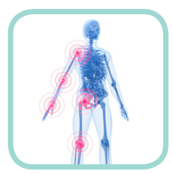
women's health australia

australian longitudinal study on women's health

Future health service use and cost:

Insights from the Australian Longitudinal Study on Women's Health



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Future health service use and cost: Insights from the Australian Longitudinal Study on Women's Health

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TABLE OF CONTENTS

TABLE OF FIGURES

LIST OF TABLES

1. Executive Summary

The Australian Longitudinal Study on Women's Health (ALSWH) includes three cohorts of women (born in 1921-26, 1946-51, 1973-78) who have been repeatedly surveyed since 1996, and a new cohort (born in 1989-95) first surveyed in 2013. The survey data are linked to Medical Benefits Scheme (MBS), Pharmaceutical Benefits Scheme (PBS), and hospital inpatient data, providing information on healthcare use, aged care data for women in the oldest cohort, and mortality data. The data provided by the women have been widely used to assess their health status and behavioural and sociodemographic characteristics that may affect health.

This report uses ALSWH data to identify expected trends in health status, health risks, and behaviours over the next two decades, and to compare trends across cohorts. Analysis of linked data on key health service use for women with different health and social needs provides an indication of potential service burden. The report also examines projected health disparities between women with different sociodemographic characteristics.

Needing help with daily tasks

The prevalence of Australian women who needed help with daily tasks in 2015 was 3.9 per cent and this is predicted to increase to 4.6 per cent by 2035. As women age, their physical function scores decline and the prevalence of reported need for help with daily tasks increases. By the time women are in their late eighties, around 22 per cent will need help with daily tasks, and there is no evidence that this percentage will be lower for subsequent cohorts of women. Consequently, as the Australian population ages, the percentage of women who need help with daily tasks will increase proportionally. The increase in the number and proportion of women who need help is likely to translate into large increases in demands on healthcare and increases in healthcare costs.

Obesity

Total health expenditure for obese women will double over the next 20 years, whereas the rate of increase in MBS, PBS, and hospital costs will be slower for women who are not obese. Women's body mass index increases with age to around 70 years, and is higher with successive cohorts. The prevalence of women who are obese increased 3.5 fold in the 1973-78 cohort from 1996 to 2012 and 1.6 fold in the 1946-51 cohort from 1996 to 2013. The prevalence of women who are obese is higher in the 1989-95 cohort compared to when the 1973-78 cohort were the same age. The increasing prevalence of obesity across successive cohorts, the increase in weight associated with ageing, and the projected changes in population size and structure all lead to a large projected increase in the number of obese women over the next two decades. Our projections show that the number of obese women will double from 2.4 million (or 26.6 per cent) to 4.8 million (or 40.0 per cent) between 2015 and 2035.

Smoking

The prevalence of smoking decreases with age and across successive cohorts. The uptake of smoking in the 1989-95 cohort is lower than in the 1973-78 cohort at the same age. If this trend continues, from 2015 to 2035, the prevalence of smokers among Australian women aged 20-90 is predicted to decrease from approximately 10 per cent to 3 per cent. The consequence of this decrease in smoking will be a decrease in healthcare costs attributable to smoking.

Mental Health

With population growth, the number of women aged 20-90 with psychological distress will increase from 1.2 million to 1.7 million from 2015 to 2035 – however the prevalence of psychological distress in this population is projected to decrease from 14 per cent to 13.6 per cent over that same period due to population ageing. Mental health scores are relatively stable with age, and women in the 1921-26 cohort score slightly better than the 1973-78 cohort. Correspondingly, the prevalence of women with psychological distress decreases with age. Women who experience psychological distress in the 1946-51 and 1921-26 cohorts have higher MBS, PBS, and hospital costs than women who do not have psychological distress.

Dementia

The number of women in the Australian population living with dementia is predicted to double between 2015 and 2035 if the prevalence of dementia remains constant. If the incidence of dementia remains constant, the number of new cases of dementia diagnosed each year in Australian women is predicted to double between 2015 and 2035. By 2012, 20 per cent of the ALSWH older cohort aged 85-90 had a report or record of dementia. After accounting for the possible underestimation of dementia in the cohort, 28 per cent of women were estimated to have dementia by age 90.

Highest educational attainment

The prevalence of women who attain a university qualification has increased by birth cohort and over time within each cohort. The number of women with a university education is predicted to increase from 2.6 million (or 28.5 per cent) to 4.4 million (or 36.1 per cent) between 2015 and 2035. Women with university education have lower healthcare costs than women with no university education. Consequently, while healthcare costs will increase overall, the increase in costs will be lower among more educated women.

Ability to manage on income

Younger women found it most difficult to manage on their available income, however managing on income became easier with age. Women who have difficulty managing on income have more MBS, PBS, and hospital costs overall. The number of women aged 20-90 who have difficulty managing on income is predicted to increase from 3.5 million to 4.6 million between 2015 and 2035, however prevalence will decrease by 1 per cent. We recognise that this is likely to be an underestimate of the proportion of women who have difficulty managing on income over the next 20 years. Women who have difficulty managing on income are predicted to have a total of $1.6 billion in MBS costs, $3.4 billion in PBS costs, and $9.8 billion in hospital costs in 2035.

Marital status

The prevalence of women who have partners increases from early adulthood until the late thirties, and by middle age, approximately 80 per cent of women are married or are in a de facto relationship. The percentage of women who are divorced increases with age in the 1946-51 cohort, and the percentage of women who are widowed increases with age in the 1921-26 cohort. The total number of women aged 20-90 who have partners is projected to increase from 6.2 million in 2015 to 8.2 million in 2035, however the prevalence will remain stable at approximately 67 per cent.

There was no consistent trend for MBS, PBS, and hospital claims and costs between partnered and unpartnered women, except that hospital costs for partnered women in the 1973-78 cohort were approximately $1000 higher than unpartnered women. It is projected that in 2035, the MBS, PBS, and hospital costs for women with a partner will be $2.5 billion, $4.8 billion, and $14.2 billion, respectively. For women who do not have partners, it is projected that in 2035, the MBS, PBS, and hospital costs will be $1.6 billion, $3.7 billion, and $8.2 billion, respectively.

Area of residence

The percentage of women who live in a major city (approximately 70 per cent), inner regional areas (20 per cent), and outer region and remote areas (10 per cent) are relatively stable across all observed ages for the women in ALSWH. With population growth, the number of women who live in a major city will increase, however the proportion of women who live in a major city is predicted to remain stable at 70 per cent. There was little difference in estimated MBS and PBS claims and costs between women who live in a major city and those who lived in a regional or remote area. However, hospital costs were higher for older women living in a major city than those who live in a regional or remote area.

Women who live in a major city are predicted to have total MBS, PBS, and hospital costs of $2.8 billion, $6.1 billion, and $17.1 billion, respectively, in 2035. In comparison, women who live in regional or remote areas are predicted to have total MBS, PBS, and hospital costs of $1.2 billion, $2.5 billion, and $6.7 billion, respectively, in 2035.

Summary

The overall effects of population ageing and population growth will result in an increase in healthcare expenditure. However, these effects are not equal for all population subgroups. A major driver of increased expenditure is obesity, with obesity rates increasing with age and over subsequent generations, and with obesity being a major driver of healthcare costs. Smoking is also a major driver of healthcare costs, but rates of smoking are projected to decrease so that smoking will account for a lower proportion of costs. Other factors likely to drive large increases in healthcare costs in the future include dementia and declines in phsyical function with consequent increased need for help with daily tasks. Education levels are projected to increase, potentially offsetting some increases in healthcare costs since women with higher levels of education have lower overall healthcare costs.

2. Introduction

2.1. The Australian Longitudinal Study on Women's Health

The Australian Longitudinal Study on Women's Health (ALSWH) was established in 1995 and in 1996, recruited 47,000 women in three age cohorts: aged 18 to 23 years (women born in 1973-1978), 45 to 50 years (1946-51 cohort), and 70-75 years (1921-26 cohort). The age groups were selected so that health of Australian women could be characterised across the life course. All cohorts have completed surveys approximately every three years since 1996. Since 2011, the 1921-26 cohort have additionally completed six-monthly follow-up surveys. Over the course of the study, participants have provided information on social, psychological, physical, and environmental aspects of their health and their use of health services. Self-reported survey data have also been linked to records for the Medicare Benefits Scheme (MBS), the Pharmaceutical Benefits Scheme (PBS), Cancer Registries, National Death Index, and hospital data for New South Wales, Queensland, South Australia, and Western Australia. Furthermore, record linkage to aged care data has been obtained for the 1921-26 cohort.

In 2013, a new cohort of 17,000 women aged 18 to 23 (1989-95 cohort) was recruited to examine the health and wellbeing of the next generation of young women. Where possible, data from the 1989-95 cohort have been included in analyses in this report.

ALSWH has now obtained 20 years of data on women's health from early adulthood to old age. This provides a unique opportunity to use this historical data to predict changes to women's health, and health service cost and utilisation for the next 20 years.

The purpose of this report is to:

- identify expected trends in health status, health risks, and behaviours over the period 2015 to 2035;
- provide an indication of potential health service utilisation and burden on the healthcare system;
- assess expected health and health service utilisation according to key drivers of poor health; and,
- assess expected health and health service utilisation for women from different population subgroups.

2.2. Forecasting health trends and expenditure

Long-term projection (more than ten years into the future) of healthcare use and expenditure is valuable in helping governments develop and implement policies to ensure the healthcare system can cope with the needs of the population. For this reason, the Australian Government produces an Intergenerational Report every five years to present changes that are likely to occur over the next forty years in the Australian population and how these may affect our economy, work force, budget, and environment. The Intergenerational Report generates these projections under the assumption that current Government policies will remain in place for the 40 year forward projection period and assesses their long-term sustainability. The 2015 Intergenerational Report is the fourth report in the series and describes the changes leading up to 2054-55 (Treasury, 2015).

Treasury projections for the 2015 Intergenerational Report are based on the following predictions and assumptions:

- Life expectancy at birth is projected to increase from 91.5 years for men and 93.6 years for women today to 95.1 and 96.6 years in 2054-55, respectively.
- Fertility rate will remain stable as is it has been since the late 1970s.
- Net overseas migration will be at 215,000 people a year.
- The average annual growth rate in the population will be 1.3 per cent.

Key findings from the 2015 Intergenerational Report related to this report are:

- Ageing in the population is predicted to contribute approximately 10 per cent to the increase in health spending.
- The key drivers of health expenditure are expected to be non-demographic factors such as changes in disease rates and technology; these are expected to account for approximately 80 per cent of the projected increase in health spending.
- Under current legislation, the Australian Government health expenditure is projected to increase from 4.2 per cent of GDP in 2014-15 to 5.7 per cent of GDP (or $260 billion in 2015 Australian dollars) by 2054-55.
- Also under current legislation, real health spending per person (adjusted for inflation and population growth) is projected to increase from $2,800 in 2014-15 to $6,600 in 2054-55.
- Spending per person on Medicare services is projected to increase by over 25 per cent per person (from $855 in 2014-15 to $1,017 in 2027-28 in 2015 Australian dollars).
- Pharmaceutical spending per person is projected to increase from $420 in 2014-15 to $474 in 2027-28 (in 2015 Australian dollars).

- Australian Government funding for public hospitals is estimated to increase from $647 per person in 2014-15 to $680 in 2017-18 (in 2015 Australian dollars) and projected to remain constant going forward.
- Projections from 2028-29 onwards was not separated by different health components, but rather total of Australian Government health spending based on historical data.

This report will complement the 2015 Intergenerational Report by producing projections in health expenditure for women based on generation-specific and age-specific trends identified in ALSWH for key drivers of poor health and population subgroups.

2.3. Key drivers of poor health and health inequalities

This report will focus on four key drivers of poor health: obesity, smoking status, mental health problems, and dementia. The latest available data from the Australian Bureau of Statistics (ABS) showed that these are major contributors to burden of disease in Australia, or strongly associated with conditions that are amongst the top twenty causes of death in Australia overall and top ten, specifically, in Australian women in 2014 (ABS, 2016). Mental and behavioural disorders accounted for 13 per cent of total burden and 23 per cent of non-fatal burden in 2010 (AIHW, 2014a). High body mass index and smoking contributed 9 and 8 per cent, respectively, of the total burden in 2010 (AIHW, 2014a). In 2011, dementia accounted for 4 per cent of total disease burden and was ranked second for overall burden of disease for people aged 65 and over, and third for leading causes of disability burden (AIHW, 2012).

There are also known health disparities between population subgroups categorised by highest educational attainment, ability to manage on income, marital status, and area of residence. These characteristics represent an individual's circumstances and affect their health behaviour and status. For example, people in regional and remote areas were more likely to be overweight or obese, to drink excessive amounts of alcohol, and to suffer from acute or chronic injury than those in major cities in 2004-05 (AIHW, 2008). In addition to these health issues and lifestyle behaviours, people in regional and remote areas were more likely to be daily smokers and to have high blood cholesterol compared with those in urban areas in 2011-12 (AIHW, 2014a). Research from ALSWH showed a higher incidence of heart disease for women living in remote areas, even after adjusting for lifestyle factors (McLaughlin, Hockey & Mishra, 2013), and death rates for lung cancer and chronic obstructive pulmonary disease were substantially higher in rural compared to urban areas (Dobson et al., 2010). Similarly, those with lower educational qualifications were more likely to develop arthritis, bronchitis or emphysema, and diabetes, and to drink excessively and smoke (AIHW, 2006).

Findings from ALSWH also show that lower education levels were associated with heavier weight in women aged 18-23 and greater weight gain with age (Holowko et al., 2014), as well as increased risk of stroke in mid-aged women (Jackson, Jones & Mishra, 2014). Therefore, it is important to consider how changes in population subgroups will affect future health expenditure.

2.4. Strategy for projection modelling

In this report, longitudinal data from ALSWH were used to identify the trends for prevalence of health conditions and lifestyle factors (physical functioning and needing help with daily tasks, obesity, smoking status, mental health problems, and dementia) from 1996 to 2013. At each survey, data from all women who provided information for the required health condition or socioeconomic status were used in the analysis, regardless of whether or not the condition or status was also reported in subsequent surveys. Because there are four cohorts in this study, it was possible to distinguish age, period, and cohort differences in trends. If age is the only determinant of a condition, the trends for each cohort follow trajectories that can be joined up smoothly to provide estimates for each year of age. In contrast, period effects are identified when trends for each cohort follow similar patterns that can be attributed to factors such as policy changes that impact similarly on all cohorts. Finally, cohort effects are apparent when the trends are markedly different for each cohort; for example, younger women are gaining weight faster than previous generations. The trends in ALSWH data were then used to project prevalence of these health issues of interest over the next twenty years, from 2015 to 2035. The strength of ALSWH data, compared to data used for Intergenerational Reports and similar projections, is the ability to use longitudinal data to incorporate period and cohort differences.

To examine changes in health expenditure, the ALSWH survey data were first linked to MBS, PBS, and hospital datasets. The average (mean) use and cost of each service were calculated to determine the difference in health expenditure between healthy women and women who had a health issue of interest (e.g. obese and non-obese women). The trends were then incorporated with population projections provided by the ABS to project total health service use and cost from 2015 to 2035. The methods are described in detail in the Appendices.

There are important advantages to this strategy. Firstly, it acknowledges and accounts for the fact that prevalence of health conditions may change in a non-linear fashion over time and differently for different generations. This contrasts with assumptions in many projection studies. Goss (2008) also projected health expenditure based on future prevalence and incidence on a large range of diseases, and estimated that growth of health costs was attributed to increases in volume of services per treated case (50 per cent), population ageing

(23 per cent), population changes (21 per cent), and excess health price inflation (5 per cent). Another advantage of our report is that different components of government health expenditure (MBS, PBS, and hospital costs) have been projected by analysing average cost trends per woman and by health condition rather than using historical overall health expenditure. The latter does not account for changes in the health status of people by birth cohort, or that people with poorer health have higher health costs on average.

2.5. How will the Australian population change from year 2015 to 2035?

The population projections for years 2015 to 2035 used in this Report were obtained from the Australian Bureau of Statistics' publication, *Population Projections, Australia, 2012 to 2101* (ABS, 2013). Three series of projections (Series, A, B, and C) are described. They vary in the assumptions made of future rates of fertility, mortality, immigration, and migration. Series B projections are based on current levels in fertility, life expectancy at birth and emigration, whereas Series A and C projections assume a higher and lower rate for each of these variables, respectively (Table 2-1). Note that net overseas migration is the net gain or loss of population through immigration and emigration. The base population used in the ABS projections is the preliminary estimated resident population at 30 June 2012.

Table 2-1: Assumptions and characteristics of the population projections generated by the Australian Bureau of Statistics (ABS, 2013).

	Assumptions			**Projected population at 30 June**	
	Total fertility rate (from 2026), babies per woman	Net overseas migration (from 2021), persons	Life expectancy at birth, females (from 2061), years	2015	2035
Series A	2.0	280,000	93.6	24,002,458	33,926,911
Series B	1.8	240,000	88.3	23,940,552	32,046,518
Series C	1.6	200,000	88.3	23,877,708	30,442,199
Recent average	1.9[a]	199,860[a]	84.2[b]		

[a] Observed average for 2010-12; [b] Observed average for 2009-11

Based on the assumptions described in Table 2-1 above, the Australian population is projected to increase by 9.9 million (Series A), 8.1 million (Series B), or 6.6 million people (Series C) between 2015 and 2035 (Figure 2-1).

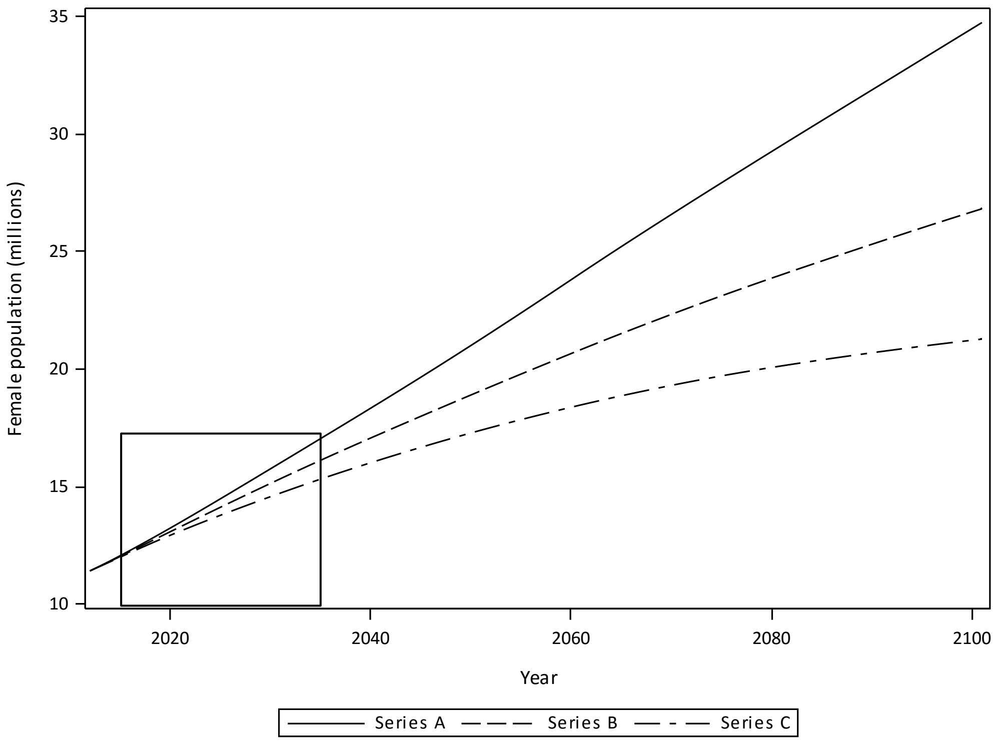

Figure 2-1: Projected population of Australia from 2012 to 2101 (box shows projections for 2015 to 2035) (ABS, 2013).

There are a number of important considerations about the population projections. Although assumptions have been made based on demographic trends from the last decade or longer, the ABS have incorporated a 'phase-in' period for each assumption. This is shown in Table 2-1, where the net overseas migration and total fertility rates are phased in by 2021 and 2026, respectively. The increase in life expectancy at birth is phased in by 2061. Following the phase-in period, the assumptions remain constant for all projections.

The differences in age-structure of the Australian female population at 2015 and 2035 are shown in Figure 2-2. The 2015 population age structure has noticeable peaks and troughs that can be explained by historical events:

- a post-World War II baby boom from 1946 to 1966 where the total fertility rate ranged from 3.0 to 3.5 babies per woman, resulting in a steady increase in the total population (ABS, 2012d, 2013).
- more than 170,000 European migrants, the majority of whom were aged 15-35, arrived in Australia between 1947 and 1954 through the Displaced Persons Scheme (Mence, Gangell & Tebb, 2015).
- the introduction of the Pill in 1961 contributed to a dramatic reduction in fertility rate (ABS, 1996).

- changing social attitudes towards family size and women engaging in employment in the 1960s and 70s (ABS, 1998).
- first echo of the baby boom from 1970-73 when children of the baby boomers started having children of their own (ABS, 2004a).
- approximately 95,000 refugees resettled in Australia between 1975 and 1985 (DIEA, 1985).

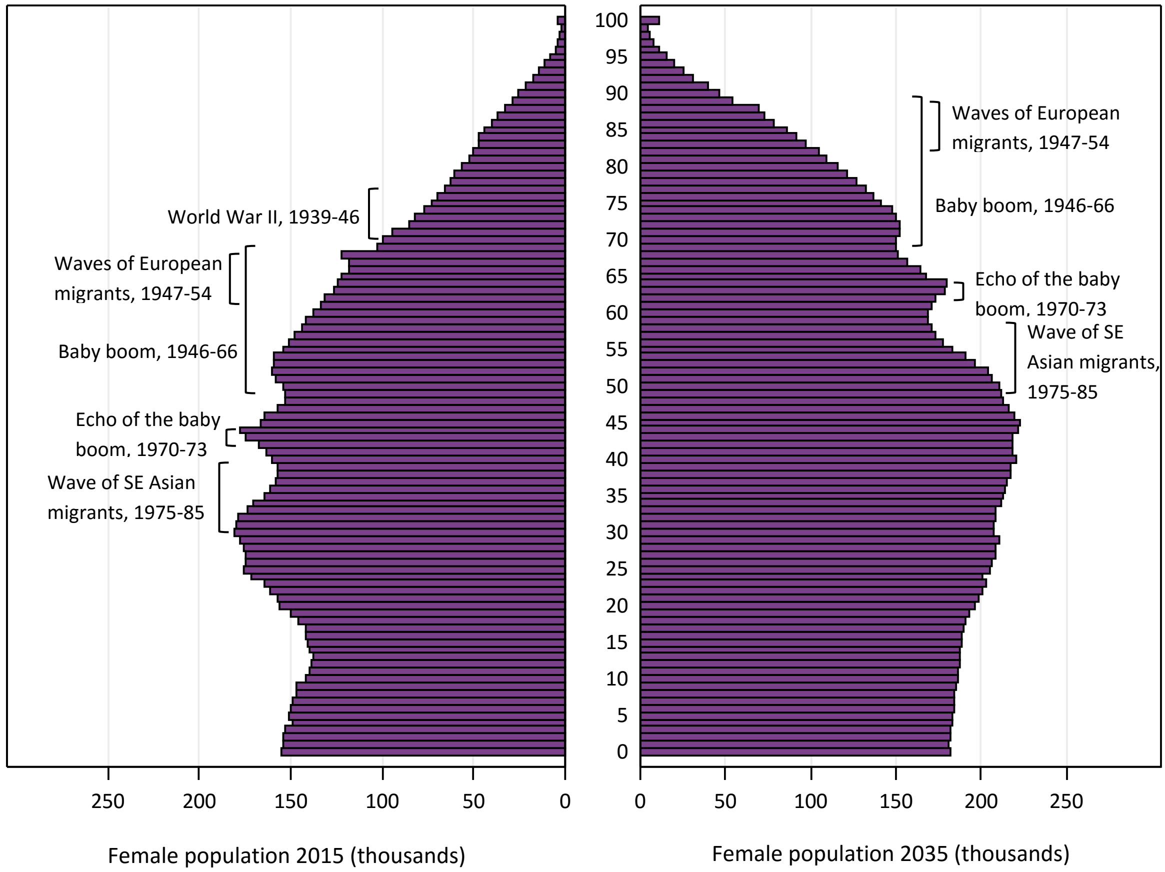

Figure 2-2: Comparison of the estimated Australian female resident age structure in 2015 and 2035 (ABS, 2013, 2015a).

The following chapters present the outcomes of projections that apply weights from ALSWH data and observed trends to these population projections. The next chapter (Chapter 3) presents trends in physical function and need for help with daily tasks. The next four chapters focus on major contributors to poor health: obesity, smoking status, mental health problems, and dementia. The final four chapters focus on health disparities between people with different sociodemographic characteristics.

3. Physical function and needing help with daily tasks

3.1. Background

Physical functioning refers to the ability to perform typical activities of daily living (ADL) such as walking, climbing stairs, bending, and bathing, and instrumental ADLs (IADLs) such as using a telephone, handling finances, preparing food, and shopping. Difficulty or inability to carry out ADLs and IADLs is associated with poorer quality of life, increased hospitalisation, loss of independence (dependency), and mortality (Gill et al., 2001; Miller & Weissert, 2000). The 2012 Survey of Disability, Ageing and Carers reported that 4.2 million Australians (18.5 per cent) had a disability, defined as 'any limitation, restriction or impairment which restricts everyday activities and has lasted or is likely to last for at least six months' (ABS, 2012a). The percentage of people with disabilities in Australia has remained fairly stable at 18-20 per cent over the last 18 years (ABS, 1999, 2004b, 2010b, 2012a), however with the rising population, the number of people with disability is also increasing. The number of women aged over 25 years who had a disability increased from 1.76 million in 2003 to 1.96 million in 2012. As expected, the prevalence of disability also increases with age (Hosseinpoor et al., 2012). Approximately 8 per cent of Australians aged 20-24 years had a disability compared to 80 per cent by the age of 85 years (AIHW, 2013).

Gender inequalities in disability have also been reported with women more likely to have a disability compared to men (Crimmins, Kim & Sole-Auro, 2011; Hosseinpoor et al., 2012; Oksuzyan et al., 2014; Sole-Auro & Crimmins, 2014). It has been suggested that the longer life expectancy of women increases their likelihood of developing disabling conditions with age whereas men are more likely to develop diseases with high mortality rates. According to the ABS Survey of Disability, Ageing and Carers Australia conducted in 2012, there was no difference in disability rates overall, however the prevalence of people with profound or severe disability was higher for women than men after the age of 70-74 (ABS, 2012a).

Internationally, the percentage of people aged over 50 years with a disability and who receive help ranges from 39 per cent (USA) to 79 per cent (Spain) and is associated with availability of government-funded formal care (Sole-Auro & Crimmins, 2014). Findings from the English Longitudinal Study of Ageing demonstrated that the need for help with ADLs was exacerbated by frailty; of the people aged 60 and over who had difficulties with ADLs, 71 per cent of those who were frail reported receiving help compared to 31 per cent of those who were not frail (Gale, Cooper & Sayer, 2015). In Australia, 60 per cent of people living with a disability needed assistance, and of these, 98 per cent received some help in 2012 (ABS, 2012a).

In ALSWH, participants who subsequently have missing data, drop out, or die during the study have lower levels of physical function and physical activity in addition to being less educated and more likely to be smokers (Peeters et al., 2013). Therefore, the analyses shown here are likely to under-represent the prevalence of disability and the need for help with daily tasks compared to the general population.

3.2. Measurement of physical functioning and needing help in ALSWH

Physical functioning was measured using the short-form general health survey (SF-36), which is widely used to assess health-related quality of life. The SF-36 has 36 items that can be used to construct eight subscales and two summary measures. Physical functioning is a subscale whose scoring is based on ten of the thirty-six items as follows:

'The following questions are about activities you might do during a typical day. Does YOUR HEALTH NOW LIMIT YOU in these activities? If so, how much?

a VIGOROUS activities such as running, lifting heavy objects, participating in strenuous sports

b MODERATE activities such as moving a table, pushing a vacuum cleaner, bowling or playing golf

c Lifting or carrying groceries

d Climbing SEVERAL flights of stairs

e Climbing ONE flight of stairs

f Bending, kneeling or stooping

g Walking MORE THAN ONE kilometre

h Walking HALF a kilometre

i Walking 100 metres

j Bathing or dressing yourself'

The response options are 'Yes, limited a lot', 'Yes, limited a little', and 'No, not limited at all'.

Raw scores are then derived from the 10 items and transformed to a 0 to 100 scale (Appendix A). The SF-36 has been included in all surveys for the 1973-78, 1946-51, and 1921-26 cohorts.

The need for help with daily tasks was determined in all surveys for all cohorts using the following questions:

'Do you regularly need help with daily tasks because of long-term illness, disability or frailty (e.g. personal care, getting around, preparing meals etc)?' (1921-26 and 1946-51 cohorts)

'Do you regularly need help with daily tasks because of a long-term illness or disability (e.g. help with personal care, getting around, preparing meals etc)?' (1973-78 cohort)

The response options for these questions are ‘yes’ or ‘no’.

These questions were sourced from the Australian Bureau of Statistics 1993 Survey on Disability, Ageing and Carers.

3.3. Physical functioning and disability

3.3.1. Changes in physical functioning across the adult lifespan

As expected, the 1973-78 cohort of women have high and stable physical functioning scores (Figure 3-1). In contrast, women in the 1946-51 and 1921-26 cohorts have, on average, declining physical functioning scores (from approximately 85 to 40) and the rate of decline increases with age. The relationship between physical functioning and age has been reported in previous ALSWH research (Lucke et al., 2010; Peeters et al., 2013; Windsor, Burns & Byles, 2013) and supports evidence from other studies (Long & Pavalko, 2004).

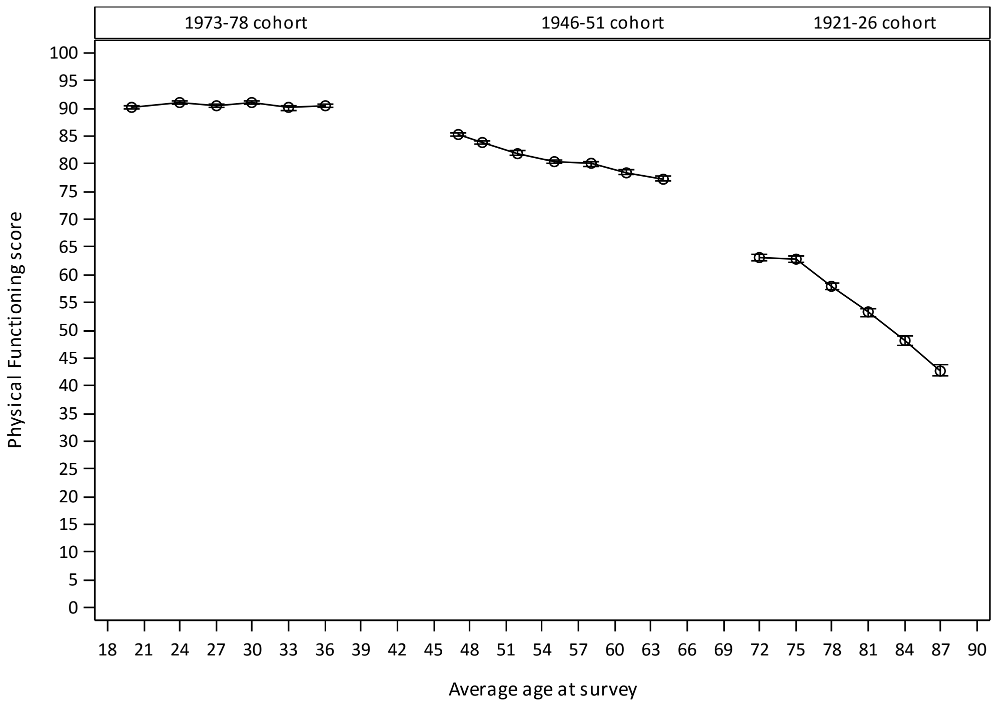

Figure 3-1: Trajectory of physical functioning with average age in each cohort (1973-78, 1946-51, 1921-26) at each survey.

3.3.2. Needing help with daily tasks as a measure of disability

Research from ALSWH demonstrated that the mean physical functioning score for women in the 1921-26 cohort who reported needing help with daily activities was 62.8 (Peeters et al., 2013). However, this disability threshold cannot be applied across the lifespan as it differs with age. We, therefore, used a one-item survey instrument on needing help with daily activities (Section 3.2). When the percentage of women who indicated that they needed help was plotted by age, those in the 1973-78 cohort needed the least help (no more than 1.6 per cent) and the percentage increased gradually for the 1946-51 cohort (from 2.6 to 3.7 per cent) and dramatically for the 1921-26 cohort (from 8.6 to 22 per cent; Figure 3-2). Together with Figure 3-1, it can be seen that with increasing age, physical functioning decreases and the need for help increases. Further, there is no evidence that these trajectories would be different for each cohort. The 2006 Australian Census also demonstrated similar trends; the prevalence of people needing assistance was 29 per cent amongst 80-84 year olds and was as high as 68 per cent for people over the age of 90 (ABS, 2008). The ABS also noted that more than half the people who needed assistance were aged 65 years and over.

In other countries, the percentage of people aged 50 years and over who need help with ADLs and IADLs in 2006 was 17.7 per cent (USA), 17.5 per cent (England), and 15.3 per cent (Spain) (Sole-Auro & Crimmins, 2014). In Canada, 65.1 per cent of women aged 75 years and over reported needing help with at least one ADL or IADL (Quail, Wolfson & Lippman, 2011). These results are similar to our findings.

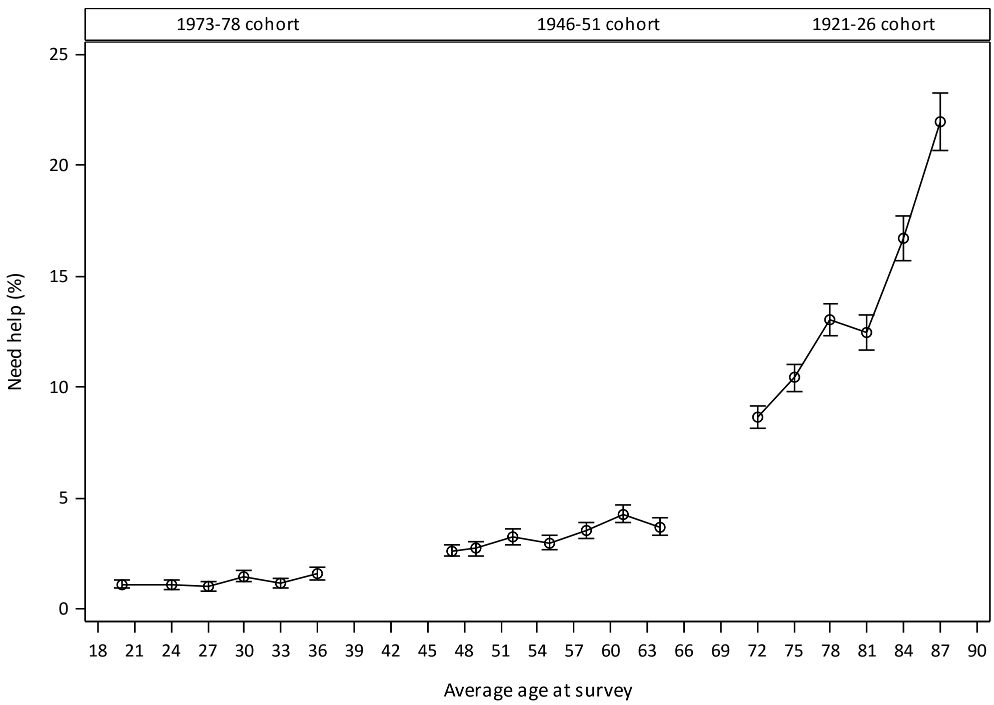

Figure 3-2: Percentage of women who reported needing help with daily tasks by average age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

3.4. Projections of needing help with daily tasks over the next 20 years

To forecast the prevalence of women who need help over the next 20 years, we first modelled the prevalence of needing help by age based on trends shown in Figure 3-2. The graph shows that there is an age effect, but not a birth cohort-, effect for whether or not a person needs help with daily tasks. The resultant model provides the prevalence of women who need help at every age from the ages of 20 to 90 years (Figure 3-3 and Appendix B Section 13.1).

