The Ageing Australian Population and Future Health Costs: 1996-2051

Occasional Papers:
New Series No. 7

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The Department gratefully acknowledges the cooperation of the Health Department Western Australia.

Foreword

This paper evolved from a collaborative data-linking project between the Commonwealth Department of Health and Aged Care and the Health Department of Western Australia. The three health systems that are the subjects of the paper are treated separately and the analysis does not depend on linked data. Furthermore, Western Australian hospital morbidity costs are not used in the paper but were imputed by the Department of Health and Aged Care using internal cost data. Therefore, the costs in this paper do not necessarily reflect actual hospital morbidity costs in Western Australia.

This study projects future health costs attributable to the progressive ageing of the Australian population based on extensive administrative data on medical practitioner visits (to GPs and specialists), prescription drug consumption and hospital admissions. Scenarios based on these cost data were applied to projections of the Australian population by age and sex out to 2051 — by which time the transient effects of the 'baby-boom' cohort will have worked their way through the system. The long-term nature of the projection period (more than 50 years) and the strong assumptions that have to be made in the study concerning the future course of health care costs (namely that today's health care costs are a good guide to those likely to be apply over the long term — in real terms) mean that the cost projections reported in this paper must necessarily be heavily qualified. Nevertheless, given such a cost assumption and the future demography of Australia (which is far less uncertain,) the study's conclusions supports the view that although the ageing of Australia's population will undoubtedly be a significant cost driver of future health costs, the increased costs attributable to ageing alone should be manageable.

The study's key results are first that the projected annual real (i.e., inflation-adjusted) increase in health costs due to the combined effect of population growth and the ageing of the Australian population reaches a maximum value of about 1.6 per cent in the years 2006-2018 (and thereafter the annual rate of growth decreases to about 0.5 per cent by 2051) and secondly that the annual per cent increase of health costs due to ageing alone reaches its maximum value of about 1.0 per cent in the period 2012-2019 (and thereafter decreases to about 0.3 percent by the year 2051).

The study uses a health cost model developed within the Commonwealth Department of Health and Aged Care whose starting point is the methodology used by the Australian Bureau of Statistics to produce projections of the population of Australia. The analysis then applies current treatment patterns and associated costs based on Medical Benefits Scheme (MBS), Pharmaceutical Benefits Scheme (PBS) and hospital morbidity data for Western Australians — to produce estimates of health costs into the distant future. A new set of indices is introduced. The indices are characteristic of a health system (hospital care, visits to medical practitioners and the consumption of pharmaceuticals) and are calculated for a cohort of people — in this case all people in a one-year age group. The indices are a combined measure of the propensity of the cohort to consume health care resources: being the product of the proportion of the cohort who uses a particular health care service in a given year, the average number of such episodes per year and the average cost per episode. Projected health costs are partitioned into two components: one attributable to population growth and the other to the ageing of the population.

1 Introduction

The ageing population in Australia, as in other countries, will affect the country's economic and social systems. The likely of such effects are the subject of considerable conjecture, commentary, research and analysis. In the health sector, contributions to the debate are found in the literature[1,2,3,4,5] and in the proceedings of national workshops, one of the most recent being held in March 1999.[6]

Researchers have adopted a variety of approaches to project part or all of future health and aged care costs. This paper focuses on projecting acute care hospital costs for public and private patients, and government expenditure on benefits paid for Medical Benefits Schedule (MBS) items and Pharmaceutical Benefits Schedule (PBS) items. Although accounting for a considerable proportion of total health outlays, these components of costs do not cover all such costs: for example they do not include out-of-pocket payments to cover the 'gaps' between what doctors charge and what government subsides cover for medical procedures.

Although no consensus on the magnitude of the effect of the ageing population on health costs has emerged, there is growing evidence to suggest that the problem is not as large as some commentators have suggested. This paper leans towards the optimistic end of the spread of opinion in that it argues that, although the progressive ageing of the Australian population will present significant challenges for policy makers, the problem should be manageable to the extent that today's cost are good guide to those that will apply over the long term (in real terms), and that the Australian economy continues to grow (on average) over the long run at rates that is has over the last ten-to-fifteen years.

Australia's Medical Benefits Schedule (MBS), Pharmaceutical Benefits Scheme (PBS) and Hospital Morbidity Data (HMD) administrative data collections provide cost information on health care consumption by residents. Using 1996 data for Western Australia, this study projects health care expenditures (excluding co-payments) for the Australian population out to the year 2051 based on projections of the Australian population generated using similar methodology to that developed by the Australian Bureau of Statistics (ABS) to produce its population projections.

The calculations of possible future health care costs are based on likely future demand (rather than the supply of services consistent with a limited budget). The reason for pursuing a demand- rather than a supply-side approach is that health services are increasingly coming to be regarded as an 'entitlement' (i.e., health care services will increasingly be utilised whenever consumers demand them). Australians consult general practitioners (GPs) wherever they feel the need (and can get to see a doctor), and GPs refer

[1] *Goss, J., Eckermann, S., Pinyopusarerk, M. & Wen, X. 1994,* Economic Perspective on the Health Impact of Ageing of the Australian Population in the 21st Century. *Seventh National Conference Australian National University, Canberra Australia.*

[2] *Fuchs, V. 1984,* The Health Sector's Share of the Gross National Product, Science, *vol 247.*

[3] *Howe, A.. 1997,* Health Care Costs to the Ageing Population: The Case of Australia. *Reviews in Clinical Gerontology, 1997.*

[4] *Evans R. G. 1984,* Strained Mercy, *Butterworths, Toronto.*

[5] *McCallum, J., Botsman, P., Clarke, A., Pearse, W. & Keogh, S.* Ensuring Quality of Later Life, *South West Health Care Papers, No.2, University of Western Sydney, Macarthur.*

[6] *Productivity Commission & Melbourne Institute of Applied Economic and Social Research,* Policy Implications of the Ageing of Australia's Population Conference, *March, 1999.*

them on to specialists and for hospital treatment if they, in turn, judge that such services are needed (i.e., irrespective of supply) - although patients may need to queue to actually receive the services (in particular if they are admitted to hospital as public patients and they are not assessed as being in need of immediate treatment).

1.1 Aim

The aim of this study is to investigate the effect of the ageing of the Australian population on the likely costs of health services. To do this it must abstract from other confounding influences - such as the growth in the population over time, and the prospective inflationary effects on prices of the introduction of new technology (for example, new pharmaceuticals and medical procedures).

1.2 Population projections

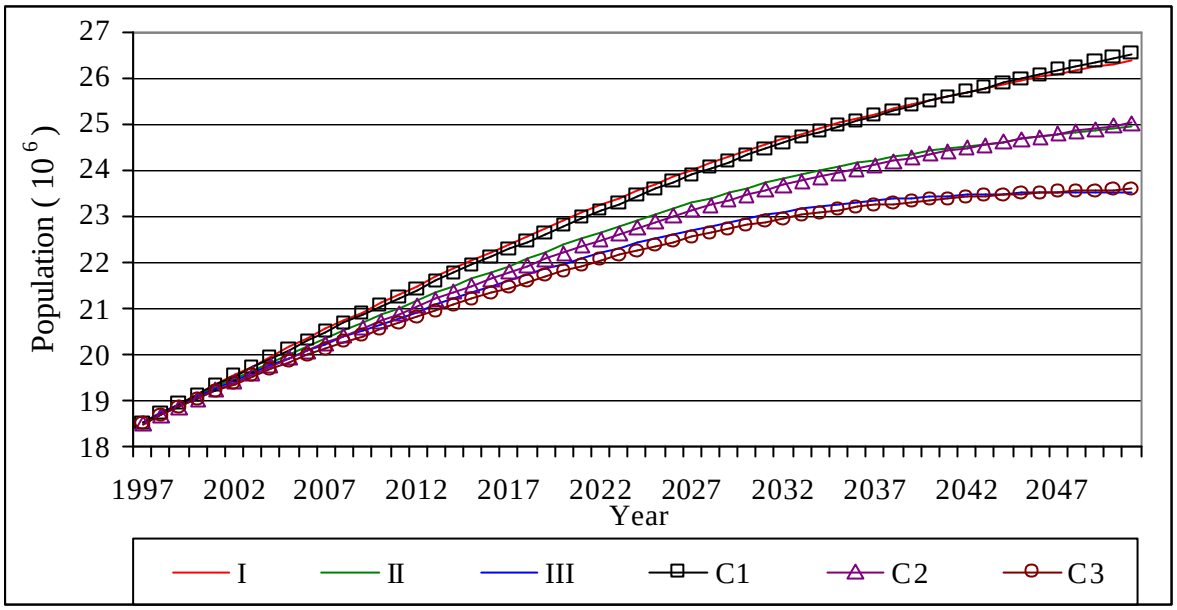
The ABS publishes three series of population projections, which incorporate different assumptions about future rates of fertility, mortality, overseas migration and internal migration.[7] Each projection is 'static' in the sense that the ABS fixes population parameters, such as the fertility rate and net immigration rate in the model for the duration of the projection period. The Department of Health and Aged Care has developed its own in-house population projection model using the same methodology as the ABS but which allows any of the population parameters to be varied at will, and which produces projected population numbers for one-year age groups, by sex.

The in-house population projection facility produces very similar projections to those produced by the ABS given similar assumptions about the underlying population parameters.[8] At this stage of its development, the differences between the three ABS population projection series and equivalent in-house prototype series are relatively small. Absolute average differences over the period 1997 to 2051 range from 0.31 per cent (with a standard deviation of 0.15 per cent) for Series I, to 0.47 per cent (with a standard deviation of 0.21 per cent) for Series II. Figure 1 compares the ABS series with the in-house series (the ABS projections are labelled I, II and III; the in-house projections are labelled C1, C2 and C3).

[7] Australian Bureau of Statistics (ABS 1998), *Population projections, 1997 to 2051*, Cat. No. 3222.0, AGPS, Canberra.

[8] It is not possible to replicate the ABS projections exactly, since the Department does not have access to all the necessary detailed data.

Figure 1: Comparison of ABS Series I-III and In-house Projections



2 Projecting Health Costs

For convenience, an *episode* (of health care) is defined as utilisation of one of the health systems. Thus, consulting a doctor, obtaining a script from a pharmacy and being admitted to a hospital are all examples of an episode.

In general terms the method used to project future health costs, HC, is:

(1) **HC = n x p x E x C**

where:

n = number of people in a given cohort;

p = proportion of the cohort who use a health service;

E = the average number of episodes per year; and
C = the average cost per episode (base year prices).

There are 101 cohorts consisting of: people aged less than one year, people aged 1 to 2 years, and so on up to people aged 99 to 100 years; with the last cohort comprising people aged 100 years and older. Equation (1) is applied to each of the MBS, the PBS and acute care health systems separately. An explanation of the parameters used in equation (1) is given in the following paragraphs.

2.1 Cohort size

The cohort sizes are produced by the population projection module of the health cost model for each one-year age group (plus the over 100s) from 1997 to 2051.

2.2 Proportion of the population utilising a health service

The proportion, p_i, of all people of a given sex who utilise a health system is defined as follows:

p_I = proportion of people of age x who utilise a health service

where $I \leq x < I+1$ for $i = 0$ to 99, and

p_{100} = proportion of people of age 100 or older who utilise a health service

That is, the proportion of all people who utilise a health system is computed in turn for each of 101 cohorts for each sex and these proportions are calculated for each of MBS, PBS and acute care systems (so that there are a total of 606 proportions).

2.3 Episodes per person

The number of people admitted to hospital for each age cohort, and the total number of episodes is extracted from the 1996 hospital morbidity data for Western Australia. The

average number of episodes for a given age/sex cohort is computed by dividing the relevant number of episodes by the number of people in the age/sex cohort.

2.4 Cost per episode

The cost of each Diagnosis Related Group (DRG) in the 1996 hospital morbidity data for Western Australia was sourced from Casemix data.[9] The total hospital cost for each cohort was then arrived at by summing over all DRGs - with the average cost per episode calculated as the total cost divided by the number of episodes. (The same approach was used to calculate average MBS and PBS costs per episode).

2.5 Assumptions

The cost projections reported in this study are predicated on the following restrictive assumptions – assumptions which necessarily heavily qualify the results and which should be borne in mind when trying to interpret them:

- The utilisation of health services by people of a particular age in Western Australia is not different to the utilisation by people of the same age in other parts of Australia. Put another way, this assumption is equivalent to presuming that the health services typically received by Australians aged, say 25, is independent of geographic location. This is a strong assumption that needs to be tested; and while it is unlikely to be true in detail (for example, the incidence of melanoma around the country), the law of large numbers suggests that it is probably a reasonable working assumption. [10]

- The proportions, p_i, of the population who utilise a health service is invariant over time (and are adequately represented by available administrative data).[11] That is, it is assumed that the predisposition towards morbidity does not change over time. This is again a strong assumption which ignores any improvement in morbidity over the next 50 years due, for example, to improved population health measures. To the extent that morbidity continues to decline over time (and there is Australian evidence of this), the estimates presented here would *overestimate* future costs. [12]

- The average number of times per year that Australians of a given age/sex cohort utilise health services is also invariant over time (and is adequately represented by available data from Western Australia). Again, this is a strong assumption, especially considering ongoing initiatives designed to improve the accessibility of health services (particularly in rural and remote areas of Australia), and the progressive adoption of new technologies (such as telemedicine) with the potential to change usage patterns

[9]Department of Health and Family Services 1997, *Australian Casemix Report on Hospital Activity 1995-1996*, AGPS, Canberra.
[10]The analysis will be done when the data are available.
[11] One problem with the date is its 'snapshot" nature. Its reliability and represtativeness for the purpose to which it has been put would more readily be able to be established if the available data covered a longer time period (so that, for example, any trends in the data could be established). This is particularly a potential problem with the hospital data (which cover only to a single year). A further problem with this particular dataset in terms of its representativeness for calculating morbidity patterns is that at both the beginning (and at the end of the year) some patients have already started (or not yet finished) their stay in hospital – so that a proportion of hospital episodes covered by the data are 'truncated'.
[12]Australian Institute of Health and Welfare (AIHW) 1998, *Australia's Health 1998*, AGPS, Canberra.

significantly over time. Against this, Australians are becoming healthier over time - suggesting that future usage may not be as intensive.[13]

- The average cost per episode is also invariant over time (and is adequately represented by available administrative data from Western Australia). This is arguably the strongest (and least defensible) assumption that has been made in order to generate projections of future health costs, since it ignores prospective changes in the cost of health services due to such things as the increase in the variety and complexity of medical procedures and the cost of the associated technologies. Neither does it consider the trend towards the use of more expensive pharmaceuticals. On the other hand, the introduction of new technologies can be expected to reduce costs (in real terms) over the long run (since that has been the experience with the vast majority of innovations that have enjoyed widespread adoption).

- Finally, no attempt is made to consider any productivity gains in the health care industry (which would lower costs).

In summary, prospective health care costs reported in this paper are calculated on the basis that patterns of morbidity and (real) costs do not change from 1996 levels (i.e., today's costs are a good guide to those that will apply indefinitely into the future). Although this cost assumption is the obvious one to make, it is nevertheless a certainty that it will not prove true in practice over the 50-year projection horizon contemplated by the succeeding analysis. Whether costs per episode will prove to be higher (in real terms) that those recorded in the available data, or lower, is moot. Perhaps a majority of readers would opt for the view that costs are more likely to increase that to decrease real terms over the long run given the nature of health care markets in Australia – characterised as they are by asymmetric information (where providers know a lot more about treatment options and their likely consequences, including costs), and third-party payment arrangements (where individuals do not bear all their health care costs due to the presence of government-provided and private health insurance.[14]

The combination of the above assumptions which have had to be made to make the calculations possible means that the projected costs in this study will largely be driven by demographic changes alone (which is the major intention of the study). So, although the other assumptions are highly restrictive they support the aim of the study by making it possible to separate the effect of ageing on health costs from other (possibly more important) cost drivers. Nevertheless, the conclusions of the study should be interpreted with caution, particularly in view of the strong nature of the assumptions on which the results are predicated.

[13] One way of exploring the importance of this assumption is to conduct sensitivity tests where utilisation rates are varied systematically to show the effects on aggregate costs. However, since this paper's principal aim is to look just at the likely effects of ageing such sensitivity tests have not been pursued here - although it is clear that a major driver of increasing real health costs per capita has been increasing utilisation rates over time.

[14] Increasing numbers medical practitioners, the emergence of new medical technologies, and expanding health insurance – in combination with fee-for-service payments – are a potent combination in terms of their potential to generate a rapidly growing demand for ever more costly tests, procedures and treatment (including a component which is purely age-related).

3 Hospital Costs

The projected hospital costs in this paper are for acute care episodes in public and private hospitals. The costs are based on the average national cost per DRG taken from Table A.1 (public acute hospitals) and Table A.2 (private acute hospitals) in the Australian Casemix Report 1995-96.[15] Since these are national averages they do not accurately reflect the costs in Western Australia. However, in terms of public acute care separations from hospital, 17 of the top 20 DRGs for Australia were in the top 20 DRGs for Western Australia and the top six were identical. For private acute care separations there were 16 common DRGs and the top 10 differed by three ranks or less. A similar level of agreement or better exists for bed days and cost by volume for the top 20 DRGs. In the context of the long-term projections in this paper, this suggests, despite the differences, that Western Australia is a reasonable proxy for Australia.

The health cost projection are worked up in three stages. First, the projected costs for the ABS Series I population projections are calculated. This series is used because it projects the greatest population increases as compared with Series II and III (and might therefore be viewed as the most pessimistic scenario in terms of likely future hospital costs). This is termed the 'Normal population projection'.

Next, a 'Constant population projection' is costed. The Constant population projection is produced by fixing the population at its 1996 levels but constraining its age/sex composition to mirror the age/sex composition of the Normal population projection year by year. The effect is to remove population growth as a factor driving estimated acute care costs. Projected hospital costs are then due entirely to the changing ratios of the number of people in each one-year age group, yielding an unadulterated view of the effect of the ageing population on acute care costs.

Finally, a 'Differential population projection' is costed. In this projection, the 1996 population is subtracted from the Constant population projection - so that the age groups contributing to increased hospital costs over time, and those leading to decreased hospital costs are revealed.

3.1 Acute-care cost parameters

The following sections discuss the determinants of hospital costs that drive the results reported for acute care.

