 2001 forward into the future based on expected changes in a) the population level and age-structure; b) disease rates; c) the volume of health service delivery per case of disease; and d) health prices.

In contrast to the method used in the UN report where expected increases in the cost per case in the future were calculated from observed differences for each area of expenditure and for each disease between 1993–94 and 2000–01, in this report the age-sex change by area of expenditure for **all** diseases for the period 1993–94 to 2004–05 was used as the main driver. The rate of change used for each area of expenditure and for the age groups 0 to 74 years and 75 years and over is set out below.

Table C1: Annual change in cost per case of disease assumptions, 2002–03 to 2032–33

	Area of expenditure			
	Admitted patient	Residential aged care (high care)	Out-of hospital medical services	Prescription pharmaceuticals
Age group				
0-74	2.0%	1.0%	0.8%	4.0%
75+	2.6%	1.0%	1.0%	6.0%

Source: AIHW Disease expenditure projection model.

The annual changes in excess health price inflation for each area of expenditure used in the model are set out in Table C2. These numbers reflect the actual excess health price inflation in the health and residential aged care system for the period 1995–96 to 2005-06.

Table C2: Annual change in excess health price inflation assumptions, 2002–03 to 2032–33

Area of expenditure						
Admitted patient	Residential aged care (high care)	Out-of hospital medical services	Prescription pharmaceuticals	Over the counter pharmaceuticals	Dental services	Community & public health
0.27%	0.27%	1.22%	-2.5%	0.42%	1.86%	0.42%

Source: AIHW Disease expenditure projection model.

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