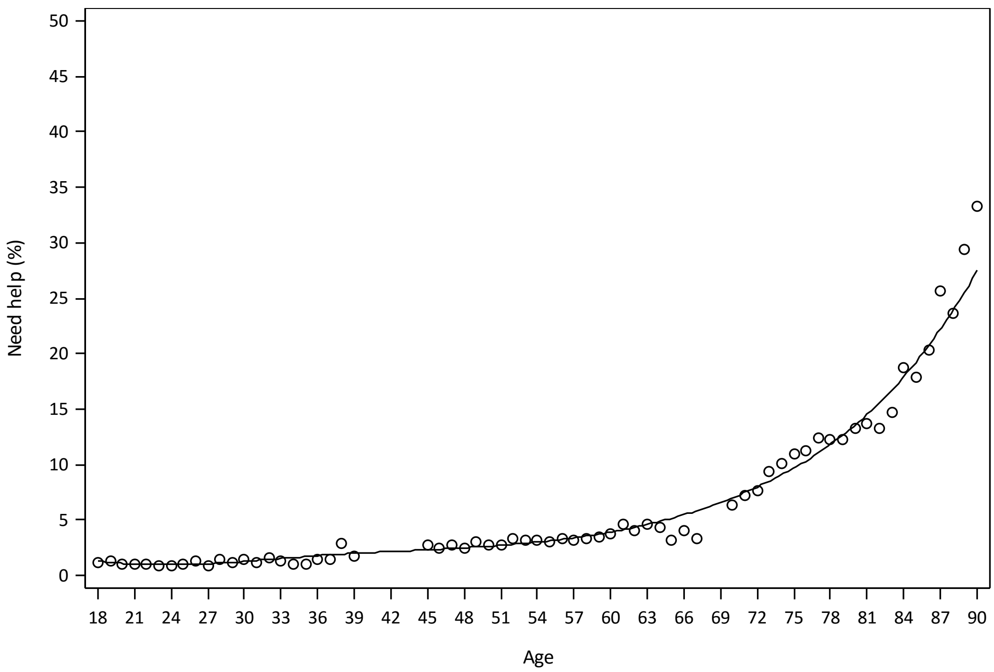

Figure 3-3: A model of the percentage of women who reported needing help with daily tasks by actual age for the 1973-78, 1946-51, and 1921-26 cohorts.

The model was then used to project the prevalence of Australian women aged 20-90 years who need help from 2015 to 2035 (Appendix C). For this purpose, we assumed that the age-specific prevalence of disability for women remains the same for this twenty-year time period. The age-specific estimates for needing help with daily tasks were multiplied by the projected number of women aged 20 to 90 years at every year from 2015 to 2035 (provided by the ABS; Introduction, Section 2.5; (ABS, 2013)) to predict the number and percentage of women who need help. Briefly, the ABS produced three different scenarios (Series A, B, and C) for the Australian population from 2012 to 2011. Series B is based on current (at 2012) rates of fertility, life expectancy at birth, and net overseas migration. Series A assumes higher rates for all three characteristics, whereas Series C assumes lower fertility and net overseas migration rates and unchanged life expectancy.

Figure 3-4 shows that the number of Australian women who need help with daily tasks was approximately 350,000 in 2015 and increased to a total of 547,786 (Series C) to 574,996 (Series A) in 2035. This equates to an increase from 3.9 per cent to 4.5-4.6 per cent for all Series (Table 3-1).

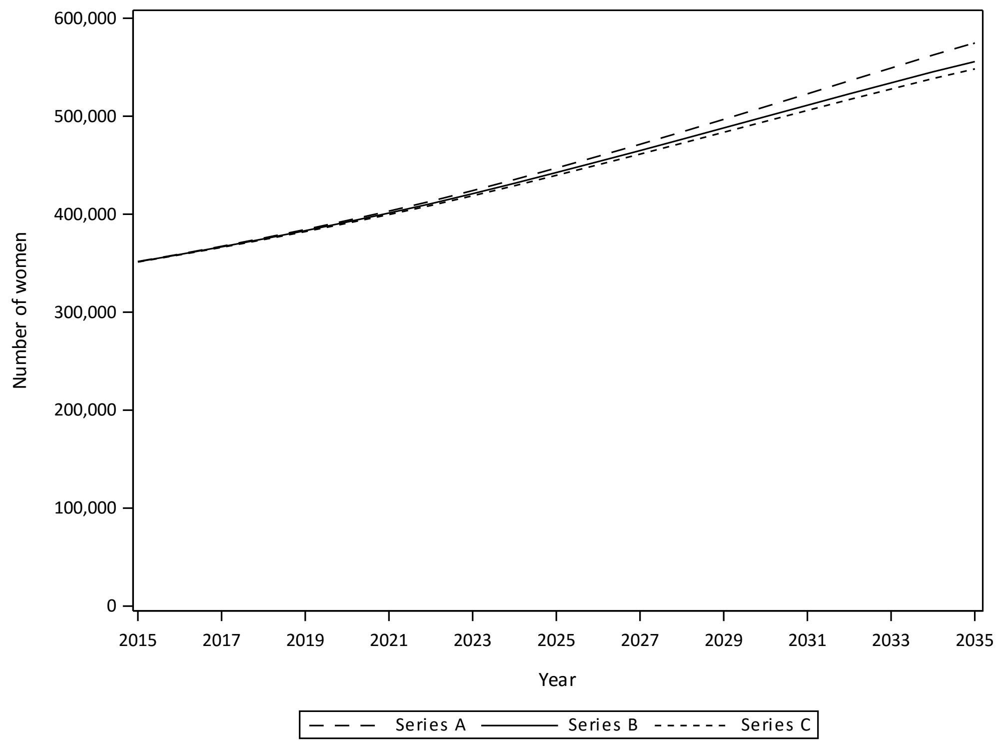

Figure 3-4: Number of Australian women aged 20-90 who will need help with daily tasks from 2015 to 2035.

Table 3-1: Projected number and prevalence of women who will need help with daily tasks in Australia from 2015 to 2035.

Year	Population projection					
	Series A		Series B		Series C	
	n	%	n	%	n	%
2015	349,912	3.88	349,672	3.88	349,427	3.89
2020	390,745	3.95	389,221	3.97	388,017	3.99
2025	443,597	4.12	438,996	4.14	436,206	4.18
2030	507,203	4.33	496,874	4.35	492,086	4.41
2035	574,996	4.54	555,123	4.54	547,786	4.62

Population pyramids were constructed to help illustrate the changes in the prevalence of Australian women aged 20 to 90 who need help with daily tasks in 2015 and 2035 (Figures 3-5 and 3-6). With a larger population of older people in 2035, the number of women who will need help with daily tasks in twenty years will also increase due to population ageing.

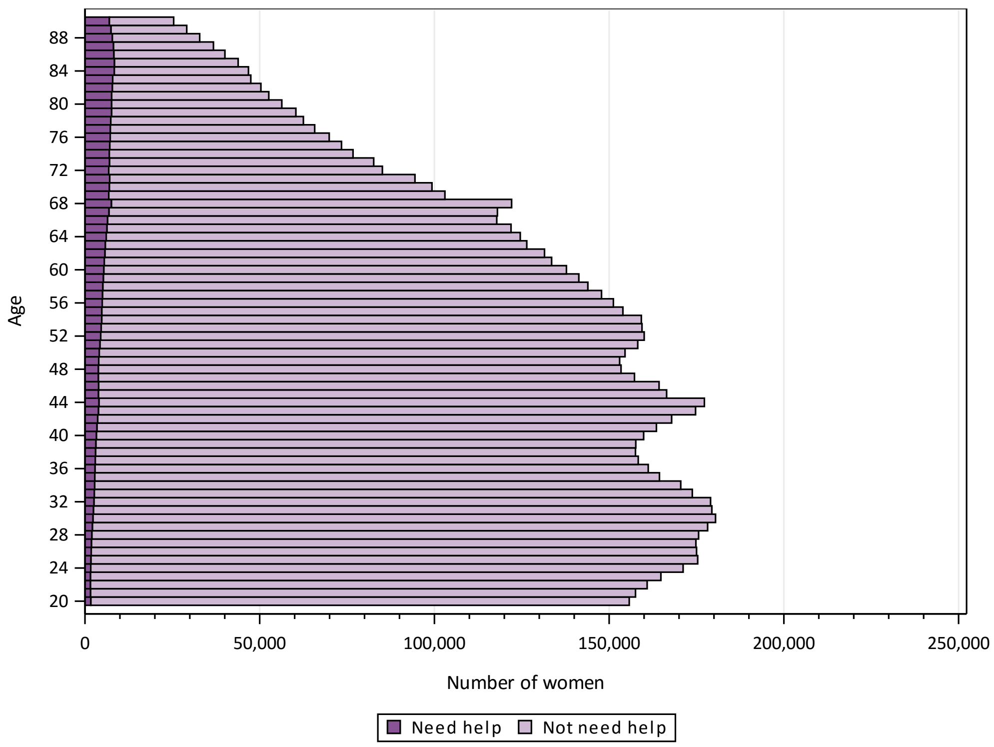

Figure 3-5: Projected number of women who need help with daily tasks in Australia by age in 2015 based on current population trends (Series B).

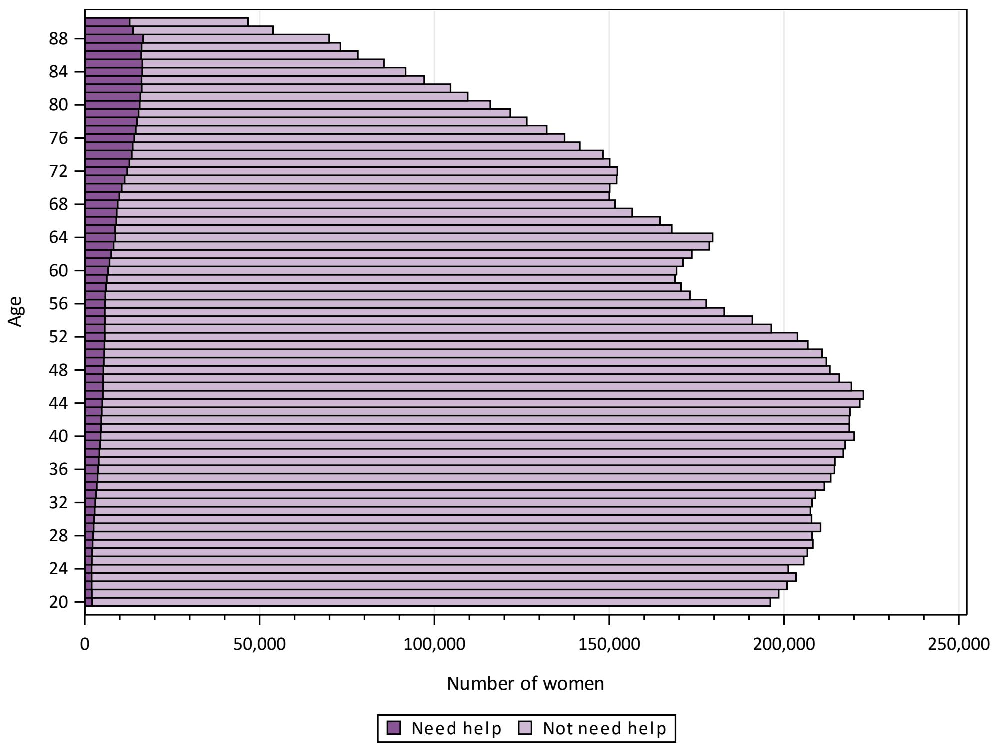

Figure 3-6: Projected number of women who will need help with daily tasks in Australia by age in 2035 based on current population trends (Series B).

3.5. Impact of needing help with daily tasks on healthcare expenditure

The use of healthcare services by Australian women who do or do not require help was determined by comparing the mean number of MBS claims, PBS prescriptions filled, and hospital admissions each year and the cost of accessing these services (Appendix D). This is important as one of the most commonly identified types of help reported by people living with a disability was help with healthcare (ABS, 2012a). Because there were so few participants who needed help in the 1973-78 cohort, the healthcare cost analysis for MBS, PBS, and hospital services was limited to the 1946-51 and 1921-26 cohorts.

3.5.1. Medicare Benefits Scheme

For the 1946-51 and 1921-26 cohorts, the survey data have been linked to MBS data from 1996 to 2013. The MBS dataset allows us to determine the number of unreferred MBS claims made by each participant. 'Unreferred' means visits to a general practitioner without requiring a referral. For both cohorts, the women who needed help with daily tasks made more unreferred MBS claims than women who did not need help (Figure 3-7). In the 1946-51 cohort, women who needed help made, on average, 6 or 7 more unreferred MBS claims than women who did not. For the 1921-26 cohort, the women who needed help made approximately 3-5 more unreferred MBS claims per year than women who did not from the age of 75 years until 81 years, and the gap between the two groups then decreased with age.

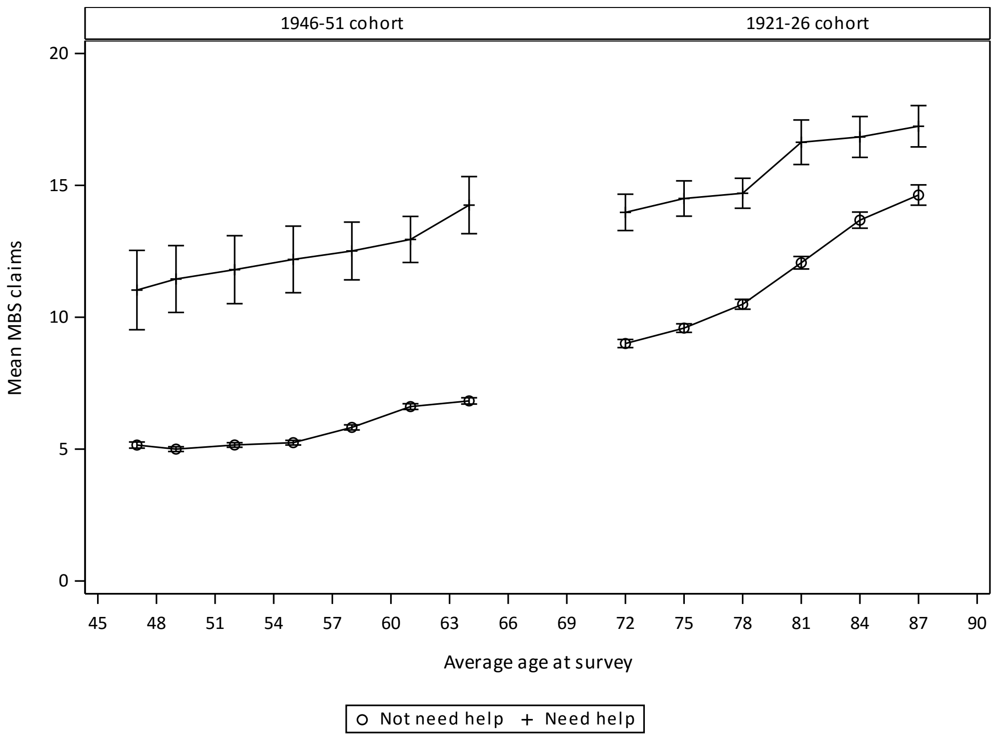

Figure 3-7: Comparison of average number of unreferred MBS claims per woman per year for the 1946-51 and 1921-26 cohorts by needing help or not needing help with daily tasks.

To estimate the total MBS cost, the average cost of unreferred MBS services in 2014 (in 2014 Australian dollars) was obtained from the Department of Human Services statistical reporting database (Medicare Group Reports, 2016) and was reported to be $48.80 per visit. To calculate total costs, it was assumed that this average cost was the same for obese and non-obese women. The total unreferred MBS cost (in 2014 Australian dollars) for each participant for every year from 1996 to 2013 was calculated by multiplying the number of unreferred MBS claims by $48.80. Then, the average unreferred MBS cost for women who did or did not need help with daily tasks was estimated (Appendix D, Section 15.1).

For the 1946-51 cohort, the estimated unreferred MBS cost per participant across the survey period was $251-333 (in 2014 Australian dollars) for those who did not need help with daily tasks (see Figure 3-8). Women who needed help had an unreferred MBS cost of $538-695 and this was approximately $287-362 more than women who did not need help. In the 1921-26 cohort, women who did not need help with daily tasks had an estimated $439 in annual unreferred MBS costs at age 72 and this increased to $714 by age 87. Those women who needed help had an annual unreferred MBS cost of $687 to $841 from age 72 to 87 years. The difference in unreferred MBS cost ($127-243) was smaller in this cohort than the 1946-51 cohort.

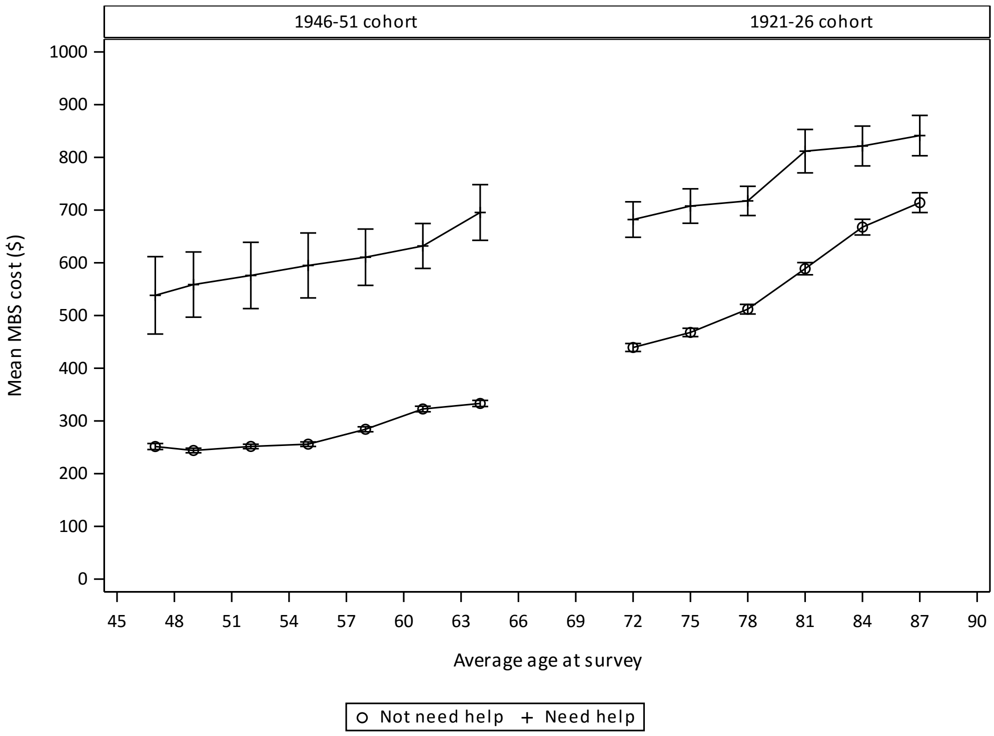

Figure 3-8: Comparison of average unreferred MBS costs per participant per year for 1946-51, 1921-26 cohorts by needing help or not needing help with daily tasks.

3.5.2. Pharmaceutical Benefits Scheme

ALSWH data were linked to the latest available PBS dataset (2012-13 financial year), which provided a record for each PBS script that was filled and its associated cost for each participant. The average number of scripts filled and cost (in 2012-13 Australian dollars) was then determined for women who did or did not need help with daily tasks (Appendix D, Section 15.2). Because the 2012-13 period corresponded to one survey per cohort, there are only two sets of data points for the graphs.

Women who needed help with daily tasks had more PBS prescriptions filled than women who did not need help (Table 3-2). In the 1946-51 cohort, women aged 64 who needed help with daily tasks had three times as many PBS prescriptions filled and almost four times greater PBS costs than women who did not need help. For the 1921-26 cohort, the difference in number of PBS claims and costs was not as great between the two groups. Women aged 87 who needed help with daily tasks had on average 70.3 prescriptions filled at a cost of $2249 (in 2012-13 Australian dollars) compared with 50.4 prescriptions at an annual cost of $1872 for women who did not need help.

Table 3-2: Mean PBS claims and cost (in 2012-13 Australian dollars) per participant 1946-51, and 1921-26 cohorts for women who needed or not needed help with daily tasks.

		ALSWH Cohort	
		1946-51	**1921-26**
Group	**Corresponding survey**	Survey 7	Survey 6
	Year	2013	2011
	Average age (years)	64	87
Need help with daily tasks	Mean number of PBS claims per participant	64.9	70.3
	Mean PBS cost per participant ($)	3250	2249
Not need help with daily tasks	Mean number of PBS claims per participant	21.4	50.4
	Mean PBS cost per participant ($)	836	1872

3.5.3. Hospital costs

Due to the limitations of the hospital datasets available, the numbers of ALSWH participants who were hospitalised in NSW were used to determine differences in hospital admission and costs accrued by obese and non-obese women (see Appendix for further details). For the 1946-51 and 1921-26 cohorts, the survey data for participants living in NSW were linked to NSW Admitted Patient Data Collection. This dataset provides a record of the patient's diagnosis using Australian Refined Diagnosis Related Group (AR-DRG) codes. Each AR-DRG represents a group of similar conditions that require similar hospital services. Public hospital costs are available through the National Hospital Cost Data Collection (NHCDC) provided by the Independent Hospital Pricing Authority (IHPA). The NHCDC lists the average cost for all AR-DRG codes. For each participant, a hospital cost (in 2012-13 Australian dollars) was determined for every admission using AR-DRG from the hospital record and matching it to the average cost of AR-DRG from the NHCDC. Then, the hospital costs for each admission were summed to obtain the annual cost for each woman (Appendix D, Section 15.3).

Hospital costs (in 2012-13 Australian dollars) were substantially higher for women who needed help with daily tasks compared to women who did not need help (Figure 3-9). In the 1946-51 cohort, women who did not need help accrued approximately $930-1600 in average hospital costs whereas for women who needed help, average hospital costs were approximately $6500. This represented a $4100-5600 difference. In the 1921-26 cohort, the hospital costs were $2900 to $3800 for those who did not need help with daily tasks from age 78 to 87 years compared to $6500 to $8000 for those who needed help in the same age range. The difference in hospital costs between the two groups was not as great as observed for the 1946-51 cohort.

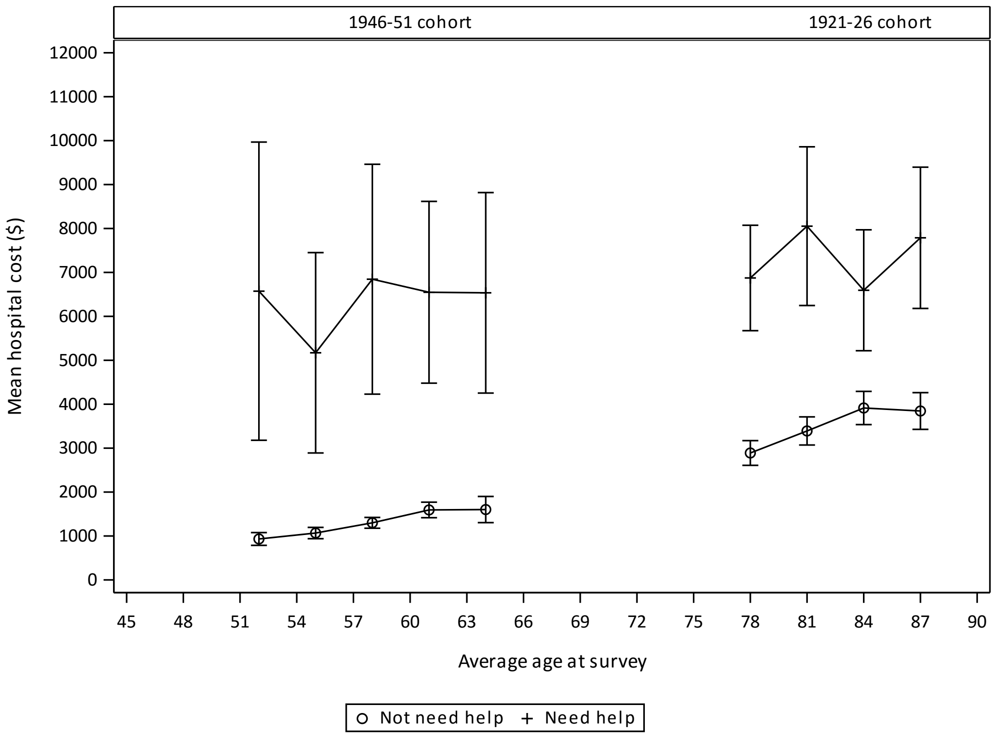

Figure 3-9: Comparison of average hospital costs per participant per year for the 1946-51 and 1921-26 cohorts by needing help or not needing help with daily tasks.

There are no known reports comparing the healthcare expenditure of Australian people who need help with daily tasks with those who do not. Many other studies focus on specific types of conditions or disabilities, however they are not comparable to our analyses.

3.6. Projected impact of needing help on healthcare utilisation

Based on the trends identified in section 3.5, the impact of increasing numbers of women needing help with daily tasks on healthcare utilisation from 2015 to 2035 was examined. We compared the use of MBS, PBS, and hospital services for (a) the total population of women aged 20-90, (b) women who needed help with daily tasks, and (c) women who did not need help with daily tasks. For MBS, PBS, and hospital projections, models were generated for the number of claims and cost of each service for women at every year of age between 20 and 90, inclusive (Appendix E). The major assumption is that the number of MBS claims and cost (in 2014 Australian dollars), PBS claims and cost (in 2012-13 Australian dollars), and hospital costs (in 2012-13 Australian dollars) vary with age in patterns which are the same for every year between 2015 and 2035. The age-specific estimates for the number of claims and cost of each service were multiplied by the projected number of women aged 20 to 90 years at every year from 2015 to 2035, as well as by the prevalence of women who needed or did not need help to predict the total number of claims and cost for MBS, PBS, and hospital services over the next twenty years (Appendix F).

3.6.1. Medicare Benefits Scheme

Total unreferred MBS claims for women aged 45-90 who need help with daily tasks is estimated to increase from 4.2 million in 2015 to 7.2 million in 2035 and total unreferred MBS costs will rise from $207 million to $351 million (in 2014 Australian dollars) in that time (Figure 3-10 and 3-11). For women who do not need help with daily tasks, 32 million unreferred MBS claims at a cost of $1.6 billion are estimated to have been made in 2015 and by 2035, these are predicted to increase to 48 million unreferred MBS claims and $2.4 billion (in 2014 Australian dollars).

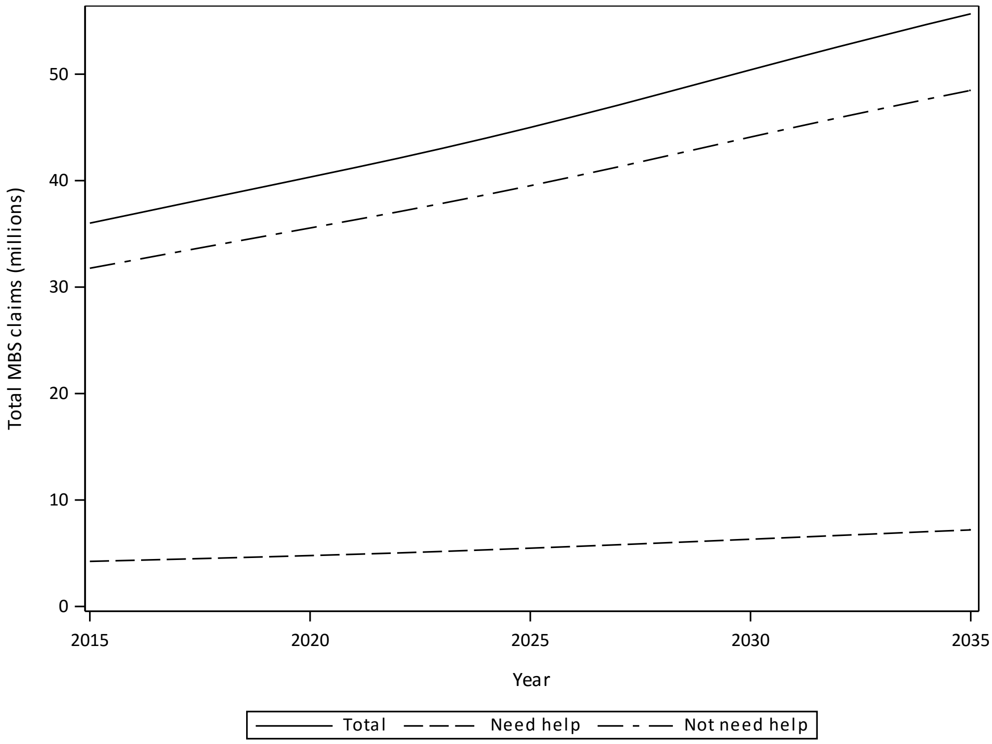

Figure 3-10: Projected number of unreferred MBS claims for Australian women aged 45-90 from 2015 to 2035 by needing help or not needing help with daily tasks.

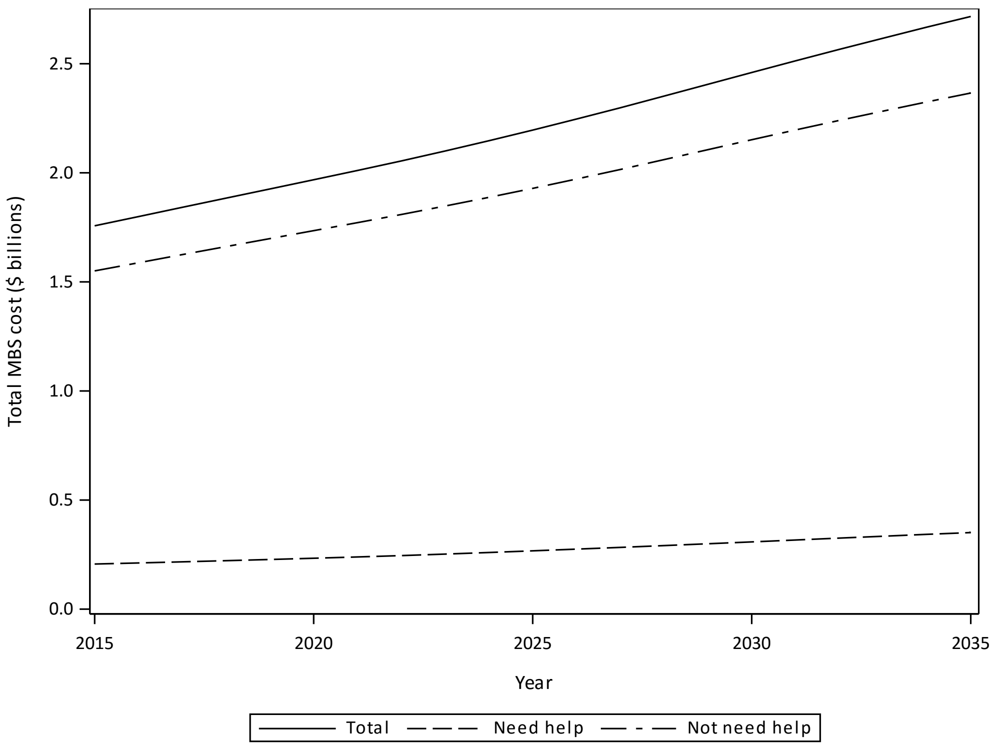

Figure 3-11: Projected total unreferred MBS cost (in 2014 Australian dollars) for Australian women aged 45-90 from 2015 to 2035 by needing help or not needing help with daily tasks.

3.6.2. Pharmaceutical Benefits Scheme

The total number and cost of PBS prescriptions filled by women who needed help with daily tasks in 2015 were 20.2 million claims and $873 million (in 2012-13 Australian dollars), respectively (Figures 3-12 and 3-13). By 2035, these numbers are predicted to increase by 14 million prescriptions and $560 million (in 2012-13 Australian dollars). For women who did not need help, it is estimated that 109 million PBS prescriptions were filled at a cost of $4.2 billion in 2015 and these numbers are expected to increase by 60 million prescriptions and $2.2 billion over the next 20 years.

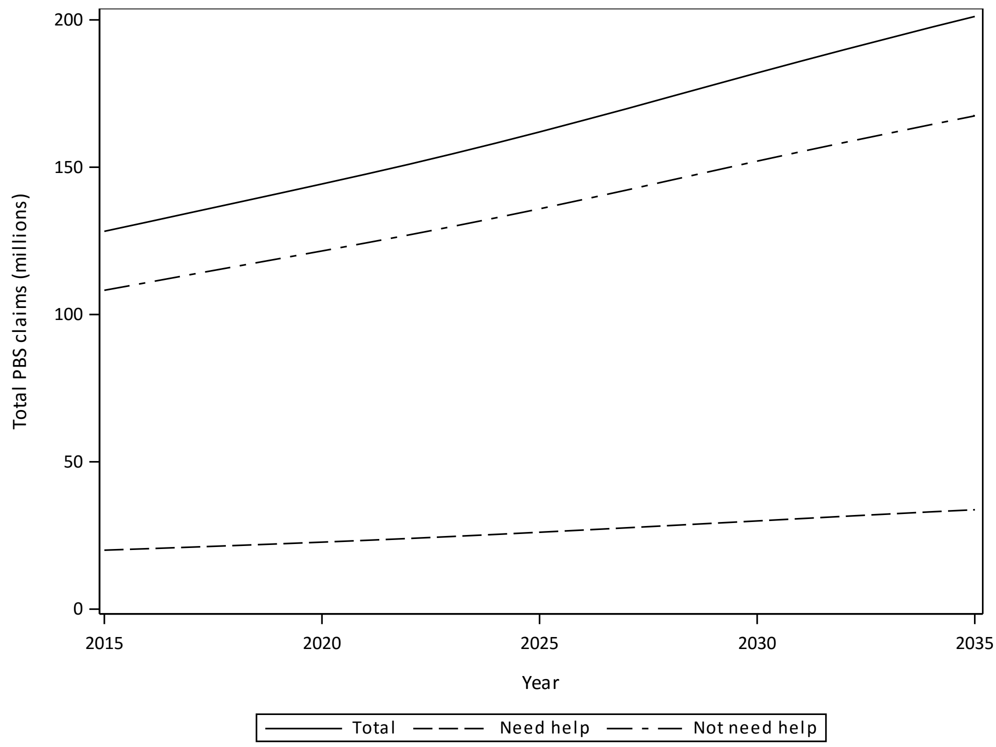

Figure 3-12: Projected number of PBS claims for Australian women aged 45-90 from 2015 to 2035 by needing help or not needing help with daily tasks.

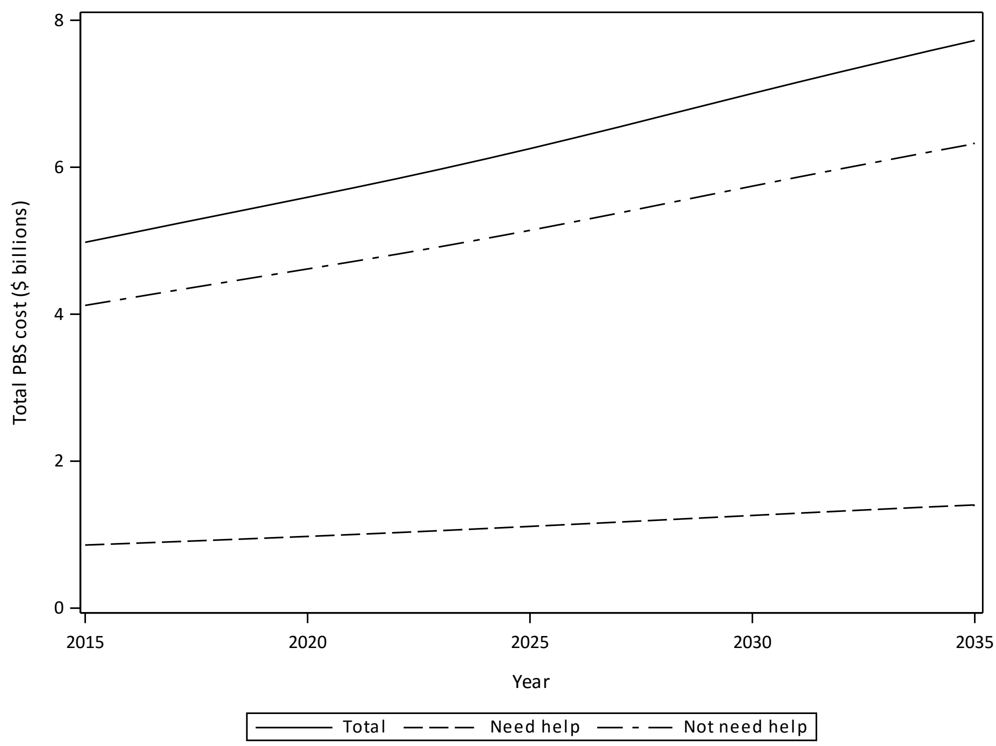

Figure 3-13: Projected total PBS cost (in 2012-13 Australian dollars) for Australian women aged 45-90 from 2015 to 2035 by needing help or not needing help with daily tasks.