Proportion of people admitted to hospital

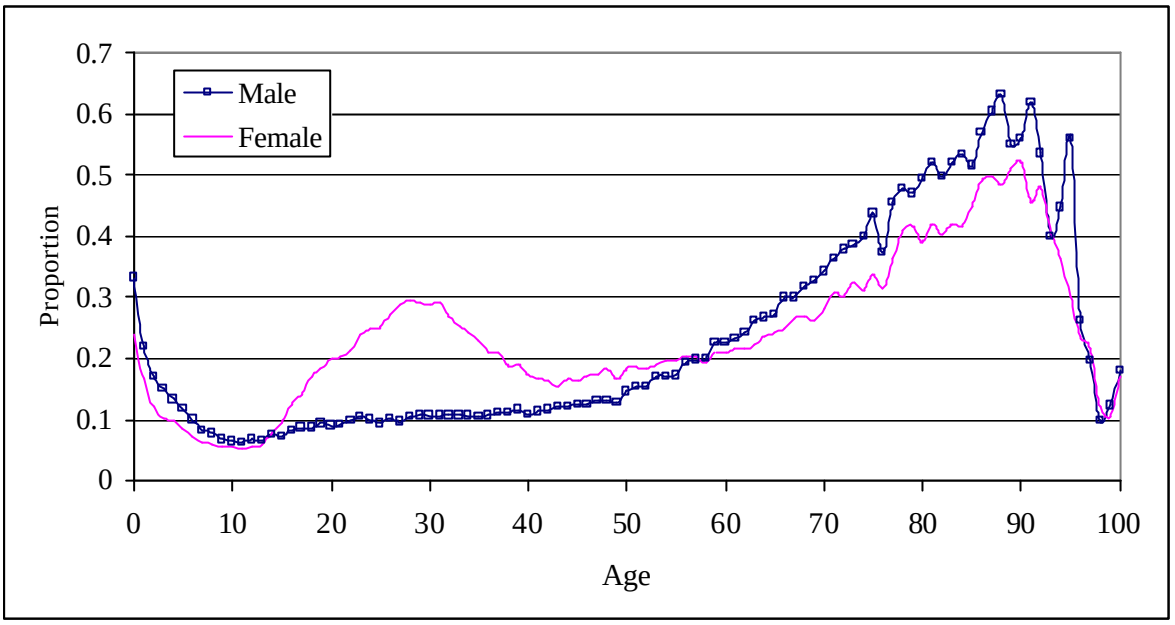
Figure 2 shows the proportions, by sex and age, of Western Australians admitted to hospital annually. As expected, the proportions of the very young for both sexes start at relatively high levels and decrease to about 5 per cent by around age 10. The proportion of women admitted to hospital, predominantly for childbirth, increases from 9 per cent from about 15 years of age to a peak of just less than 30 per cent at about 30 years, and then declines to 15 per cent at about 43 years of age. From about 50 years of age, the proportion

[15]Department of Health and Family Services, 1997, *Australian Casemix Report on hospital activity for 1995-1996*, AGPS, Canberra.

of both sexes admitted to hospital increases with age, peaking at over 60 per cent for men and about 50 per cent for women.

The data depicted in Figure 2 suggest that the health costs related to child bearing is the likely dominant factor for ages less than about 43 years and suggest that the costs for men are likely slightly higher than women for ages greater than about 60.

Figure 2: Proportion of people using acute care services

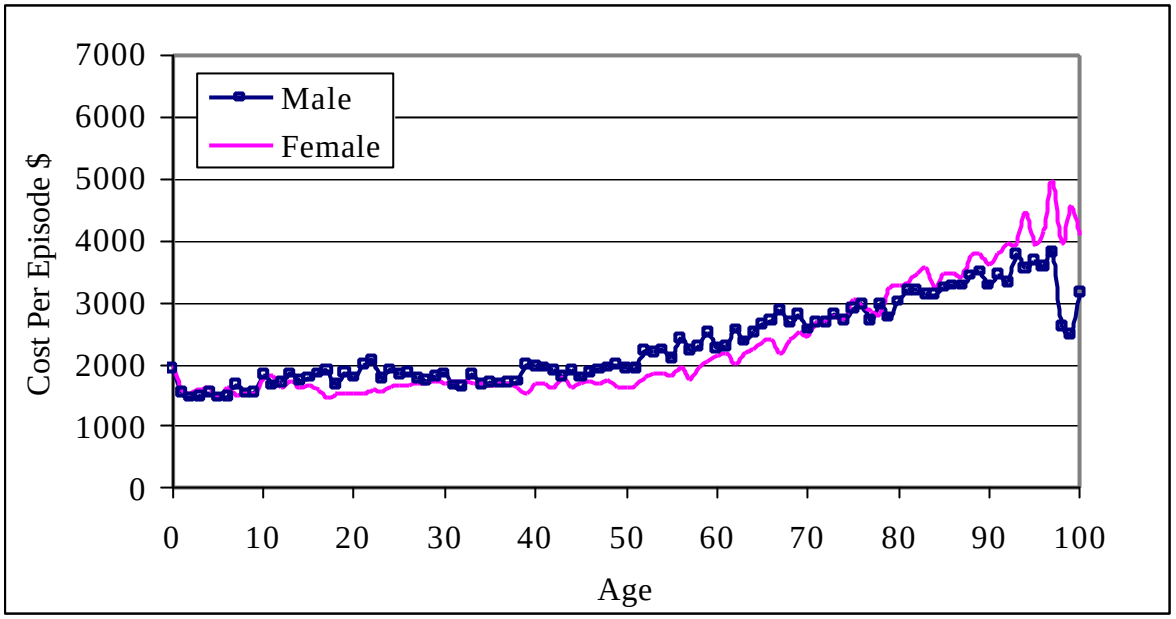


Cost per episode

Figure 3 shows how average costs per episode vary with age and sex. For women, the cost per episode remains relatively constant to about age 60, after which average costs rise to between $4,000 and $5,000 per annum for the very old. For males aged from 9 to 71 the costs per hospital episode are either very nearly the same as or higher than those for females. For ages greater than 71, the costs per hospital episode is greater for females. The dip in costs for men aged 98-99 is probably an anomaly caused by only having access to one year's data.

The cost per episode variation depicted in Figure 3 suggests that hospital costs for men are generally higher than for women (except for men aged 98-99).

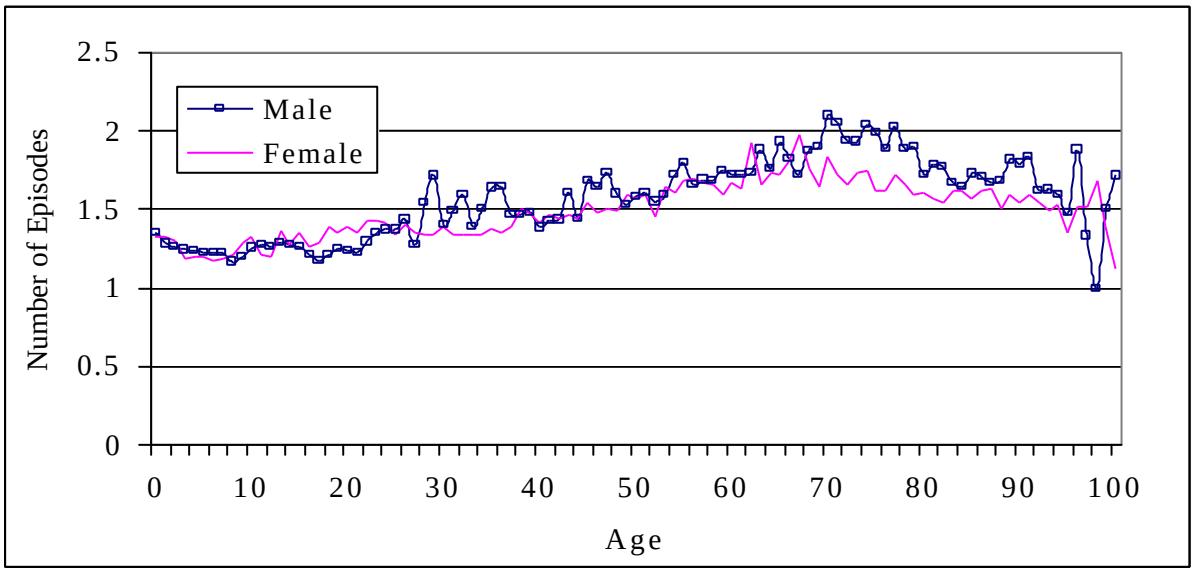
Figure 3: Cost per hospital episode



Number of hospital episodes per person

Figure 4 shows that the average number of episodes per year varies from about 1.2 to about 2.1 and that, except for the age groups from 70 to 97 - where the average number of episodes for men is slightly greater than that for women, there is very little difference between men and women.

Figure 4: Average number of hospital episodes per person

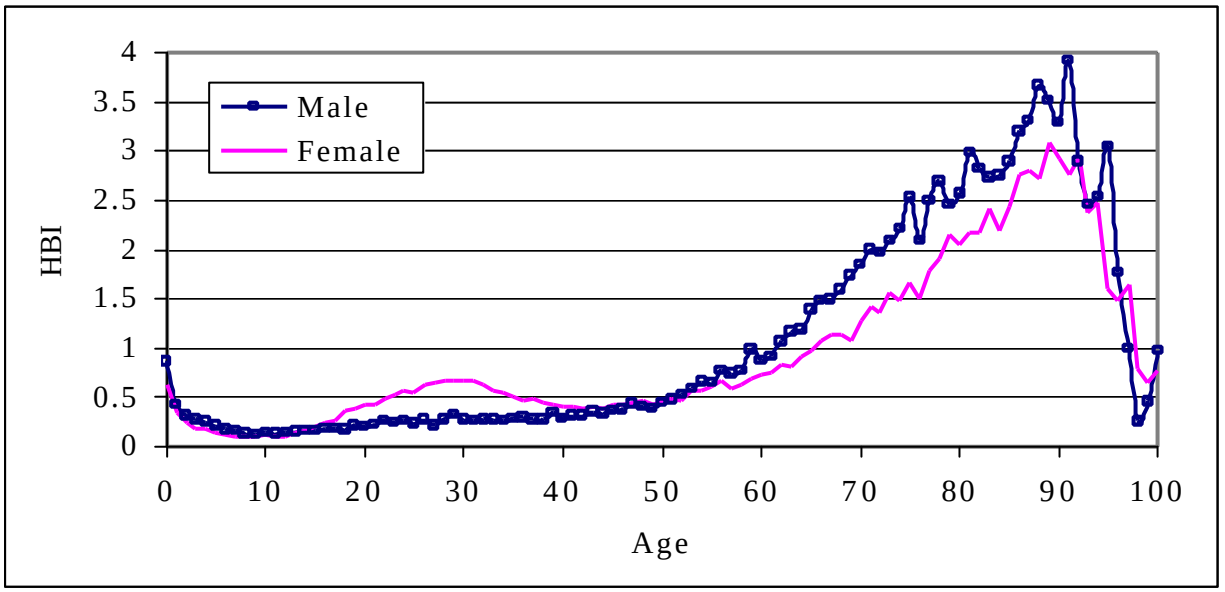


Hospital Index (HI)

When the proportion of people utilising hospital services, the average number of episodes per person and the average cost per episode for each age group are multiplied together, then an indication of the demands placed on the hospital system is obtained. The scaled product is termed the Hospital Index (HI) in this study, and it is a characteristic of a cohort consisting of all people in a one-year age group of the same sex. Clearly, the hospital cost for any age group is obtained by multiplying the HI by the number of people in the age group.

The variations in HI by age and sex is shown in Figure 5. Surprisingly, women between the ages of 15 and 43 do not place an appreciable demand on the hospital system, as may have been suggested by the data presented Figure 2. Also, for ages greater than 50 (but with the exception of ages 97 to 99), the demands of men on the hospital system is much greater than that of women. Clearly, men older than 50 are much more morbid than their female counterparts.

Figure 5: Hospital index



3.2 Normal population projection

It is not possible to conveniently represent the projected population for each of the 202 one-year age groups (101 for each sex) in either tabular or graphical form. Instead, the projected numbers are illustrated using five-year age groups (but it should be emphasised that the projected costs are determined using one-year age groups). Some sample projections for five-year age groups are shown in Figure 6.

Figure 6: Normal population projection – sample age groups

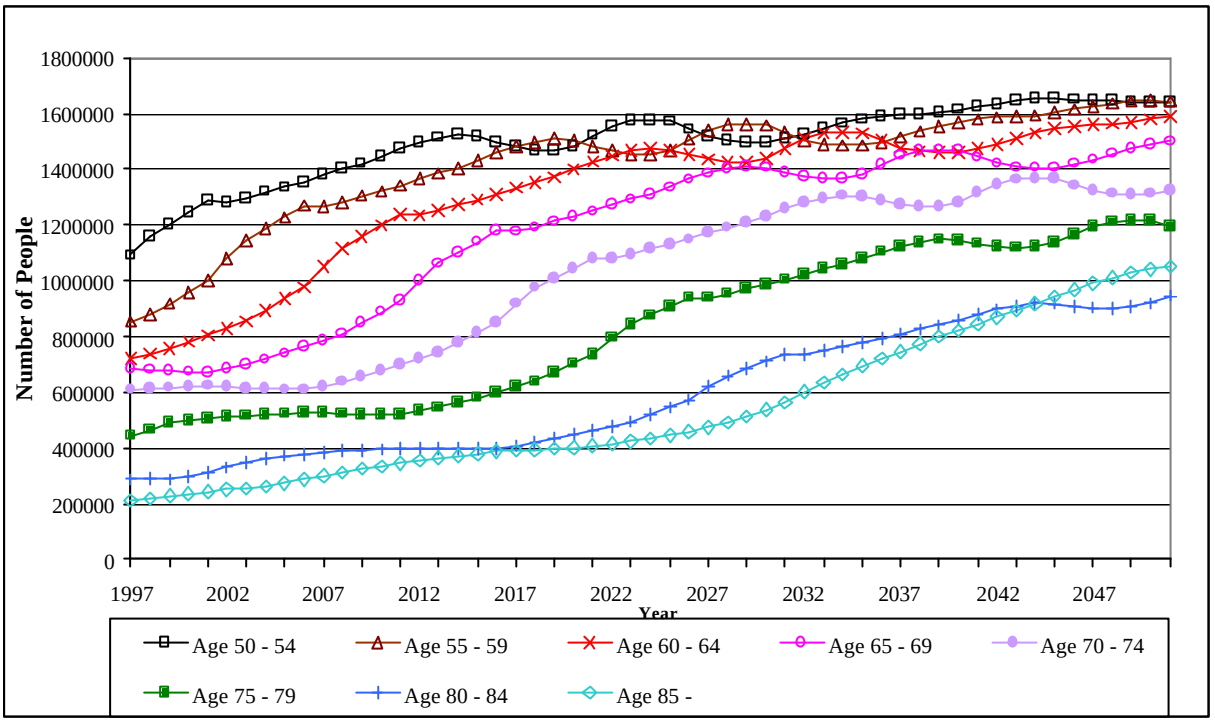
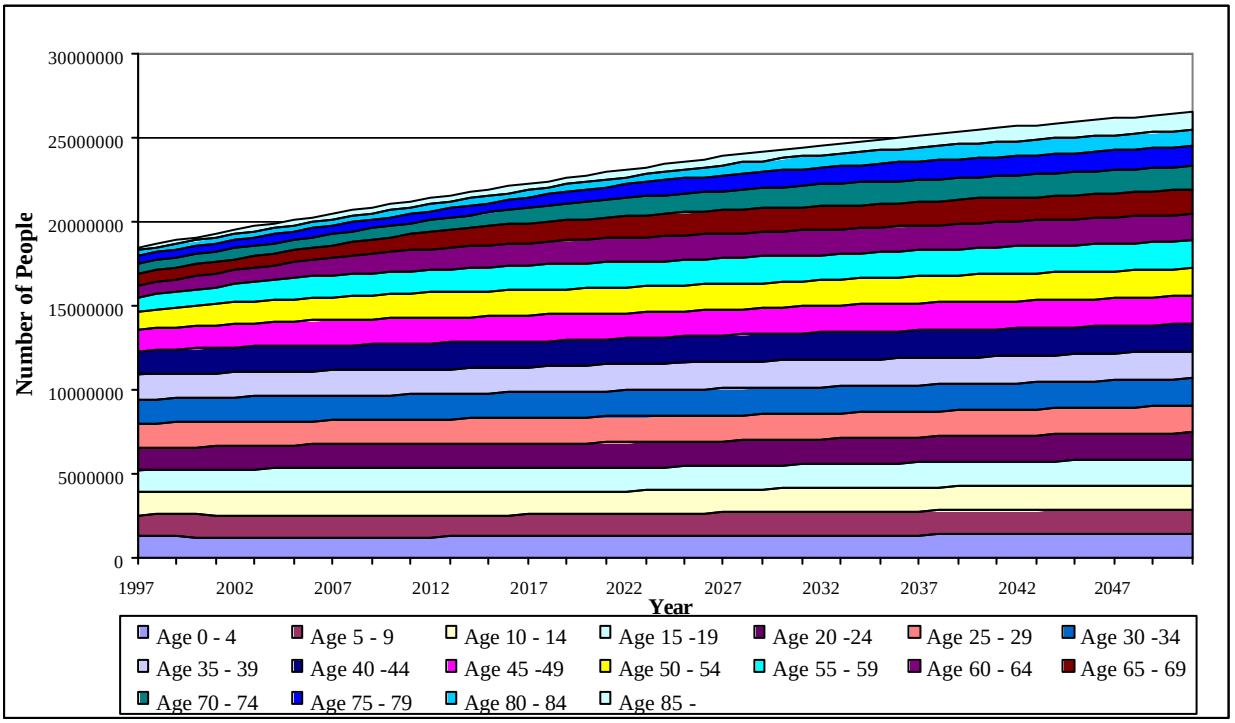


Figure 6 shows that the older age groups grow at a greater rate, but the representation fails to convey a sense of how the different age groups make up the total population. Figure 7 conveys, in simple terms, the changing composition of the population.

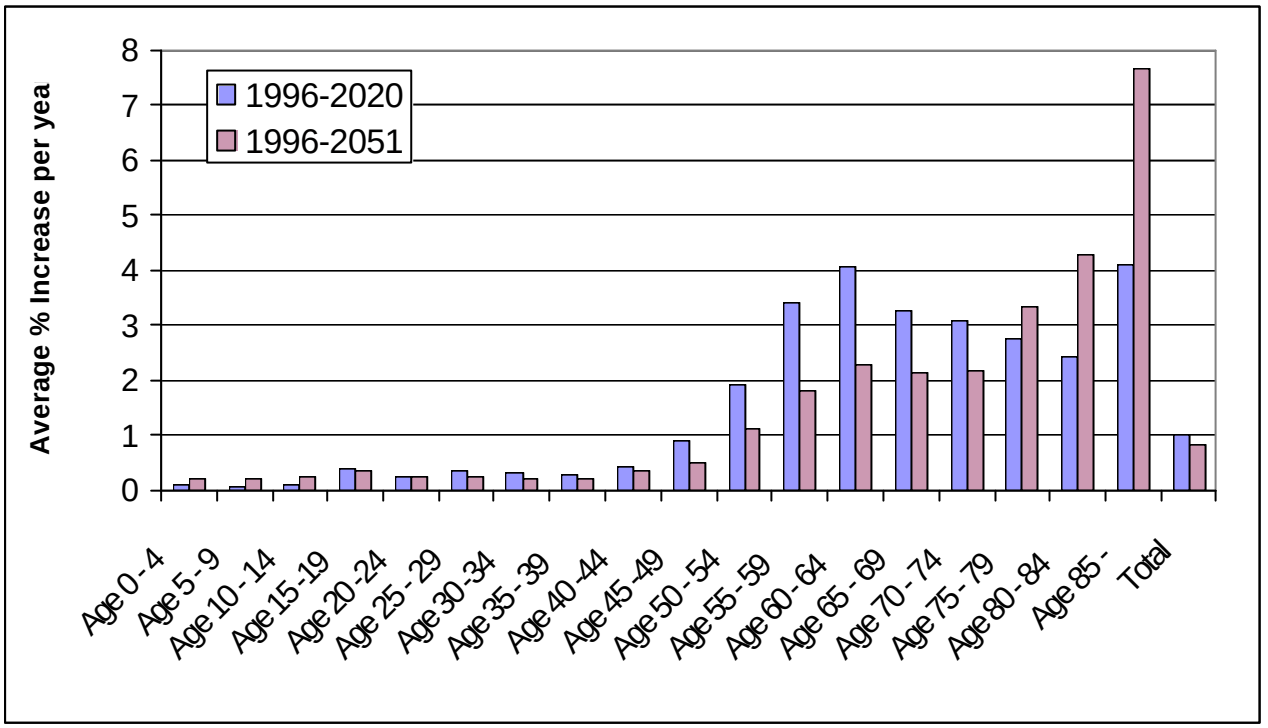
Figure 7: Normal population projection - all age groups



For age groups less than 50-54, the increase per year is relatively small and the older age groups increase at a greater rate.