3.6.3. Hospital costs

Total hospital cost is predicted to increase from $2.0 billion in 2015 to $3.4 billion (in 2012-13 Australian dollars) for women who need help with daily tasks (Figure 3-14). For women who do not need help, the total hospital cost is projected to increase from $7.7 billion to $12.1 billion over the next 20 years.

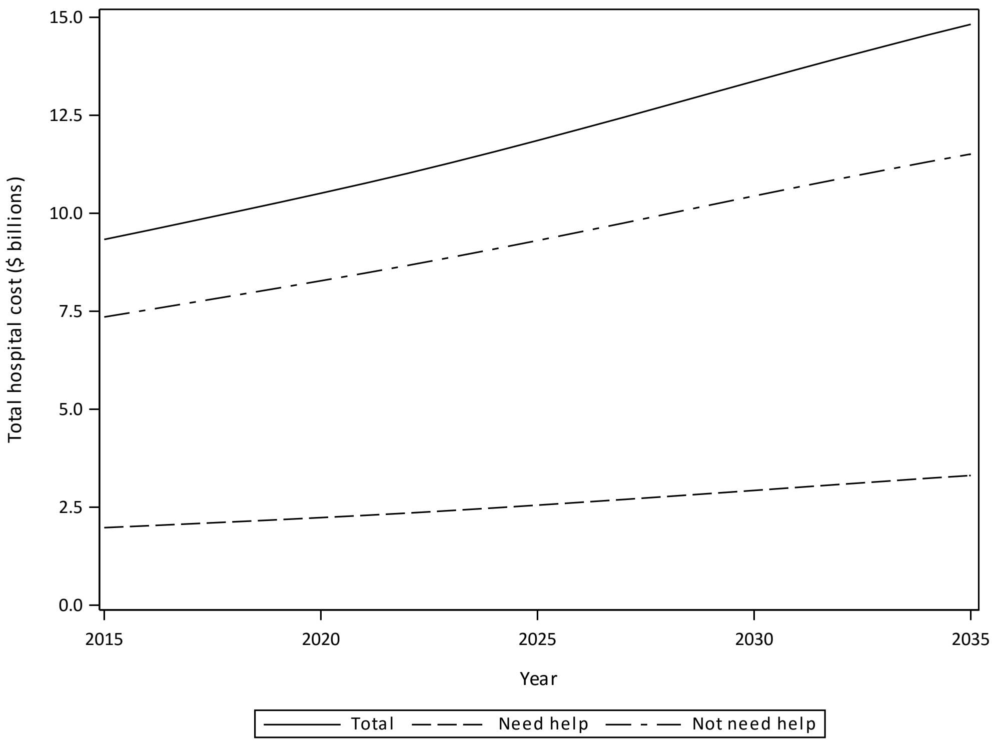

Figure 3-14: Projected hospital cost (in 2012-13 Australian dollars) for Australian women aged 45-90 from 2015 to 2035 by needing help or not needing help with daily tasks.

3.7. Summary points

- Physical function begins to decline in midlife and the rate of decline is most rapid in older age.
- The decline in physical function corresponds with the increasing need for help with daily tasks.
- The prevalence of women who needed help with daily tasks increased from 1 per cent in early adulthood to 22 per cent in the elderly.
- While 3.9 per cent of Australian women needed help in 2015, this is predicted to increase to 4.6 per cent by 2035.
- Women who needed help with daily tasks made more MBS and PBS claims and incurred higher hospital costs than women who did not need help with daily tasks.

4. Obesity

4.1. Background

Obesity is a major risk factor for cardiovascular and metabolic diseases, cancer, musculoskeletal disorders, and respiratory problems (WHO, 2000). Being overweight or obese has a negative impact on physical and mental health, and contributes to poor quality of life. In Australia, the 2014-15 National Health Survey reported that 63 per cent of Australians aged 18 years and older were overweight or obese; an increase from 56 per cent in 1995 and 61 per cent in 2007-08 (ABS, 2015e). Additionally, being overweight or obese is the second highest risk factor for burden of disease, accounting for nine per cent of the total burden (AIHW, 2014a).

In ALSWH, participants are asked to report their height and weight in every survey and their BMI is derived from these variables.

$$\text{body mass index (BMI)} = \frac{\text{weight (kg)}}{[\text{height (m)}]^2}$$

This report utilises a classification system recommended by the World Health Organization (WHO, 2000): Underweight BMI < 18.5 kg/m^2, Normal weight BMI 18.5 – 24.99 kg/m^2, Overweight BMI 25 – 29.99 kg/m^2, and Obese BMI ≥ 30 kg/m^2. The number of participants with BMI data that was used in this analysis is shown in Appendix A, Section 12.2.

Although self-reported height and weight were found to be underestimated in ALSWH (mean difference of 0.67cm and 0.95kgs in middle-aged women), the difference in the derived BMI was small and not statistically significant (0.12 kg/m^2) (Burton, Brown & Dobson, 2010). Other studies have similarly found that self-reported weight is underestimated by 0.2-3.4 kg and that the overweight and obese people tend to underestimate weight more than healthy weight people (Bowring et al., 2012; Connor Gorber et al., 2007; Engstrom et al., 2003). In addition, we have shown that higher educational attainment is associated with lower initial weight and BMI, and less weight gain over time (Holowko et al., 2014). Given that there was some over-representation of university educated women in ALSWH at Survey 1, and that this bias was increased at Survey 6 (Dobson et al., 2015), it is likely that the BMI trends and the projections in the following sections will underestimate the actual prevalence of obesity in the Australian women over the next 20 years.

4.2. Changes in BMI across the adult lifespan

Figure 4-1 shows how the average BMI of women across all four cohorts has changed over time. Women in the 1973-78 cohort had an average BMI of 22.8 in 1996 when their average age was 20; this has increased steadily over a sixteen year period, reaching an average of 26.4 by Survey 6. At 38 years of age, the BMI of this cohort was already higher than that of the women in the 1946-51 cohort when they first participated in the study at 47 years of age. The average BMI of women in the 1946-51 cohort also increased over time, from 25.9 (Survey 1) to 27.8 (Survey 6). In contrast to the younger and mid-aged women, the average BMI of women in the 1921-26 cohort gradually decreased from 25.3 (Survey 1, 1996) to 24.7 (Survey 6, 2011).

The average BMI of women aged 18-23 in 2013 (the 1989-95 cohort) was higher (24.2 kg/m^2) than that of the same age group of women (1973-78 cohort) in 1996 (22.8 kg/m^2). This observation illustrates the extent to which the Australian population is getting heavier at a younger age. Similarly, another Australian study found a difference of 1.9 in BMI between women aged 20-24 years in 1995 and 2008 (Hayes et al., 2015).

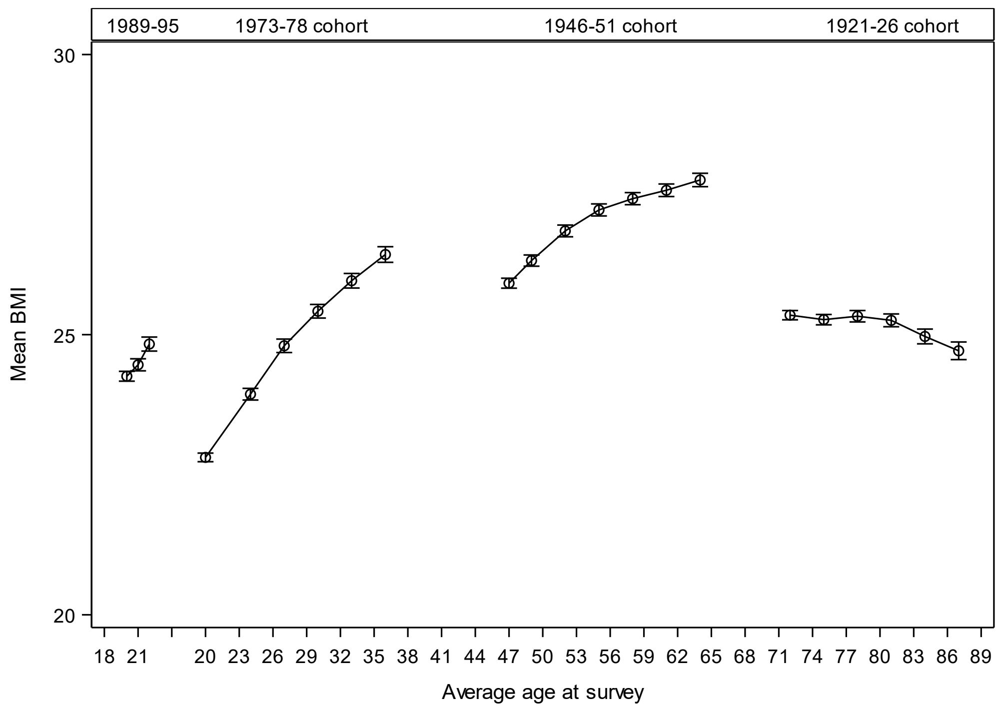

Figure 4-1: BMI trends with age for women in each cohort (1989-95, 1973-78, 1946-51, and 1921-26).

Corresponding with these results, we have shown that the 1973-78 cohort had an average weight of 62.5 kg at Survey 1, increasing to 72.6 kg by Survey 6 (Gomersall, Dobson & Brown, 2014). On average, these women gained 636, 746, 615, 608, and 376 grams/year between successive surveys. It is predicted that if their current weight trajectory continues, the 1973-78 cohort will, on average, be 8 kg heavier when they are 47 years of age, than the mid-age cohort was at the same age. At Survey 1, the average weight of women in the 1946-51 cohort was 68.7 kg; this increased to 73.2 kg at Survey 6. The average weight gain between surveys was 278, 474, 332, 171, and 204 g/year, which is markedly lower than that in the 1973-78 cohort over the same period. At Survey 1, their average weight was 65.9 kg and this decreased to 62.8 kg at Survey 6 (Gomersall, Dobson & Brown, 2014). Other studies have reported life course changes in BMI for women, which are similar to those identified in ALSWH (Cameron et al., 2003; Dahl et al., 2014; Haby et al., 2012; Hendrie et al., 2015; Tanamas et al., 2013).

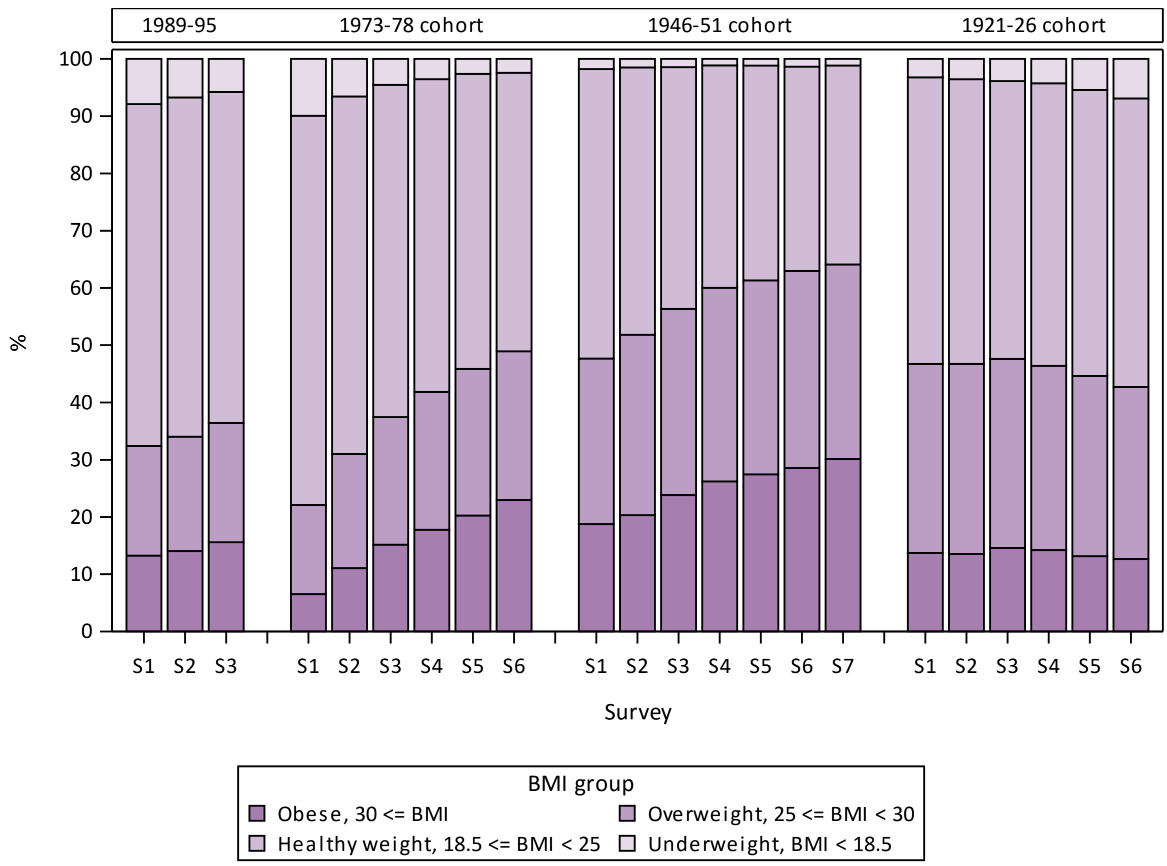

Figure 4-2: Percentage of women in each BMI category at each survey for all cohorts (1989-95, 1973-78, 1946-51, and 1921-26).

Percentages of women in each BMI category are shown for all surveys in Figure 4-2. The greatest changes from the first to the most recent surveys can be seen for the 1973-78 and 1946-51 cohorts. At Survey 1 (1996) of the 1973-78 cohort, almost 80 per cent of the women had a healthy BMI (<25). This percentage reduced to 49 per cent by Survey 6 (2012). In contrast, fewer than half the women in the 1946-51 cohort had a healthy BMI from Survey 2 (1998) to Survey 7 (2013). For the 1973-78 and 1946-51 cohorts, the prevalence of obese women increased from Survey 1 to 6 by 3.5-fold and 1.6-fold, respectively. The prevalence of overweight women also increased by 1.7-fold and 1.2-fold in these cohorts. At the most recent surveys, 23 per cent of women in the 1973-78 cohort and 28 per cent of women in the 1946-51 cohort were obese.

In the 1921-26 cohort, the percentages of women in each BMI category remained more stable from 1996 to 2011. Approximately 13 per cent of women in the 1921-26 cohort were obese at each survey whereas the percentage of underweight women increased over time.

In the 1989-95 cohort, there were only minimal differences in the percentage of women in each BMI category at Surveys 1 (2013), 2 (2014), and 3 (2015). This is expected because the surveys were conducted in consecutive years. The percentage of women in this cohort who were obese (13 per cent) was almost twice that of the corresponding percentage of women in the 1973-78 cohort at Survey 1 (7 per cent, Figure 4-2).

4.3. Projected BMI changes for the next 20 years

To forecast average BMI change over the next twenty years from 2015 to 2035, we assumed that the initial BMI (at average age 20) and rates of increase of BMI are higher for the two younger cohorts, however the rate of increase slows over time so that prevalence of women who are overweight or obese becomes more stable at older ages (but at different levels according to women's year of birth). We modelled the change in BMI for each of the ALSWH cohorts over the next twenty years using a linear mixed model (Figure 4-3 and Appendix B, Section 13.2).

Projections for average BMI change over the next twenty years from 2015 to 2035 are shown in Figure 4-3. These are based on the BMI trends identified in the previous section. Women born in 1973-78 will be 57-62 years old in 2035 and their average BMI is estimated to continue to rise, until it peaks at approximately age 60 years, when their average BMI will be almost 30. In contrast, women who were born in 1945-51 will be 84-89 years old in 2035 and their average BMI is projected to remain stable, at approximately 28, over the next twenty years.

The average BMI of women in the 1989-95 cohort is projected to increase over the next twenty years at a similar rate to women born in 1973-78 (although they start at a higher level). Their BMI is predicted peak earlier than the latter cohort, at 46 years of age (compared with 60 years for the 1973-78 cohort; Figure 4-3).

Note that there are no projections for the 1921-26 cohort as they have all reached the age of 90, which is the maximum age for our analyses.

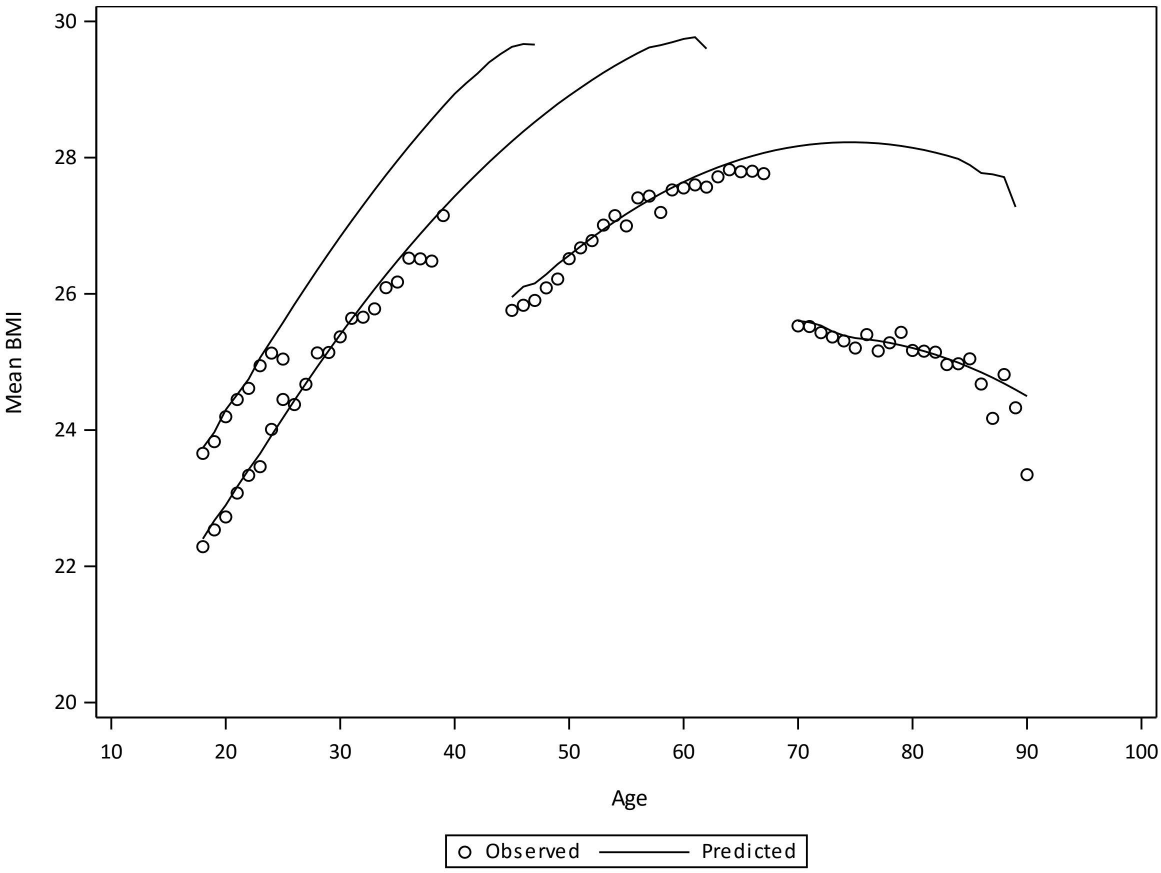

Figure 4-3: Average BMI projections from 2015 to 2035 for each cohort (1989-95, 1973-78, 1946-51, and 1921-26). The circles represent actual data from ALSWH and the lines represent the predicted change in mean BMI for each cohort separately for the next 20 years.

4.4. Projected obesity prevalence over the next 20 years

Other studies have shown that excess burden on the healthcare system is largely associated with obesity rather than overweight (Korda et al., 2015). Therefore, the focus of the following analyses is on obesity and the impact of obesity on healthcare service utilisation. To forecast the prevalence of obesity by age for each cohort over the next twenty years, a generalised linear mixed model was fitted to the data using a log-log link function (Figure 4-4; Appendix B, Section 13.2).

The projection model shows that the prevalence of obese women will continue to increase in both the 1989-95 and 1973-78 cohorts over the next twenty years, reaching about 46 per cent

(Figure 4-4). The prevalence of obese women in the 1946-51 cohort is projected to peak at about 30 per cent by 72 years of age, and is then projected to gradually decrease until 2035. There are no projections for the 1921-26 cohort, for the reasons given previously.

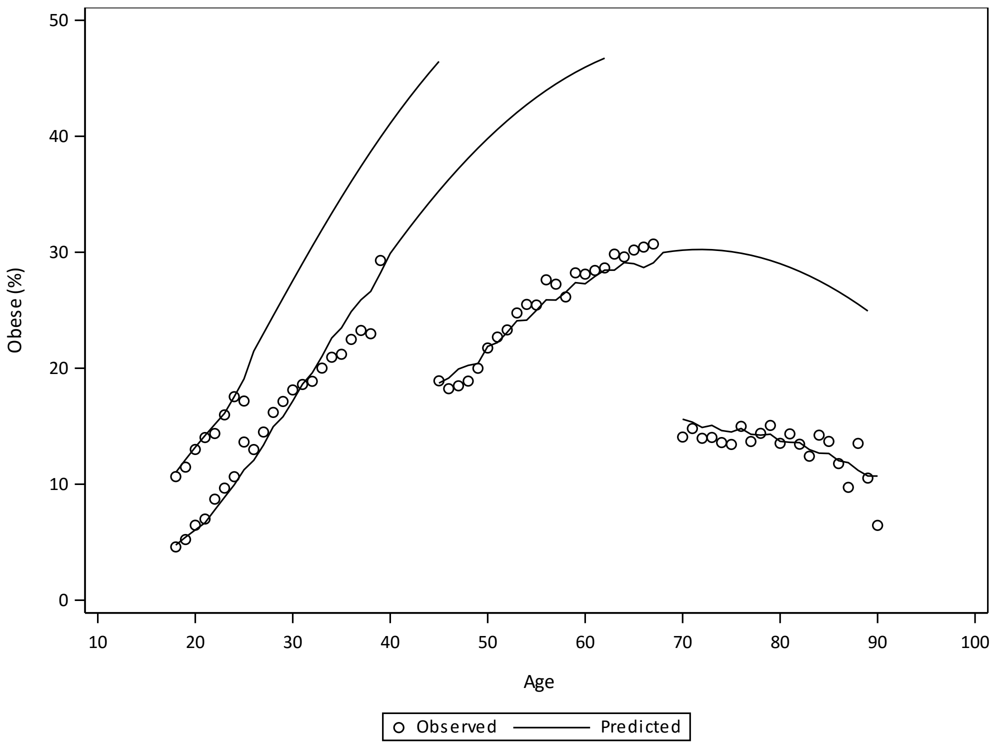

Figure 4-4: A model of the projected prevalence of obese women from 2015 to 2035 for each cohort (1989-95, 1973-78, 1946-51, and 1921-26).

One other Australian study has estimated similar trajectories for the prevalence of obesity. The researchers reported that 14.7 per cent of people aged 25-29 in 2000 (including men and women) were obese, and predicted that when these people reach the age of 65-69 years, 43 per cent will be obese (Walls et al., 2012). This is slightly lower than our prediction of 47 per cent obese by age 62 years in the 1973-78 cohort (Figure 4-4), however their analyses include data from men.

Other Australian studies have produced different forecasts for obesity prevalence. Dal Grande *et al*. (2005) used data from South Australian health surveys collected in 1991-98 and 2001-03 to predict that in 2013, 40 per cent of female Baby Boomers and 30 per cent of female Generation X will be obese. This is compared to approximately 30 per cent of women in the 1946-51 cohort and 25 per cent in the 1973-78 cohort, respectively. In contrast, Haby *et al*. (2012) predicted that the prevalence of overweight and obesity in females will be 45-80 per cent across all age groups in 2015, and 67-87 per cent by 2025. These differences may be explained by the use of repeated cross-sectional surveys (Dal Grande et al., 2005; Haby et al., 2012; Hendrie et al., 2015), use of data that are not nationally representative (Dal Grande et al., 2005; Hendrie et al., 2015), different birth cohort groupings (Dal Grande et al., 2005) or grouping by age range (Haby et al., 2012; Walls et al., 2012), and reporting of overweight and obesity prevalence rather than obesity alone (Haby et al., 2012).

The advantages of the modelling approach used in this report are that the ALSWH longitudinal dataset allows us to take account of non-linear weight trajectories of women across their lifespan and different patterns for women born at different times (i.e. age and cohort effects). Our data (Figure 4-4) and those from others have shown that BMI has an inverted U-shaped trajectory across a woman's life course (Hendrie et al., 2015; Wang, Colditz & Kuntz, 2007).

To estimate the number of obese women, population projections Series A-C from the ABS were incorporated into the model, shown in Figure 4-4, to produce the data shown in Figure 4-5 and Table 4-1 (methods described in Appendix C). Briefly, the ABS produced three different scenarios (Series A, B, and C) for the Australian population from 2012 to 2011. Series B is based on current (at 2012) rates of fertility, life expectancy at birth, and net overseas migration. Series A assumes higher rates for all three characteristics, whereas Series C assumes lower fertility and net overseas migration rates and unchanged life expectancy.

The model shows that approximately 2.4 million adult women (26.6 per cent) were obese in 2015, which is similar to the prevalence estimate of 27.4 per cent from the ABS National Health Survey conducted in 2014-15 for women aged 18 years and over (ABS, 2015b). The number of obese women is projected to double, from approximately 2.4 million (all series) in 2015 to 5 million (Series A), 4.8 million (Series B), and 4.7 million (Series C) in 2035. For each population projection series, the prevalence of women aged 20-90 who are obese is predicted to increase from 27 per cent to 40 per cent over the next twenty years.

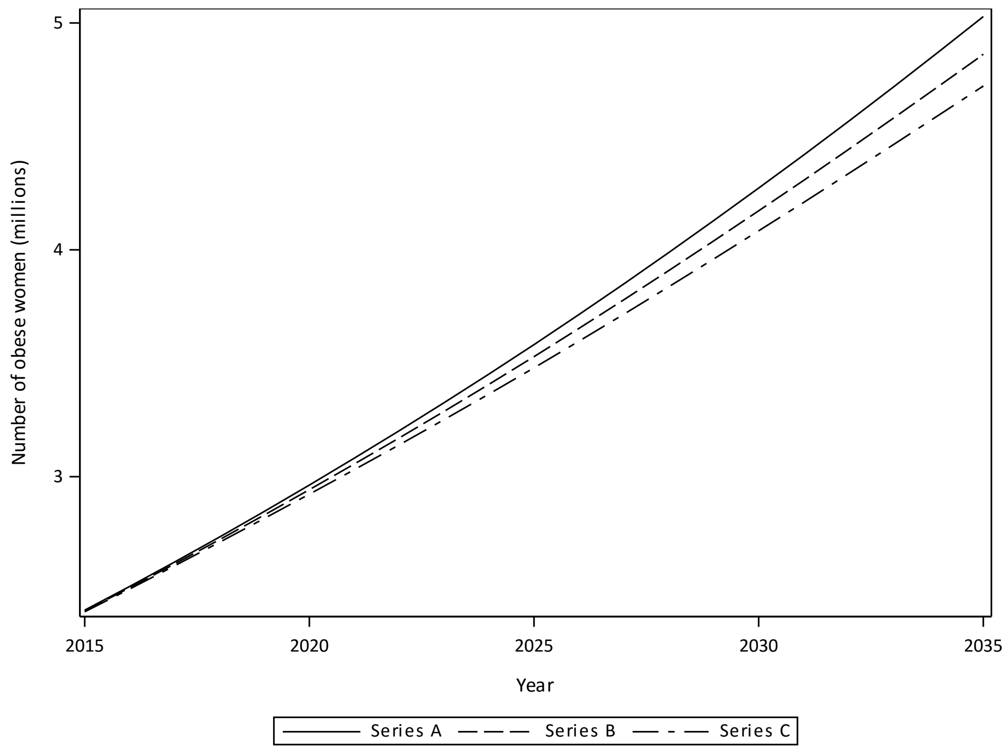

Figure 4-5: Projected number of obese women in Australia from 2015 to 2035.

Table 4-1: Projected number and prevalence of obese women in Australia from 2015 to 2035.

Year	Population projection					
	Series A		Series B		Series C	
	n	%	n	%	n	%
2015	2,403,135	26.6	2,399,598	26.6	2,395,977	26.6
2020	2,952,239	29.9	2,932,006	29.9	2,912,306	29.9
2025	3,568,750	33.1	3,515,980	33.2	3,466,929	33.2
2030	4,256,267	36.4	4,156,416	36.4	4,068,619	36.4
2035	5,009,249	40.0	4,843,121	39.6	4,704,384	40.0

Our prediction is similar to that of another Australian study using AusDiab data, which predicted that 36 per cent of adult women will be obese in 2025 (Walls et al., 2012). This corresponds well with observations from ALSWH and other studies that younger generations are heavier than previous generations at the same age and that obesity prevalence increases with age in early adulthood to mid-age (Lee et al., 2010; Ng et al., 2014; Walls et al., 2012). Furthermore, this has also been demonstrated in the Australian National Health Surveys conducted between 1995 and 2011-12.

However, the predicted increase in obesity prevalence contrasts with the result of the most recent ABS National Health Surveys (2014-15) that indicated obesity prevalence in women has plateaued. In both the 2011-12 and 2014-15 National Health Surveys, obesity prevalence in women remained constant at approximately 28 per cent (ABS, 2012b, 2015e). The reason for this discrepancy may be due to differences in study design (longitudinal versus cross-sectional data collection, age-specific estimates versus age groups). The 2014-15 National Health Survey also showed that obesity prevalence was 17.3 per cent for women aged 18-24 and 25-34. This is in contrast to findings from ALSWH and other studies that have reported a rise in obesity prevalence with age in early adulthood.

Future Australian Health Surveys and future surveys of ALSWH participants may show whether or not obesity prevalence is steadily increasing or continuing to plateau in Australia. However, the current ALSWH data suggests that the former is likely to occur over the next twenty years.

Using data from the population projection series B, Figures 4-6 and 4-7 show the population pyramid for Australian women and the prevalence of obese women aged 20 to 90 in 2015 and 2035. Most of the obese women are predicted to be in the 35 to 55 age range in 2035.

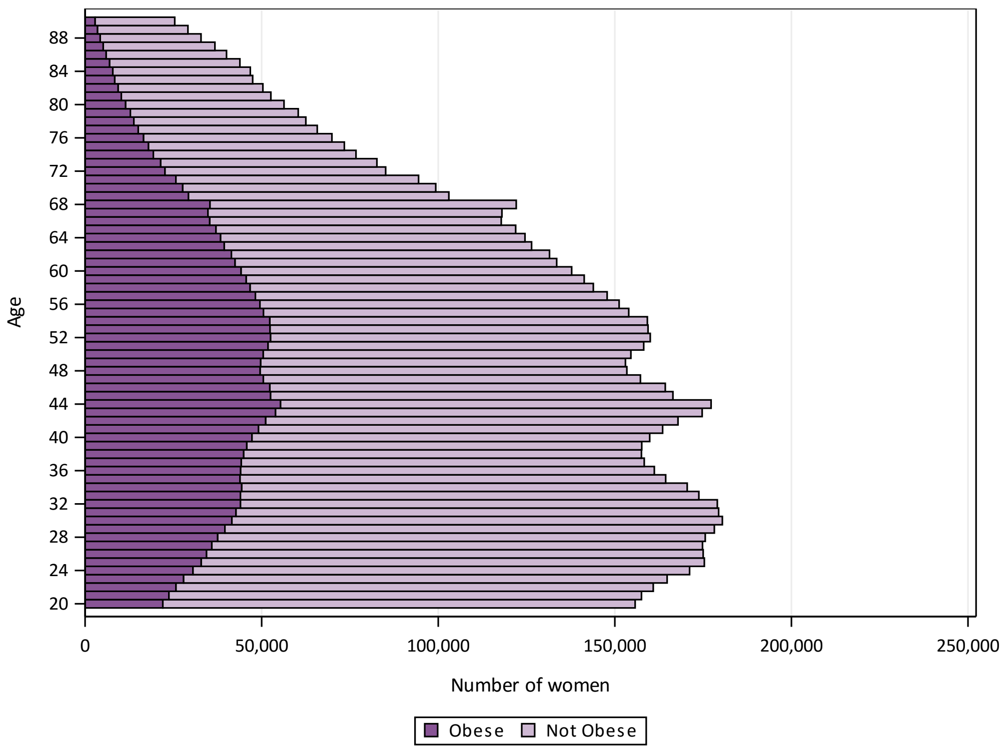

Figure 4-6: Projected numbers of obese women in Australia by age in 2015 based on current population trends (Series B).

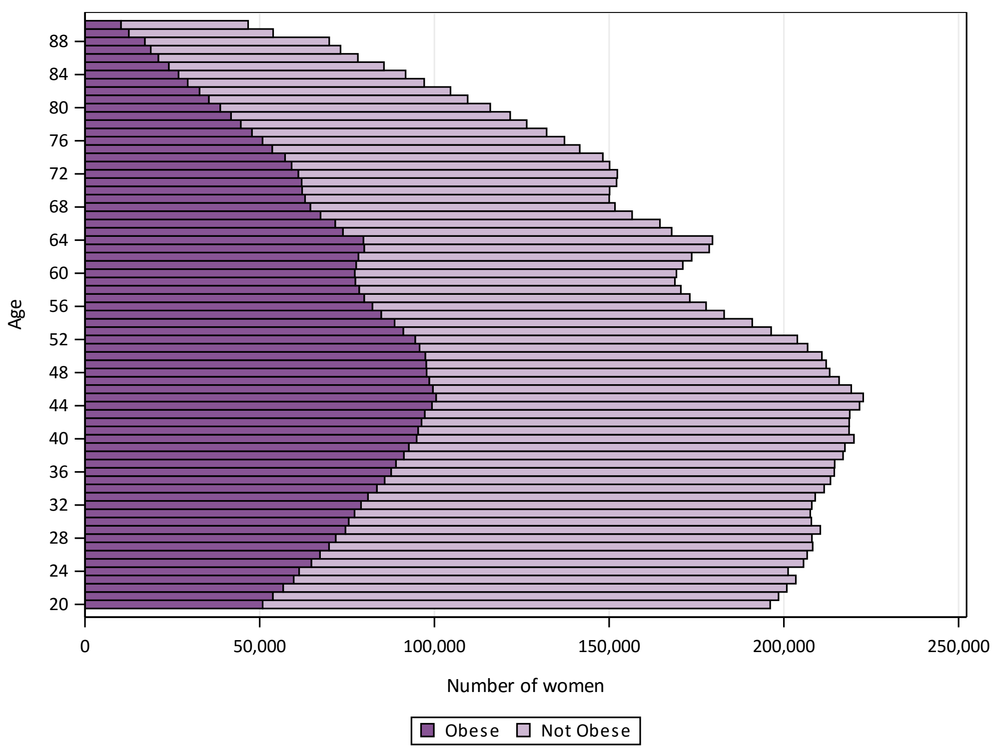

Figure 4-7: Projected numbers of obese women in Australia by age in 2035 based on current population trends (Series B).

4.5. Impact of obesity on healthcare expenditure

The impact of obesity on healthcare utilisation was examined by comparing the mean number of MBS claims, PBS prescriptions filled, and hospital admissions accrued by women each year, and the cost of these services between obese and non-obese ALSWH participants.

4.5.1. Medicare Benefits Scheme

Survey data were linked to MBS data from 1996 to 2013 and this allowed us to determine the number of unreferred MBS claims made by each participant. 'Unreferred' means visits to a general practitioner without requiring a referral. To estimate the total unreferred MBS cost, the average cost of MBS services in 2014 (in 2014 Australian dollars) was obtained from the Department of Human Services statistical reporting database (Medicare Group Reports, 2016) and was reported to be $48.80 per visit. To calculate annual costs, it was assumed that this average cost was the same for obese and non-obese women. The annual unreferred MBS cost (in 2014 Australian dollars) for each participant for every year from 1996 to 2013 was calculated by multiplying the number of unreferred MBS claims by $48.80. Then, the estimated annual unreferred MBS cost per woman according to whether or not she was obese was estimated (Appendix D, Section 15.1).

During the period 1996 to 2013, the average annual number of unreferred MBS claims and the corresponding unreferred MBS costs increased with age (Figure 4-8 and 4-9). The average number of unreferred MBS claims and total unreferred MBS costs per year were higher for obese women than for non-obese women until at least 78 years of age. The largest difference was in the 1946-51 cohort: obese women made 1-2 more unreferred MBS claims and the cost of MBS services was $50-70 more per year in obese than non-obese women.

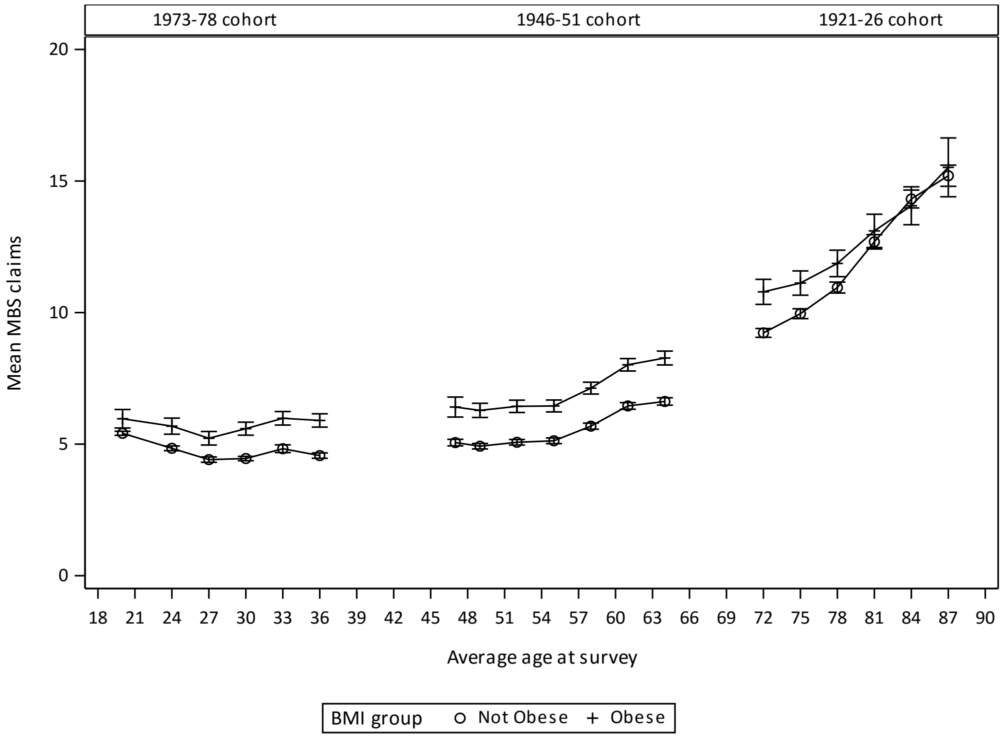

Figure 4-8: Comparison of average number of unreferred MBS claims per participant per year for the 1973-78, 1946-51, and 1921-26 cohorts by obesity status.

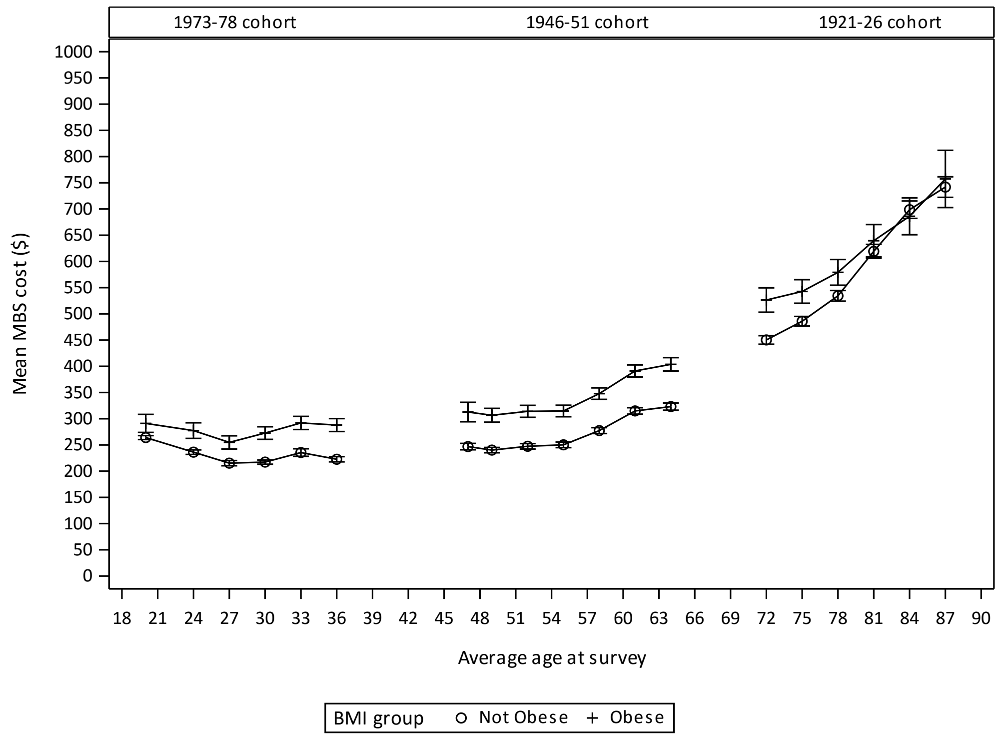

Figure 4-9: Comparison of average unreferred MBS costs per participant per year for the 1973-78, 1946-51, and 1921-26 cohorts by obesity status.

4.5.2. Pharmaceutical Benefits Scheme

ALSWH data were also linked to the latest available PBS dataset (2012-13 financial year), which provided a record for each dispensed PBS script and its associated cost for each participant. The average number of scripts filled and cost (in 2012-13 Australian dollars) was then determined by obesity group (Appendix D, Section 15.2). Because the 2012-13 period corresponded to one survey per cohort, there are only three sets of data points.

In the 1973-78 and 1946-51 cohorts, obese women had almost double the number of PBS prescriptions filled than non-obese women (Table 4-2). Non-obese women aged 36 years had, on average, 5 PBS scripts filled compared to 9 scripts for obese women of the same age. Similarly, non-obese women aged 64 years had 19 scripts filled, compared with 32 scripts for obese women of the same age. In the 1921-26 cohort, non-obese women had 53 PBS prescriptions filled compared to 65 for obese women.

Non-obese women aged 36 years had $271 (in 2012-13 Australian dollars) in PBS costs compared with $374 for obese women. By the age of 87, the mean PBS cost increased to $1949 for non-obese women and $2060 for obese women. For the 1946-51 cohort, non-obese women had a mean PBS cost of $810 compared with $1212 for obese women, representing a $402 difference.

Table 4-2: Mean PBS claims and costs (in 2012-13 Australian dollars) per participant for the 1973-78, 1946-51, 1921-26 cohorts by obesity status.

		ALSWH Cohort		
		1973-78	**1946-51**	**1921-26**
Group	**Corresponding survey** **Year** **Average age (years)**	Survey 6 2012 36	Survey 7 2013 64	Survey 6 2011 87
Not Obese	Mean number of PBS claims per participant	4.9	19.0	53.0
	Mean PBS cost per participant ($)	271	810	1949
Obese	Mean number of PBS claims per participant	9.0	32.3	65.4
	Mean PBS cost per participant ($)	374	1212	2060

4.5.3. Hospital costs

Due to the limitations of the hospital datasets available, data from ALSWH participants who were hospitalised in NSW were used to determine differences in hospital admission and cost accrued by obese and non-obese women (Appendix D, Section 15.3). The NSW Admitted Patients dataset provided hospital admission of participants by Australian Refined Diagnosis Related Group (AR-DRG) codes that were then matched to the AR-DRG costs reported by the Independent Hospital Pricing Authority (IHPA). Each AR-DRG represents a group of similar conditions that require similar hospital services. The hospital cost for each admission was then summed to obtain the annual cost for each person.

Obese women had higher hospital costs than non-obese women in both the 1973-78 and 1946-51 cohorts (Figure 4-10). The mean hospital cost for non-obese women in the 1973-78 cohort was $984 at age 24 and peaked at $1754 at age 33. The average hospital cost for obese women aged 24 was $600 (in 2012-13 Australian dollars) higher than for non-obese women. From 27-36 years of age, obese women had approximately $112-$320 more hospital costs than non-obese women.

Mean hospital costs for non-obese women in the 1946-51 cohort increased from $1069 (in 2012-13 Australian dollars) at age 52 to $1549 at age 64 (Figure 4-10). For obese women in this cohort, the hospital costs were higher, ranging from $1283 (at 52 years) to $2504 (at 64 years). Similarly, another study has shown that women aged 45-64 years in 2006 averaged $1101 (for those with 18.5≤BMI<20) to $2480 (40≤BMI≤50) in hospital costs per year (Korda et al., 2015). They also showed that the obese women accrued $1528 to $2480 in hospital costs per year, which is comparable to our results; obese women in the 1946-51 cohort had hospital costs of $1200-$2400 per year. Similar to the MBS and PBS findings, Figure 4-12 shows that the greatest cost difference between obese and non-obese women occurs in the 1946-51 cohort. At age 51, the cost difference in hospital use was approximately $200 and increased with age, so that at age 66 years, the difference was $1000.

Once women reached their 70s and 80s, average hospital costs increased dramatically with age, from $1677 (in 2012-13 Australian dollars) to as high as $4210 per annum. In contrast to the younger cohorts, obese women in the 1921-26 cohort had similar hospital costs to non-obese women. The difference in cost was greatest at age 78 ($733 per year). The hospital costs of women aged 80 years and over in 2006 in the 45 and Up study was significantly higher than that of the women in the 1921-26 cohort (Korda et al., 2015), probably reflecting the very high upper age range in the 45 and Up cohort.

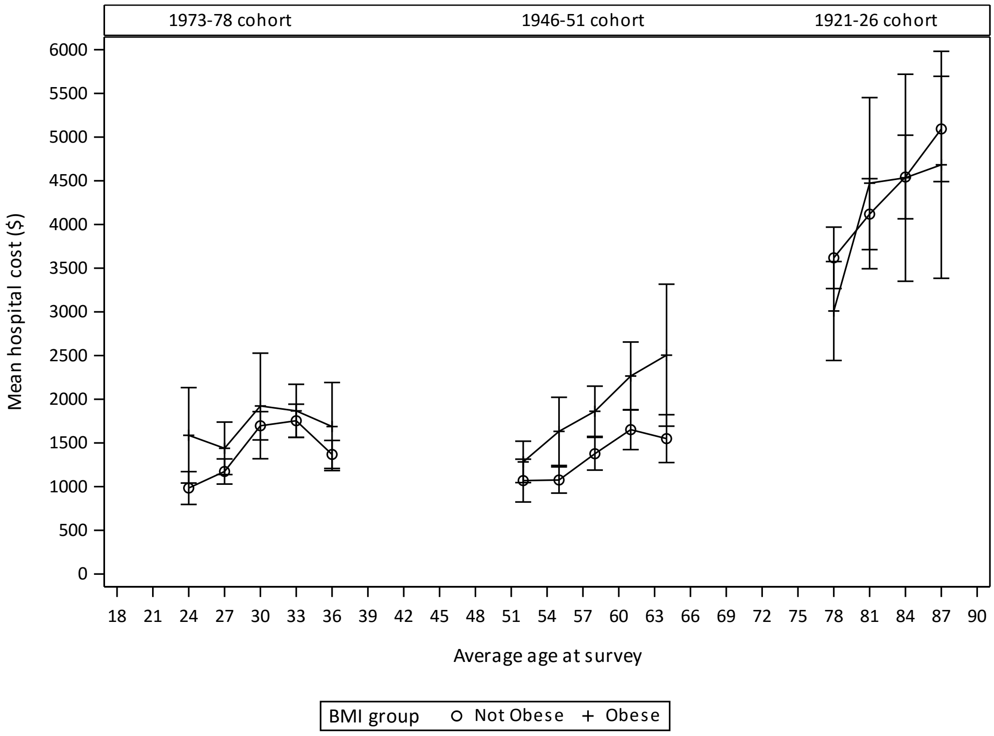

Figure 4-10: Comparison of average hospital costs in 2012-13 Australian dollars per participant per year for the 1973-78, 1946-51, and 1921-26 cohorts living in NSW by obese status.

4.6. Projected impact of obesity on healthcare utilisation

The impact of obesity on healthcare utilisation from 2015 to 2035 was examined using the trend data shown in section 4.5. We compared the number of MBS claims, PBS prescriptions filled, and hospital admissions accrued by women each year and the cost of using these services for (a) the total population of women aged 20-90, (b) obese women, and (c) non-obese women. For MBS, PBS, and hospital projections, a model was generated for the number of claims and cost of each service for women at every age between 20 and 90, inclusive (Appendix E). The major assumption is that the number of MBS claims and costs (in 2014 Australian dollars), PBS claims and costs (in 2012-13 Australian dollars), and hospital costs (in 2012-13 Australian dollars) vary with age in the same way for every year between 2015 and 2035. The age-specific estimates for the number of claims and cost of each service were multiplied by the projected number of women aged 20 to 90 years at every year from 2015 to 2035, as well as by prevalence of obese and non-obese women, to predict the total number of claims and costs for MBS, PBS, and hospital services over the next 20 years (Appendix F).

4.6.1. Medicare Benefits Scheme

The total number of unreferred MBS claims for all Australian women aged 20-90 will increase from 57 million in 2015 to 85 million in 2035, corresponding to an annual unreferred MBS cost of $2.8 billion and $4.1 billion (in 2014 Australian dollars), respectively (Figures 4-11 and 4-12). The number of unreferred MBS claims made by obese women will more than double from 17 million to 36 million from 2015 to 2035 whereas for non-obese women, there will be a more gradual increase from 40 million to 48 million. As a result, annual unreferred MBS costs will double for obese women from $0.8 billion to $1.8 billion (in 2014 Australian dollars) between 2015 and 2035. For non-obese women, the annual unreferred MBS costs will increase from a little under $2 billion to $2.4 billion over the next twenty years.

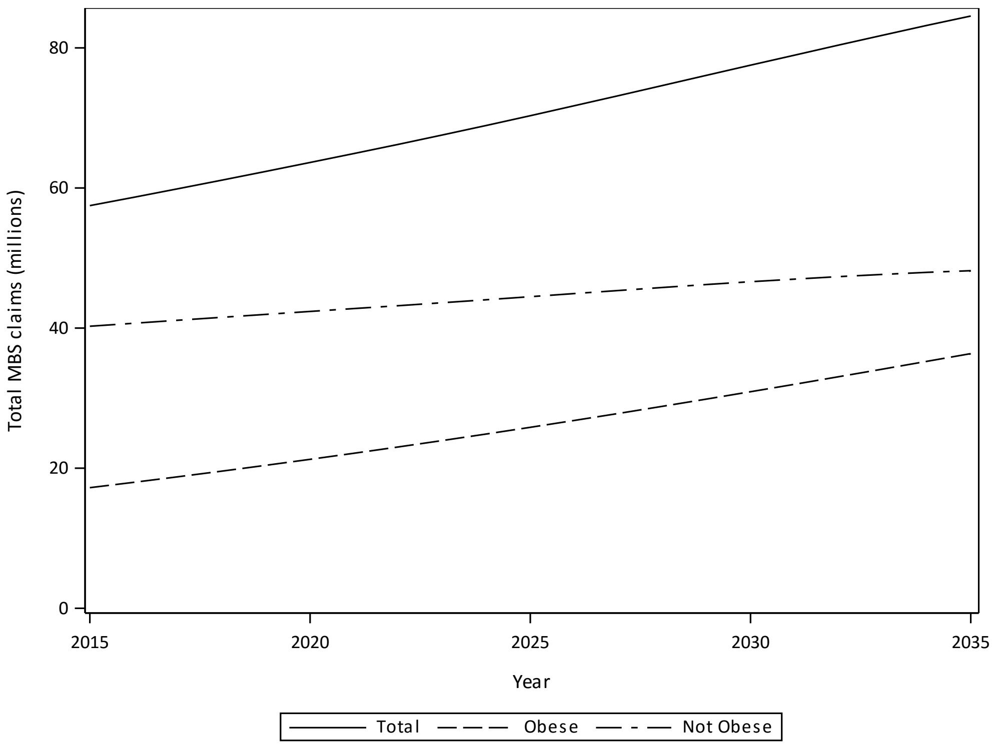

Figure 4-11: Projected number of unreferred MBS claims for Australian women aged 20-90 from 2015 to 2035 for obese, non-obese, and all women.

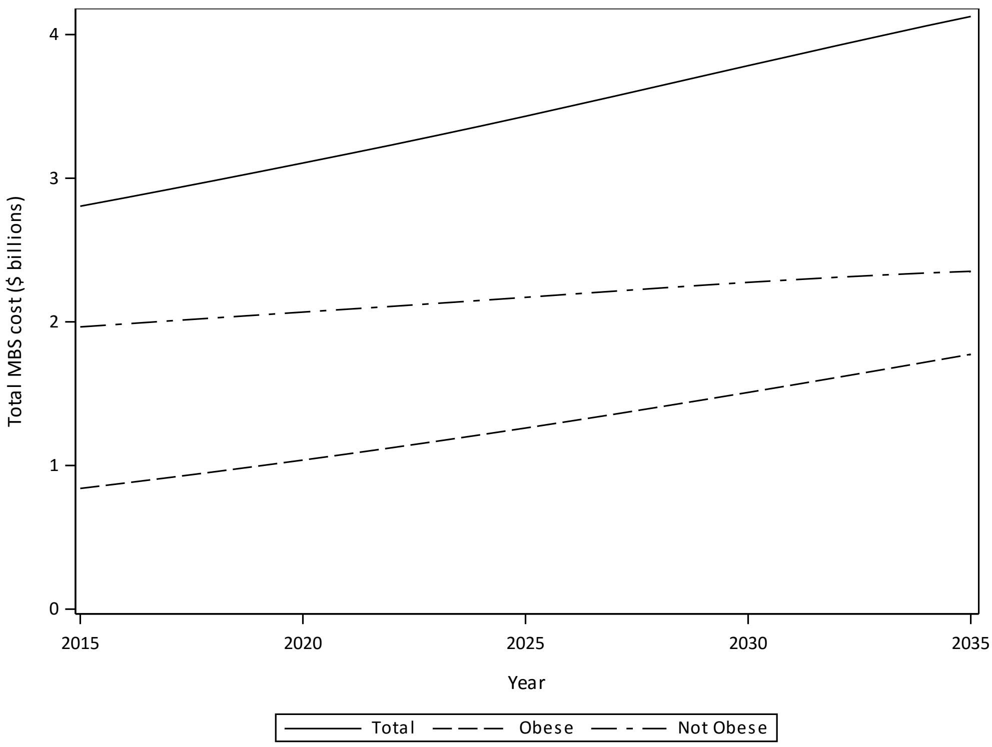

Figure 4-12: Projected total unreferred MBS costs (in 2014 Australian dollars) for women aged 20-90 from 2015 to 2035 for obese, non-obese, and all women.

4.6.2. Pharmaceutical Benefits Scheme

Australian women aged 20-90 were estimated to fill approximately 133 million PBS prescriptions in 2015 at a total cost of $5.6 billion (in 2012-13 Australian dollars; Figures 4-13 and 4-14). Similar to the MBS, the total number of PBS prescriptions filled for obese women will more than double from 49 million in 2015 to 108 million in 2035, accounting for a total PBS cost of $1.9 billion and $4.0 billion (in 2012-13 Australian dollars), respectively. For non-obese women, the PBS prescriptions filled will increase from 84 million to 110 million between 2015 and 2035. As a result, the total PBS cost is projected to increase from $3.7 billion in 2015 to $4.6 billion in 2035.

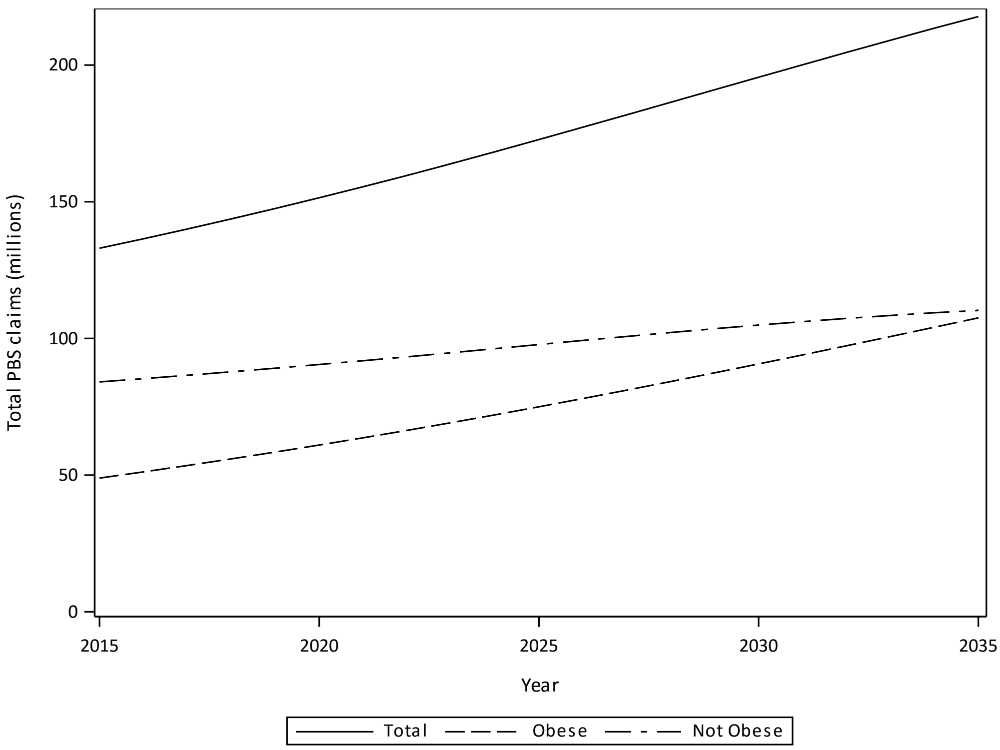

Figure 4-13: Projected total number of PBS claims for Australian women aged 20-90 from 2015 to 2035 for obese, non-obese, and all women.

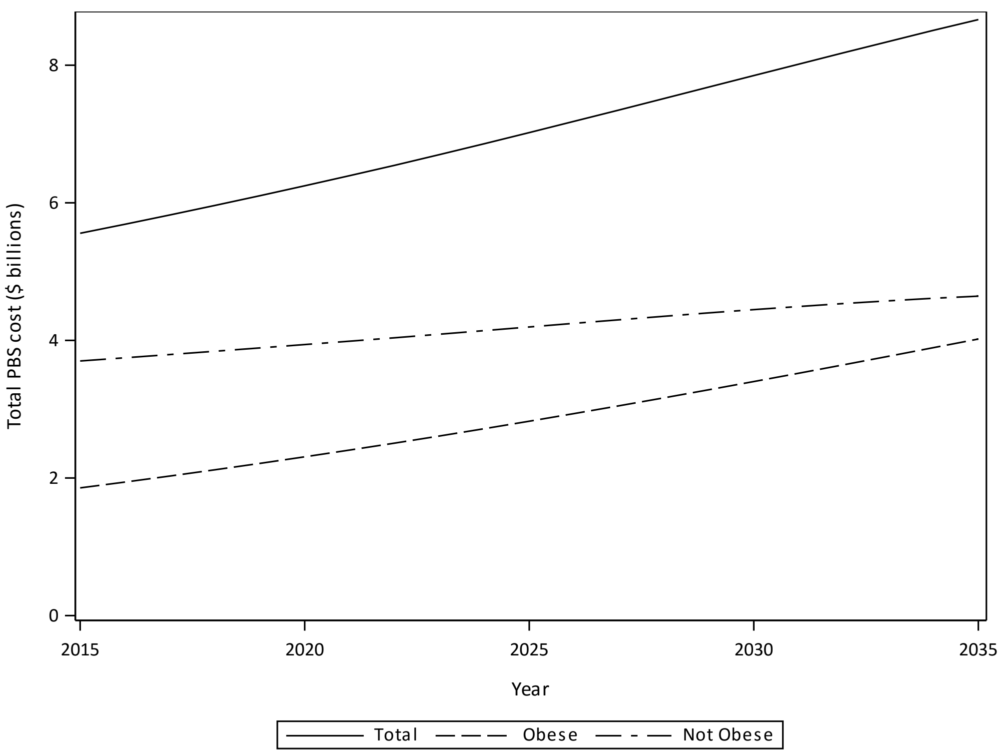

Figure 4-14: Projected total PBS costs (in 2012-13 Australian dollars) for women aged 20-90 from 2015 to 2035 for obese, non-obese, and all women.

4.6.3. Hospital services

Australian women aged 20-90 were estimated to use a total of $15.8 billion (in 2012-13 Australian dollars) in hospital services in 2015 and $23.6 billion in 2035 (see Figure 4-15). The total hospital cost for obese women will double from $4.7 billion to $10 billion between 2015 and 2035. For non-obese women, the total hospital cost will increase from $11 billion to $13.6 billion (in 2012-13 Australian dollars) from 2015 to 2035.

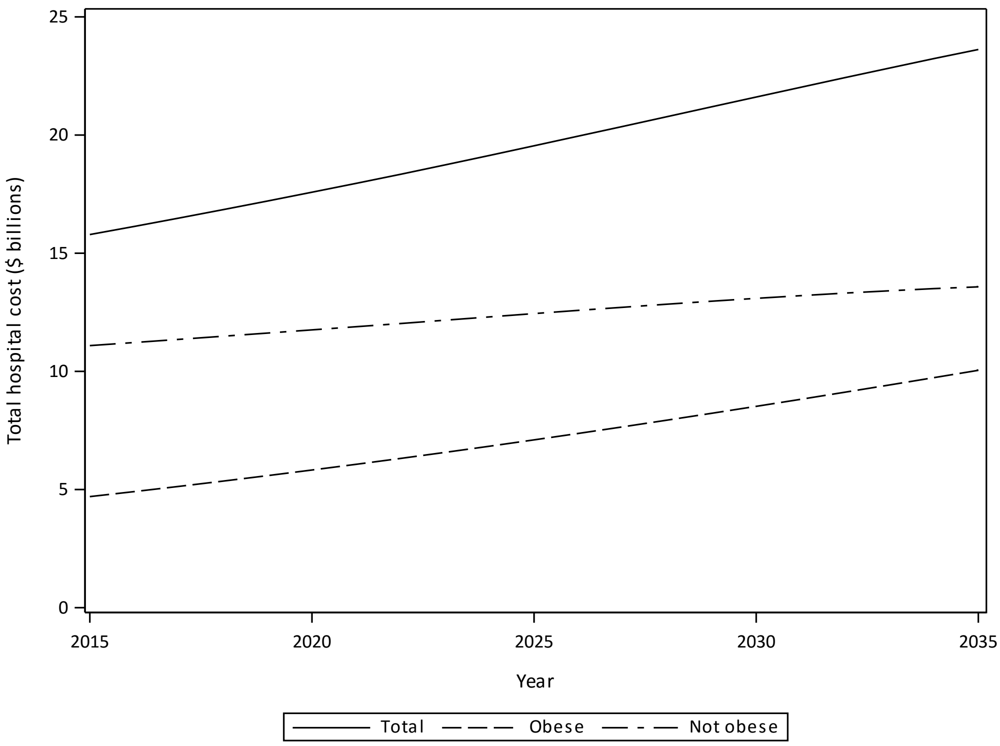

Figure 4-15: Projected total hospital cost in 2012-13 Australian dollars for women aged 20-90 from 2015 to 2035 for obese, non-obese, and all women.

Obese Australians aged ≥30 years in 2005 accounted for $6.6 billion in direct health costs and $13.6 billion in government subsidies (Colagiuri et al., 2010). For 2011-12, PriceWaterhouseCooper estimated that the additional direct costs of obese Australians aged ≥18 years was $3.8 billion, however they predicted that in 2025, there will be 7.2 million obese individuals and $87.7 billion in additional healthcare costs (PriceWaterhouseCooper, 2015).

Our report focuses on Australian women aged 20 to 90 years whereas the other studies include men in their analyses and only report on health expenditure of obese individuals. Irrespective of these differences, it is clear that the increasing prevalence of obesity will lead to higher healthcare costs in the future.

4.6.4. Summary points

- Women's BMI increased with age from early adulthood until 60-70 years (when it was projected to slowly decrease), and by birth cohort, with more recent cohorts having higher BMI.
- The prevalence of obese women increased by 3.5 fold in the 1973-78 cohort from 1996 to 2012, and 1.6 fold in the 1946-51 cohort from 1996 to 2013.
- The number of obese women is predicted to double from 2.4 to 4.8 million between 2015 and 2035.
- Total health expenditure for obese women will double over the next twenty years, whereas the rate in which MBS, PBS, and hospital costs increase will be slower for non-obese women.

5. Tobacco use

5.1. Background

Smoking cigarettes and other tobacco products is a major risk factor for a wide range of diseases including cancer, cardiovascular disease, and respiratory disease. In Australia, the prevalence of smoking among women increased then declined in the mid-20th century. Approximately 1 in 4 women were current smokers in 1945 and this prevalence increased to 1 in 3 by 1976 (Banks et al., 2015; Woodward, 1984). Accumulating evidence of the harmful effects of tobacco use and the introduction of control programs prompted a decline in current smokers over the last three decades. According to the National Drug Strategy Household Survey (NDSHS), the percentage of people aged 14 years and over who were daily smokers fell from 25.1 per cent in 1998 to 12.8 per cent in 2013 (AIHW, 2000, 2014b). For women in particular, the latest National Health Survey (2014-15) shows that only 13.3 per cent of women aged 18 years and over are current smokers (ABS, 2015e). History has shown that there are more men than women who smoke, however the gap in prevalence sharply decreased from approximately 46 per cent in 1945 (Woodward, 1984) to 5.6 per cent in 2014-15 (ABS, 2015e). Globally, the prevalence of tobacco smoking from 2000 to 2010 has fallen in 155 out of 178 countries for women and 125 out of 173 countries for men (Bilano et al., 2015).

Smoking has wide-reaching effects: non-smokers who inhale environmental tobacco smoke are at greater risk of poorer respiratory function (Jaakkola & Jaakkola, 2002), lung cancer (Kim et al., 2014), and coronary heart disease (He et al., 1999). In addition, mothers who smoke at any time from preconception to after child birth increase the risk of Sudden Infant Death Syndrome (Mitchell & Milerad, 2006) and their child/ren developing asthma and wheeze (Burke et al., 2012) and lower respiratory infections (Jones et al., 2011).

The prevalence of smoking also varies with age and gender. There are more men aged 25 to 34 who smoke than any other age group (ABS, 2012b, 2015e). In contrast, smoking prevalence is highest amongst women aged 18-34, and 45-54 (ABS, 2012b, 2015e). Work conducted by ALSWH has demonstrated that women quit smoking around the time when they become involved in a committed relationship, marriage, or pregnancy (McDermott, Dobson & Russell, 2004; McDermott, Dobson & Owen, 2006).

5.2. Ascertainment of smoking status in ALSWH

Smoking status was asked in all surveys of the 1973-78 and 1946-51 cohorts, and Surveys 1, 2, and 6 of the 1921-26 cohort. The smoking status of participants was ascertained from the questions:

> 'How often do you currently smoke cigarettes or any tobacco products?'

'In your lifetime, would you have smoked at least 100 cigarettes (or equivalent)?

Smoking status was also determined in Survey 1 of the 1989-95 cohort using the following questions:

'Do you currently smoke tobacco?'

'On a day when you smoke, how many cigarettes do you usually smoke?'

'In the past, have you smoked tobacco?'

At Survey 2 and 3, the questions were asked:

'How often do you currently smoke cigarettes or any tobacco products?'

'If you smoke daily, on average how many cigarettes do you smoke EACH DAY?'

'If you smoke, but not daily, on average how many cigarettes do you smoke PER WEEK?'

'In your lifetime, would you have smoked at least 100 cigarettes (or equivalent)?

From the responses to these questions, the participant was classified as never smoker, ex-smoker, and current smoker (Appendix A).

5.3. Prevalence of tobacco use across the adult lifespan

Approximately 50 per cent of participants in both the 1973-78 and 1946-51 cohorts have never smoked, and this percentage has remained consistent throughout the survey period (Figure 5-1). In 1996, 32 per cent of participants aged 18-23 and 18 per cent of women aged 45-50 were smokers. This finding is comparable with the 1998 NDSHS where 37.2 per cent of women aged 20-29 years and 17.6 per cent of women aged 40-49 were smokers in 1998 (AIHW, 2000). By Surveys 6 and 7, the prevalence of smokers in both cohorts dropped to approximately 12 and 8 per cent, respectively, which is also comparable to the NDSHS for 2013 (30-39 years, 13.2 per cent; 60-69 years, 11.1 per cent) (AIHW, 2014b).

In the 1921-26 cohort, 62 per cent of participants reported they had never smoked in 1996. This percentage increased from Surveys 1 to 6, which indicates that a percentage of participants who smoked or had smoked tobacco no longer participated in the study, which may be due to earlier deaths (Jamrozik et al., 2011).

Between 1996 and 2013, the uptake of smoking in young adults was dramatically reduced, from 32 per cent in 1996 (1973-78 cohort, Survey 1) to 18.6 per cent in 2014 (1989-95 cohort, Survey 2). Similar results were reported by the NDSHS, where the prevalence of regular smokers amongst 18-24 year old women was 36 per cent in 1995 (Scollo & Winstanley, 2012) and 14.7 per cent in 2013 (AIHW, 2014b). In ALSWH, the percentage of ex-smokers also declined during this time period.

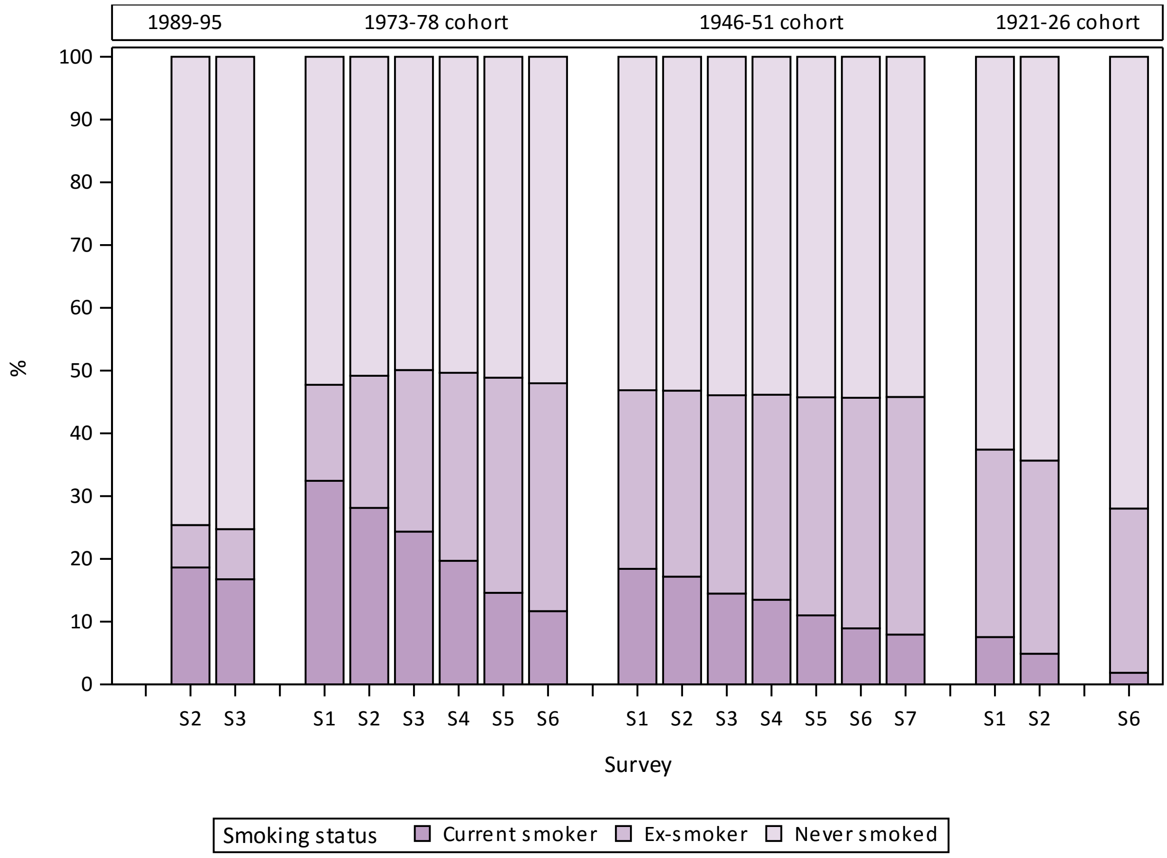

Figure 5-1: Percentage of women in each smoking category at each survey for all cohorts (1989-95, 1973-78, 1946-51, and 1921-26).