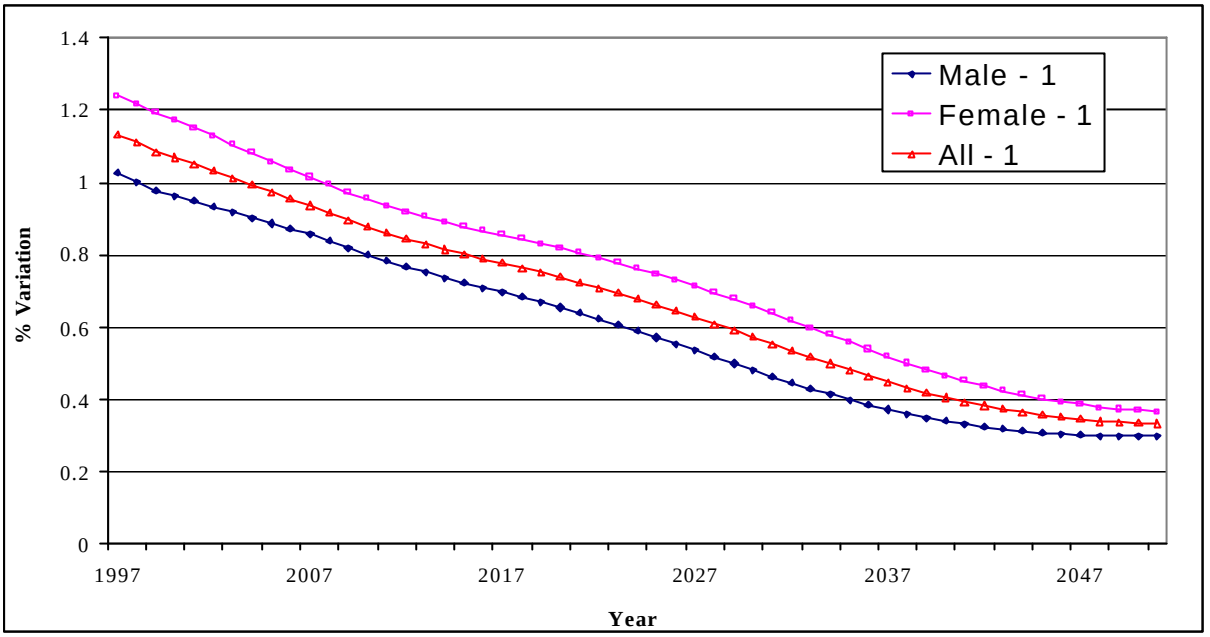
As an example, Figure 8 illustrates the increase in the age groups over two periods - 1996 to 2020 and 1996 to 2051. The average annual increase in the population over both periods is less than 1 per cent (see 'Total'). For age groups less than 45-49, the average annual increase is also less than 1 per cent, but for all other groups the average annual increases is greater than 1 per cent - and peaks at an average annual increase of over 4 per cent for the period 1996-2020 for the over-85 year olds, and over 2 per cent for the same group over the period 1996-2051.

Figure 8: Comparison of annual rates of increase



Finally, the projected annual rate of increase for the total Australian population is shown in Figure 9. This emphasises the fact that there is a projected gradual decline in the annual rate of increase from about 1.1 per cent in 1997 down to about 0.3 per cent in 2051 (as the transient 'baby boom' generation moves through the system).

Figure 9: Annual variation of total normal population

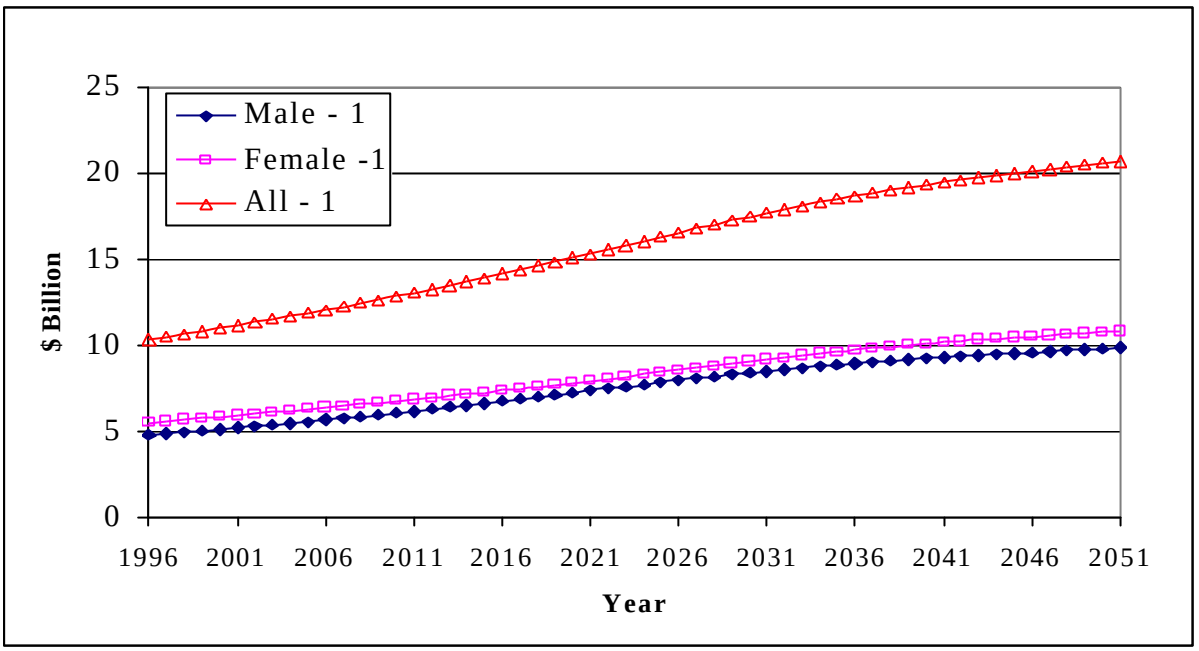


3.3 Normal population projection: hospital costs

The projected hospital costs for the normal population projection are shown in Figure 10. For the whole population, the total cost more than doubles over the period - from about $10.4 billion in 1996 (compared with an estimated $10.9 billion according to an independent source)[16] to just over $20 billion in 2051.

[16] According to the *Australian Casemix Report on Hospital Activity for 1995-1996* the total expenditure on public and private acute care was estimated to be $10.9 billion. This close correspondence obtained using the health cost model described in this paper suggests that the Western Australian data is a good proxy for estimating the cost of acute care for the whole of the Australian population.

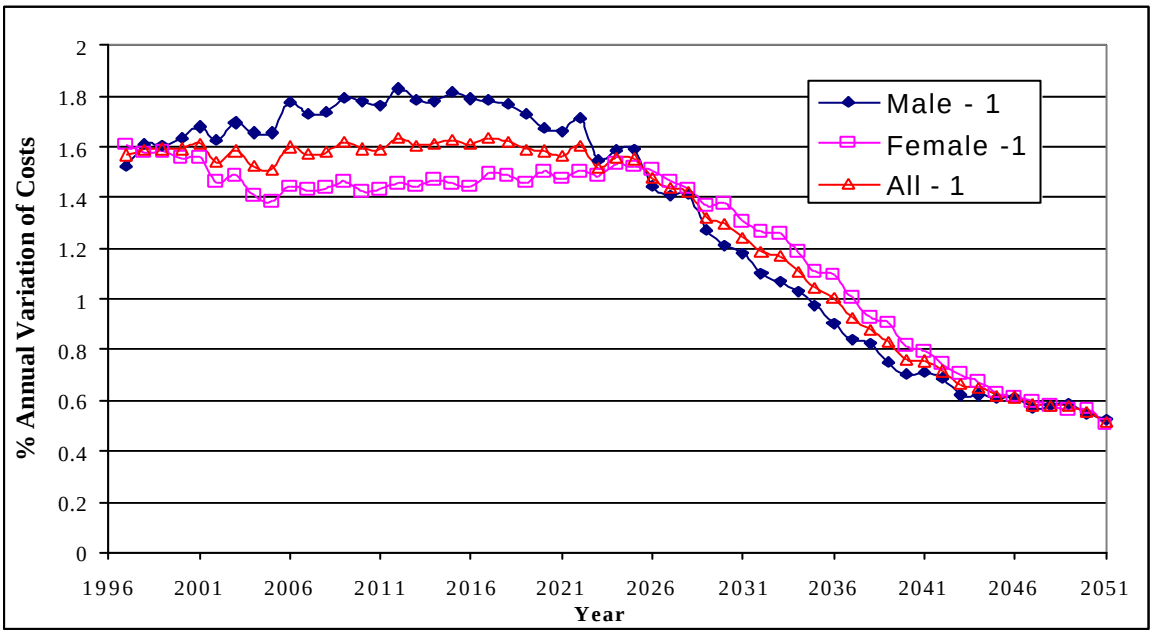
Figure 10: Normal population projection hospital costs



A more informative view of the costs is revealed by the annual rate of increase, as depicted in Figure 11.

The projected annual rate of increase rises to just over 1.8 per cent per year in 2012. Thereafter, the annual rates of increase gradually decline to about 0.5 per cent by 2051.

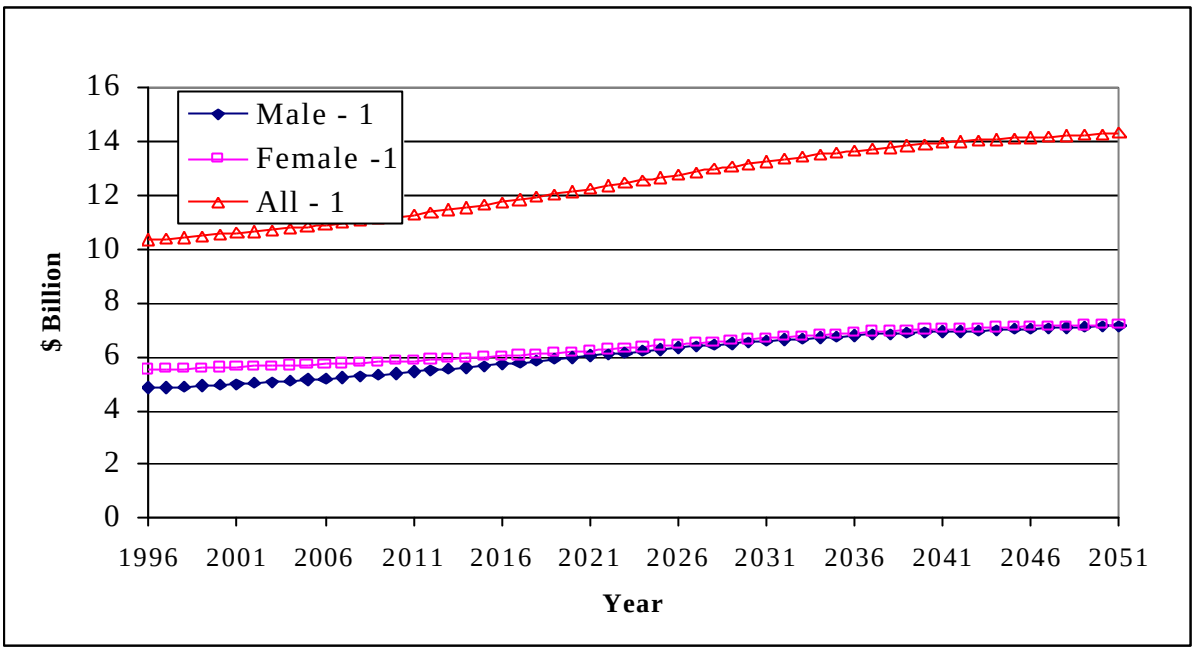
Figure 11: Annual per cent variation of normal population hospital costs



3.4 Constant population projection: hospital costs

The variation of the total hospital costs for the Constant population projections is shown in Figure 12.

Figure 12: Constant population projection hospital costs



The distribution of the costs by five-year age groups is shown in Figure 13.

Figure 13: Constant population projection hospital costs by age group

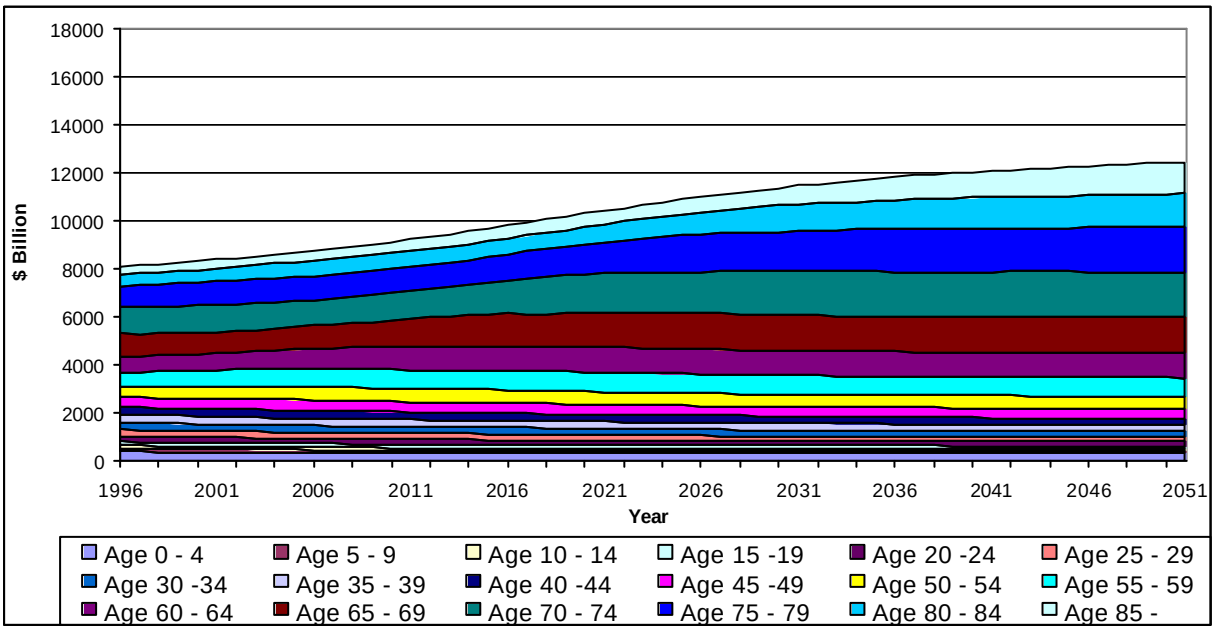
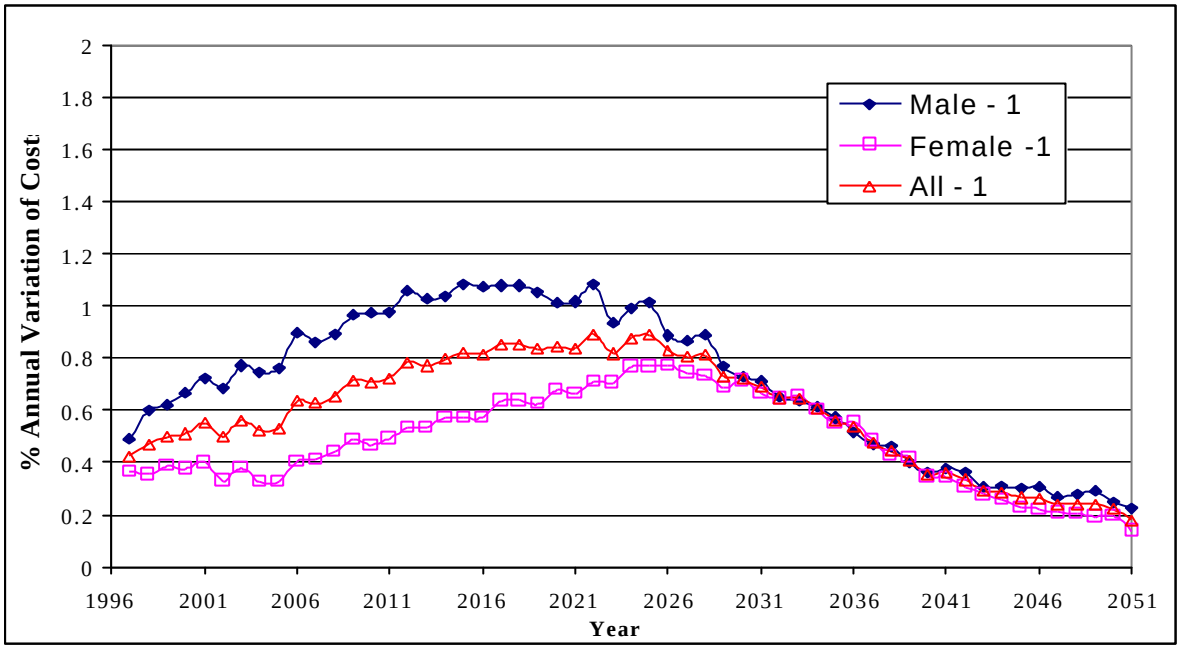


Figure 13 clearly illustrates the ageing effect on prospective health care costs as the 'baby boomers' move through the system. The costs for age groups up to 50-54 either decrease slightly or remain relatively constant. In contrast, the costs for the age groups 55-59 and older increase.

Annual variations in costs for the Constant population projections are shown in Figure 14.

Figure 14: Annual variation of constant population projection hospital costs

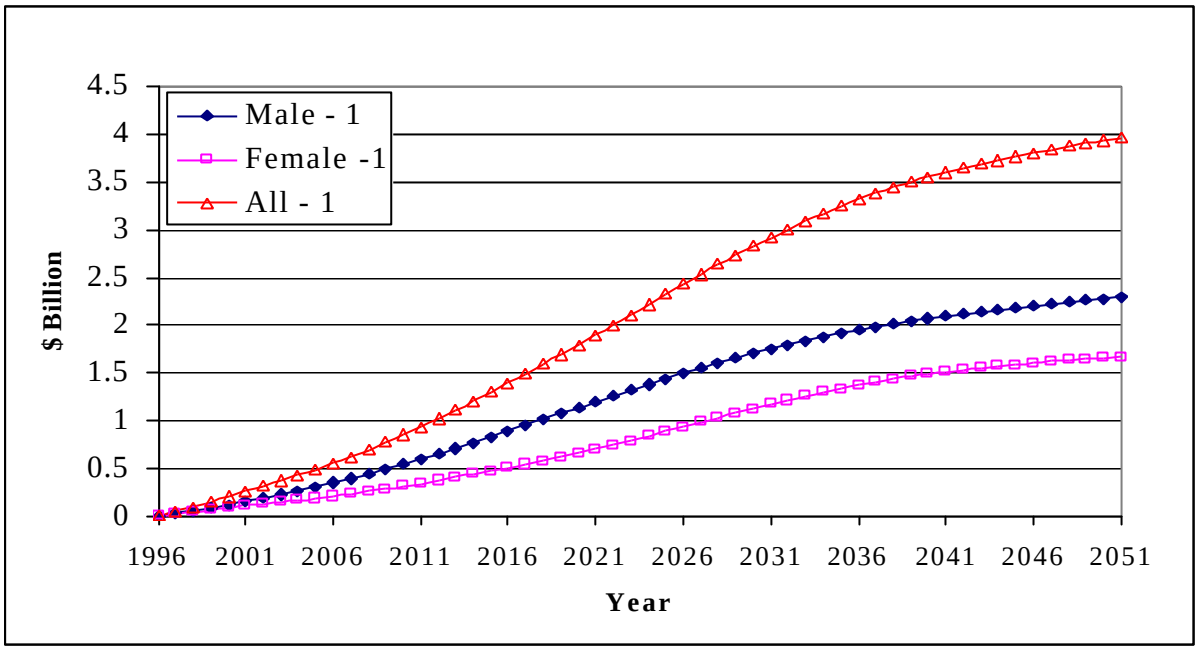


The annual rate of increase rises from about 0.5 per cent in 1997 to a peak of about 1.1 per cent in about 2015, and thereafter decrease to about 0.2 per cent by 2051.

3.5 Differential population projection: hospital costs

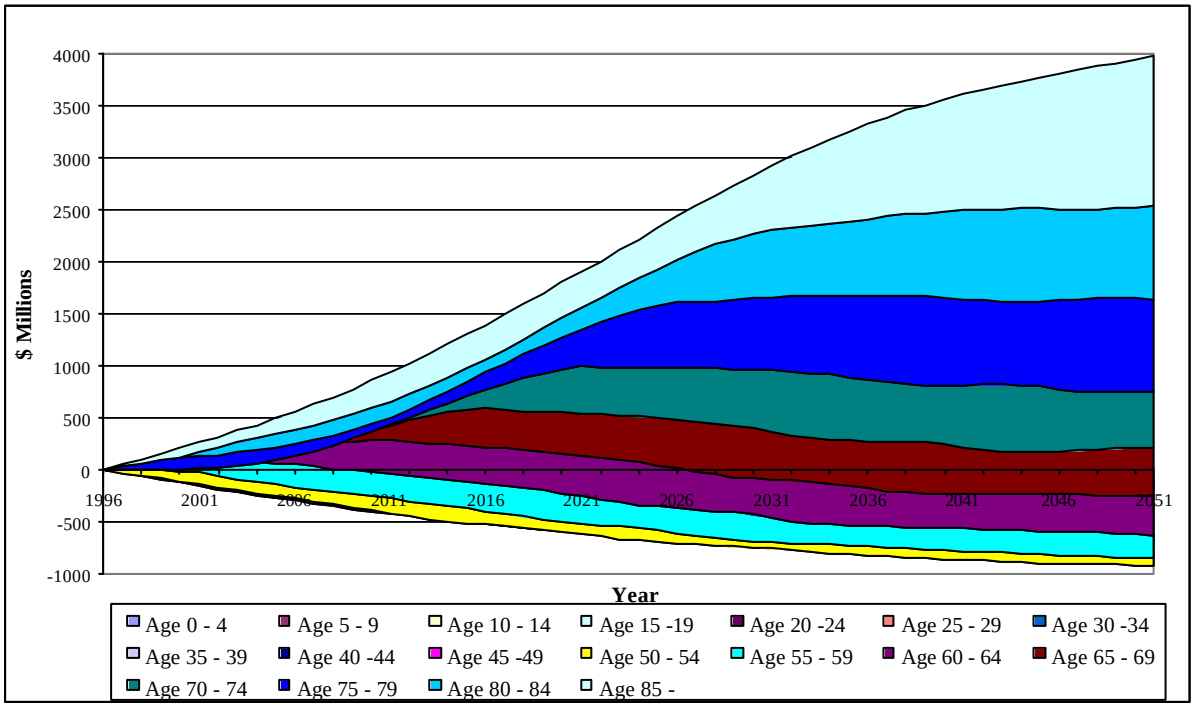
The variation of the total hospital costs for the Differential population projection is shown in Figure 15. The total cost 'gap' starts, of course, at 0 since the differential population consists of the Constant population projections minus the 1996 population. The maximum differential cost - of about $4 billion at the end of the projection period - represents the net cost due to ageing (of which about $2.4 billion is attributed to men while about $1.6 billion is attributed to women).

Figure 15: Differential population projection hospital costs



The 'losses' and 'gains' by age group are shown in Figure 16. By 2051, the age groups of 65-69 and above contribute the majority of projected increased costs, while the other age groups contribute less. The ageing effect is clearly apparent for age-groups 50-54 and older.

Figure 16: Differential population projection hospital costs by age group



4 Medicare Costs

4.1 Medicare cost parameters

The following sections examine the determinants of doctor attendances that drive the results reported for medical costs to the Government (benefit paid to patients). The approach parallels that for estimating future acute care costs, involving similar cost parameters.

Proportion of people using Medicare

The proportion of people using Medicare is defined to be the number of people in a given age/sex cohort who use Medicare in a one-year period divided by the estimated resident population in that age/sex cohort. A proportion of 1 means that every member of the resident population in the age/sex cohort had at least one Medicare service during the course of the year. Figure 17 shows the proportions of Western Australian residents for each age group who used Medicare at least once during 1996. As expected, most people made a claim on Medicare at least once during the year, but there are some interesting features in the graph.

First, the number of people for some ages who use Medicare appears to be greater than the corresponding resident population. At face value this is, of course, impossible. So, either the number of people recorded as using Medicare is too large or the estimated resident population in Western Australia is too small. Since the number of residents in Western Australia using Medicare was determined by selecting all those people with a postcode of 6XXX only[17] it is quite likely that the latter alternative is the case, that is the estimated resident population in Western Australia is under estimated. Furthermore, the estimated resident population is the population at 30 June. Thus, any people who die in the first half of the year and who used Medicare would not be counted, as would any person who migrated either interstate or overseas. In fact, a better estimate of the proportion of the resident population using Medicare is obtained if the estimated resident population is replaced by the number of people who lived in the state at any time during the year. An adjustment for deaths was included in the analysis.

The proportions that are greater than 1 for people in their late 80s or early 90s is probably due to the smaller number of people in those age groups because a relatively small error in either the number of residents or the estimated resident population causes a significant change in the ratio of the two.

The peaks at ages 1, 5 and 50 for both sexes are interesting. The first two peaks are almost certainly due to childhood vaccinations. The peaks at 50 for both men and women are perplexing, unless the 'half century' in some manner induces people to seek a medical 'check-up' which, although plausible, hardly seems likely.

The proportion of women using Medicare begins to exceed the proportion of men from about the age of 15 and continues to be higher until people are in their early 60s. Childbirth and various types of screening (e.g., for breast and cervical cancer) are a

[17] If a person had a 6XXX postcode and another postcode (other than 6XXX), then that person was not counted.

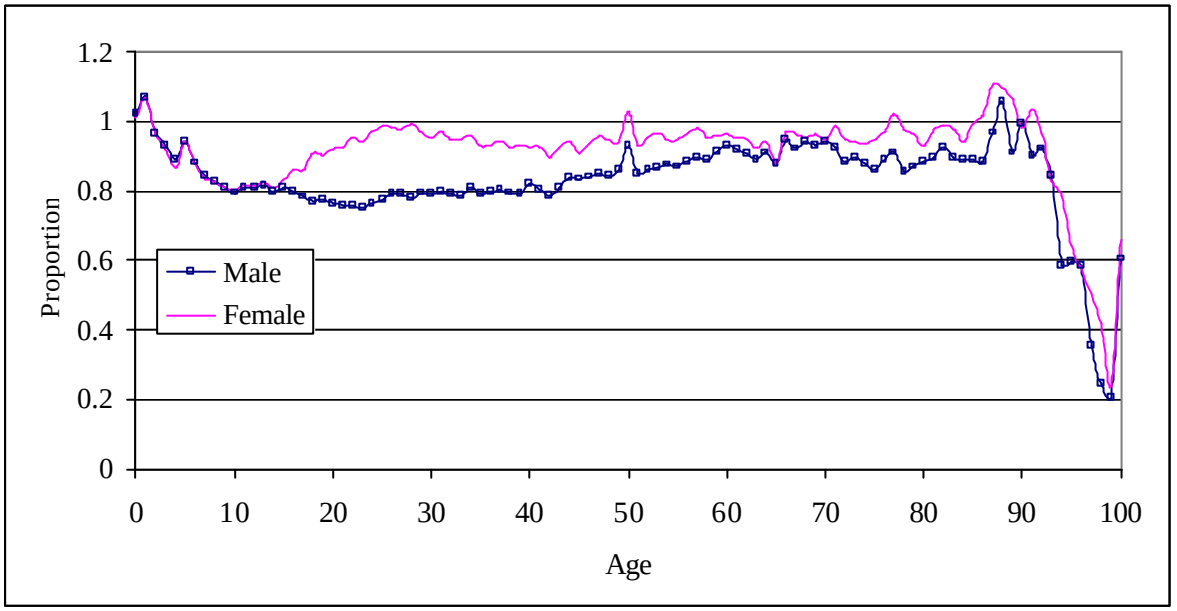
plausible explanation for women, while for men it is possibly their general reluctance to seek medical care.

The significant decrease in the proportion of people over 90 using Medicare is interesting. The downturn could suggest that the very elderly experience a period of relatively good health, or they elect not to receive treatment knowing that they are dying. Alternatively, this could just be random variability in the data due to the very small number of people involved.

Finally, the proportion of the population using Medicare is quite different to the proportion of the population who are admitted to hospital. The two main differences are:

- The proportion of women using Medicare is greater than men for nearly all ages; and
- The proportions using Medicare is greater than 80 per cent for nearly all ages. In contrast to acute care (Figure 2), the proportions do not peak around the 80 plus year mark.

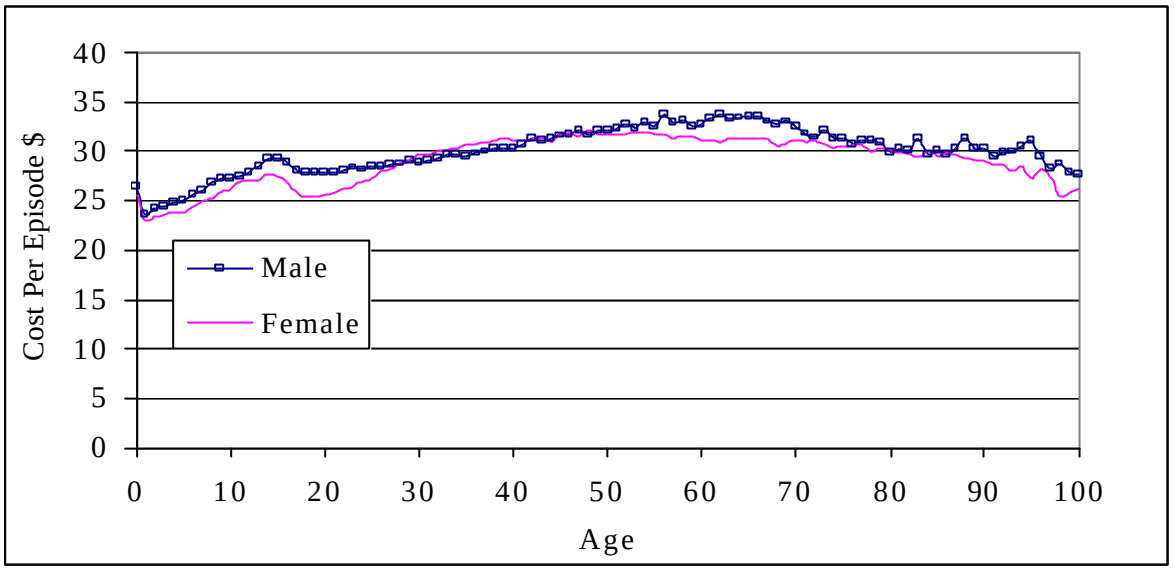
Figure 17: Proportion of people using Medicare



Cost per Medicare item

Figure 18 shows how the average cost per user varies with age. The cost varies between about $25 and $35 with some minor differences between men and women. Interestingly, the average costs decrease slightly with increasing age, in contrast to acute care costs per episode - which increase quite sharply with increasing age.

Figure 18: Average cost per Medicare item

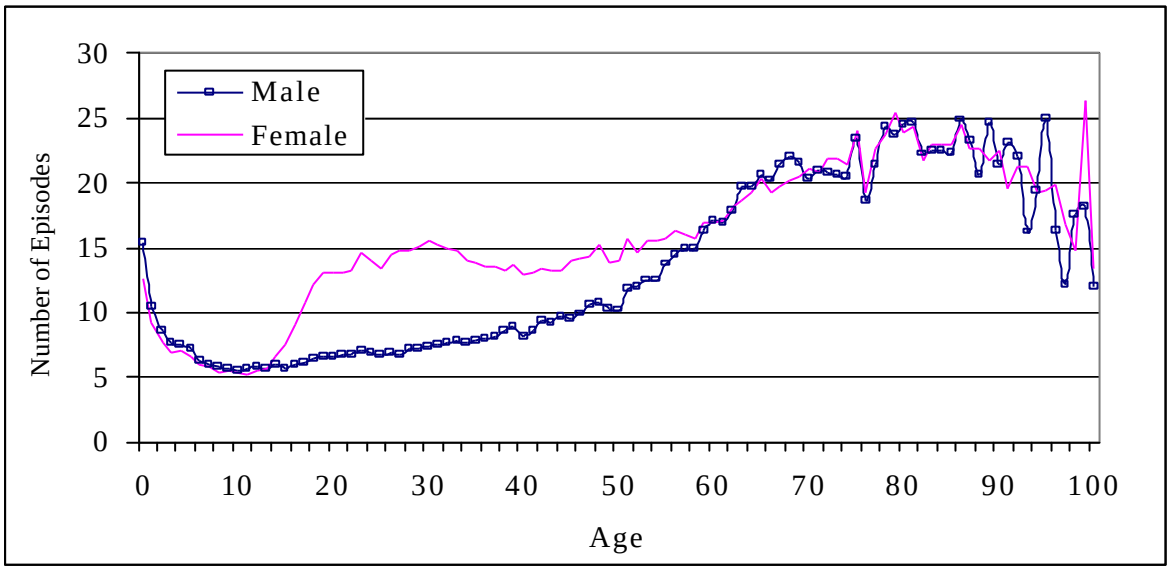


Average number of Medicare items per user

The average number of Medicare items per capita does vary in Australia from State/Territory to State/Territory.[18] Consequently, the average numbers of items per user for Western Australia were scaled to the Australian average, using an estimated single factor for men and an estimated single factor for women. Ideally, a different factor should be used for each age group, but this was not done because Medicare statistics record services (items) per capita, rather than services per user, and to re-do the computations by extracting the data from unit record Medicare data would be a major task both in terms of user resources and processing time.

Figure 19 shows that the average number of Medicare items per user varies from about 5 to 25 as age increases, but with a slight reduction for people over the age of 90. In contrast to acute care episodes, women aged between about 15 and 60 have significantly more Medicare items than men do. As in the case for the proportions of people using Medicare, this is probably due to childbirth and screening for women and, for men, possibly their reluctance to go to the doctor.

Figure 19: Average number of Medicare items per user

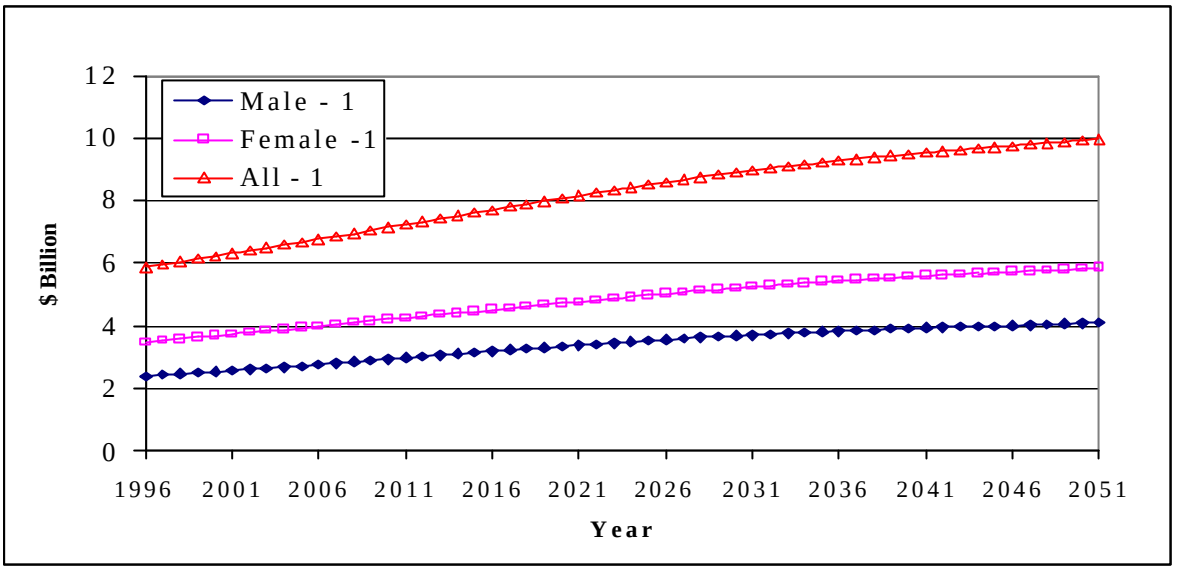


Medicare Index (MI)

As shown in Figure 20, the combination of greater utilisation and a larger proportion of women using Medicare results in a greater demand on the scheme for women from about 15 to 60 years of age than is the case for men.

[18]Department of Health and Family Services, *Medicare Statistics 1984-85 to June Quarter 1998*, AGPS, Canberra, Graph 1 page 16.

Figure 20: Medicare index



4.2 Medicare costs projections

As in the case for acute care, the analysis of Medicare costs is presented in three stages. The Normal population projection is intended to show the increase in costs attributable just to the combined effects of population growth and ageing (i.e., excluding other potentially important factors which could drive future costs, such as: new procedures and technologies, productivity gains, access initiatives and policy interventions). The Constant population projection hold the population fixed at 1996 levels but are constrained to follow the demographic composition of the Normal population projection, thus revealing estimated costs due to ageing only. The Differential population projections, which is obtained by subtracting the 1996 population figures from the Constant population projections, quantify the cost effects of the ageing population by age group.

The following sections describe each of the population projections.

4.3 Normal population projection

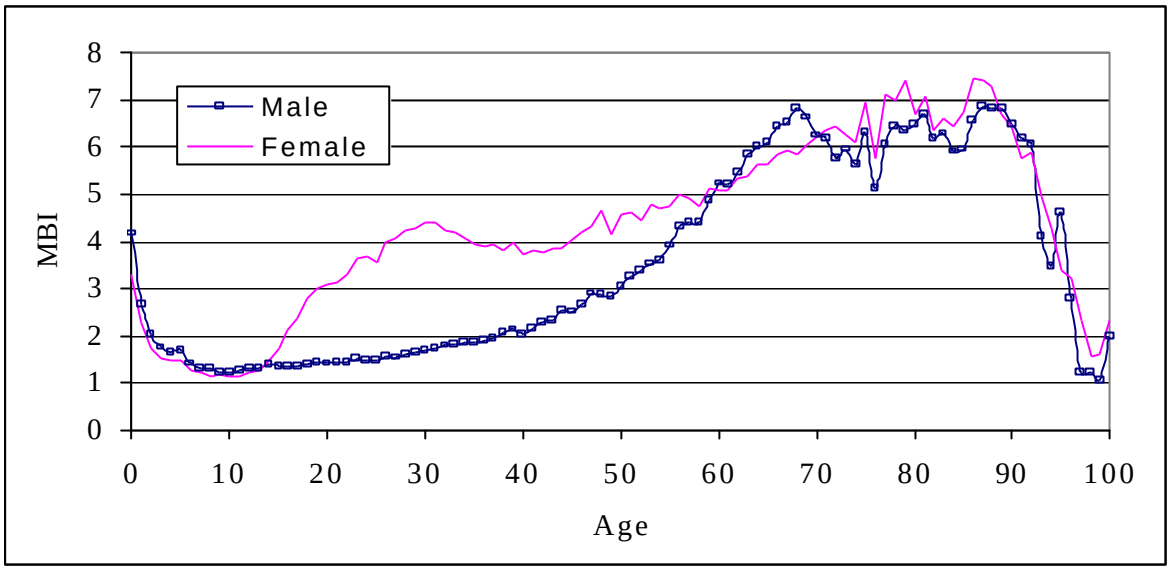
The demographic composition of the projected population and the annual per cent variations are identical to those shown in Figure 7 and Figure 9 and are not repeated here.