5.4. Projections of smoking prevalence over the next 20 years

The trajectory for prevalence of smokers over the next twenty years was modelled using linear mixed models (Figure 5-2 and Appendix B, Section 13.3). The main assumption for this model was that smoking prevalence will continue to fall for all cohorts, but will not reach 0 per cent.

For all cohorts, the prevalence of women who are current smokers is likely to continue to fall with age until the prevalence reaches approximately 1-3 per cent (Figure 5-2). Because the uptake of smoking is lower in women in the 1989-95 cohort than in the 1973-78 cohort, smoking prevalence is predicted to reach approximately 2 per cent at age 45 years for women in the former cohort and at age 60 years in the latter cohort.

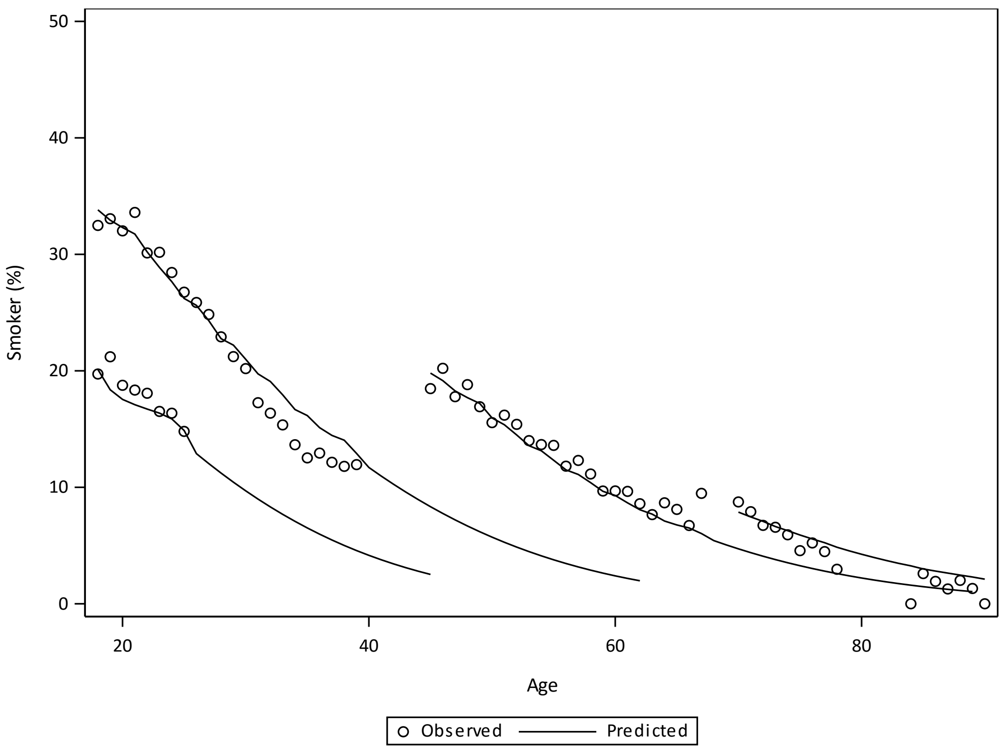

Figure 5-2: Projections of smoking prevalence from 2015 to 2035 for each cohort (1989-95, 1973-78, 1946-51, and 1921-26).

To estimate the number of women who smoke, population projections Series A-C from the ABS were incorporated into the model, shown in Figure 5-2, to produce the data shown in Figures 5-3 and 5-4, and Table 5-1 (methods described in Appendix C). Briefly, the ABS produced three different scenarios (Series A, B, and C) for the Australian population from 2012 to 2011. Series B is based on current (at 2012) rates of fertility, life expectancy at birth, and net overseas migration. Series A assumes higher rates for all three characteristics, whereas Series C assumes lower fertility and net overseas migration rates and unchanged life expectancy.

It is predicted that the total number and prevalence of female smokers will decrease from 2015 to 2035 (Figures 5-3, Table 5-1). Approximately 920,000 Australian women (or 10 per cent) were current smokers in 2015 and this decreased to 320,000 women (or 2.7 per cent) by 2035. There is little difference between the population projection series. No other study has reported such low projected or current smoking rates for Australia or other high-income countries by 2035.

One other study projected smoking prevalence based on historical data from the NDSHS and Cancer Council Victoria surveys between 1980 and 2007; based on the rates of decline from 2001 to 2007, it was projected that overall smoking prevalence in Australia would fall to 8-

10% by 2035 (Gartner, Barendregt & Hall, 2009). In other countries, the projected prevalence was proposed to be 6.4 per cent for non-Maori women in New Zealand by 2025 (van der Deen et al., 2014), and 13.2 per cent for Italian women by 2030 (Carreras et al., 2012).

Some high-income countries already have low current prevalence of smoking. In Canada, 10.1 per cent of women were daily smokers in 2013 (Reid et al., 2015). In the United States, the overall prevalence of smoking was 16.8 per cent in 2014 (CDC, 2015) with the lowest reported smoking rates in Utah and California. In California, the prevalence of smoking in women was 8.5 per cent in 2013 (CDPH, 2015) whereas gender-specific statistics were not reported for Utah.

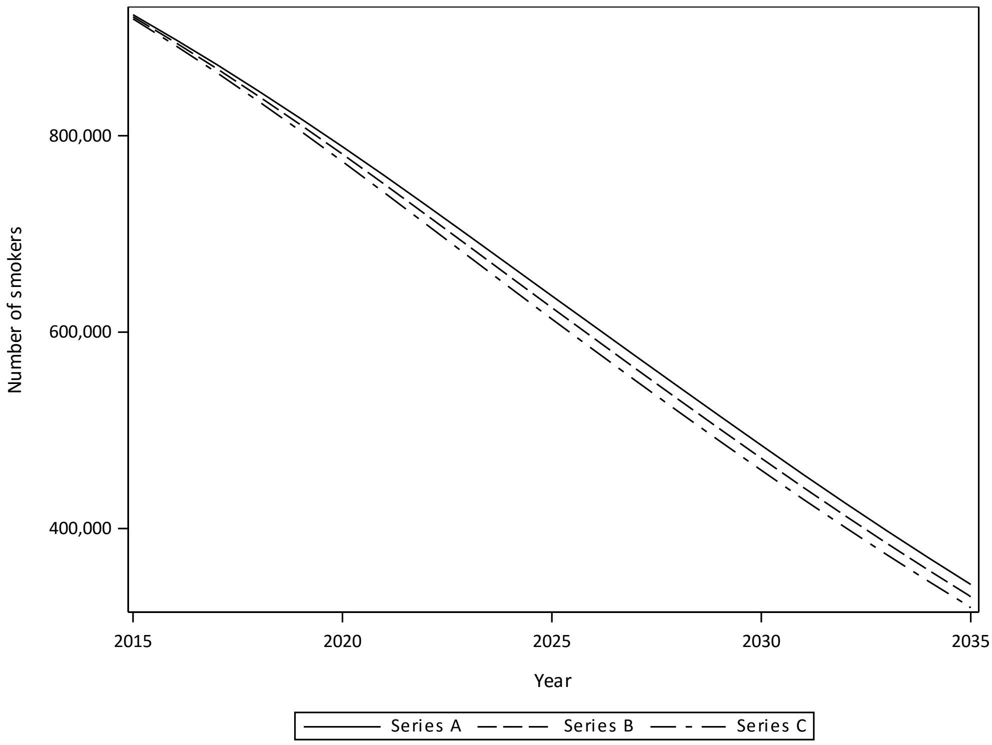

Figure 5-3: Projected number of current smokers in Australian women aged 20-90 from 2015 to 2035.

Table 5-1: Projected number and percentage of women in Australia who are current smokers from 2015 to 2035.

Year	Population projection					
	Series A		Series B		Series C	
	n	%	n	%	n	%
2015	921,716	10.2	919,641	10.2	917,515	10.2
2020	786,708	8.0	779,158	7.9	771,666	7.9
2025	634,260	5.9	622,322	5.9	610,733	5.9
2030	481,844	4.1	468,760	4.1	456,582	4.1
2035	340,112	2.7	327,868	2.7	317,015	2.7

Figures 5-4 and 5-5 show the population pyramid for Australian women and the percentage of women who are current smokers aged 20 to 90 in 2015 and 2035, respectively. The prevalence of female smokers aged 20 to 90 will decline at all ages.

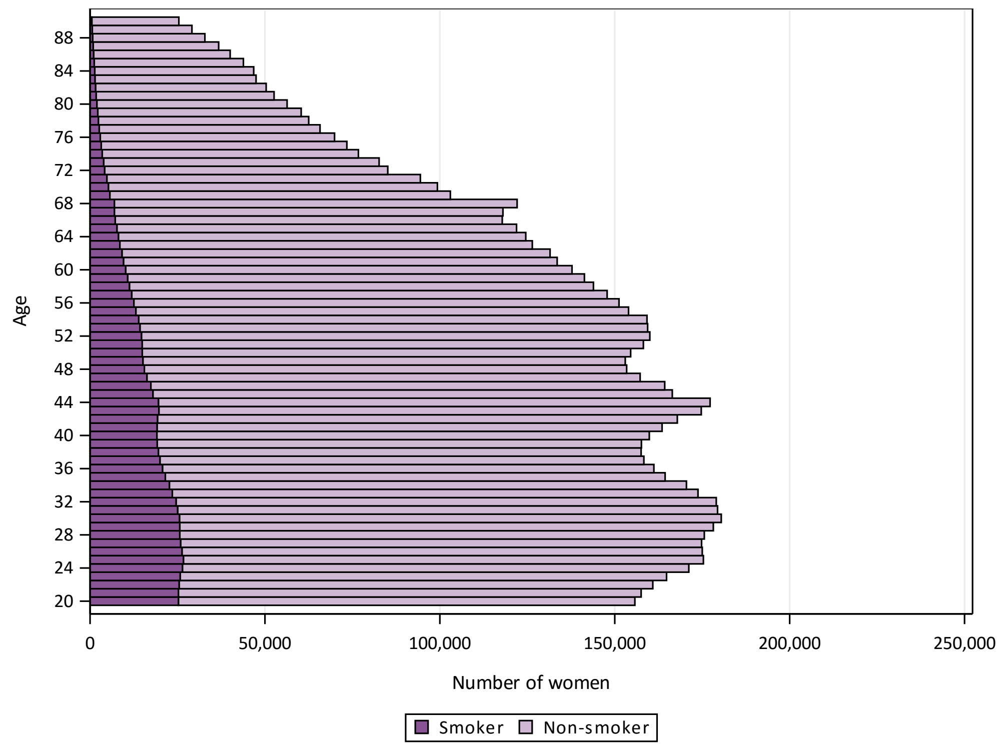

Figure 5-4: Projected numbers of women aged 20-90 who smoke in Australia in 2015 based on current population trends (Series B).

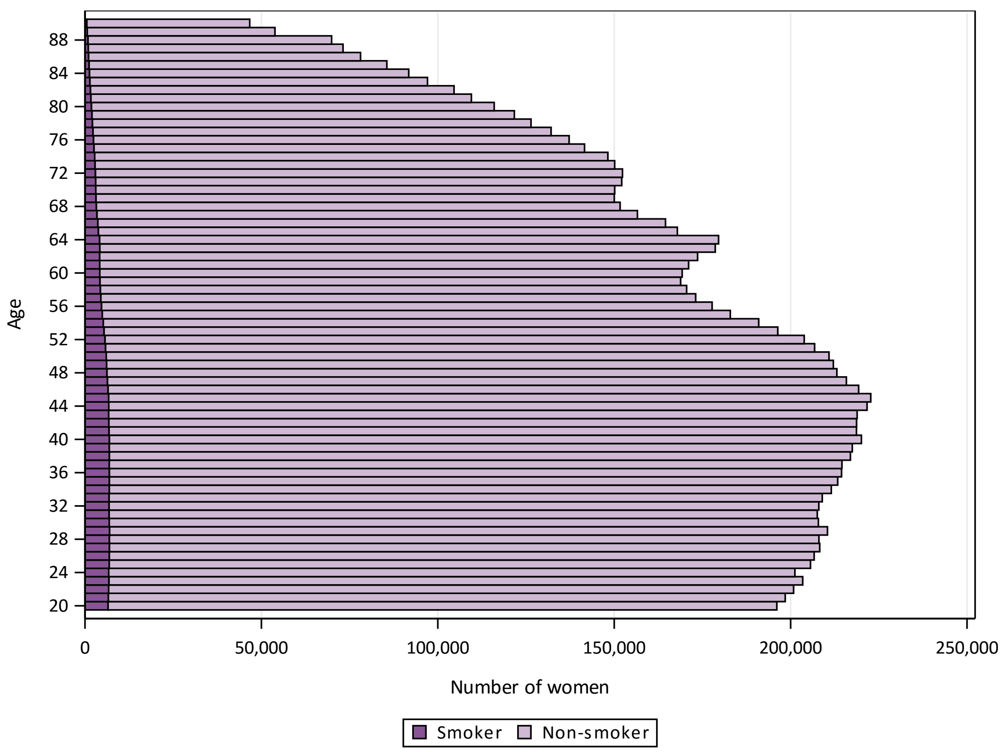

Figure 5-5: Projected numbers of women aged 20-90 who smoke in Australia by age in 2035 based on current population trends (Series B).

5.5. Impact of smoking on healthcare expenditure

The impact of smoking on healthcare utilisation was examined by comparing the mean number of MBS claims, PBS prescriptions filled, and hospital admissions accrued by women each year and the cost of these services by ALSWH participants who are current smokers, ex-smokers, and never smokers.

5.5.1. Medicare Benefits Scheme

Survey data were linked to MBS data from 1996 to 2013, allowing us to determine the number of unreferred MBS claims made by each participant. 'Unreferred' means visits to a general practitioner without requiring a referral. To estimate the total MBS cost, the average cost of unreferred MBS services in 2014 (in 2014 Australian dollars) was obtained from the Department of Human Services statistical reporting database (Medicare Group Reports, 2016) and was reported to be $48.80 per visit. To estimate the annual costs, it was assumed that this average cost was the same for women who currently smoke, are ex-smokers, or have never smoked. The total unreferred MBS cost (in 2014 Australian dollars) for each participant for every year from 1996 to 2013 was estimated by multiplying the number of unreferred MBS claims by $48.80. Then, the annual unreferred MBS cost by smoking status was estimated (Appendix D, Section 15.1).

The mean number of claims increases with age regardless of smoking status (Figure 5-6). For the 1973-78 cohort, the mean number of MBS claims made by never smokers is lower than current smokers. In the 1946-51 cohort, there is little difference in mean unreferred MBS claims between the smoking status groups across the seven surveys, however women who never smoked had the least claims. In the 1921-26 cohort, ex-smokers made the highest number of unreferred MBS claims whereas there was little difference between never smokers and current smokers.

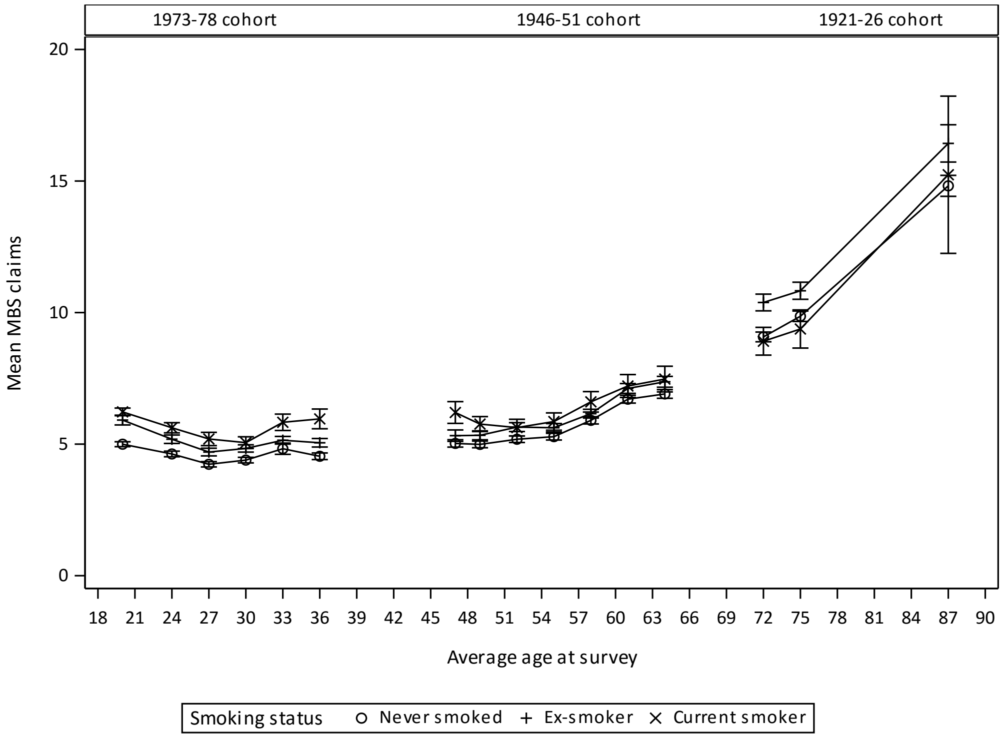

Figure 5-6: Mean number of unreferred MBS claims per woman per year and categorised by smoking status for the 1973-78, 1946-51, and 1921-26 cohorts.

5.5.2. Pharmaceutical Benefits Scheme

ALSWH data were linked to the latest available PBS dataset (2012-13 financial year), which provided a record for each PBS script that was filled and its associated cost. The average number of scripts filled and their cost (in 2012-13 Australian dollars) was then determined by smoking status (Appendix D, Section 15.2). Because the 2012-13 period corresponded to one survey per cohort, there are only 3 sets of data points.

The mean number of PBS prescriptions filled and their cost increased with age (Table 5-2). For all cohorts, never smokers had the least number of PBS prescriptions filled compare with ex-smokers and current smokers. In the 1973-78 cohort, the mean PBS cost was approximately $280-290 (in 2012-13 Australian dollars) for both never and ex-smokers aged 36. Current smokers of the same age had $100 more in PBS costs. For the 1946-51 cohort, never smokers aged 64 had the lowest average PBS cost ($859) whereas current smokers had the highest PBS cost ($1202). At age 87, the never smokers continue to have the lowest PBS cost ($1924) and the current smokers to have the highest PBS cost ($2213).

Table 5-2: Mean PBS claims and cost (in 2012-13 Australian dollars) per participant for the 1973-78, 1946-51, and 1921-26 cohorts by smoking status.

		ALSWH Cohort		
		1973-78	**1946-51**	**1921-26**
Group	**Corresponding survey**	Survey 6	Survey 7	Survey 6
	Year	2012	2013	2011
	Average age (years)	36	64	87
Current smoker	Mean number of PBS claims per participant	8.9	26.6	45.8
	Mean PBS cost per participant ($)	381	1202	2213
Ex-smoker	Mean number of PBS claims per participant	5.7	24.5	58.3
	Mean PBS cost per participant ($)	290	964	2019
Never smoked	Mean number of PBS claims per participant	5.4	21.5	51.3
	Mean PBS cost per participant ($)	280	859	1924

5.5.3. Hospital services

Due to the limitations of the hospital datasets available, the numbers of ALSWH participants who were hospitalised in NSW were used to determine differences in hospital admission and cost accrued by smoking status (Appendix D, Section 15.3). The NSW Admitted Patients dataset provided hospital admission of participants by Australian Refined Diagnosis Related Group (AR-DRG) codes that were then matched to the AR-DRG costs reported by the Independent Hospital Pricing Authority (IHPA). Then hospital cost for each admission was then summed to obtain the annual cost for each person.

In the 1973-78 cohort, the mean hospital cost peaked around the age of 30, regardless of smoking status (Figure 5-7). The range of hospital costs amongst the different groups was similar ($1000-1700).

In the 1946-51 cohort, hospital costs steadily increased for all participants across the survey period. There was little difference in hospital costs between the smoking status groups (approximately $1200 per woman) at the first survey when the women were aged 45-50. However, after this age, current smokers had the highest increase in hospital costs from 57 to 66 years of age ($1800 to $2700). Ex-smokers and never smokers had similar hospital costs, increasing from $1200 to $1800.

The 1921-26 cohort had the highest hospital cost of all cohorts: $5680 for current smokers, $5620 for ex-smokers, and $4850 for never smokers.

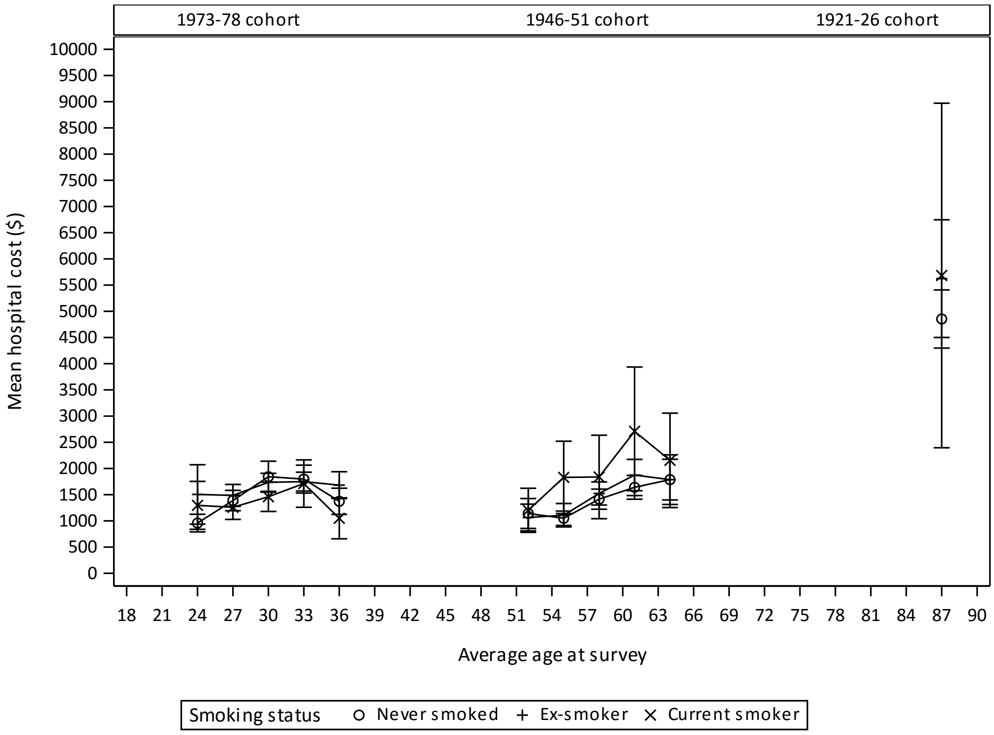

Figure 5-7: Mean hospital cost (in 2012-13 Australian dollars) per woman per year and categorised by smoking status for the 1973-78, 1946-51, and 1921-26 cohorts.

No other study has investigated the healthcare costs of women by smoking status and age. One study used data from three-yearly cross-sectional health surveys conducted in Busselton, Western Australia and reported that current smokers were admitted to hospital more frequently (1.3 times) and had more hospital bed-days (1.4 times higher) than never smokers (English, Vu & Knuiman, 2002). Based on these rates, it was determined that $682 million in healthcare costs could be attributed to smoking in Australia in 2001-2002, however this estimate does not account for hospitalisation costs of people aged 80 years and over or PBS costs (Hurley, 2006). Similarly, it was estimated that $669.6 million could be attributed to smoking in 2004-2005 (Collins & Lapsley, 2008).

5.6. Projected impact of smoking on healthcare utilisation.

Based on the trends identified in section 5.5, the impact of smoking on healthcare utilisation from 2015 to 2035 was examined. We compared the number of MBS claims, PBS prescriptions filled, and hospital admissions accrued by women each year and the cost of these services for (a) the total population of women aged 20-90, (b) women who are current smokers, and (c) non-smoking women (i.e. combining never smokers and ex-smokers). For MBS, PBS, and hospital projections, models were generated for the number of claims and cost of each service for women at every age between 20 and 90, inclusive (Appendix E). The major assumption is that the number of MBS claims and cost (in 2014 Australian dollars), PBS claims and cost (in 2012-13 Australian dollars), and hospital costs (in 2012-13 Australian dollars) vary with age in the same way for every year between 2015 and 2035. The age-specific estimates for the number of claims and cost of each service were multiplied by the projected number of women aged 20 to 90 years at every year from 2015 to 2035, as well as by the prevalence of current smokers and non-smokers women to predict the total number of claims and cost for MBS, PBS, and hospital services over the next 20 years (Appendix F).

5.6.1. Medicare Benefits Schedule

The total number of unreferred MBS claims made by current smokers will decrease from 5.7 million in 2015 to 2.2 million by 2035 (Figure 5-8). As a result, the total unreferred MBS cost for current smokers will also decrease from $280 million to $107 million (in 2014 Australian dollars) in that time period (Figure 5-9). As the number of non-smokers increases, the total number of unreferred MBS claims will also increase from 51 million to 80 million between 2015 and 2035 at a cost of $2.5 billion and $3.9 billion (in 2014 Australian dollars), respectively.

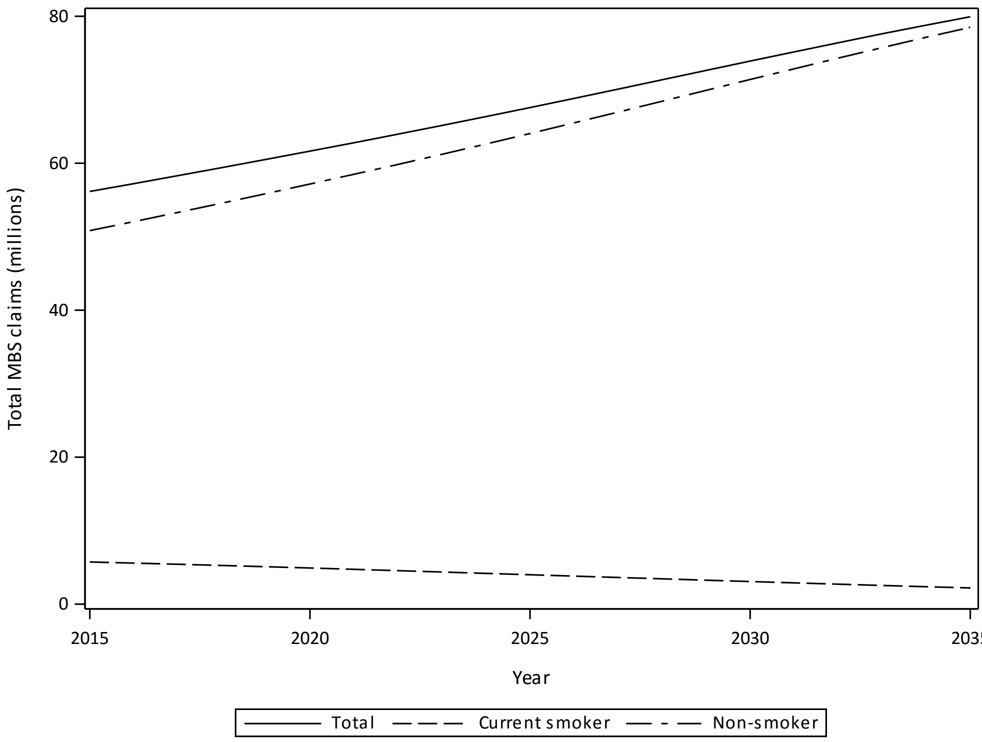

Figure 5-8: Projected total number of unreferred MBS claims for Australian women aged 20-90 from 2015 to 2035 for all women, current smokers, and non-smokers.

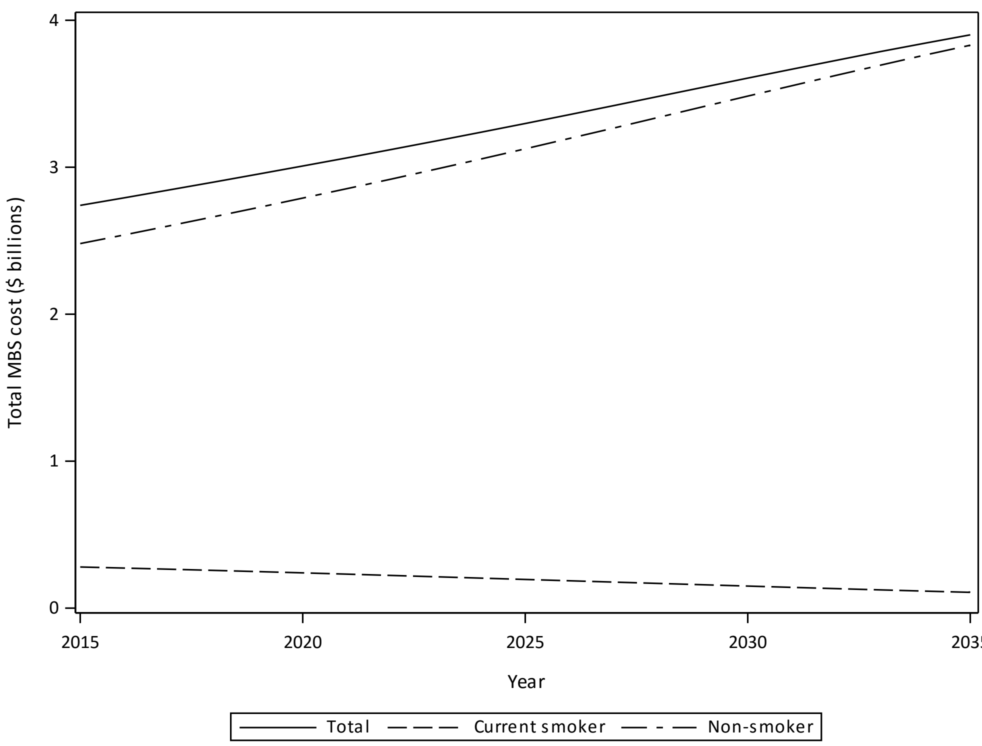

Figure 5-9: Projected total unreferred MBS cost (in 2014 Australian dollars) for Australian women aged 20-90 from 2015 to 2035 for all women, current smokers, and non-smokers.

5.6.2. Pharmaceutical Benefits Scheme

Similar to the MBS projections, the decreasing prevalence of smoking is also reflected in the total PBS claims and cost shown in Figures 5-10 and 5-11. The total number of PBS prescriptions filled by current smokers was 12.3 million in 2015 and this will decrease to 5.4 million by 2035. Consequently, the total PBS cost for current smokers is projected to also decrease from $534 million in 2015 to $233 million (in 2012-13 Australian dollars) by 2035. Non-smokers had 117 million PBS prescriptions filled at a total cost of $4.9 billion in 2015 and this is predicted to increase to 191 million prescriptions at a total PBS cost of $7.8 billion (in 2012-13 Australian dollars).

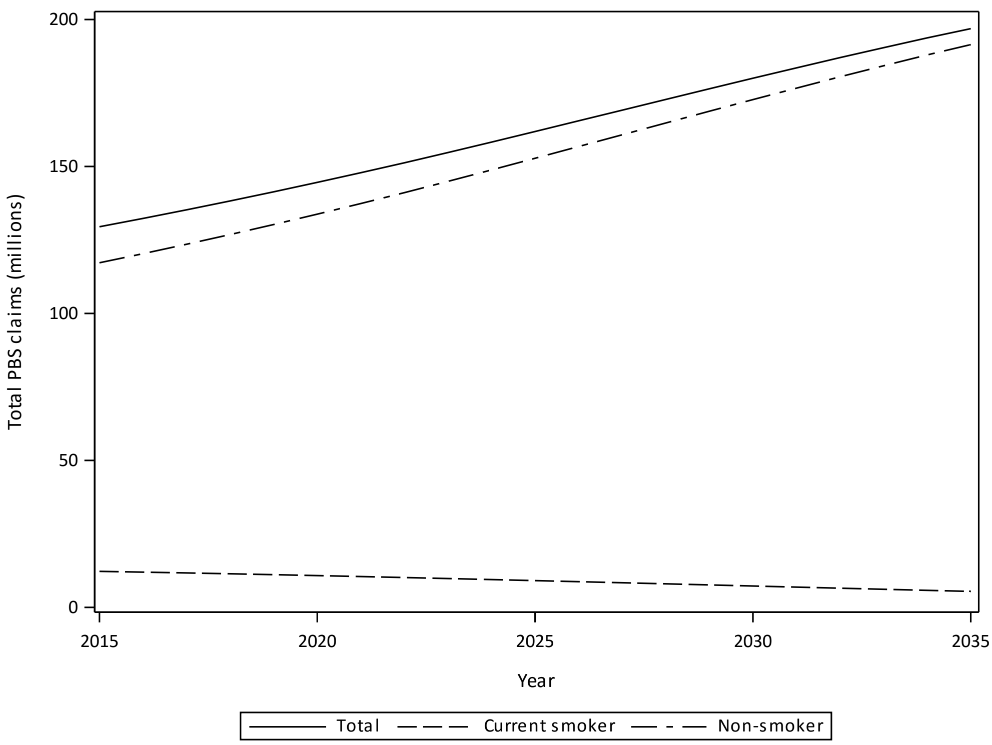

Figure 5-10: Projected number of PBS claims for Australian women aged 20-90 from 2015 to 2035 for all women, current smokers, and non-smokers.

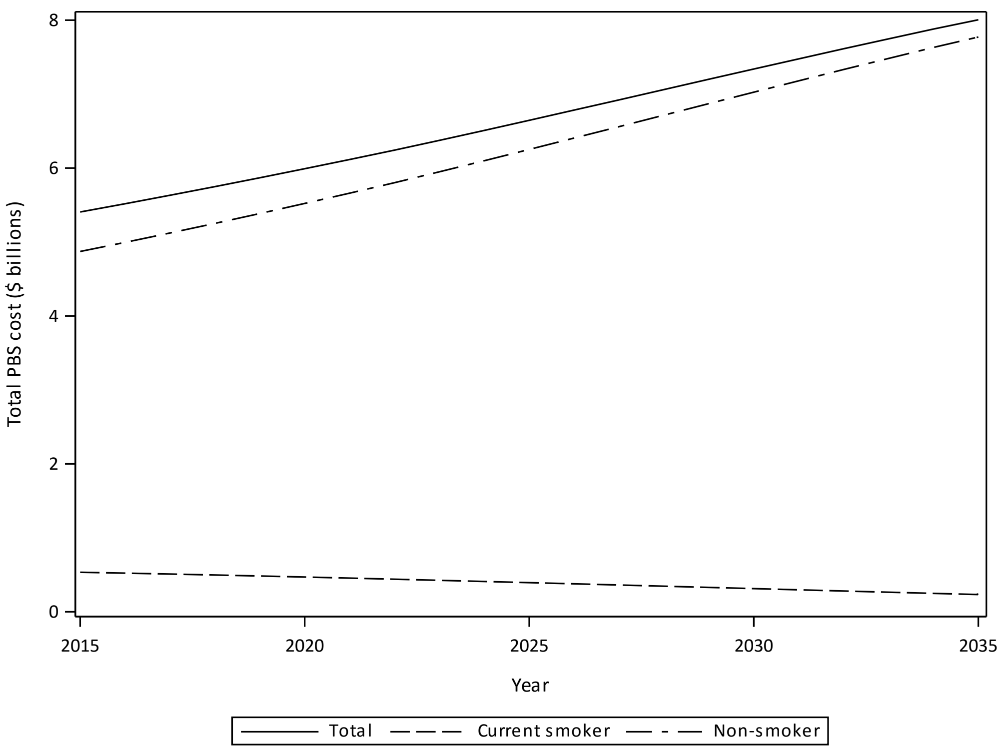

Figure 5-11: Projected total PBS cost (in 2012-13 Australian dollars) for Australian women aged 20-90 from 2015 to 2035 for all women, current smokers, and non-smokers.

5.6.3. Hospital services

As the prevalence of smoking in Australian women aged 20-90 is predicted to decline to 2-3 per cent, the total hospital cost (in 2012-13 Australian dollars) for women aged 20-90 who are current smokers, which was approximately $1.5 billion in 2015, is predicted to decrease to $638 million by 2035 (Figure 5-12). Over these twenty years, the difference in hospital costs between current smokers and non-smokers is predicted to increase from $14.2 billion in 2015 to $22.2 billion (in 2012-13 Australian dollars) in 2035.

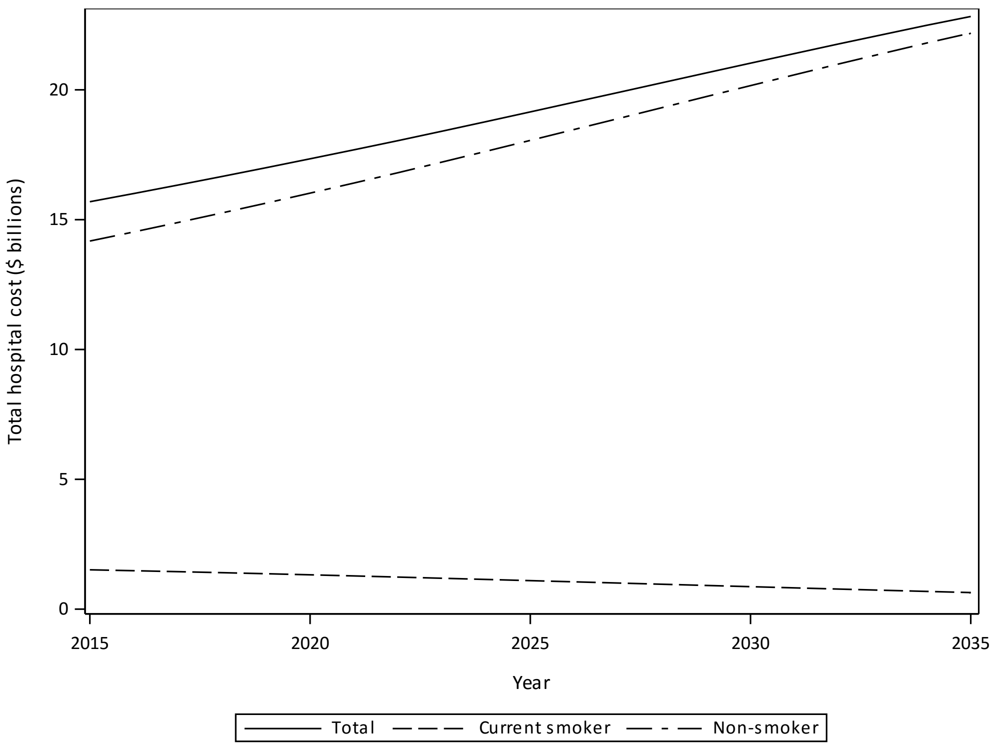

Figure 5-12: Projected total hospital cost (in 2012-13 Australian dollars) for Australian women aged 20-90 from 2015 to 2035 for all women, current smokers, and non-smokers.

5.7. Summary points

- The prevalence of women who are current smokers has declined with age in all cohorts.
- The uptake of smoking in the 1989-95 cohort is lower than in the 1973-78 cohort at the same age.
- From 2015 to 2035, the prevalence of smokers among Australian women aged 20-90 is predicted to decrease from approximately 10 per cent to 3 per cent.

6. Mental health

6.1. Background

The World Health Organization defines good mental health as '…a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community' (WHO, 2014). Poor mental health comprises a wide range of mental illness of varying severity and duration. The 2007 National Survey of Mental Health and Wellbeing reported that 45.5 per cent of Australians aged 16-85 have experienced a mental disorder in their lifetime (Slade et al., 2009). Furthermore, 22.3 per cent of females and 17.6 per cent of males reported having a mental disorder in the 12 months prior to the survey. The prevalence of mental health disorders declines with age. Approximately 25-30 per cent of women aged 16-54 experienced a mental disorder in the 12 months before the survey. Prevalence dropped to 15 per cent for women aged 55-64 and was less than 10 per cent for women aged 65 and over. The three most common mental health disorders were affective (mood) disorders (6.2 per cent), anxiety (14.4 per cent), and substance abuse (5.1 per cent). The survey also showed that mental disorders were more prevalent in women than men for all age groups and women were more likely to experience anxiety and affective disorders whereas males were more likely to abuse substances (Slade et al., 2009). Men accounted for a larger proportion of fatal burden of disease due to mental illness and behavioural disorders (72 per cent) than women (28 per cent) (AIHW, 2015).

Mental health disorders are a risk factor for other diseases. Depression is a risk factor for heart disease (O'Neil et al., 2016), and fractures (Whooley et al., 1999; Williams et al., 2016). Similarly, anxiety may also be a risk factor for heart disease (Kawachi et al., 1994; Shen et al., 2008), however the association is not as strong as depression (Bunker et al., 2003). Studies from ALSWH showed that women with depression were more likely to have subsequent urinary incontinence (Mishra et al., 2015) and were also at risk for stroke at mid-age (Jackson & Mishra, 2013). Comorbid depression and anxiety was also found to be associated with new onset heart disease in mid-aged women (Berecki-Gisolf et al., 2013).

6.2. Measurement of mental health and identifying psychological distress in ALSWH

Mental health was measured using the short-form general health survey (SF-36), which is widely used to assess health-related quality of life (Ware et al., 1993). The SF-36 has 36 items that can be used to construct eight subscales and two summary measures. The Mental Health Index (MHI) is a subscale whose scoring is based on five of the thirty-six items as follows:

‘For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the PAST 4 WEEKS:

a Have you been a very nervous person

b Have you felt so down in the dumps that nothing could cheer you up

c Have you felt calm and peaceful

d Have you felt down

e Have you been a happy person’

The response options are ‘all of the time’, ‘most of the time’, ‘a good bit of the time’, ‘some of the time’, ‘a little of the time’, and ‘none of the time’. Raw scores are then derived from the five items and transformed to a 0 to 100 scale with higher scores indicating better mental health (Appendix A). MHI is well-validated and reliable measure of mental health status (Berwick et al., 1991; Rumpf et al., 2001). The SF-36 was included in all surveys for the 1973-78, 1946-51, and 1921-26 cohorts. It was, however, not included in surveys for the 1989-95 cohort.

People with psychological distress or poor mental health can be identified using an MHI cut point of 52 (Silveira et al., 2005; Thorsen et al., 2013).

6.3. Changes in mental health across the adult lifespan

The mean MHI was plotted by average age at each survey for the 1973-78, 1946-51, and 1921-26 cohorts (Figure 6-1). The average MHI is relatively stable across the adult lifespan, ranging from 69 to 80 and it is slightly higher in the 1921-26 cohort compared with the 1973-78 cohort.

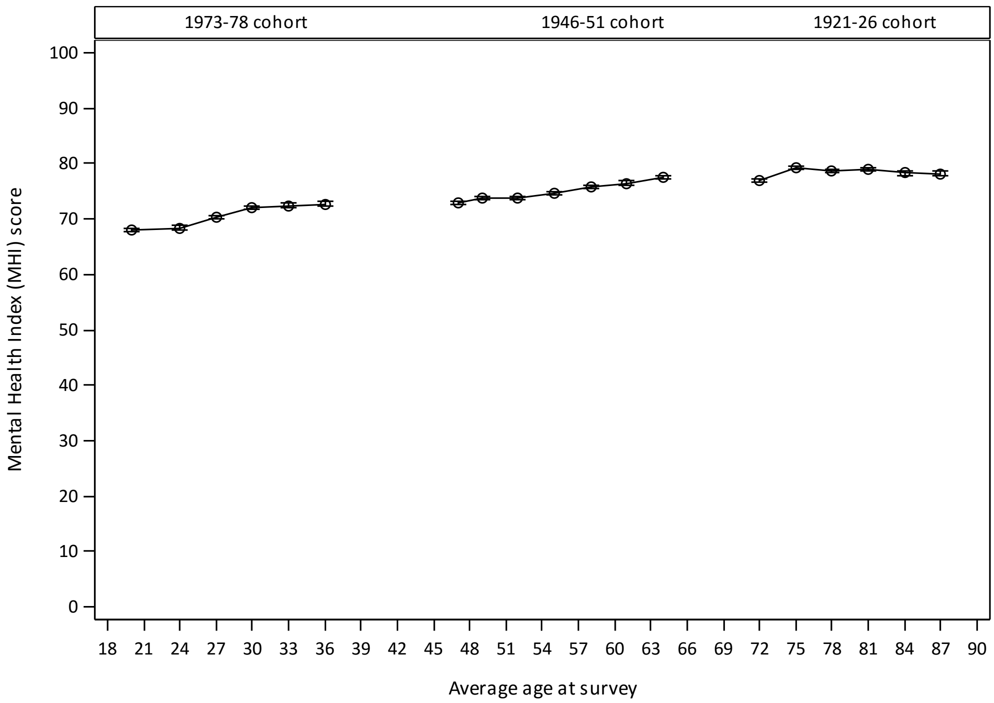

Figure 6-1: Trajectory of mental health with age in each cohort (1973-78, 1946-51, and 1921-26).

The prevalence of psychological distress (MHI ≤ 52) among ALSWH participants is shown in Figure 6-2. Corresponding to the trend that mental health improves with age, the prevalence of women with psychological distress is higher in the 1973-78 cohort than the 1921-26 cohort, however it decreases for all cohorts from Surveys 1 to 6. In the 1973-78 cohort, the percentage of women with psychological distress is 21.7 at age 20 and this decreases to 13.7 at age 36 years. For women in the 1946-51 cohort, 15.4 per cent reported psychological distress in the first survey at average age 47 years and by age 64, this fell to 10.2 per cent. The 1921-26 cohort has the lowest prevalence with psychological distress, ranging from 10.2 per cent at age 72 years to 8.8 per cent at age 87 years.

This trend is consistent with the trajectory shown when using the Mental Health Component Score (Mishra, Hockey & Dobson, 2014), which is derived from four subscales of the SF-36, including Mental Health (used in Figure 6-1). Furthermore, it is similar to the findings reported in the 2007 National Survey of Mental Health and Wellbeing (described in section 6.1) as well as the 2014-15 National Health Survey (ABS, 2015e).

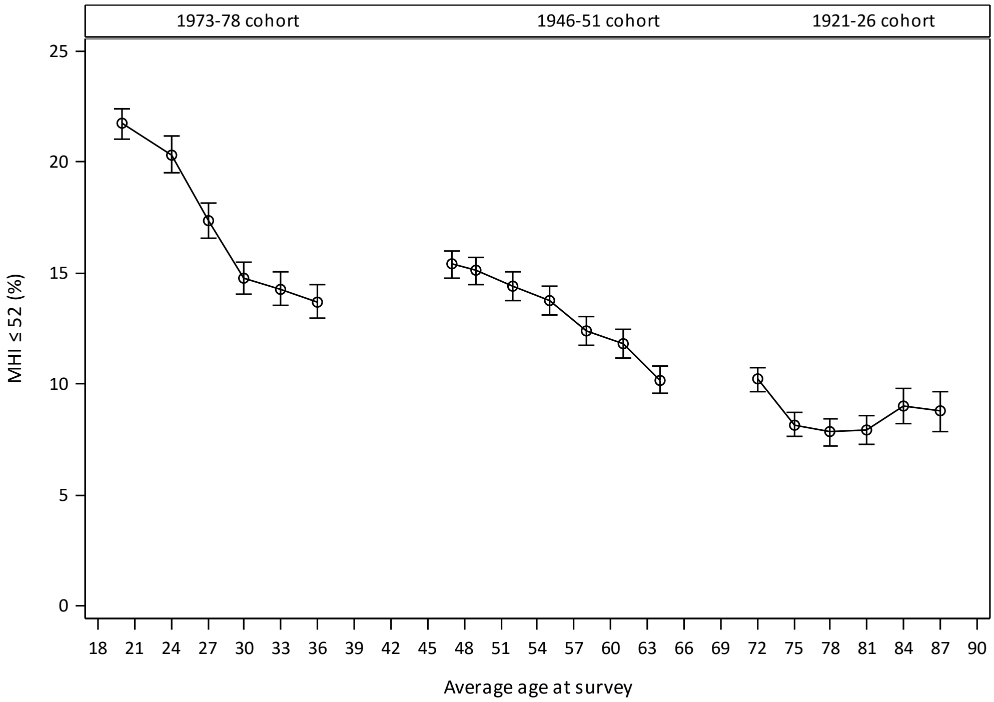

Figure 6-2: The percentage of ALSWH participants with a MHI ≤ 52 for each cohort (1973-78, 1946-51, and 1921-26).

6.4. Projections of psychological distress for the next 20 years

To forecast the prevalence of women with psychological distress over the next twenty years, the prevalence of psychological distress by age was modelled based on trends shown in Figure 6-2. The resultant penalised B-spline model provides the prevalence of women with psychological distress at every age from the ages of 20 to 90 years (Figure 6-3 and Appendix B, section 13.4). The model was then used to project the prevalence of Australian women aged 20-90 years with psychological distress from 2015 to 2035. We assumed that the age-specific prevalence of psychological distress for women remains the same for this twenty-year time period.

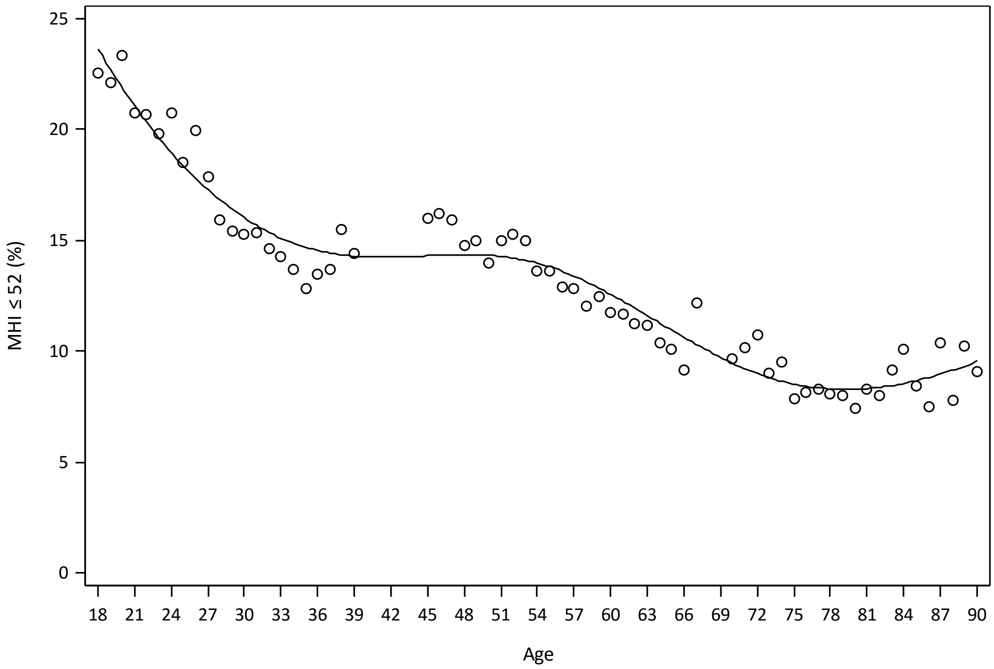

Figure 6-3: A model of the prevalence of women with psychological distress (MHI≤52) by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

The age-specific estimates for psychological distress were multiplied by the projected number of women aged 20 to 90 years at every year from 2015 to 2035 to predict the number and percentage of women with psychological distress (Appendix C). Briefly, the ABS produced three different scenarios (Series A, B, and C) for the Australian population from 2012 to 2011. Series B is based on current (at 2012) rates of fertility, life expectancy at birth, and net overseas migration. Series A assumes higher rates for all three characteristics, whereas Series C assumes lower fertility and net overseas migration rates and unchanged life expectancy.

Figure 6-4 shows that the estimated number of Australian women with psychological distress was approximately 1.3 million in 2015, which is projected to increase to a total of 1.6 million (Series C) to 1.7 million (Series A). This, however, equates to a decrease from 14.0 per cent to about 13.6 per cent for all Series (Table 6-1). The projected increase in numbers of women with psychological distress likely corresponds to population growth of women in the younger age groups who also have the highest prevalence of psychological distress. However, because the Australian population is predicted to have a high life expectancy and low fertility rate, the number of older women (who have the least psychological distress) is expected to increase more rapidly than the number of younger women (who have the highest psychological distress), resulting in an overall decrease in the prevalence of psychological distress amongst women aged 20-90 between 2015 and 2035.

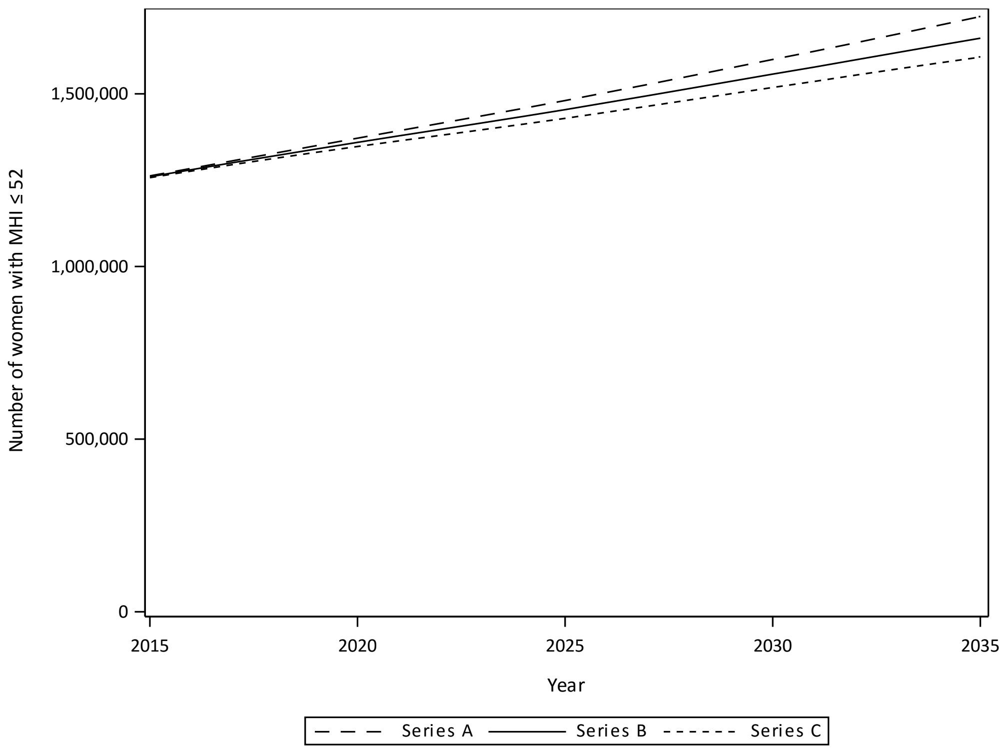

Figure 6-4: Number of Australian women aged 20-90 years with psychological distress from 2015 to 2035.

Table 6-1: Projected number and prevalence of women with psychological distress in Australia from 2015 to 2035.

Year	Population projection					
	Series A		Series B		Series C	
	n	%	n	%	n	%
2015	1,262,407	14.0	1,259,852	14.0	1,257,235	14.0
2020	1,371,583	13.9	1,359,464	13.9	1,347,524	13.8
2025	1,480,554	13.0	1,454,164	13.7	1,429,009	13.7
2030	1,599,563	13.7	1,557,180	13.6	1,518469	13.6
2035	1,723,766	13.6	1,661,145	13.6	1,606,262	13.5

Population pyramids were constructed to help illustrate the changes in the numbers of Australian women aged 20 to 90 who have psychological distress in 2015 and 2035 (Figures 6-5 and 6-6).

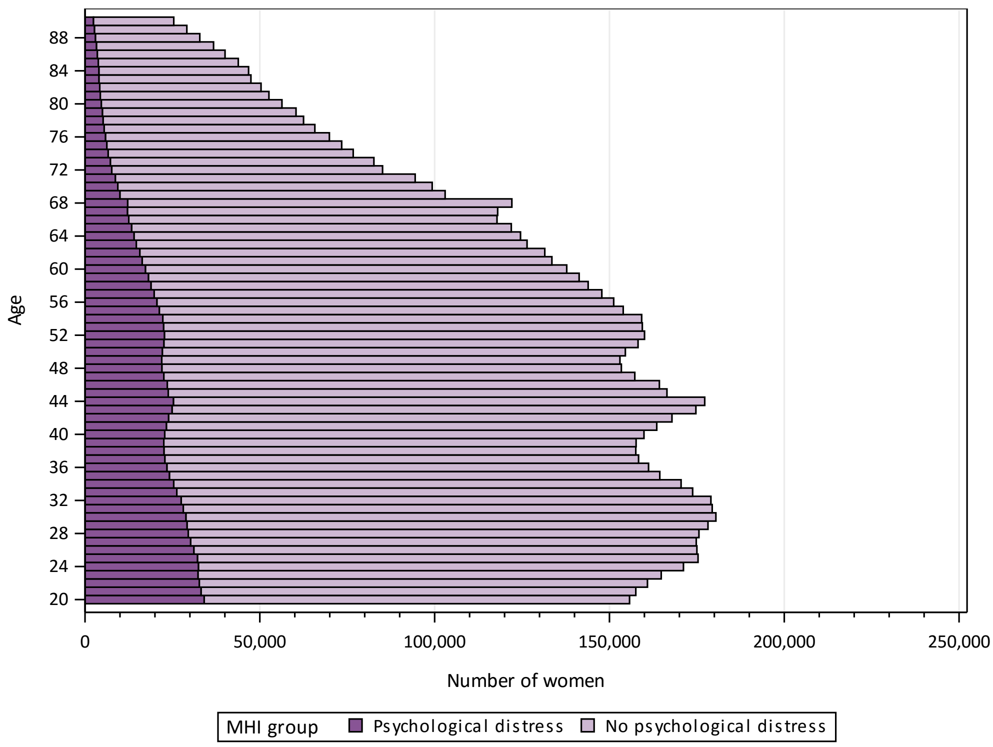

Figure 6-5: Projected numbers of women aged 20-90 who have psychological distress in Australia by age in 2015 based on current population trends (Series B).

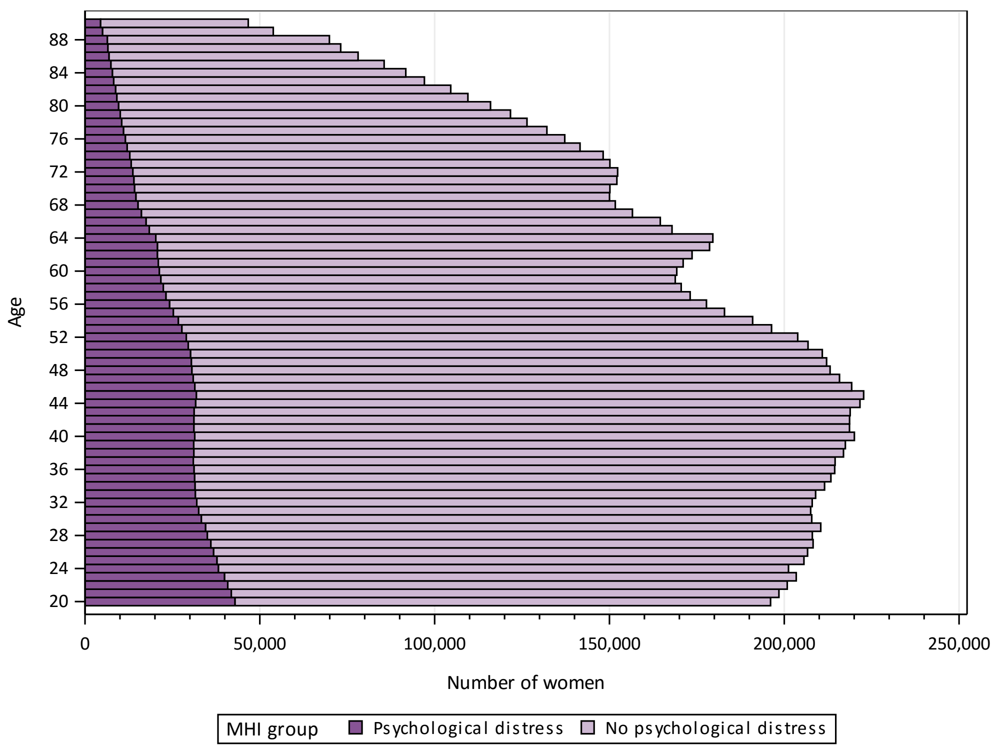

Figure 6-6: Projected numbers of women aged 20-90 who will have psychological distress in Australia by age in 2035 based on current population trends (Series B).

6.5. Impact of psychological distress on healthcare expenditure

The use of healthcare services by Australian women who do or do not have psychological distress was determined by comparing the mean number of MBS claims, PBS prescriptions filled, and hospital admissions each year and the cost of using these services (Appendix D). This is important because mental disorders was the third most costly disease group in 2008-09 according to the AIHW, accounting for $6.38 billion in health expenditure costs (AIHW, 2014a).

6.5.1. Medicare Benefits Scheme cost

The survey data were linked to unreferred MBS data from 1996 to 2013. The MBS dataset allowed us to determine the number of unreferred MBS claims made by each participant. 'Unreferred' means visits to a general practitioner without requiring a referral. Women who experience psychological distress made more unreferred MBS claims than those without psychological distress for all cohorts (Figure 6-7). The difference in mean unreferred MBS claims was approximately 2 for the 1973-78 cohort and 3 for the 1946-51 cohort, both from Surveys 1-6. In the 1921-26 cohort, women with psychological distress at the start of the study (age 72 years in 1996) made 4 unreferred MBS claims more than those who did not; by Survey 6 when they were 87 years of age, the difference in mean number of MBS claims was 2.

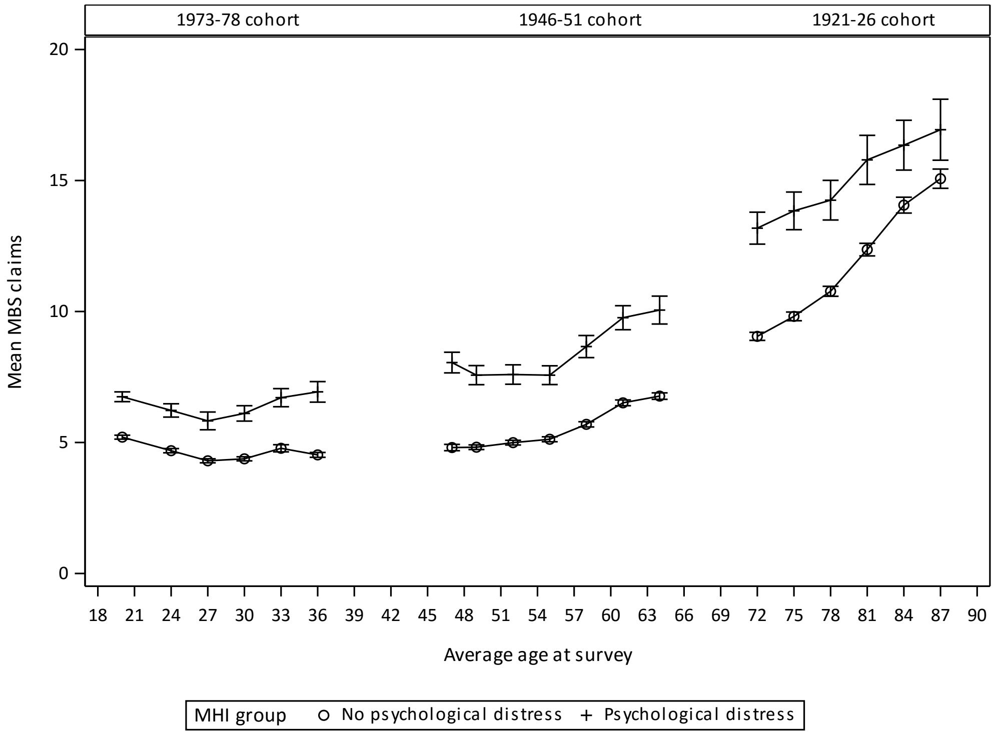

Figure 6-7: Comparison of average number of unreferred MBS claims per woman per year for 1973-78, 1946-51, and 1921-26 cohorts by the presence or absence of psychological distress.

To estimate the total unreferred MBS cost, the average cost of unreferred MBS services in 2014 (in 2014 Australian dollars) was obtained from the Department of Human Services statistical reporting database (Medicare Group Reports, 2016) and was reported to be $48.80 per visit. To estimate total costs, it was assumed that this average cost per visit was the same for women who did or did not have psychological distress. The total unreferred MBS cost (in 2014 Australian dollars) for each participant for every year from 1996 to 2013 was calculated by multiplying the number of unreferred MBS claims by $48.80. Then, the average unreferred MBS cost by whether or not a woman has psychological distress was estimated (Appendix D, Section 15.1).

In the 1973-78 cohort, the estimated annual unreferred MBS cost was $210-254 (in 2014 Australian dollars) for women without psychological distress, whereas for those with psychological distress, the cost was $75-117 higher (Figure 6-8). In the 1946-51 cohort, the estimated annual unreferred MBS cost increased from $235 at age 47 to $330 at age 64 for women without psychological distress. It was $120-160 more for women with psychological distress. In the 1921-26 cohort, women who did not experience psychological distress had $442 in annual unreferred MBS cost at age 72 and this increased to $735 by age 87. Those women who experienced psychological distress had an annual unreferred MBS cost of $643 to $827 from age 72 to 87 years.

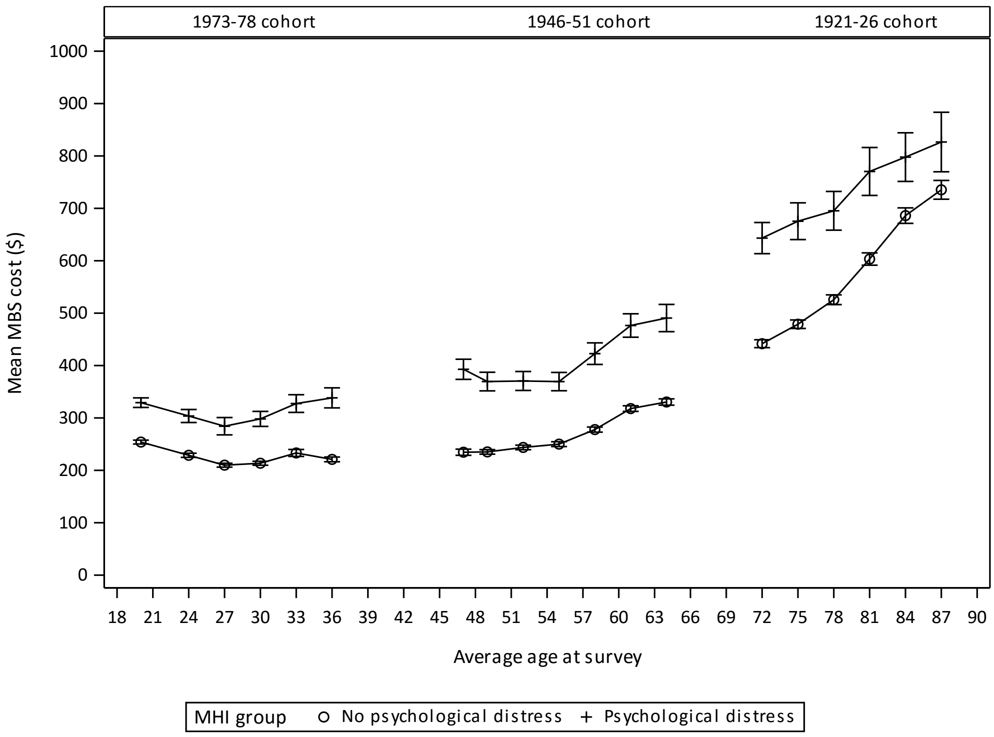

Figure 6-8: Comparison of average unreferred MBS costs (in 2014 Australian dollars) for women aged 20-90 for the 1973-78, 1946-51, and 1921-26 cohorts by the presence or absence of psychological distress.

6.5.2. Pharmaceutical Benefits Scheme

ALSWH data were linked to the latest available PBS dataset (2012-13 financial year), which provided a record for each PBS script that was filled and its associated cost for each participant. The average number of scripts filled and cost (in 2012-13 Australian dollars) was then determined by groups defined by psychological distress (Appendix D, Section 15.2). Because the 2012-13 period corresponded to one survey per cohort, there are only three sets of data points.

Women who had psychological distress had more PBS prescriptions filled than women who did not have psychological distress (Table 6-2). For the 1973-78 cohort, both the number and cost of PBS prescriptions filled by women with psychological distress were double those of women without psychological distress (11.4 scripts at a cost of $507 versus 5.1 scripts at a cost of $262 (in 2012-13 Australian dollars)). For the other cohorts, the difference was not as great.

Table 6-2: Mean PBS claims and cost (in 2012-13 Australian dollars) per participant in the 1973-78, 1946-51, and 1921-26 cohorts by psychological distress.

		ALSWH Cohort		
		1973-78	**1946-51**	**1921-26**
Group	**Corresponding survey** **Year** **Average age (years)**	survey 6 2012 36	survey 7 2013 64	survey 6 2011 87
Psychological distress	Mean number of PBS claims per participant	11.4	35.7	65.6
	Mean PBS cost per participant ($)	507	1418	2320
No psychological distress	Mean number of PBS claims per participant	5.1	22.6	53.5
	Mean PBS cost per participant ($)	262	869	1927

6.5.3. Hospital costs

The survey data for participants living in NSW were linked to NSW Admitted Patient Data Collection from 2000 to 2013. The dataset provides a record of the patient's diagnosis using Australian Refined Diagnosis Related Group (AR-DRG) codes. Each AR-DRG represents a group of patients with similar conditions and who require similar hospital services. Public hospital costs are available through the National Hospital Cost Data Collection (NHCDC) provided by the Independent Hospital Pricing Authority. The NHCDC lists the average cost for all AR-DRG codes. For each participant, a hospital cost (in 2012-13 Australian dollars) was determined for every admission using the AR-DRG code from the hospital record and matching it to the average cost of that AR-DRG from the NHCDC. Then hospital cost for each admission was then summed to obtain the annual cost for each woman (Appendix D, Section 15.3).

In the 1973-78 cohort, there was little difference in the mean hospital cost (Figure 6-9). For the 1946-51 cohort, the hospital cost for women with psychological distress increased from $723 to $2389 (in 2012-13 Australian dollars) more than for women without psychological distress from Survey 1 to 6, except at Survey 3, when the cost was similar between the two groups. In the 1921-26 cohort, the hospital cost for women without psychological distress increased with age from $3276 at age 78 to $4994 at age 87. Women with psychological distress in this cohort initially incurred increased hospital costs between age of 78 and 81 before levelling out to $6318 (in 2012-13 Australian dollars) at age 87.