4.4 Normal population projection: Medicare costs

The projected Medicare costs for the Normal population are shown in Figure 21. Costs increase from about $6 billion in 1996 to very nearly $10 billion in 2051. [19]

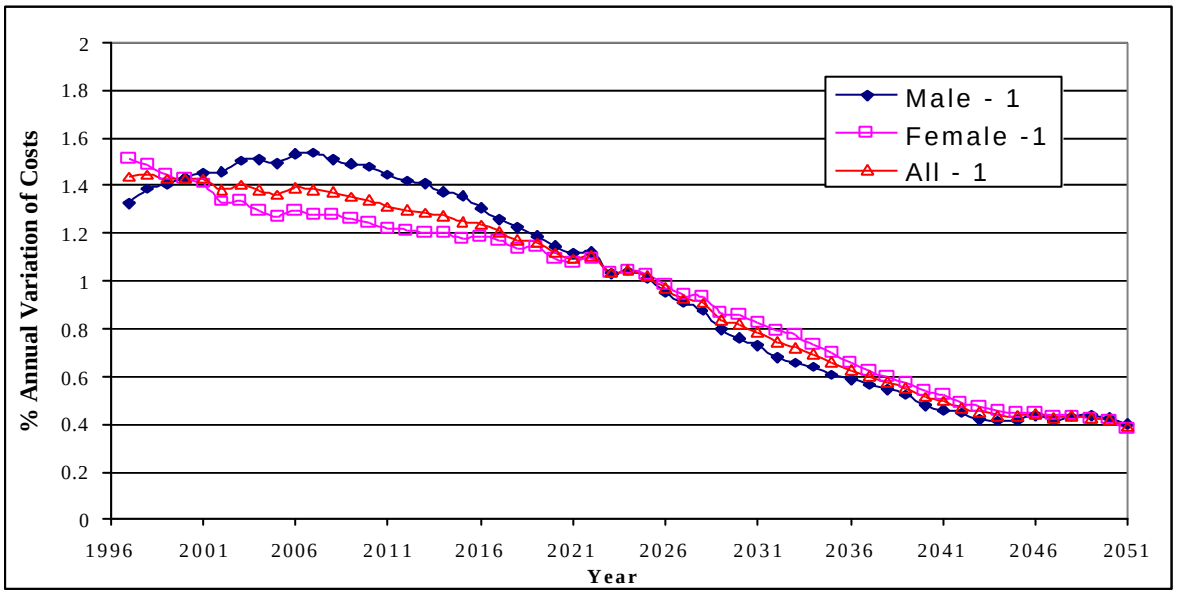
[19] According to Table D2 1995-1996, page 189 in *Medicare Statistics 1984-85 to June Quarter 1998*, the actual Medicare benefit paid was estimated at $6.04 billion.

Figure 21: Normal population projection Medicare costs



The annual percent variations in Medicare costs for the Normal population projection are shown in Figure 22. These variations include the effect of population growth and ageing. It can be seen that the maximum annual increase is estimated to be nearly 1.6 per cent in about 2007, and by about 2015 the annual rates of increase have returned to their 1996 levels.

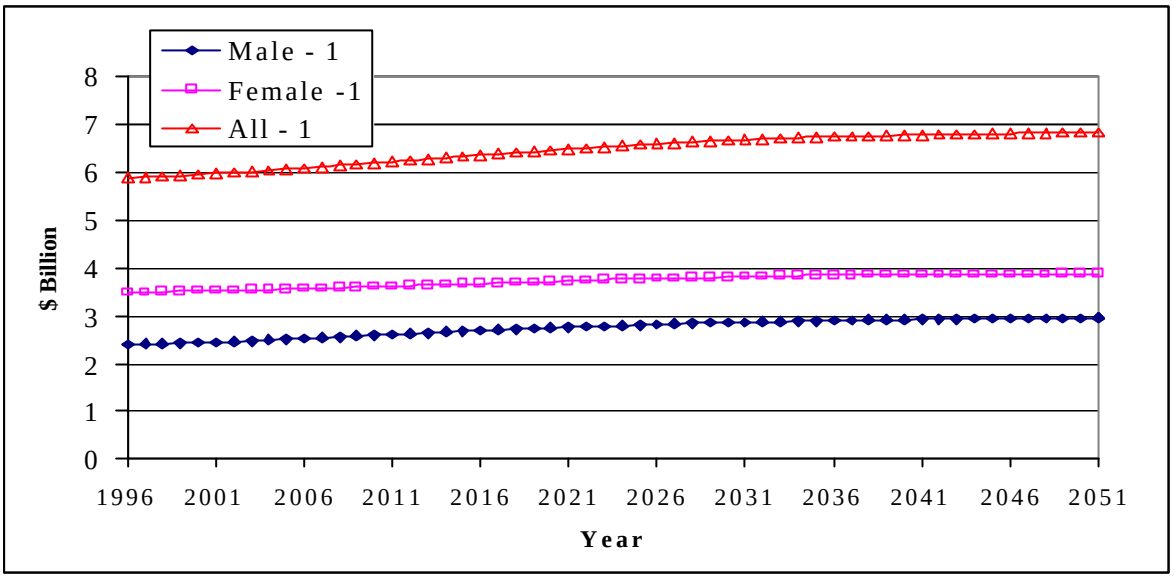
Figure 22: Annual Per Cent Variation of Normal Population Medicare Costs



4.5 Constant population projection: Medicare costs

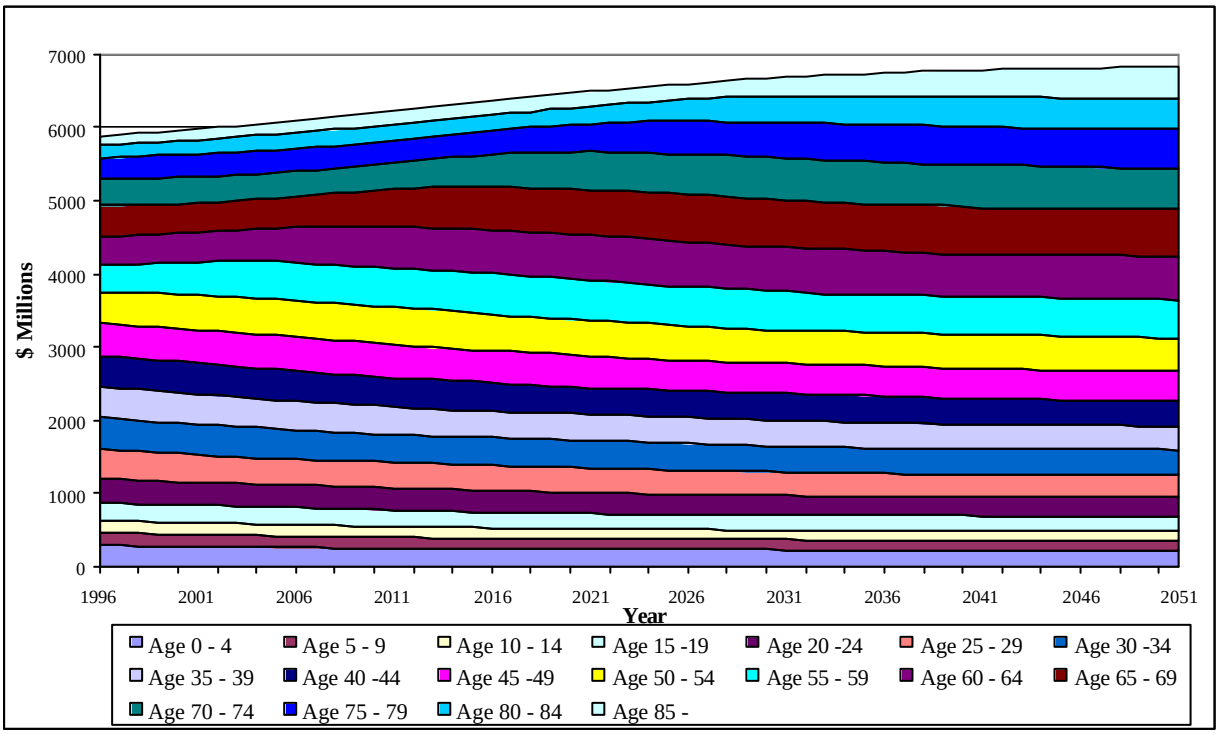
The Constant population projection: Medicare costs, which represents the effect of ageing only, are shown in Figure 23. It can be seen that the ageing of the population is projected to eventually add about $1 billion to the Medicare bill by 2051.

Figure 23: Constant Population Projection Medicare Costs



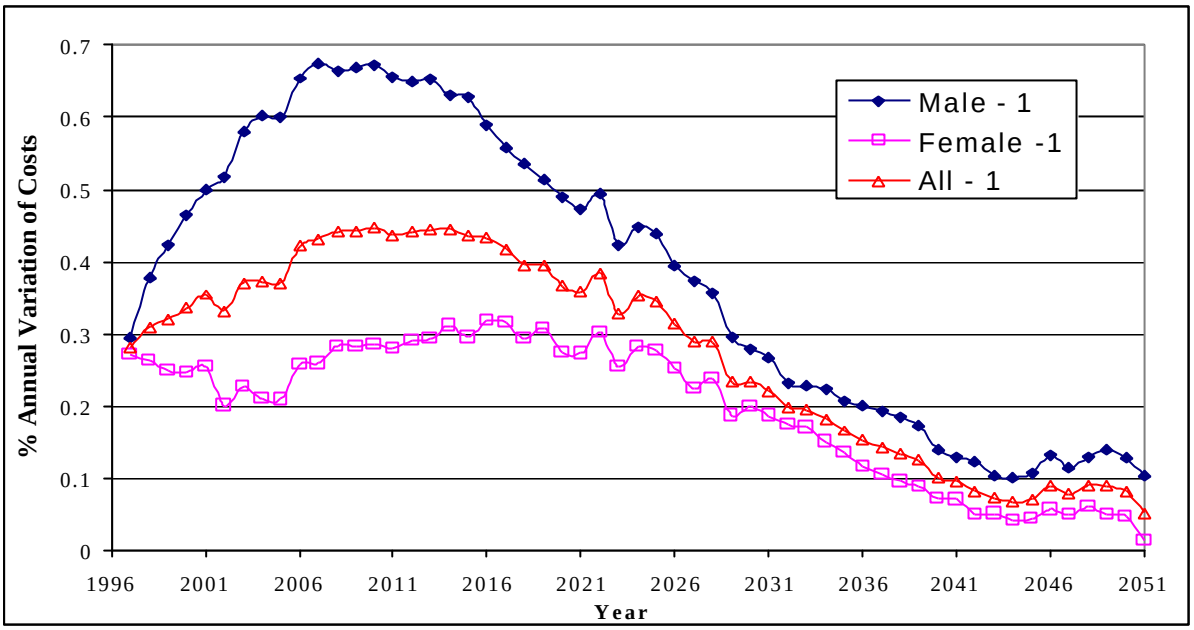
The distribution of costs by age groups are shown in Figure 24. As is the case for acute care, most of the increase is attributed to the age groups older than 55-59.

Figure 24: Constant Population Projection Medicare Costs by Age Group



The annual variation in the constant population projections are shown in Figure 25. The maximum annual rate of change is nearly 0.7 per cent for men in about 2007. Thereafter, the annual rate of increase declines to less than 0.1 per cent by 2051.

Figure 25: Annual Variation of Constant Population Projection Medicare Costs



4.6 Differential population projection: Medicare costs

The variation of the total Medicare costs for the Differential population projection is shown in Figure 26. The total cost, as for the acute care differential costs, starts at 0 because the Differential population consists of the constant population minus the 1996 population. The additional cost of nearly $1 billion represents the net cost due to ageing, of which about $0.55 billion is attributed to men and about $0.4 billion to women.

The “losses” and “gains” by age group are shown in Figure 27. By 2051 the age groups of 55-59 and above contribute the majority of the increased costs while the other age groups cost less. The effect of ageing is clearly apparent for the age groups of 55-59 and older.

Figure 26: Differential Population Projection Medicare Costs

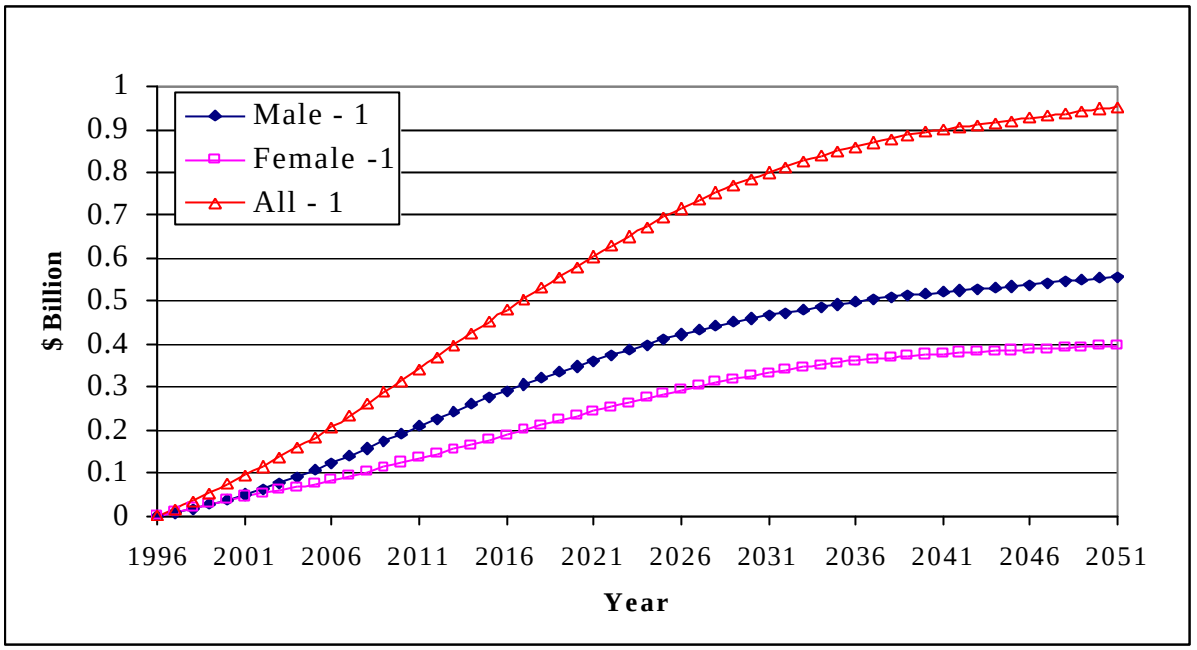
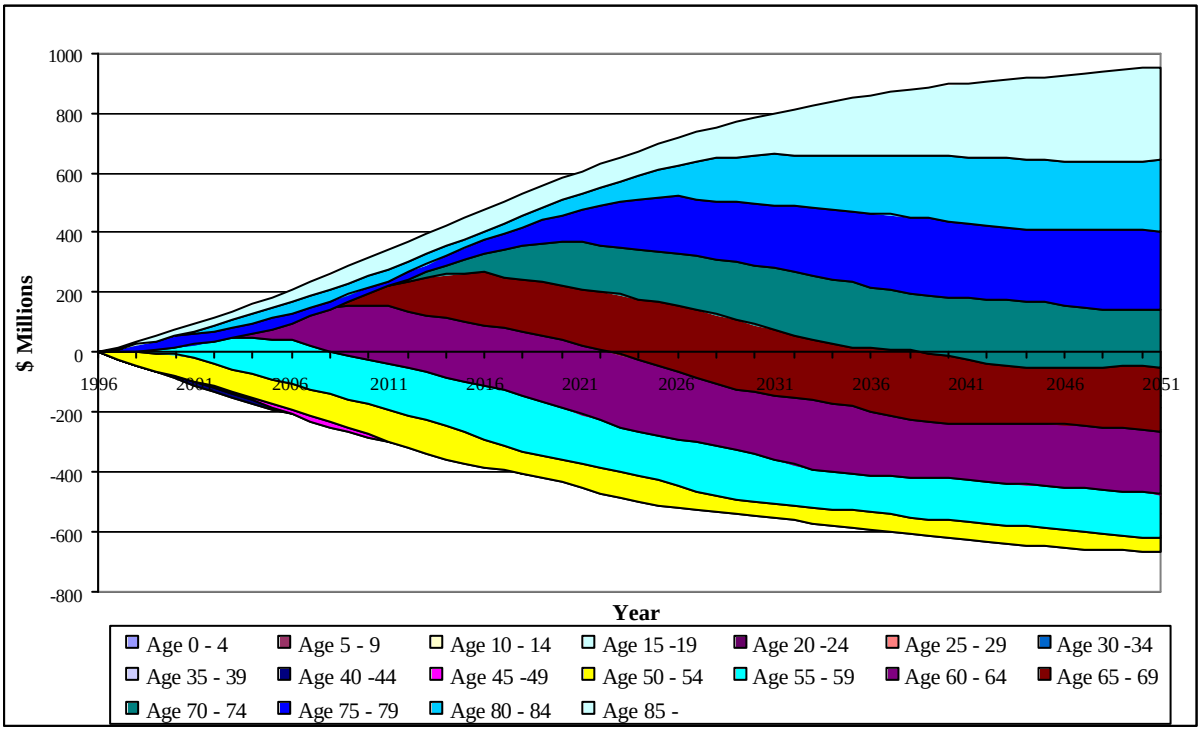


Figure 27: Differential Population Projection Medicare Costs by Age Group



5 Pharmaceutical Costs

5.1 Limitations on projecting future pharmaceutical costs

As explained in the following sections, projections of future Pharmaceutical Benefits Scheme (PBS) costs presented here must be viewed with considerable caution. To understand the reasons for this it is necessary to describe the salient features of the PBS.

Australia's Pharmaceutical Benefits Scheme

The PBS is a universal scheme that provides subsidised pharmaceuticals to Australian residents. In addition to a general subsidy, where the patient pays a maximum co-payment (out-of-pocket contribution) of $20 per item and the government pays the rest, patients may also benefit from two other subsidy arrangements: one applying to individuals and the other to families.[20] Concessional patients (basically those with low incomes who are in receipt of social security payments) pay a maximum of $3.20 per PBS item.[21] Families with large pharmaceutical expenditures in a given year are protected by the PBS 'safety net'. For general patients, once expenditure exceeds $612.60 per year the maximum cost is reduced to $3.20 per PBS item.[22] For concessional patients, PBS items are provided free of charge once expenditure exceeds $166.40 per year.[23]

Thus, there are four categories of PBS user:

- Non-safety net and non-concessional;
- Non-safety net and concessional;
- Safety net and non-concessional; and
- Safety net and concessional.