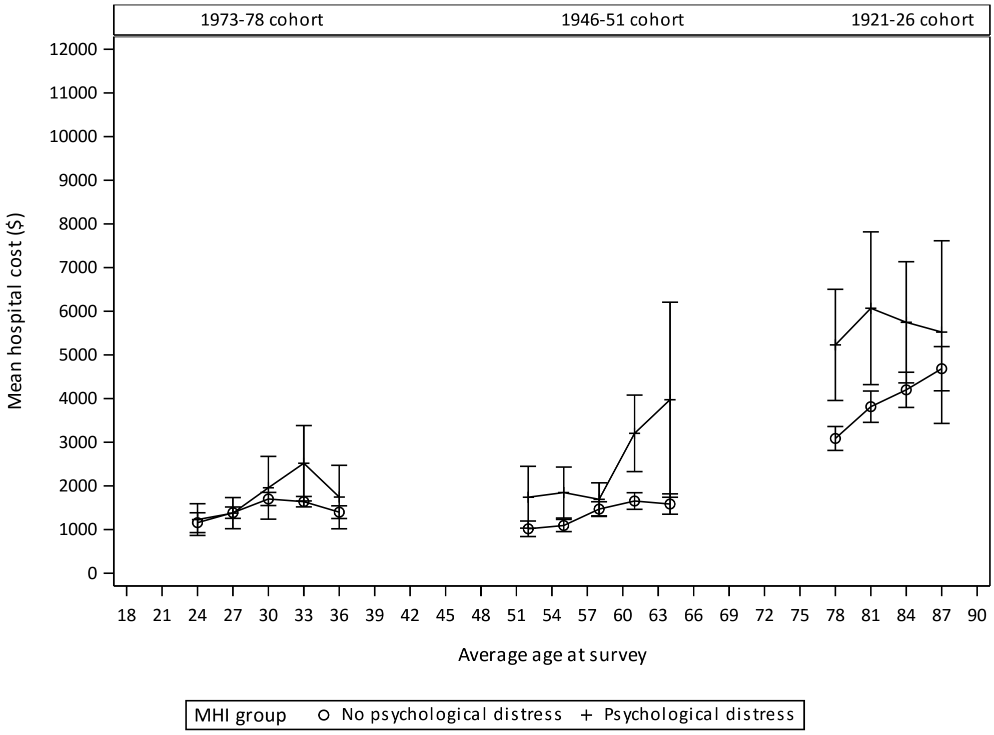

Figure 6-9: Comparison of average hospital costs per participant for the 1973-78, 1946-51, and 1921-26 cohorts by the presence or absence of psychological distress.

6.6. Projected impact of psychological distress on healthcare utilisation

Based on the trends identified in section 6.5, the impact of increasing numbers of women with psychological distress on healthcare utilisation from 2015 to 2035 was examined. We compared the use of MBS, PBS, and hospital services for (a) the total population of women aged 20-90, (b) women who experienced psychological distress, and (c) women who did not experience psychological distress. For MBS, PBS, and hospital projections, models were generated for the number of claims and cost of each service for women at every age between 20 and 90, inclusive (Appendix E). The major assumption is that the number of MBS claims and costs (in 2014 Australian dollars), PBS claims and costs (in 2012-13 Australian dollars), and hospital costs (in 2012-13 Australian dollars) vary with age in the same way for every year between 2015 and 2035. The age-specific estimates for the number of claims and cost of each service were multiplied by the projected number of women aged 20 to 90 years at every year from 2015 to 2035, as well as by prevalence of women with or without psychological distress to predict the total number of claims and cost for MBS, PBS, and hospital services over the next twenty years (Appendix F).

6.6.1. Medicare Benefits Scheme cost

In 2015, the total number of MBS claims for women with psychological distress was 10.1 million whereas women who did not have psychological distress incurred 46.5 million claims (Figure 6-10). By 2035, the number of MBS claims is predicted to increase to 13.9 million for women with psychological distress and 67.5 million for women without psychological distress. In terms of total MBS cost, women with psychological distress are estimated to incur $494 million (in 2012-13 Australian dollars) in costs of MBS services in 2015 and this will increase to $679 million in 2035 (Figure 6-11). For women without psychological distress, the total MBS cost is estimated at $2.3 billion in 2015 and is predicted to increase to $3.3 billion (in 2012-13 Australian dollars) in 2035.

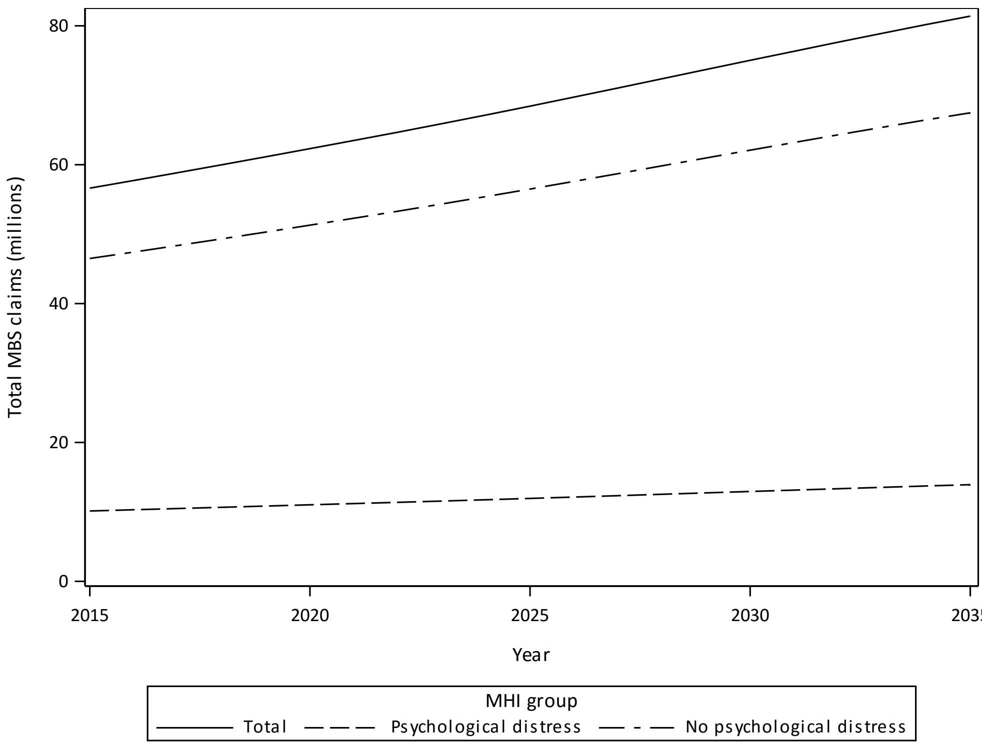

Figure 6-10: Projected total number of MBS claims for Australian women aged 20-90 from 2015 to 2035 by the presence or absence of psychological distress.

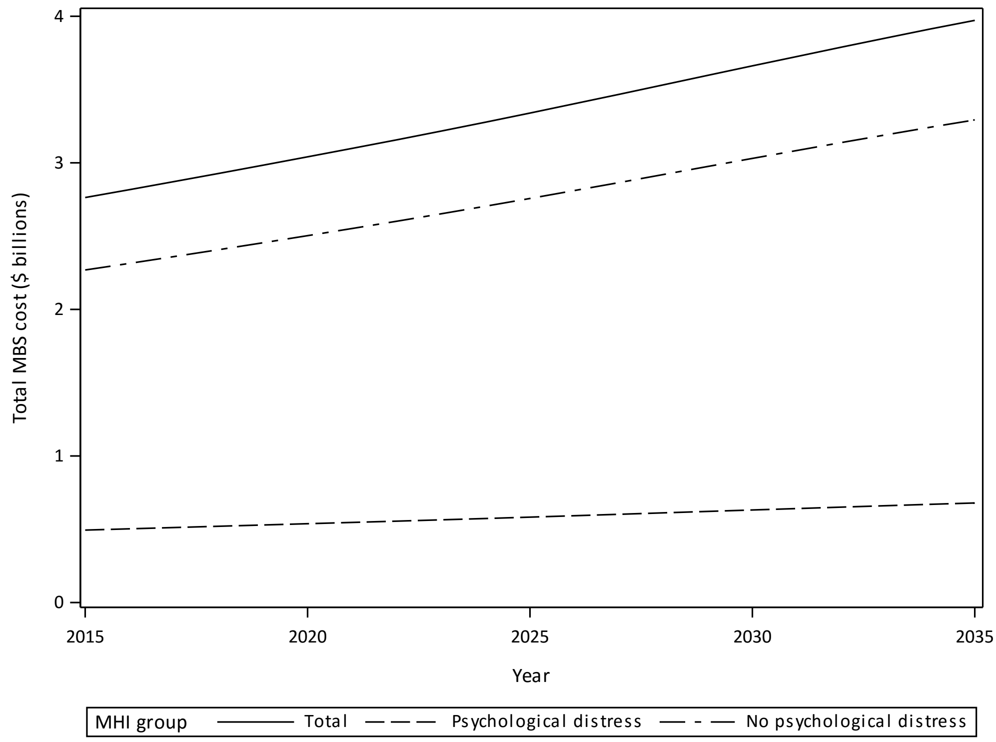

Figure 6-11: Projected total MBS cost (in 2014 Australian dollars) for women aged 20-90 from 2015 to 2035 categorised by the presence or absence of psychological distress.

6.6.2. Pharmaceutical Benefits Scheme

Women with psychological distress are estimated to have had 26 million prescriptions filled at a cost of $1.1 billion (in 2012-13 Australian dollars) in 2015 (Figure 6-12 and 6-13). By 2035, this is predicted to increase to 37 million prescriptions and $1.5 billion. In comparison, women who did not have psychological distress are estimated to have had 108 million prescriptions filled at a cost of $4.5 billion in 2015 and this is predicted to increase to 169 million prescriptions at a cost of $6.8 billion in 2035.

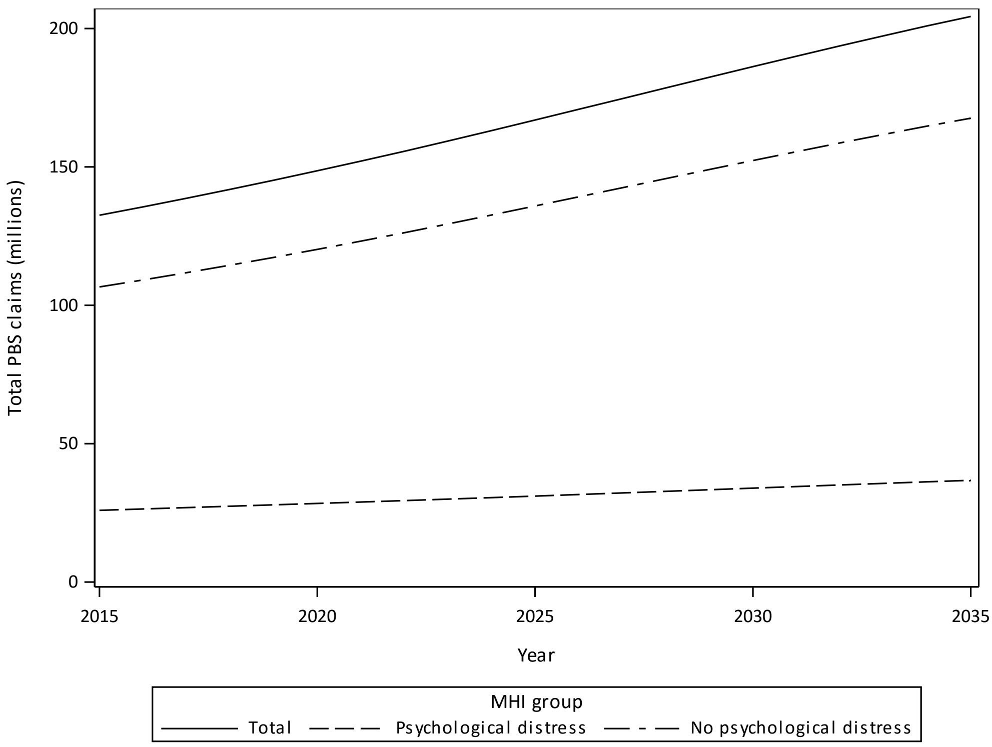

Figure 6-12: Projected total number of PBS claims for Australian women aged 20-90 from 2015 to 2035 by the presence or absence of psychological distress.

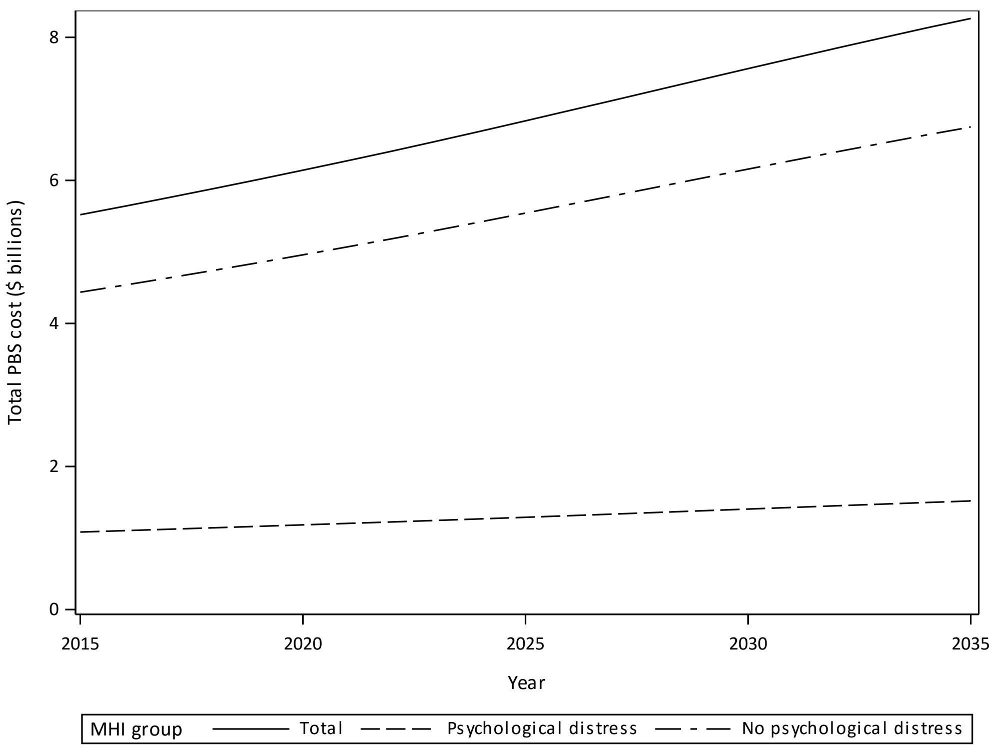

Figure 6-13: Projected total PBS cost (in 2012-13 Australian dollars) for women aged 20-90 from 2015 to 2035 by the presence or absence of psychological distress.

6.6.3. Hospital costs

Women with psychological distress are estimated to have had $2.8 billion (in 2012-13 Australian dollars) in hospital costs in 2015 and this is predicted to increase to $3.9 billion in 2035 (Figure 6-14). In comparison, women who did not have psychological distress are estimated to have had $12 billion in hospital costs in 2015 and is predicted to increase to $18 billion by 2035.

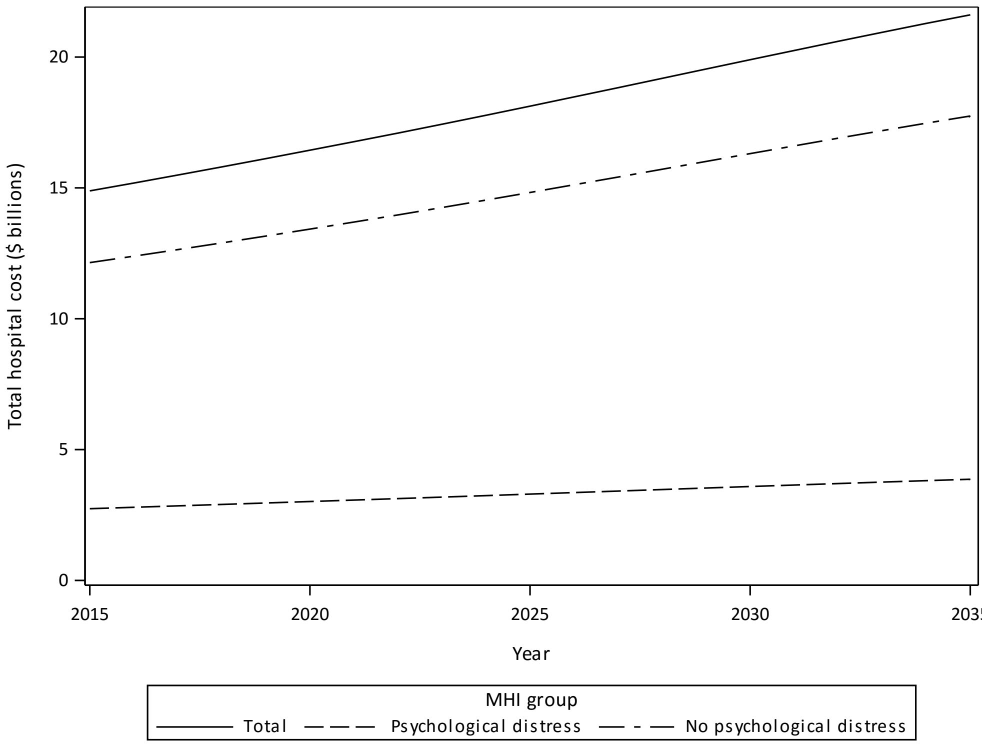

Figure 6-14: Projected total hospital cost (in 2012-13 Australian dollars) for women aged 20-90 from 2015 to 2035 by the presence or absence of psychological distress.

6.7. Summary points

- Scores for good mental health are relatively stable with age and are slightly higher in the 1921-26 cohort than in the 1973-78 cohort.
- The prevalence of women with psychological distress decreases with age.
- The number of women aged 20-90 with psychological distress is predicted to increase from 1.2 million to 1.7 million from 2015 to 2035, however the prevalence of psychological distress in this population will decrease from 14.1 per cent to 13.7 per cent over that time period.
- Women who experience psychological distress in the 1946-51 and 1921-26 cohorts have higher MBS, PBS, and hospital costs than women who do not have psychological distress.

7. Dementia

7.1. Background

In high-income countries, life expectancy has increased steadily in the past three decades, with no clear evidence that this improvement is slowing down (Mathers et al., 2015). Since age is a primary risk factor for dementia (Wu et al., 2016), improved life expectancy will likely result in an increase in the total number of people with dementia, even if age-specific rates of dementia decrease.

Although an ageing population would most likely mean an increase in the number of people living with dementia, there has been some recent evidence to suggest that the numbers of *new* diagnoses of dementia (the incidence) is declining (Grasset et al., 2015; Lobo et al., 2007; Manton, Gu & Ukraintseva, 2005; Matthews et al., 2013; Qiu et al., 2013; Schrijvers et al., 2012). Rising levels of education and improved treatment and prevention of cardiovascular risk factors have been proposed as possible reasons for this decline (Langa, 2015). However, it is unknown whether incidence of dementia will continue to decline in the face of increasing rates of obesity and diabetes (Langa, 2015), which have previously been identified as risk factors for the condition (Wu et al., 2016).

7.2. Ascertainment of dementia among ALSWH participants in the 1921-26 cohort

Dementia records for ALSWH participants were obtained from five sources:

1. survey data, where dementia is reported by a woman or her proxy.
2. death certificate records, where dementia is identified as a cause of death or contributing factor.
3. pharmaceutical benefits scheme data, identified from drugs used to treat dementia.
4. aged care data, where dementia is identified from a diagnosis code.
5. hospital admissions data (available from New South Wales, Queensland and South Australia) where dementia is identified from a diagnosis code.

Any woman could have had multiple records of dementia from the same or different sources. Assessment of dementia, using these various sources, was for the period 31 May 1996 (the first survey response date) to 6 March 2012 (the last survey response date for the sixth survey). The earliest notification of dementia was classified as the ‘date of dementia’ for analysis purposes.

Record linkage of all these datasets was used to identify the total number of women with dementia and to assess the overlap in reporting between these sources. In total, 2,534 women with a diagnosis of dementia were identified from at least one of the first four data sources which were available in all States. From these records and reports, it is estimated that 20 per cent of the cohort (i.e. 2,534 out of 12,432 who responded to Survey 1) had a record of dementia between 1996 and 2012. The main source of records of dementia was the aged care data, with 79 per cent of women with dementia identified from this source. Prescription data and cause of death data were used to identify 35 per cent and 31 per cent of women with dementia respectively. The smallest number of women with dementia were identified from survey data (18 per cent). When the same analyses were conducted for women in the States/Territories for which we had hospital data, 56 per cent of women with dementia were identified from this source (Appendix 18 Table 18-1).

Just as some women with dementia were identified from multiple sources, it is likely that some women with dementia were not identified in any of the data sources. Therefore, estimates of the prevalence and incidence of dementia for the 1921-26 ALSWH cohort were refined using the capture-capture method (Hook & Regal, 1995). This technique is used to estimate the number of women with dementia who might not have been identified from any of the data sources. Using this method, the estimated number of women with dementia was 3,448 compared with 2,534 identified from the four main data-sources. This means that 28 per cent (i.e. 3,448 out of 12,432 who participated in Survey 1) had a record of dementia in the period 1996-2012.

7.3. Estimated incidence and prevalence rates of dementia

Age-specific rates of dementia were first calculated from the ALSWH data. The age-specific prevalence rate was calculated from the number of women at that age identified as having dementia as a percentage of all women of that age at any time during the study period. The age-specific incidence rate (i.e. the rate of new cases) was calculated from the number of women first identified as having dementia at that age as a percentage of all women (without dementia) at that age.

The prevalence and incidence estimates generated from the ALSWH data are comparable to published findings from women over the age of 80, but were smaller than previously published estimates for women at younger ages (Anstey et al., 2010; Economics, 2005; Fratiglioni et al., 2000; Matthews et al., 2013). The criterion that each ALSWH participant completed the first survey may have introduced a 'healthy responder bias', leading to lower than expected estimates at younger ages. Therefore, the ALSWH estimates were supplemented with data from previously published estimates (Anstey et al., 2010; Economics, 2005; Fratiglioni et al., 2000; Matthews et al., 2013) to estimate yearly rates by single year of age.

Incidence rates for dementia for the ages 60-64 and 65-69 were taken from Gao et al (Gao, Hendrie & Hall, 1998), while estimates for ages 70-74 and 75-79 were sourced from Fratiglioni's meta-analysis of eight European studies (Fratiglioni et al., 2000). Estimates of dementia incidence at ages 80-90 were from the ALSWH study, while above the age of 90 they were taken from a study by Corrada et al (Corrada et al., 2008). Spline regression was used to fit a smooth line through the age specific estimates of dementia incidence and to generate estimates by single age-years. For ages 60-74 and 99-100, linear regression (as opposed to spline regression) was used to ensure that the incidence rates increased with each year of age (Figure 7-1, Appendix 18 Table 18-2).

Prevalence rates for dementia were taken from an Access Economics report, for the five-year age groups for 60-84 years and 91-100 years, which used averaged estimates from four meta-analyses (Hofman et al., 1991; Jorm, Dear & Burgess, 2005; Jorm, Korten & Henderson, 1987; Lobo et al., 2000; Ritchie & Kildea, 1995). Rates from ALSWH were used for the ages 85-90. Spline regression was used to generate single year estimates of dementia prevalence for the ages 75-89. Linear regression was used to generate estimates for ages 60-74 and 91-100 (Figure 7-2, Appendix 18 Table 18-3).

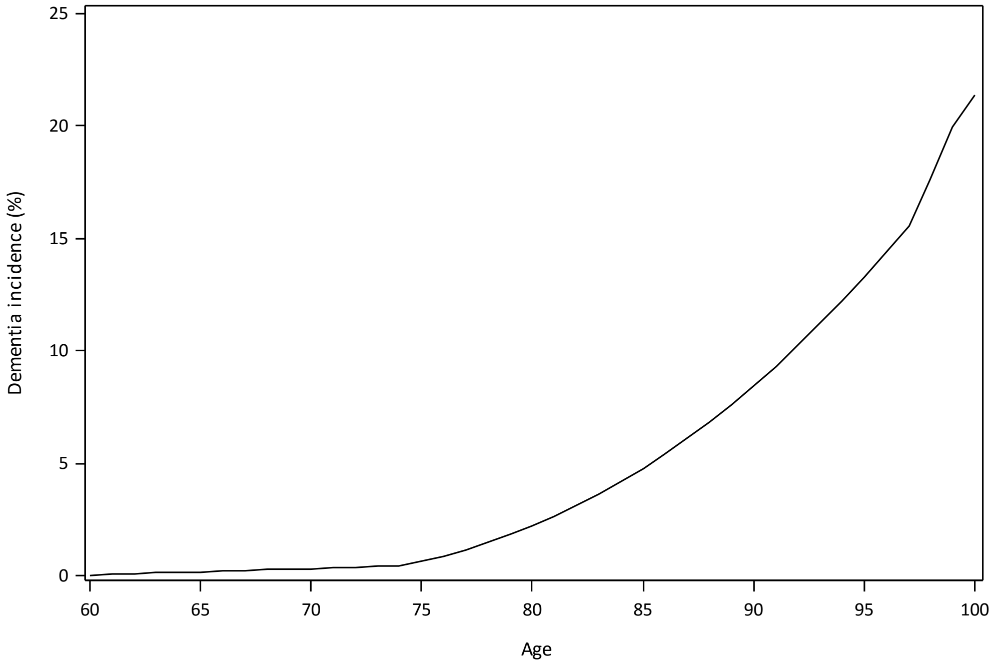

Figure 7-1: Estimated incidence rate of dementia by age (percentage) based on data from ALSWH and other sources.

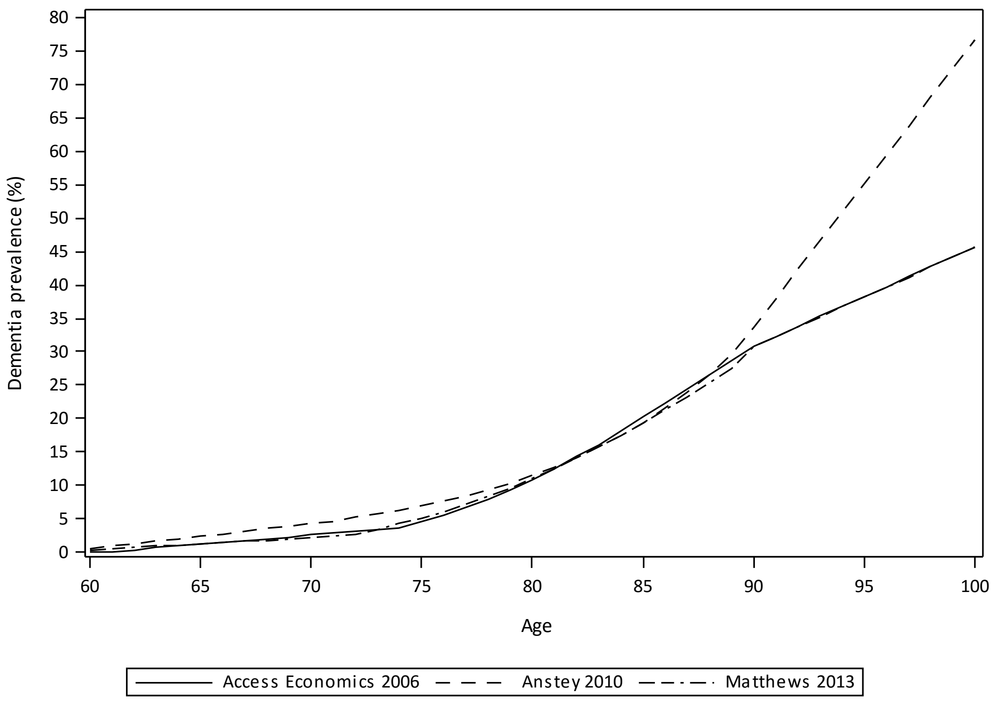

Figure 7-2: Estimated prevalence rate of dementia by age (percentage) based on data from ALSWH and other sources.

7.4. Projected number of women aged 60 years and over living with dementia from 2015 to 2035

The age-specific estimates of dementia prevalence and incidence were assumed to remain stable between the years 2015 and 2035. These rates were applied to three Australian Bureau of Statistics population projection scenarios (ABS, 2013) as outlined in Chapter 2 (Section 2.5). Therefore, the results show how changes in the population distribution are likely to affect the number of women with dementia.

Based on the population projection series A, which assumes life expectancy in women will reach 93.6 by 2061, the number of women living with dementia would double between 2015 and 2035 (from 168,744 to 339,061; Table 7-1). Using population projection series B and C, which assumed a more conservative increase in life expectancy, there were 1.9 times more women living with dementia in 2035 compared to 2015. The similarity in the estimates for series B and C indicates that the number of women living with dementia in Australia is unlikely to be affected by overseas net migration between 2015 and 2035.

While the age-specific prevalence rates of dementia were held constant in this analysis, the overall prevalence increased from 6.6 per cent to 7.7-7.9 per cent using each population projection series due to increases in the number of women alive at older ages.

Table 7-1: Projected number of women living with dementia (prevalence) in Australia from 2015 to 2035 and percentage among women aged 60 years and over.

Year	Population projection					
	Series A		Series B		Series C	
	n	%	n	%	n	%
2015	168,744	6.6	168,736	6.6	168,728	6.6
2020	193,095	6.5	192,700	6.5	192,651	6.5
2025	227,711	6.7	225,550	6.7	225,411	6.7
2030	276,721	7.2	269,959	7.2	269,644	7.2
2035	339,061	7.9	321,504	7.7	320,870	7.7

An illustration of how the age distribution of the population and the prevalence of dementia is projected to change between 2015 and 2035, based on current population trends (Series B), is presented in Figures 7-3 and 7-4 for women aged 60 years and over.

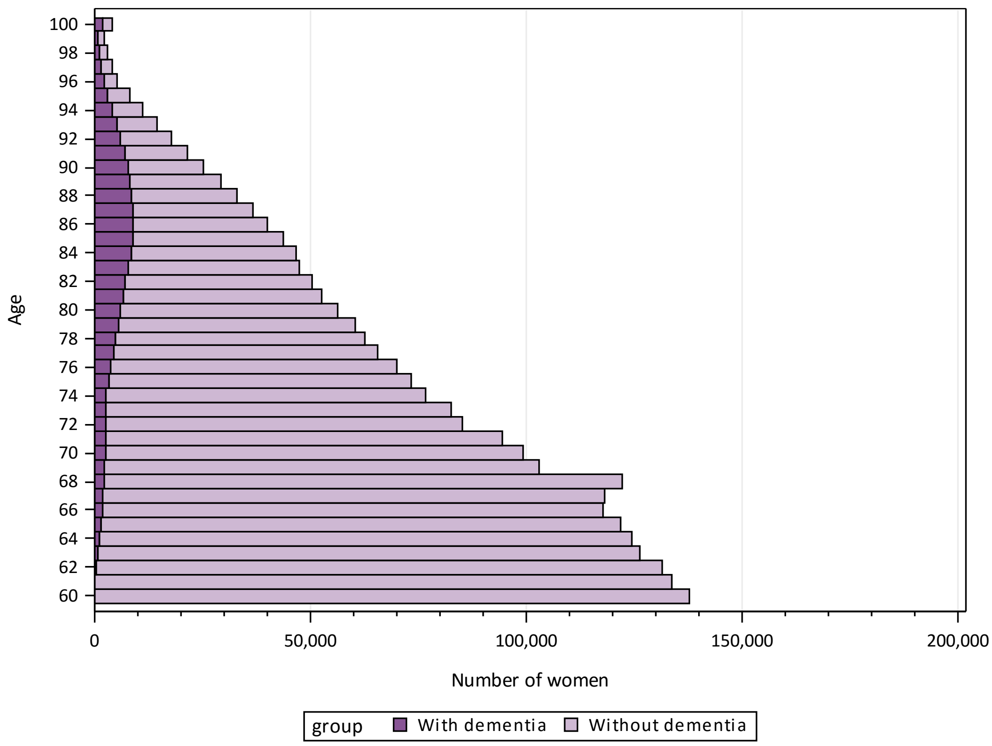

Figure 7-3: Projected numbers of women with dementia in Australia by age in 2015 based on current population trends (Series B) for women aged 60 years and over.

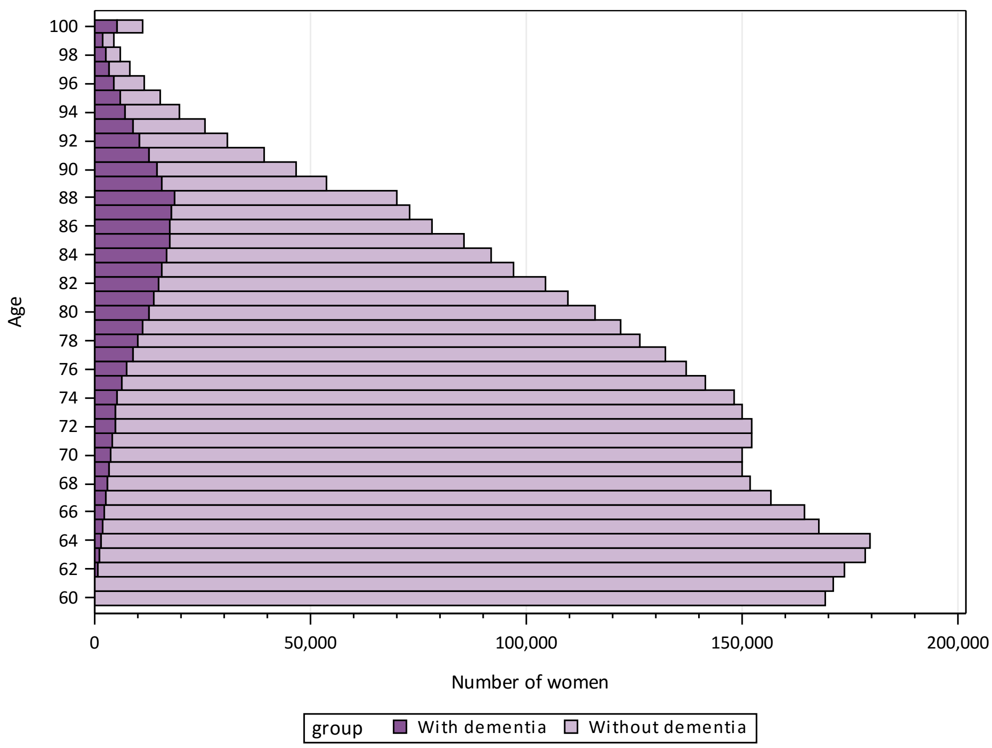

Figure 7-4: Projected numbers of women with dementia in Australia by age in 2035 based on current population trends (Series B) for women aged 60 years and over.

Based on population projection series A, the number of women newly diagnosed with dementia in each year would double between 2015 and 2035 (from 30,610 to 62,144; Table 7-2). The population projections which assume a smaller increase in life expectancy (B and C) show a 90% increase in the number of women newly diagnosed with dementia between 2015 and 2035. As with the prevalence projections, changes in the level of overseas net migration appear unlikely to significantly influence the number of women newly diagnosed with dementia between 2015 and 2035.

Although the age-specific incidence rates were held constant, the overall incidence increased slightly from 1.3 per cent to 1.5-1.6 per cent (as a percentage of women aged 60 years and over) due to increases in the number of women alive at older ages between 2015 and 2035.

Table 7-2: Projected number of women with newly diagnosed dementia (incidence) in a year in Australia from 2015 to 2035 and percentage of women aged 60 years and over.

Year	Population projection					
	Series A		Series B		Series C	
	n	%	n	%	n	%
2015	30,610	1.3	30,609	1.3	30,608	1.3
2020	34,970	1.3	34,897	1.3	34,888	1.3
2025	41,251	1.3	40,845	1.3	40,822	1.3
2030	50,310	1.4	49,027	1.4	48,975	1.4
2035	62,144	1.6	58,736	1.5	58,631	1.5

7.5. Risk factors for dementia

Because increasing age is a primary risk factor for dementia, as life expectancy increases the total number of people with dementia is also likely to rise (Jorm, Dear & Burgess, 2005; Rocca et al., 2011). A greater understanding of the causes and predictors of dementia could aid in the development of preventive strategies to reduce the overall burden of disease.

Risk factors of dementia are thought to include lower education and social class. Likewise smoking, low levels of physical activity, and high BMI have been shown to be associated with increased risk of dementia. Chronic disorders such as diabetes, stroke, hypertension, and depression have also been identified as risk factors for, and comorbidities of, dementia (Wu et al., 2016). Therefore, by reducing the prevalence of these potentially modifiable risk factors earlier in life, it may be possible to reduce the incidence of dementia in a population.