Data limitations

The usefulness of PBS administrative data for research purposes is limited for several reasons, including the following:

- Poor Data Quality: The 1996 PBS file for Western Australia comprises some 10 794 186 scripts, of which very nearly 2 million had to be discarded because they had invalid patient identification numbers.[24] Furthermore, date of birth, postcode and gender were often omitted or clearly in error.[25]

[20]The general concession varies from time to time. In 1996, it was $20.
[21]The concessional rate also varies from time to time. In 1996, it was $3.20.
[22]Figure applying in 1996.
[23]1996 figure.
[24]It is not possible to determine the number of patients associated with invalid patient identification numbers.
[25]However, this information was extracted from the matching MBS record if one existed.

- Incomplete drug utilisation history: Only scripts priced over the 1996 $20 threshold are recorded in the PBS for general patients. Given the high proportion of drugs priced under $20, the scheme therefore only records a partial drug history for this group.

- Family based PBS records: Patients within families that have reached the safety net will have confounding PBS script entries because scripts are then entered on a family basis, not on an individual basis. It is not therefore impossible to determine which safety net scripts belong to which family member.

- Changes in PBS patient categories during the calendar year: The unemployed and non-aged pensioners may drift in and out of concessional eligibility during the year. Movement between the general patient category and concessional category will result in an incomplete drug history. The accuracy of the drug history for this group will therefore depend on the proportion of the calendar year the patient is classified as a general patient.

- Lack of information on script quantity and dosage: A series of script counts have been calculated. These should be interpreted with caution, as there is no information on the dosage or quantity associated with each script. Furthermore, it is not known whether the drug was partially or fully consumed by the patient. The script counts are merely an indication of script volume and provide a benchmark against the dollars spent by the Commonwealth on prescription drugs via the PBS system.

A summary of the data used in this paper compared to data recorded by the PBS scheme is shown in Table 1. There are only 107 527 general scripts, representing 1.3 per cent of the sample data but in fact they should represent 11.4 per cent. Scripts for general patients are under-represented by a factor of almost nine to one. On the other hand, patients in the sample data with a health care card and who qualify for the safety net rebate accounted for 31.5 per cent of scripts in the analysis dataset (whereas they should account for only 15.1 per cent of total scripts - so that they are over-represented by a factor of about 2 to one). The remaining categories are not too dissimilar. Fortunately, the largest number of scripts, 5 471 838, has about the right level of representation, being under-represented by about 10 per cent.

Clearly there is some bias in the sample PBS data used in this analysis. The most accurate PBS data is collected for concessional patients who were entitled to a Health Care Card during the entire year. In general, PBS data is skewed to the elderly (on age pensions), the unemployed, and to patients receiving other kinds of pension.

Table 1: Sample PBS data and PBS data

Safety Net	*Concessional*	*Number of Scripts*	*% Scripts*	*PBS % Scripts (a)*	*% Benefit*	*PBS % Benefit*
No	No	107527	1.3	11.4	1.3	15.5
No	Yes	5 471 838	62.0	68.5	58.5	62.0
Yes	No	462 028	5.2	4.4	6.4	5.4
Yes	Yes	2 780 022	31.5	15.1	33.8	16.3
	Totals	8 821 415	100	99.4 (b)		

Notes:

a. The percentages shown in the PBS columns are taken from "*Expenditure and prescriptions twelve months to 30 June 1997*", Table 1 PBS Prescriptions Volume and Government Costs, page 2, Analysis Section, Pharmaceutical Benefits Branch, Commonwealth Department of Health and Family Services.

b. The 'Doctor's Bag' of 0.6 per cent is not counted (these are scripts doctors have on hand for emergency purposes).

5.2 PBS cost parameters

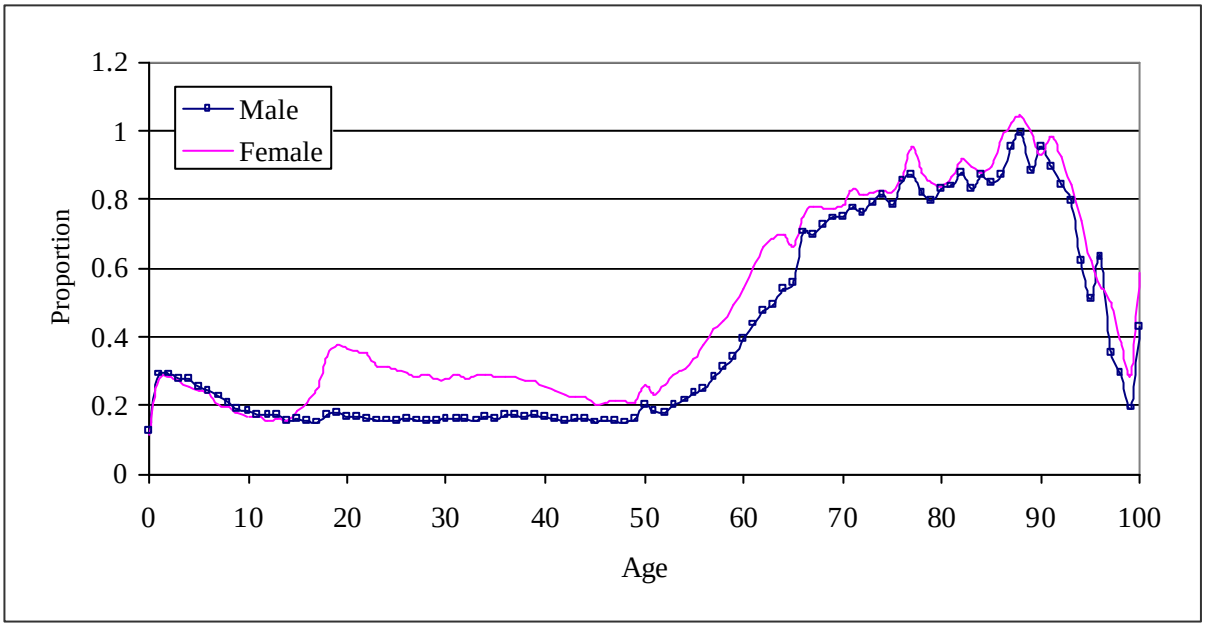
The following sections examine the parameters used to project the PBS costs to the government (benefit paid to patients). They parallel the method of the two previous sections (on the MBS and acute care).

Proportion of people using the PBS

Figure 28 shows the proportions of Western Australian residents for each age group who used PBS at least once during 1996.

Up to the age of 14 years, the proportion of male users is marginally higher than that for females. For all other ages, except for age 96, the proportion of women is significantly higher than that for men. For women aged 14 to 19 there is a sharp rise and then a gradual decline until the age of 49.

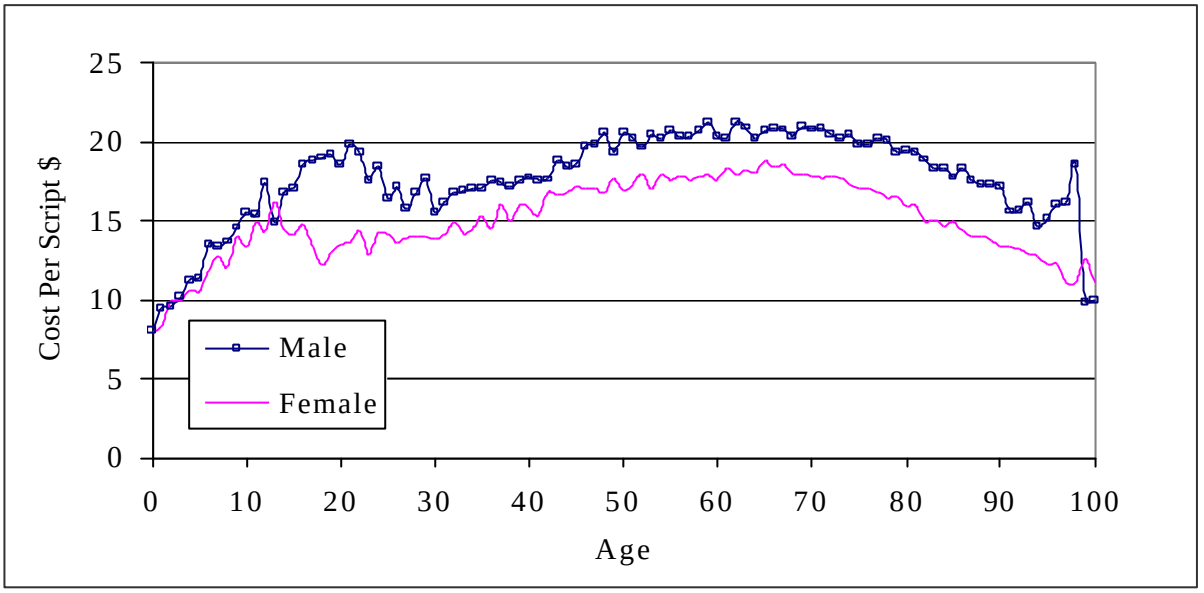
Figure 28: Proportion of People Using PBS



Cost per PBS item

Figure 29 shows the variation of the average cost per user with age. The cost varies between $8 to $21 for men and $8 to $18 for women, with the cost per script consistently higher for men than for women, except for the ages of 99 and 100. Except for a dip between the ages of 13 to about 40 for women and 19 to about 50 for men, the cost per script for both men and women increases with age up to about the mid-sixties when there is a slight decrease until age 98 for women and 94 for men.

Figure 29: Average Cost per PBS Item



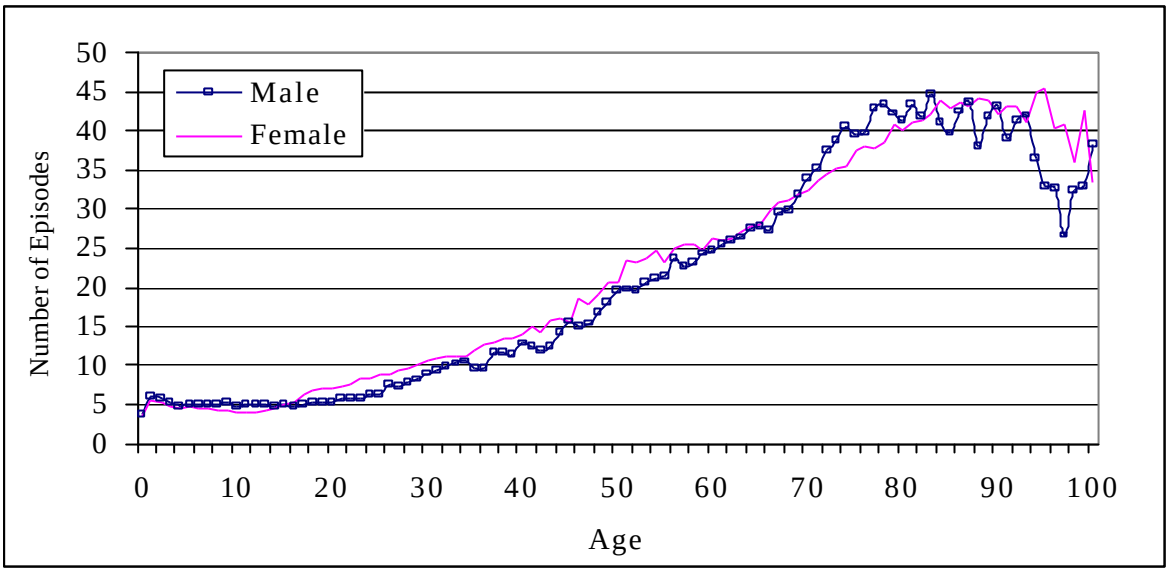
Average number of PBS items per user

As with Medicare, the number of PBS scripts per person does vary from State/Territory to State/Territory.[26] Consequently, the average numbers of items per user for Western Australia were scaled to the Australian average, using an estimated single factor. This is not ideal since a different factor should be used for each gender and each one-year age group, but the quality of PBS data does not permit analysis by age and gender.

Figure 30 shows that the average number of PBS items per user varies from about 5 to 45 as age increases, but with a slight reduction for people over the age of about 90. There are no significant differences between the average number of scripts for women compare to those for men.

[26]Commonwealth Department of Health and Family Services, *Expenditure and prescriptions twelve months to 30 June 1997*, AGPS, Canberra, Table 4 PBS Processing by State, page 4.

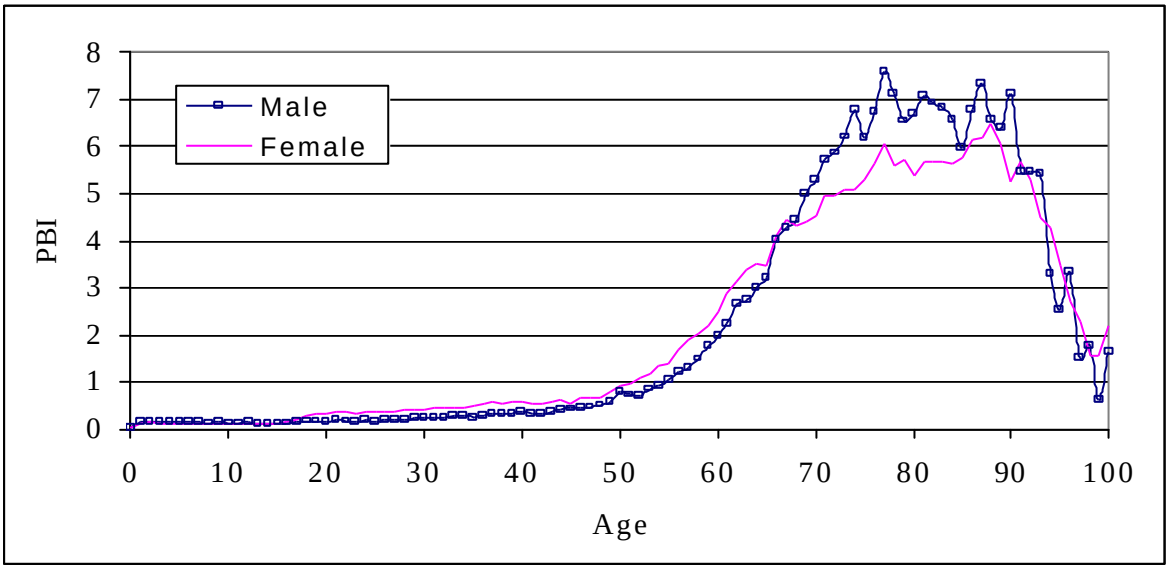
Figure 30: Average Number of PBS Items Per User



PBS Index (PI)

The PI is shown in Figure 31. As can be seen from the graph, for men the index increases with age up to about age 74, remains steady, but with some oscillations, until age 90 and then decrease quite sharply. For women, the index increases with age up to about age 88 and then decreases quite rapidly. The demands of women marginally exceed that of men up to about the age 66 but thereafter it is considerably less than men up to age 85.

Figure 31: PBS Index



5.3 PBS costs projections

As in the case for acute care and doctor attendances, the analysis of PBS costs is presented in three stages. The Normal population projection is intended to show the increase in costs

attributable solely to population growth and ageing, (i.e., excluding other confounding factors which may nevertheless be important cost drivers).

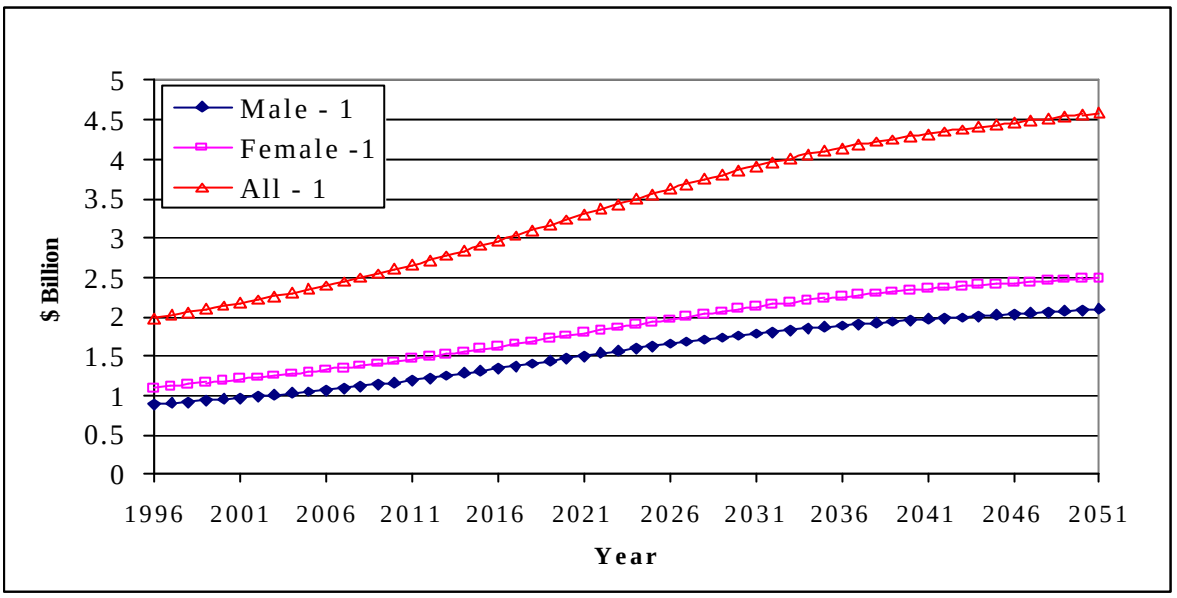
5.4 Normal population projection

The demographic composition of the projected population and the annual per cent variations are identical to that shown in Figure 7 and Figure 9 and are not repeated here.

5.5 Normal population projection: PBS costs

The projected PBS costs for the Normal population projection are shown in Figure 32. Projected costs increase from about $2 billion in 1996,[27] to about $4.5 billion in 2051.

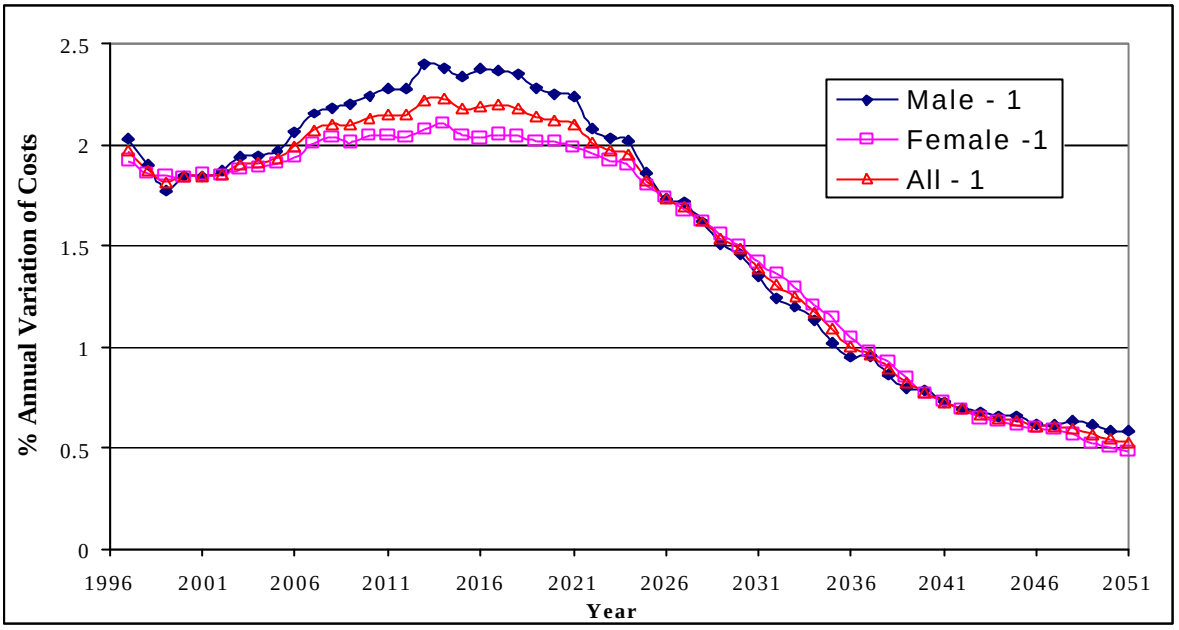
Figure 32: Normal Population Projection PBS Costs



Estimated annual percentage variations in PBS costs for the Normal population projection are shown in Figure 33. These variations include the effect of population growth and ageing. It can be seen that the maximum annual increase is nearly 2.4 per cent for men in about 2013. In the long term, the annual average increase is about 0.5 per cent.

[27] The estimated PBS expenditure in this paper for the calendar year 1996 is $1.99 billion, compared to the reported expenditure for the 1995-96 financial year of $2.19 billion (Commonwealth Department of Health and Family Services, *Expenditure and prescriptions twelve months to 30 June 1997*, AGPS, Canberra). Thus, despite the demonstrably unrepresentative nature of data used in the analysis, the data do seem to align tolerably well with PBS costs in 1996.

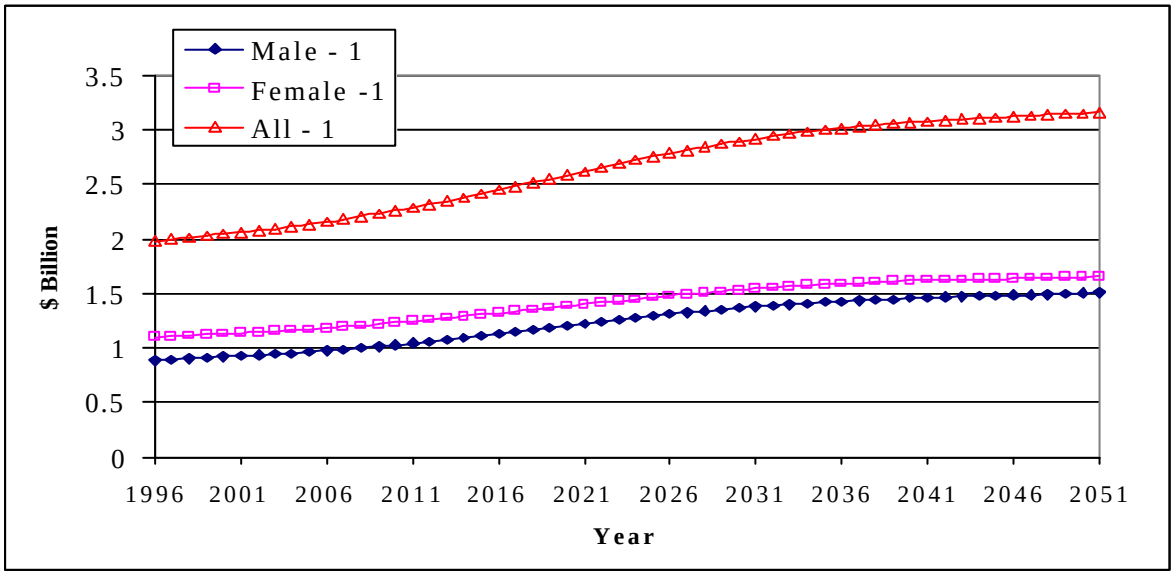
Figure 33: Annual Per Cent Variation of Normal Population PBS Costs



5.6 Constant population projection: PBS costs

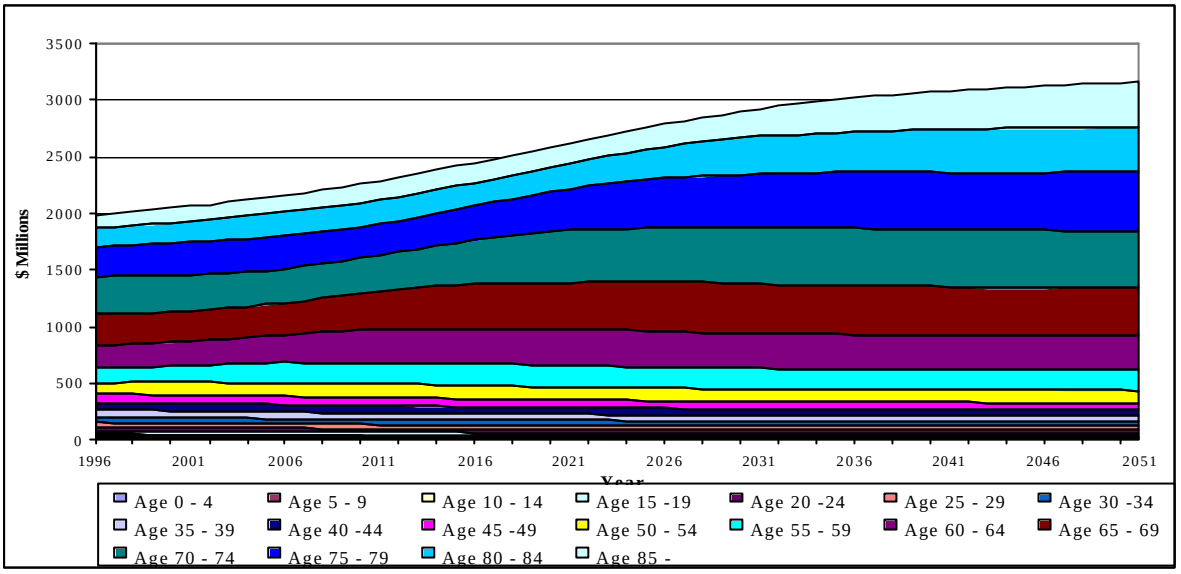
The Constant population projection: PBS costs, which represent the effect of ageing only, are shown in Figure 34. It can be seen that ageing results in an increase of about $2.5 billion by 2051.

Figure 34: Constant Population Projection PBS Costs



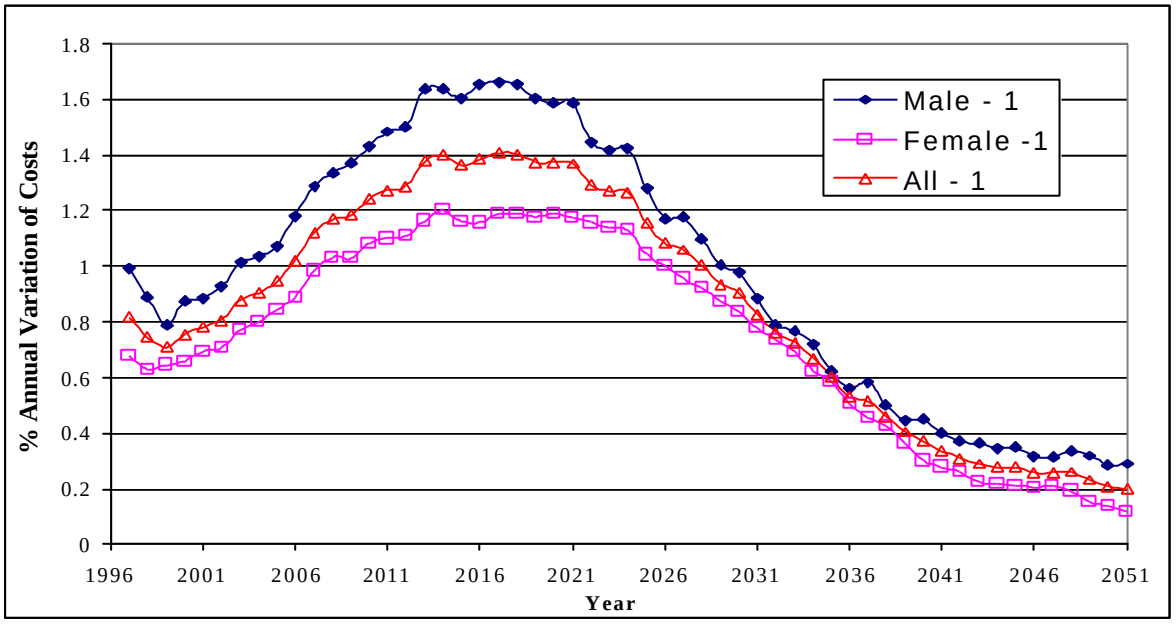
The distribution of costs by age groups is shown in Figure 35. As with acute care and the MBS, the largest increases occur in the age groups older than the 55-59 year age group.

Figure 35: Constant Population Projection PBS Costs by Age Group



Annual variations in the Constant population projections are shown in Figure 36. The maximum annual rate of change is nearly 1.7 per cent for men in about 2015. Thereafter, the annual average rate of increase declines to about 0.2 per cent by 2051.

Figure 36: Annual Variation of Constant Population Projection PBS Costs

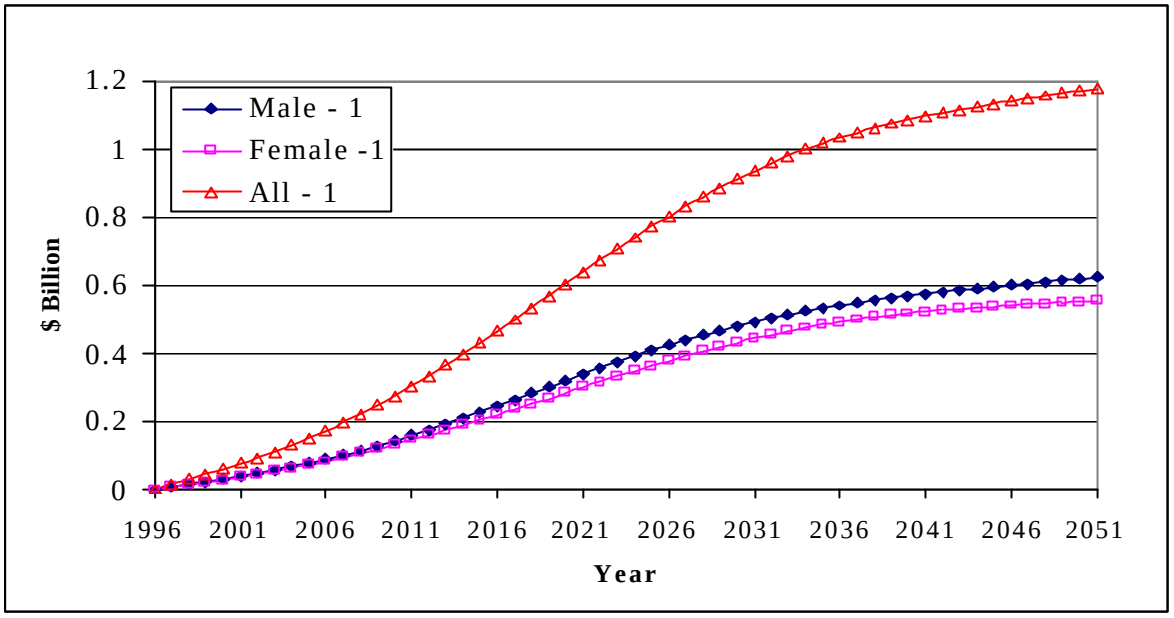


5.7 Differential population projection: PBS costs

The variation of the total PBS costs for the Differential population projection is shown in Figure 26Figure 37. As for the acute care and MBS Differential population projections, the total cost starts at 0 because the differential population consists of the constant population minus the 1996 population. The additional cost - of nearly $1.2 billion by 2051 - represents

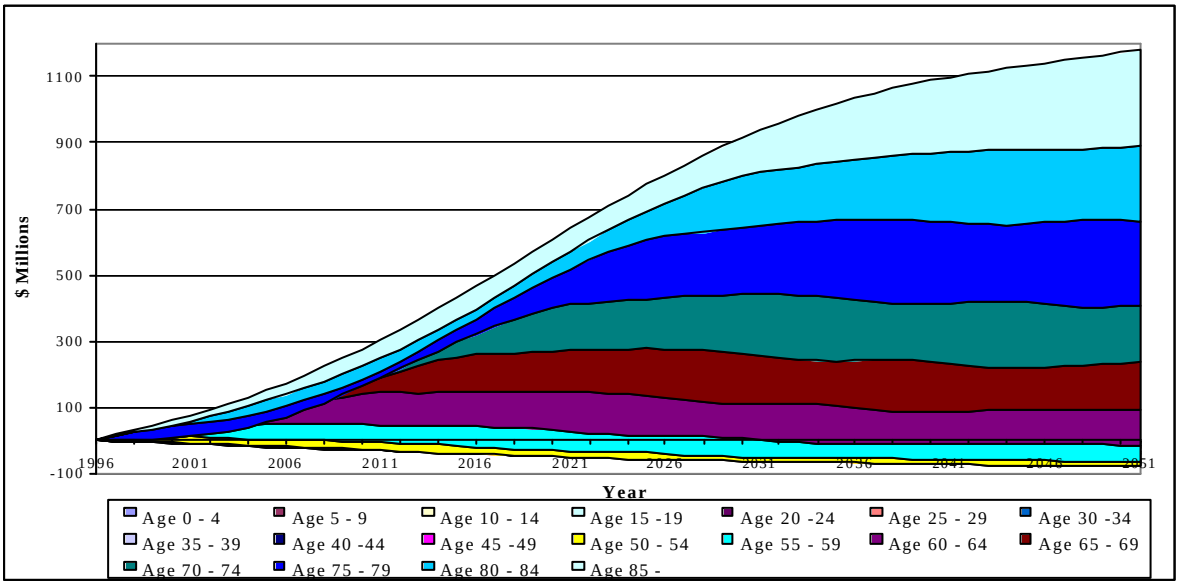
the net cost due to ageing (of which about $0.62 billion is attributed to men and about $0.55 to women).

Figure 37: Differential Population Projection PBS Costs



The “losses” and “gains” by age group are shown in Figure 38. Projected additional PBS expenditure is greatest for the age groups 55 and above, with some offsetting reductions in expenditure in the case of younger age groups.

Figure 38: Differential Population Projection PBS Costs by Age Group

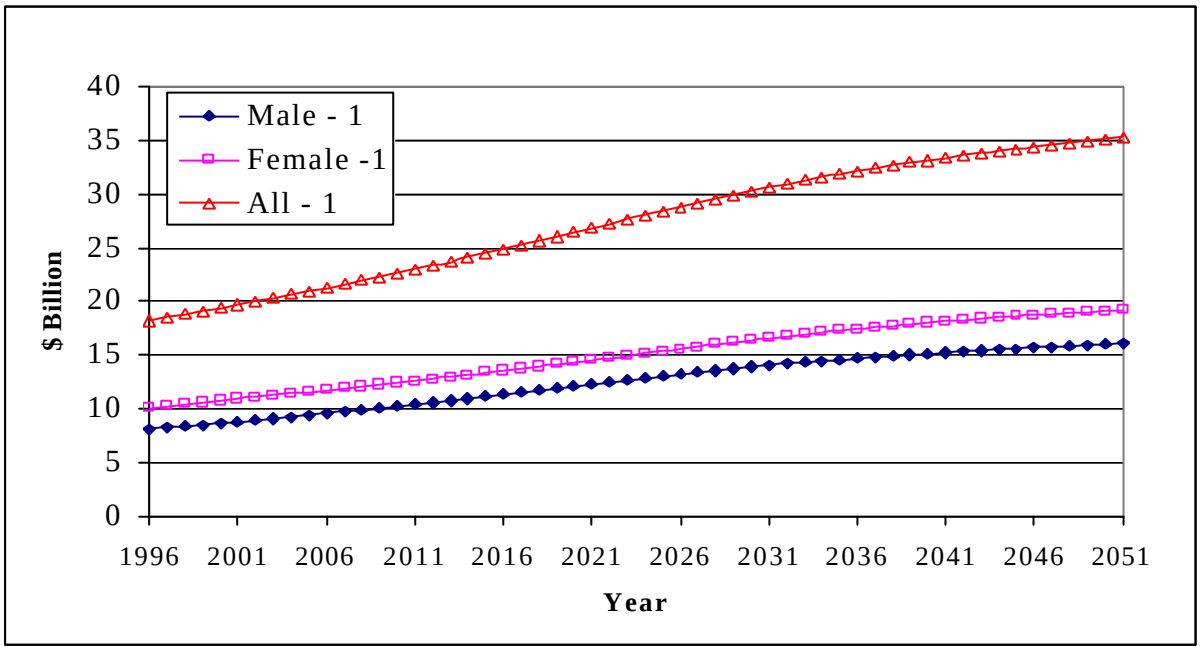


6 Combined Costs

6.1 Normal population projection: combined costs

For the Normal population projection, the sum of the costs for acute care, MBS and PBS are shown in Figure 39. It can be seen that the estimated expenditure in 1996 is about $18.2 billion. According to *Australia's Health 1998* the total recurrent health expenditure in 1995-96 was estimated at $38.95 billion.[28] Noting that the cost projections in this paper are limited to acute care hospitals, MBS and PBS expenditure only, *Australia's Health 1998* reports a total recurrent expenditure on these services of $19.84 billion. However, if the expenditures on MBS and PBS are taken from the Department of Health and Aged Care publications then this figure is reduced to $19.1 billion.[29] Whatever the case, the 1996 estimated costs in this paper compare favourably with reported expenditure in that the estimated costs are somewhere in the vicinity of 5-8 per cent of reported expenditure.

Figure 39: Normal Population Projection All Costs



The cost grows from $18.2 billion in 1996 to $35.3 billion in 2051. The costs for women are, on average, about 9 per cent higher than the corresponding cost estimates for men.

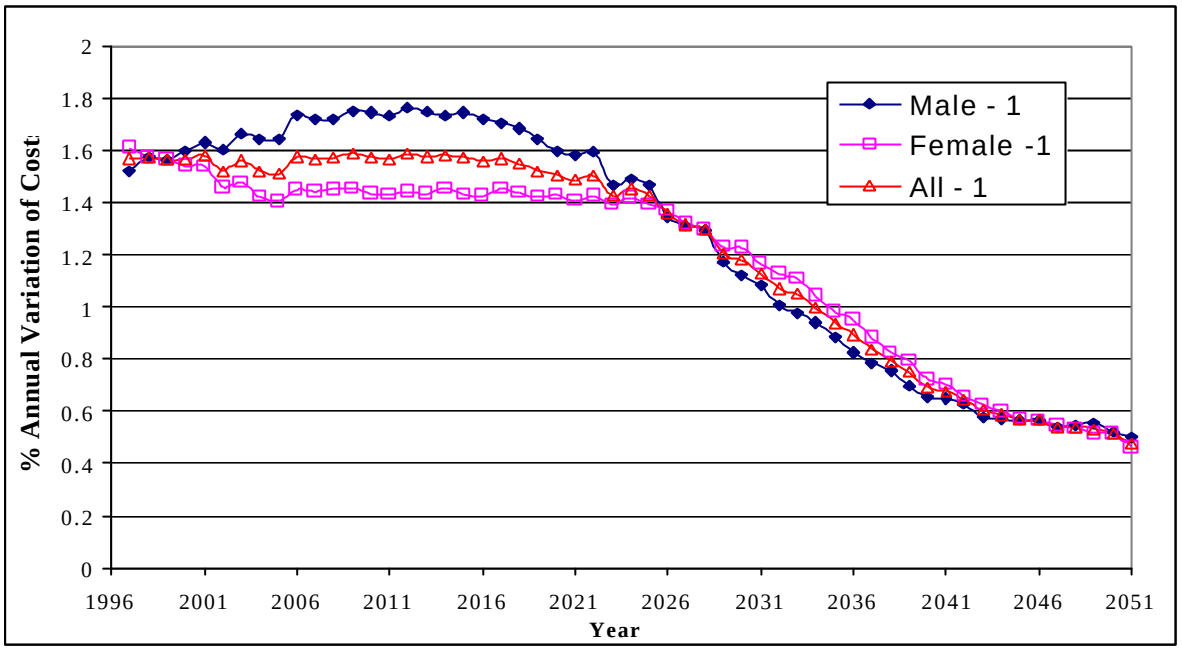
The annual percentage variations for the Normal population projection are shown in Figure 40. The maximum variation is very nearly 1.8 per cent in 2012 for men. For the total population the annual per cent variation very nearly reaches 1.6 per cent in 2006 and stays at about that level until 2017. Thereafter, it gradually decreases to about 0.5 per cent per annum by 2051.

[28] Australian Institute of Health and Welfare (AIHW), 1998, *Australia's Health 1998*, AGPS, Canberra, page 167, Table 6.5.

[29] Department of Health and Family Services, 1997, *Expenditure and prescriptions twelve months to 30 June 1997*, and *Medicare Statistics June Quarter 1998*, AGPS, Canberra.

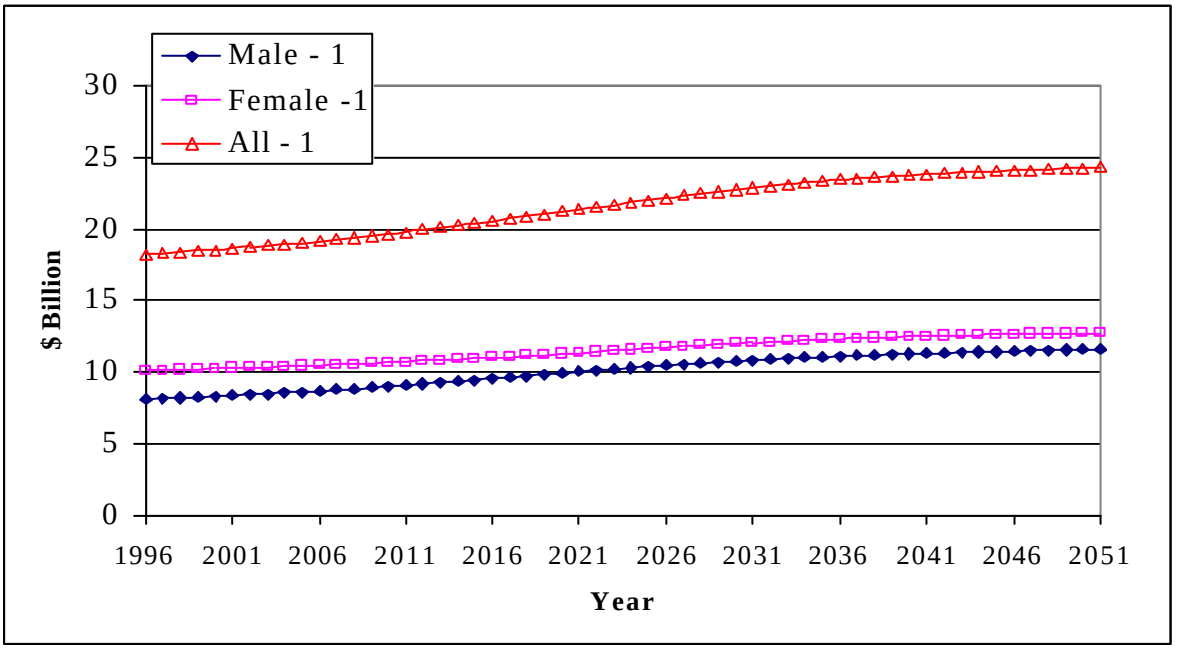
Over the period 1996 to 2051 the average annual rate of increase is equivalent to 1.2 per cent, but it is important to stress that the annual rate of increase is not constant. As noted above, the annual rate of increase peaks at 1.6 per cent and stays at that level until about 2018 - after which the extra demands placed on Australia's health care system attributable to the ageing of the 'baby boomer' generation begins to wane.

Figure 40: Annual Per cent Variation of Normal Population - All Costs



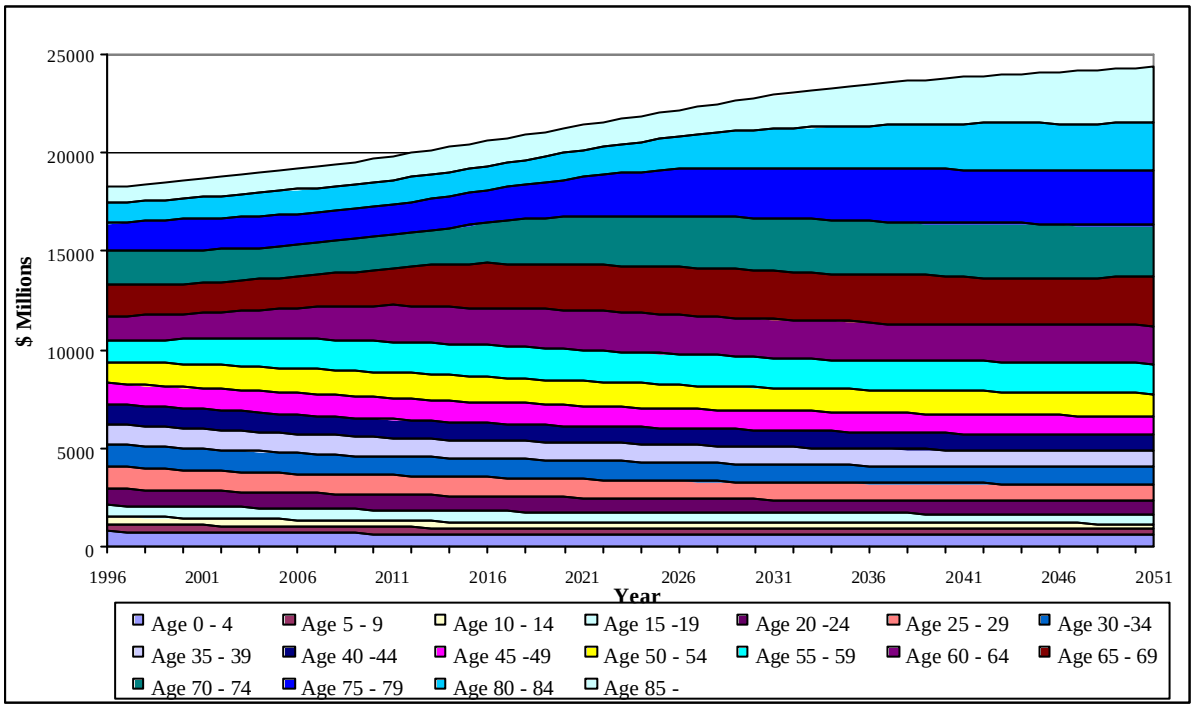
The effect of ageing on the three health systems is shown in Figure 41. Projected costs rise from about $18 billion in 1996 to about $24 billion in 2051, representing an increase of about $17 billion.

Figure 41: Constant Population Projection – All Costs



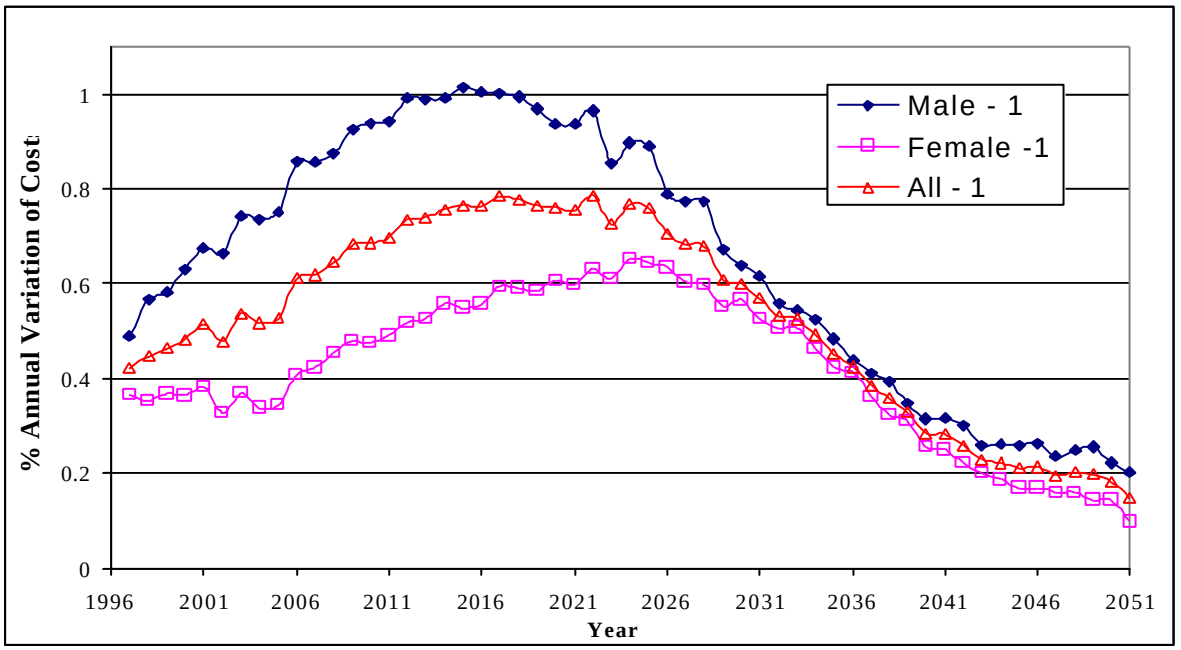
Across all three health system components the age groups from 55-59 and older exhibit the greatest increases in projected costs, with the older age groups accounting for the largest increases.

Figure 42: Constant Population Projection – All Costs by Age Group



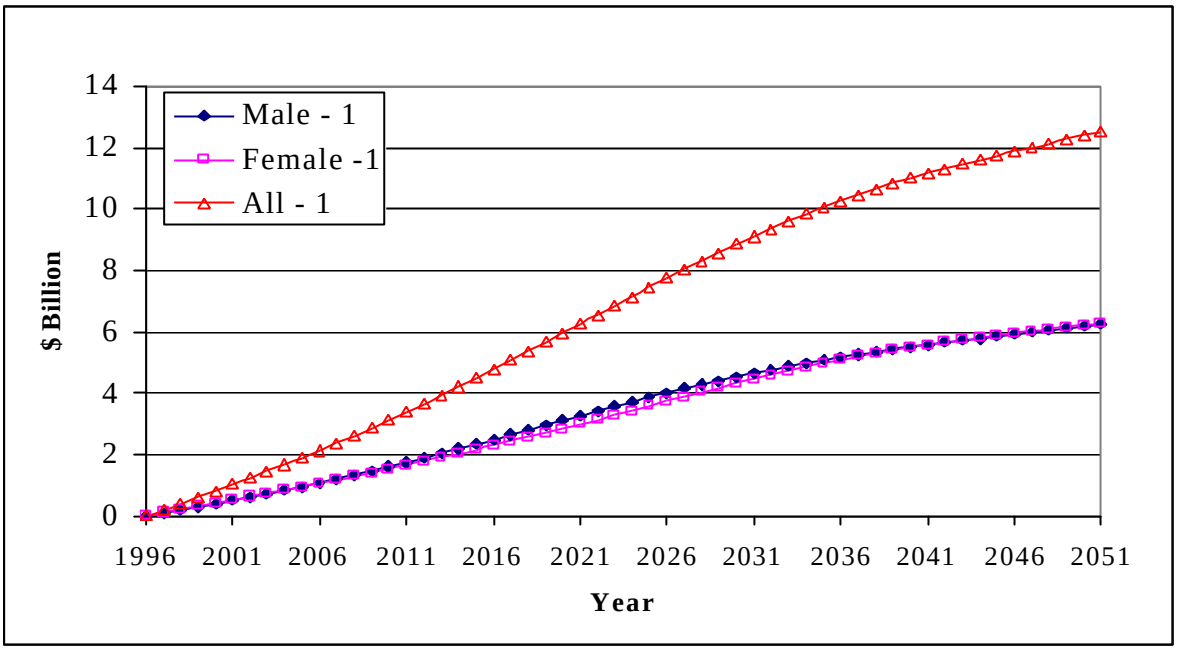
The annual rate of increase peaks at about 0.8 per cent and stays in that vicinity from about 2014 until 2025.

Figure 43: Annual Variation of Constant Population Projection – All Costs



The net effect of ageing is to increase estimated costs by about $12.5 billion, as shown in Figure 44:

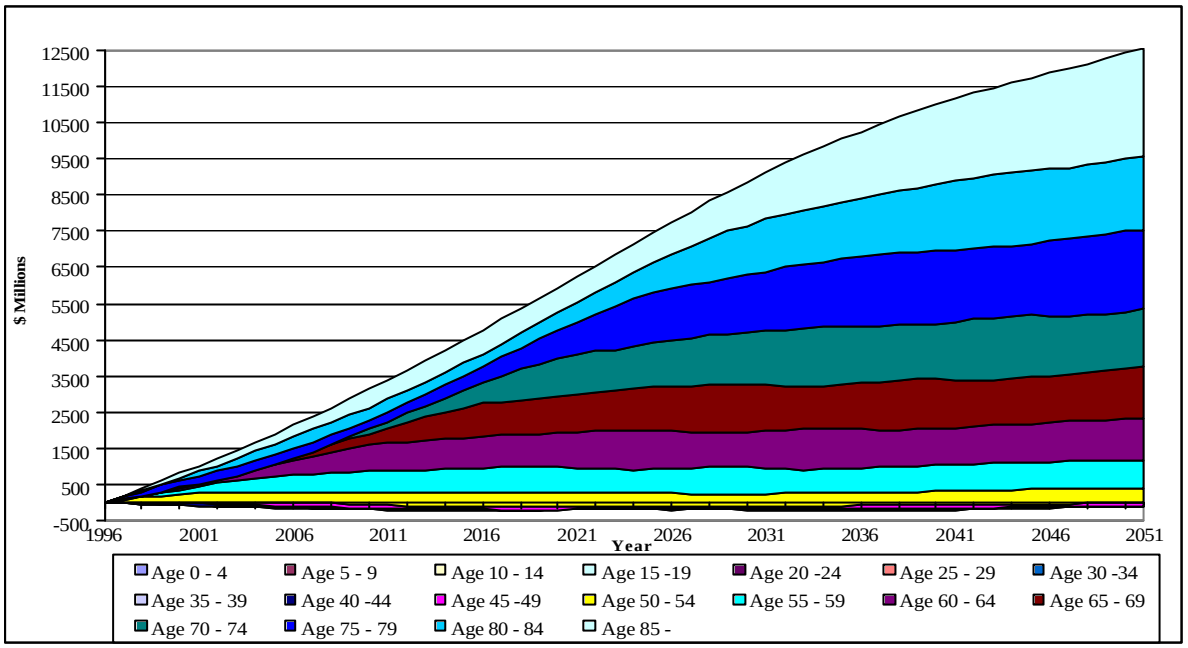
Figure 44: Differential Population Projection – All Costs



The contribution of the different age groups to the total increase in health costs is shown in Figure 45.

Generally speaking, the contribution to increased costs for the age groups below 45-49 decreases whereas the contribution to the increased costs increases for age groups above 50-59. The effect is quite pronounced for age groups 60-64 and above. Note, for example, that the increase in costs due to the 85+ age ($2.9 billion) represents some 23% of the total increase in costs ($12.5 billion) but only about 8% of the total projected health costs ($35 billion).

Figure 45 Differential Population Projection - All Costs by Age Group



7 Conclusions

The effect of population growth and the progressive ageing of the Australian population will see hospital costs increase from an annual rate of about 1.6 per cent in 1997 to just over 1.8 per cent in 2012 (abstracting from the effects of other potentially important cost drivers - such as a secular trend to utilise health care services more intensively over time). The annual rate of increase is projected to then hover around 1.8 per cent until 2018. Thereafter, the annual rate of increase is projected to decline to about 0.5 per cent by 2051.

With the effect of population growth removed, the projected annual rate of increase of hospital costs is projected to rise from 0.5 per cent in 1997 to a peak at about 1.3 per cent in the period 2015 to 2018. Thereafter, the projected annual rate of increase declines to about 0.2 per cent by 2051. Thus, the majority of projected cost increases over the period can be attributed to the ageing of the population.

The net effect of the ageing population is to increase real (i.e., inflation-adjusted) hospital costs by about $4 billion in the year 2051, mainly due to the increase in the number of people aged 65 years and over. Conversely, in relation to 1996 expenditure, about $1 billion less is projected to be spent on people less than 65 years of age.

The situation is quite similar for the MBS and PBS components of the Australian health system. Relevant statistics are brought together in Table 2.

Table 2: Summary of Effect of Population Growth and Ageing on Health Costs

Health system	*Max Annual % Increase*	*Year of Max % Increase*	*Constant % Increase for period 1996-2051*	*Cost Increase 1996-2051 $ billion*
Acute Care				
Population Growth and Ageing	1.6	2006-2022	1.3	10.39
Ageing	1.1	2015-2022	0.6	3.96
MBS				
Population Growth and Ageing	1.4	1999-2008	0.9	4.08
Ageing	0.7	2006-2013	0.3	0.96
PBS				
Population Growth and Ageing	2.2	2013-2018	1.5	2.6
Ageing	1.4	2013-2021	0.8	1.2
Combined				
Population Growth and Ageing	1.6	2006-2018	1.2	17.07
Ageing	1.0	2012-2019	0.5	6.09

In terms of annual rates of increase, consumption of pharmaceuticals are projected to increase the most (at a maximum rate of increase of 2.2 per cent), while medical services are projected to increase the least (with a maximum annual rate of increase of 0.7 per cent). In terms of absolute increases, acute care is projected to increase the most over the projection period (by $10.4 billion), with pharmaceuticals recording the smallest absolute increase (at $2.6 billion).

Given the size of the Australian population as it is today, if its demographic composition were the same as it is projected to be in 2051 then, very nearly, an extra $17.07 billion in today's dollars would be needed to maintain the same level and quality of the three health services as they exist today. This view of the costs due to ageing is isolated, deliberately

so, from the tricky issues that have been side-stepped by the assumptions underlying the analysis presented in this paper, particularly those issues related to possible increases in cost due to a larger number, greater variety and complexity of future procedures. These issues are natural candidates for further study.

The results show that the changing demographic composition of the Australian population will have a considerable, but arguably nevertheless manageable, effect on the projected cost of health services. The increase in the recurrent expenditure due to population increase and the ageing of the population on acute care, MBS and PBS will doubtless present significant challenges to health planners and policy makers, but the costs appear to be manageable in the sense that the projected annual rates of increase are below the average annual rates of increase of GDP recorded in Australia over lengthy periods (so that health care cost should not - *by virtue of the progressive ageing of the population alone* - increase as a proportion of national expenditures over the longer term).