The ALSWH study provided the opportunity to assess a number of these risk factors for dementia in a population-based sample of Australian women aged 70-75 in 1996. However, the overall risk based on ALSWH data are likely to be underestimated due to the undercounts identified in section 7.2, which will result in some women with dementia being misclassified as not having dementia.

There were 2,534 women identified as having dementia from sources 1-4 from the 1921-26 ALSWH cohort (see section 7.1.2.). For the models assessing dementia risk factors, dementias which occurred between 1 July 2003 and 6 March 2012 were included (2,254 women with dementia), because information from all data four data sources was available in this date range. Using this data, a series of statistical models were used to test the associations between hypothesised risk factors and dementia. The factors examined are those included elsewhere in this report:

- Overweight/Obesity
- Smoking
- Mental health problems
- Education
- Ability to manage on income
- Marital status
- Area of residence

Analysing risk factors for dementia is challenging because many of the factors that increase the risk of dementia also increase the risk of death. People with these risk factors may die earlier and so do not reach older ages when dementia is more likely to develop. Consequently, a factor that increases risk of death may appear to 'provide protection' against dementia. To address this problem, models for dementia risk need to account for the 'competing risk' of death (Fine & Gray, 1999). For this report, competing risk models were used to estimate associations between each risk factor and the incidence of a record of dementia between 2003 and 2012 (because there were fewer sources of ascertainment before 2003). The models were based on women's characteristics at Survey 1 in 1996 and were adjusted for single year of age. Table 7-3 shows the results when each factor was analysed separately.

Table 7-3: Association between selected risk factors and dementia.

Risk factor	Hazard ratio	95% Confidence Interval
Obesity status		
Not obese	1	(Reference)
Obese	0.86	(0.75, 0.99)
Smoking status		
Non-smoker	1	(Reference)
Current smoker	1.00	(0.84, 1.19)
Mental Health Components Score		
>52	1	(Reference)
≤52	1.25	(1.15, 1.37)
Age left school		
≤14	1	(Reference)
≥15	0.93	(0.85, 1.01)
Ability to manage on Income		
Not difficult	1	(Reference)
Difficult to manage	1.16	(1.06, 1.27)
Marital status		
No partner	1	(Reference)
Married or de facto	1.04	(0.96, 1.14)
Area of residence		
Other area	1	(Reference)
Major city	1.18	(1.08, 1.28)

Each separate model adjusted for age (≤70, 71, 72, 73, 74, ≥75).

7.5.1. Obesity

Higher BMI has previously been identified as a risk factor of dementia (Beydoun et al., 2008), so the finding that obese women had lower rates of dementia may appear contradictory. However, a similar 'obesity paradox' has also been previously observed in studies of dementia (Almeida et al., 2002; Dahl et al., 2008). While several biological explanations have been proposed, methodological biases are also possible.

For example, all ALSWH study participants were required to complete the first survey between the ages of 70-75. Therefore, women in this birth cohort who died before 1996 were not included in this analysis. The exclusion of 'unhealthier' obese women from the cohort could have impacted the results presented in Table 7-3.

7.5.2. Smoking

Results from several prospective studies have shown that smoking in middle (and older) age is associated with an increased risk of dementia (Almeida et al., 2002; Anstey et al., 2007). This might be expected as smoking is a major risk factor for cardiovascular disease. However, the effect is not apparent in ALSWH data once the competing risk of death has been taken into account.

7.5.3. Mental health problems

While depression has been identified as an early risk factor for dementia, depression is also common among dementia patients (Jorm, 2000). It is possible that some of the association between depression and dementia is due to patients developing depression as an early symptom of dementia (Li et al., 2011). In the ALSWH data, the association between MHI ≤52 and dementia is quite large (hazard ratio of 1.25 with 95% confidence interval of 1.15 to 1.37) and statistically significant – but more detailed analysis would be required to clarify the time lag between poorer mental health and a dementia diagnosis.

7.5.4. Education

Lower educational attainment has been identified as a risk factor for dementia (Beydoun et al., 2014; Caamano-Isorna et al., 2006; Prince et al., 2012). Persons with higher education may have a greater 'cognitive reserve' and be more able to cope with changes in brain pathology without observable cognition defects.

Few ALSWH participants in this cohort had a university education, so the risk of dementia was compared between women who left school aged 14 years or less, and those who left above 15 years. Those with a higher level of education had a lower risk of mortality, and there was some evidence that they also had a lower risk of dementia (even though this was not statistically significant at a conventional level of 5%).

7.5.5. Ability to manage on income

Some studies have found that those with higher socioeconomic status were at lower risk of dementia (Fotenos et al., 2008), while others have found that little effect of socioeconomic measures other than education (Lee et al., 2003). Here we used 'ability to manage on income' as a measure of socioeconomic status.

ALSWH participants who found it harder to manage on their income had higher risk of dementia, however the results in Table 7-3 did not take into account the effects of education.

7.5.6. Marital status

Previous research has identified low social participation, less frequent social contact, and more loneliness as risk factors for dementia (Kuiper et al., 2015). We examined several measures of social support and found little evidence of an association with dementia. For example there was no significant difference in the risk of dementia between those women who were married or in a de facto relationship at the beginning of the study and those who were not (predominantly widows). However, the analyses did not take into account changes in marital status or social support that occurred after 1996.

7.5.7. Area of residence

People in who live in remote areas have previously been shown to be at increased risk of dementia, compared to those in urban locations (Russ et al., 2012). In contrast, ALSWH participants who lived in major cities had the highest risk of dementia. The mean number of aged care records per person, was slightly higher in regional locations compared to major cities, so this difference in dementia rates could not be readily explained by a higher probability of diagnosis in urban locations. However, this initial analysis did not take into account any other factors and further examination of the data is needed.

7.6. Health service use and costs

As shown in section 7.2, while records of dementia were identified for 2,534 women it is estimated that the number with dementia is about 3,400. Therefore, estimating the use and cost of health services for the 2,534 women would substantially underestimate the actual healthcare resources attributable to dementia. For this reason, estimates based on ALSWH linked data are not included in this report.

7.7. Summary points

- By 2012, 20 per cent of the ALSWH older cohort aged 85-90 had a record of dementia.
- If the prevalence of dementia remains constant, the number of women in the Australian population living with dementia is predicted to double between 2015 and 2035.
- If the incidence of dementia remains constant, the number of women with newly diagnosed dementia each year is predicted to double between 2015 and 2035.
- ALSWH women with better mental health at ages 70-75 had lower rates of subsequent dementia.
- ALSWH women in rural locations at ages 70-75 had lower rates of subsequent dementia.

8. Highest level of educational attainment

8.1. Background

Highest level of educational attainment is one measure by which an individual's socioeconomic status is determined. Low educational attainment (and other measures of socioeconomic status) is associated with poorer health outcomes, partly due to less ability to access health services and to obtain information to minimise health risk (ABS, 2010a). A low education level correlates strongly with obesity (Backholer et al., 2012), and premature mortality (Bihan et al., 2016), increased risk of advanced stage diagnosis of ovarian cancer (Praestegaard et al., 2016) and vascular events, including any cardiac, cerebrovascular and peripheral vascular disease (Morton et al., 2016). In ALSWH, lower education attainment was associated with increased risk of stroke (Jackson, Jones & Mishra, 2014), and higher prevalence of diabetes, hypertension, obesity, and constipation (Mishra et al., 2002), poorer mental health (Outram, Murphy & Cockburn, 2006), and less physical activity (Mishra et al., 2002).

According to the ABS, the percentage of Australian people aged 25-34 who have attained a Bachelor degree or higher was 27 per cent in 2004 and by 2015, the percentage had increased to 37 (ABS, 2015c). In 2009, the Australian Government announced a goal that 40 per cent of people aged 25-34 will have graduated with a Bachelor degree by 2025. Women achieved this target in 2011 (ABS, 2011) and the latest available data shows that 42 per cent of women aged 25-34 have a Bachelor degree or higher (ABS, 2015c).

8.2. Ascertainment of highest level of educational attainment

Highest level of educational attainment was determined from the following questions in ALSWH.

'What is the highest qualification you have completed?'

Response options were: No formal qualifications, School or Intermediate Certificate (or equivalent), Higher School or Leaving Certificate (or equivalent), Trade/apprenticeship, Certificate/diploma, University degree, and High University degree.

This question was asked in Survey 1 for the 1921-26 cohort, Surveys 1 and 6 of the 1946-51 cohort, and all surveys of the 1973-78 cohort.

For the 1989-95 cohort, the following question was asked at every survey.

‘What is the highest level of education you have completed?’

Response options were Year 10 or below, Year 11 or equivalent, Year 12 or equivalent, Certificate I/II, Certificate III/IV, Advanced Diploma/Diploma, Bachelor degree, Graduate diploma/Graduate certificate, and Postgraduate degree (Appendix A).

8.3. Changes in highest educational attainment across the adult lifespan

The percentage of women who gained a university degree in the 1989-95 cohort increased from 23 to 41 per cent from Surveys 1 to 3 (Figure 8-1). In the 1973-78 cohort, 11 per cent of women had a university degree in 1996 and this increased to 54 per cent by 2012. Interestingly, 23 per cent of women aged 18-23 in 2013 had gained a university education compared with 11 per cent of women aged 18-23 in 1996.

In the 1946-51 cohort, 14 per cent of women aged 45-51 in 1996 had a university education and this increased to 20 per cent by the time they were aged 59-64 in 2010. During this time, the percentage of women whose highest educational level was Year 12 (or equivalent) or a Certificate/Diploma had also increased by 2-3 per cent.

In the 1921-26 cohort, almost three-quarters of women aged 70-75 did not complete Year 12 and 4 per cent of the participants had a university degree.

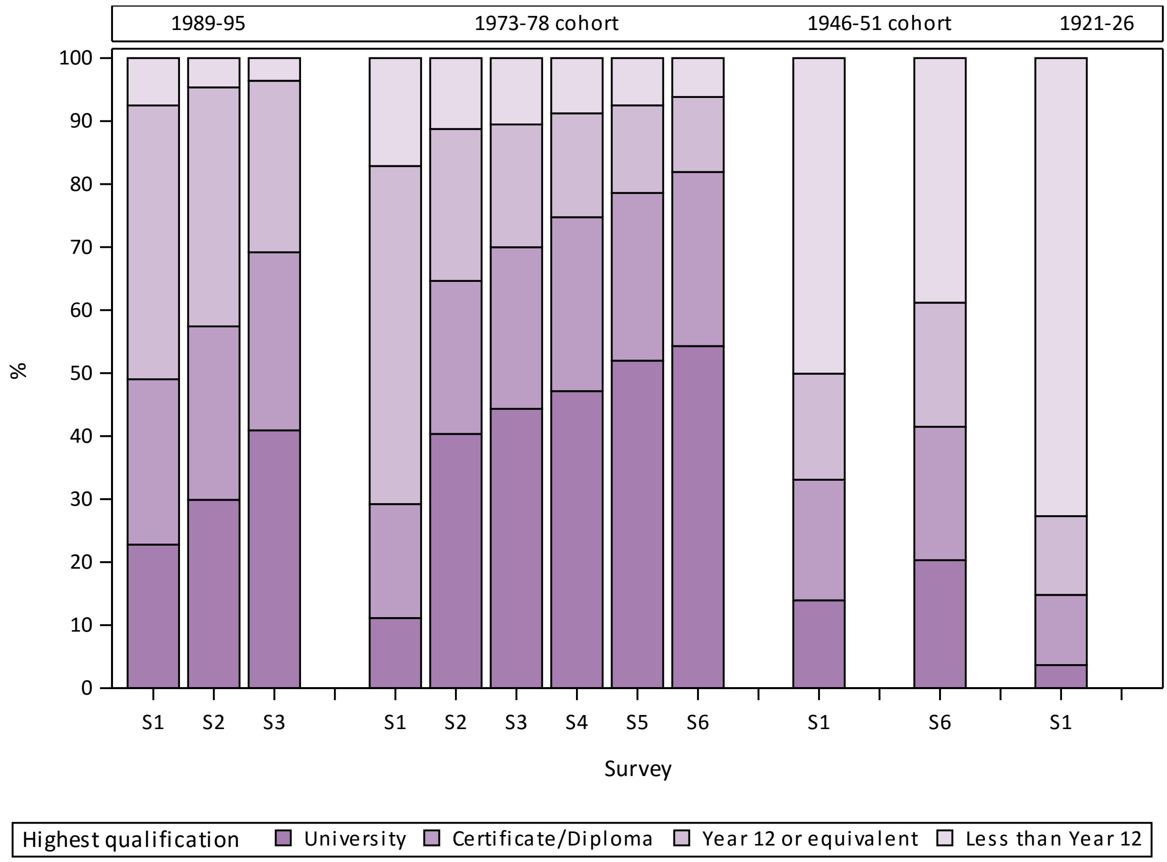

Figure 8-1: Percentage of women in each level of highest educational attainment at each survey for all cohorts (1989-95, 1973-78, 1946-51, and 1921-26).

We have previously reported that there is an over-representation of women with a university education in ALSWH and the bias increased from Survey 1 to 6, particularly for the 1973-78 cohort (Dobson et al., 2015). By Survey 6 of the 1973-78 cohort, 58.3 per cent of women aged 34-39 had a university qualification compared with 33.7 per cent of women aged 33-38 according to the 2011 Australian Census. For the 1946-51 cohort, 18.1 per cent of 59-64 year old women had a university degree compared with 14.6 per cent of women aged 33-38 sampled in the Census. The difference was the least for the 1921-26 cohort where 5.8 per cent of women aged 85-90 had a university education compared with 3.2 per cent of women of the same age in the Census.

8.4. Projection of university education trends for Australian women over the next 20 years

To project the prevalence of women who will gain university degrees over the next twenty years, the historical trends were first modelled using data from the annual ABS Survey of Education and Work for 2005 to 2015 (ABS, 2015c) to eliminate the bias that could be introduced when using ALSWH data (as described in section 8.3). The percentage of women with a university degree (Bachelor or higher) by age was obtained. These data were used to project the percentage of women at each age with a university degree from 2015 to 2035 (Appendix Figure 13-3).

The assumption for this model is that the percentage of women with a university education would remain constant up to the 30-34 age group as has been shown in the previous 5 years (Appendix Table 13-1). For ages greater than 30-34 years, a cohort approach was used where the prevalence of women with a university education in one age group was carried forward to the next age group over time (Figure 8-2 and Appendix B, Figure 13-6). The reason for using a cohort effect was because the trends in ALSWH showed that there was a cohort effect for the 1989-95 and 1973-78 cohorts (Figure 8-1).

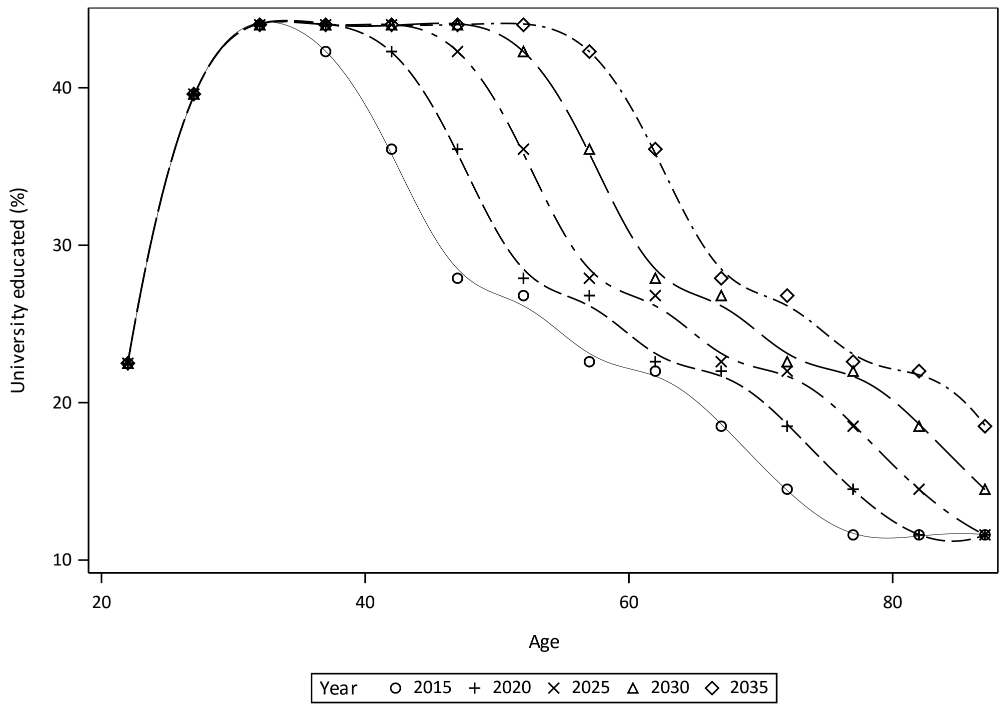

Figure 8-2: Model of the prevalence of university-educated Australian women aged 20-90 from 2015 to 2035, based on data from the annual ABS Survey of Education and Work.

To project the prevalence of Australian women aged 20-90 years with a university education from 2015 to 2035, population projections Series A-C from the ABS were incorporated into the model (methods described in Appendix C). Briefly, the ABS produced three different scenarios (Series A, B, and C) for the Australian population from 2012 to 2101. Series B is based on current (at 2012) rates of fertility, life expectancy at birth, and net overseas migration. Series A assumes higher rates for all three characteristics, whereas Series C assumes lower fertility and net overseas migration rates and unchanged life expectancy.

Approximately 2.5 million women aged 20-90 are university educated in 2015 and this is projected to increase to 4.6 million (Series A), 4.4 million (Series B), and 4.3 million (Series C; Figure 8-3, Table 8-1). The prevalence of women who have a university degree is projected to increase from 28.5 per cent in 2015 to 36.1 per cent in 2035 for all population series. Figures 8-4 and 8-5 show population pyramids of the numbers of women aged 20-90 with a university education within the general population in 2015 and 2035, respectively.

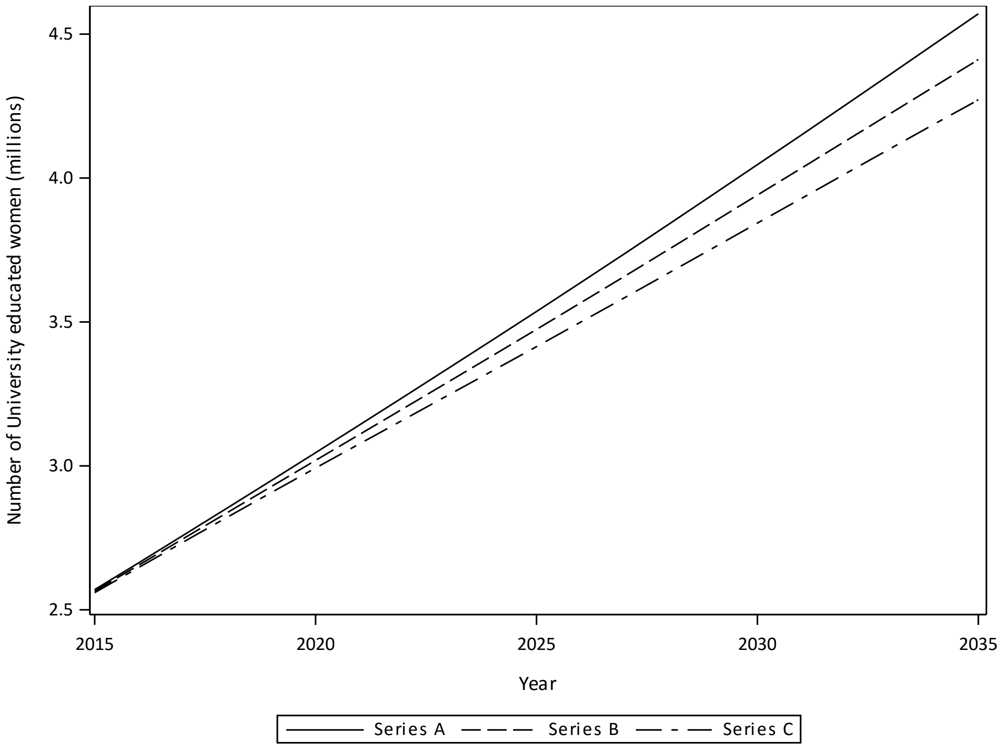

Figure 8-3: Projected number of women with a university education in Australia from 2015 to 2035.

Table 8-1: Projected number and prevalence of university-educated women in Australia from 2015 to 2035.

Year	Population projection					
	Series A		Series B		Series C	
	n	%	n	%	n	%
2015	2,570,089	28.5	2,564,902	28.5	2,559,591	28.5
2020	3,045,772	30.8	3,019,084	30.8	2,992,672	30.7
2025	3,536,348	32.8	3,474,113	32.8	3,414,283	32.7
2030	4,046,525	34.6	3,940,871	34.5	3,843,514	34.4
2035	4,570,461	36.1	4,411,103	36.1	4,271,451	36.0

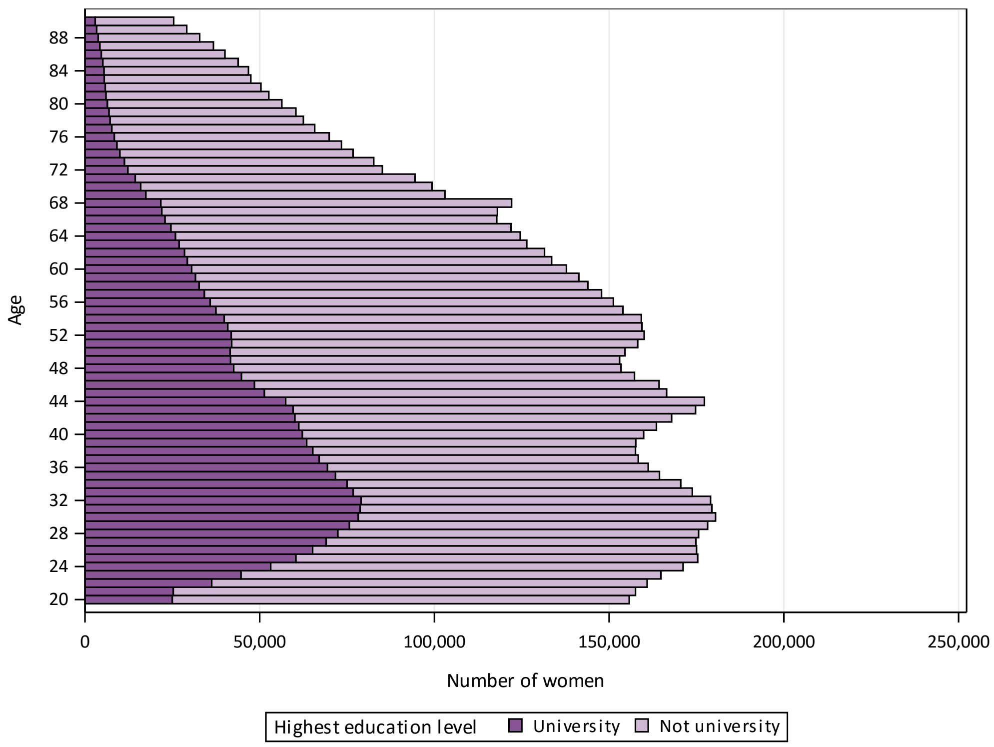

Figure 8-4: Projected numbers of university-educated women in Australia by age in 2015 based on current population trends (Series B).

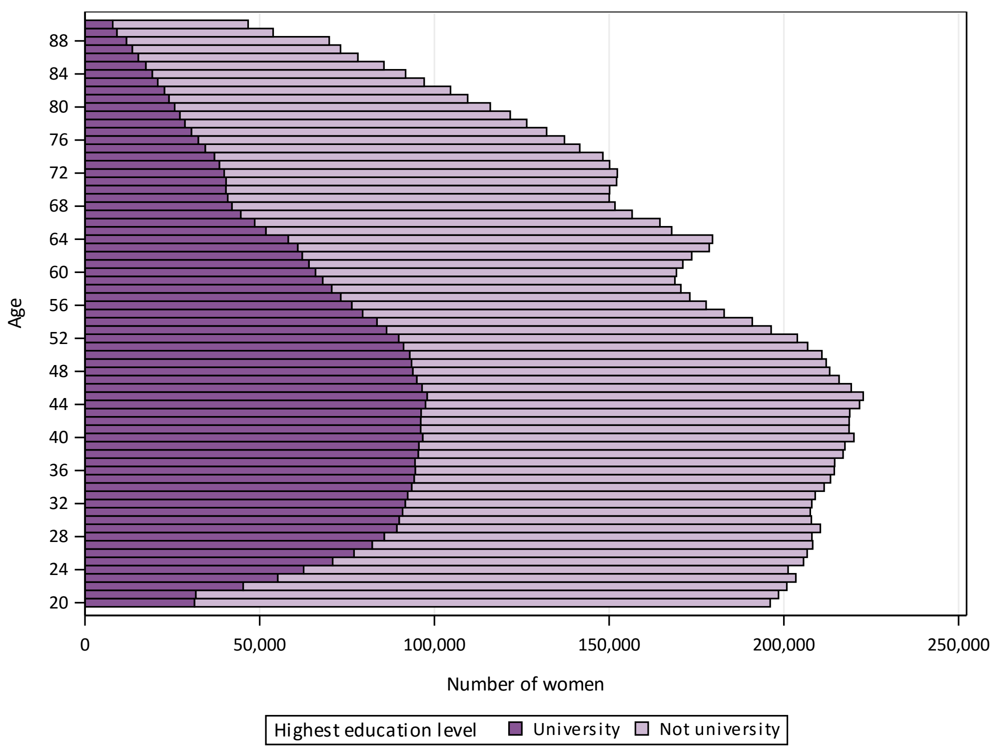

Figure 8-5: Projected numbers of university-educated women in Australia by age in 2035 based on current population trends (Series B).

8.5. Impact of highest level of qualifications on healthcare expenditure

The association between level of education attainment and healthcare utilisation was examined by comparing the mean number of MBS claims, PBS prescriptions filled, and hospital admissions accrued by women each year, and the cost of these services by level of education among ALSWH participants.

8.5.1. Medicare Benefits Scheme

ALSWH survey data were linked to unreferred MBS data from 1996 to 2013 and this allowed us to determine the number of unreferred MBS claims made by each participant. 'Unreferred' means visits to a general practitioner without requiring a referral. To estimate the total unreferred MBS cost, the average cost of unreferred MBS services in 2014 (in 2014 Australian dollars) was obtained from the Department of Human Services statistical reporting database (Medicare Group Reports, 2016) and was reported to be $48.80 per visit. The total unreferred MBS cost (in 2014 Australian dollars) for each participant for every year from 1996 to 2013 was estimated by multiplying the number of unreferred MBS claims by $48.80. Then, the annual unreferred MBS cost per participant by highest level of educational attainment was estimated (Appendix D, Section 15.1).

Overall, women whose highest qualification was less than Year 12 had the most unreferred MBS claims and women who had a university degree had the least unreferred MBS claims for all cohorts (Figure 8-6). The difference in mean unreferred MBS claims between these two groups ranged from 1-2 claims per participant. There was little difference in unreferred MBS claims between participants who achieved Year 12 or equivalent and Certificate/Diploma.

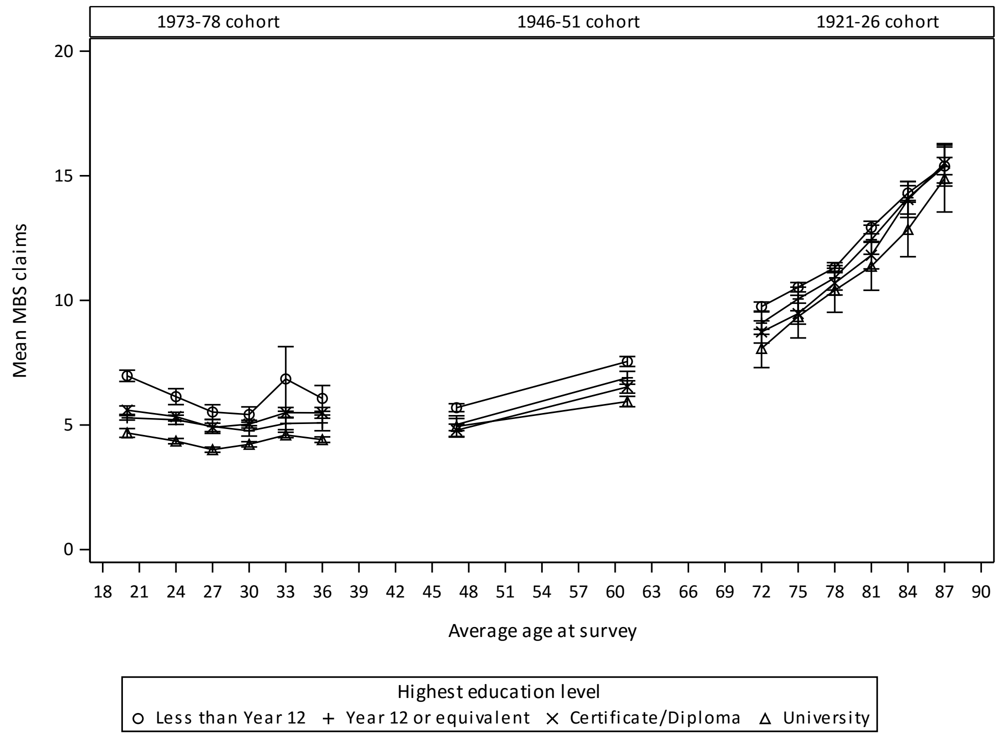

Figure 8-6: Comparison of average number of unreferred MBS claims per participant per year for 1973-78, 1946-51, 1921-26 cohorts by highest level of qualification.

8.5.2. Pharmaceutical Benefits Scheme

ALSWH data were linked to the latest available PBS dataset (2012-13 financial year), which provided a record for each PBS script that was filled and its associated cost for each participant. The average number of scripts filled and cost (in 2012-13 Australian dollars) was then determined by education group (Appendix D, Section 15.2). Because the 2012-13 period corresponded to one survey per cohort, there are only three sets of data points.

There is not a clear pattern for mean PBS claims and cost when comparing participants with different levels of qualifications (Table 8-2). There is little difference between participants who had achieved Year 12 or equivalent or a Certificate/Diploma for all cohorts. Those with qualifications of less than Year 12 had more PBS prescriptions filled compared with those who had university degrees in the 1973-78 and 1946-51 cohorts. However, these cohort differences were not reflected in the PBS cost, suggesting the use of different medicines.

Table 8-2: Mean PBS claims and cost (in 2012-13 Australian dollars) per participant for the 1973-78, 1946-51, and 1921-26 cohorts by the highest level of qualification.

		ALSWH Cohort		
		1973-78	**1946-51**	**1921-26**
Group	**Corresponding survey** **year** **average age (years)**	Survey 6 2012 36	Survey 7 2013 64	Survey 6 2011 87
Less than Year 12	Mean number of PBS claims per participant	8.7	26.8	56.2
	Mean PBS cost per participant ($)	278	1033	1947
Year 12 or equivalent	Mean number of PBS claims per participant	6.4	22.6	51.1
	Mean PBS cost per participant ($)	391	906	2003
Certificate/ Diploma	Mean number of PBS claims per participant	7.0	21.6	49.4
	Mean PBS cost per participant ($)	324	871	1918
University	Mean number of PBS claims per participant	5.0	10.1	54.4
	Mean PBS cost per participant ($)	262	802	1949

8.5.3. Hospital costs

Due to the limitations of the hospital datasets available, the numbers of ALSWH participants who were hospitalised in NSW were used to determine differences in hospital admission and cost accrued by level of education (Appendix D, Section 15.3). The NSW Admitted Patients dataset provided hospital admission of participants by Australian Refined Diagnosis Related Group (AR-DRG) codes that were then matched to the AR-DRG costs reported by the Independent Hospital Pricing Authority (IHPA).

Like the patterns observed for PBS claims and costs, there was no clear difference in hospital costs between the categories for highest educational attainment (Figure 8-7). In the 1973-78 and 1946-51 cohorts, women with less than Year 12 schooling had the highest mean hospital cost. In the 1921-26 cohort, women with a university education had the highest hospital cost.

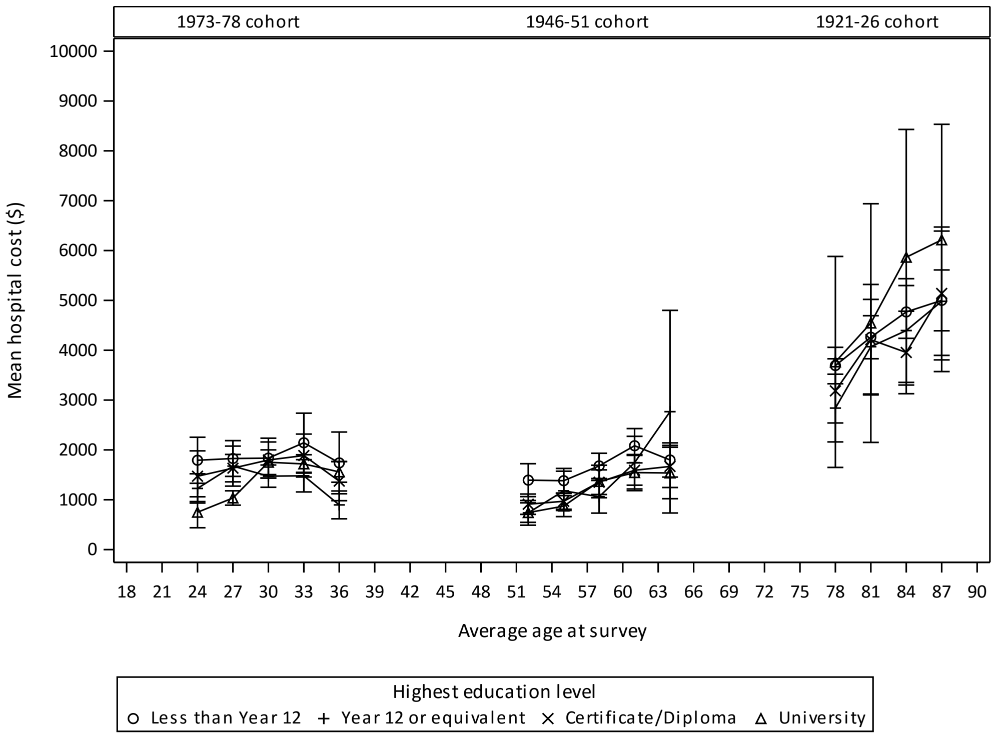

Figure 8-7: Comparison of average hospital costs (in 2012-13 Australian dollars) per participant per year for the 1973-78, 1946-51, and 1921-26 cohorts living in NSW by highest level of qualification.

8.6. Projected impact of changing levels of education on healthcare utilisation.

The association between level of education and healthcare utilisation from 2015 to 2035 was examined using the trend data shown in section 8.5. We compared the number of MBS claims, PBS prescriptions filled, and hospital admissions accrued by women each year and the cost of accessing these services for (a) the total population of women aged 20-90, (b) women who have a university education, and (c) women who do not have a university education. For MBS, PBS, and hospital projections, a penalised B-spline was fitted to the data to model the number of claims and cost of each service for women at every age between 20 and 90, inclusive (Appendix E). The major assumption is that the number of MBS claims and cost (in 2014 Australian dollars), PBS claims and cost (in 2012-13 Australian dollars), and hospital costs (in 2012-13 Australian dollars) vary with age in the same way for every year between 2015 and 2035. The age-specific estimates for the number of claims and cost of each service were multiplied by the projected number of women aged 20 to 90 years at every year from 2015 to 2035 and prevalence of women with or without a university education to predict the total number of claims and cost for MBS, PBS, and hospital services over the next twenty years (Appendix F).

8.6.1. Medicare Benefits Scheme

The total number of unreferred MBS claims for women aged 20-90 who have a university education is predicted to increase from 13.1 million in 2015 to 24.5 million in 2035; for women who do not have a university education, the increase is predicted to be from 44.2 million to 57.0 million claims (Figure 8-8). The total unreferred MBS cost for university-educated women is estimated to cost $0.6 billion (in 2014 Australian dollars) in 2015 and $1.2 billion in 2035 (Figure 8-9). In comparison, the total unreferred MBS cost for women who do not have a university education is estimated at $2.2 billion in 2015 and $2.8 billion in 2035.

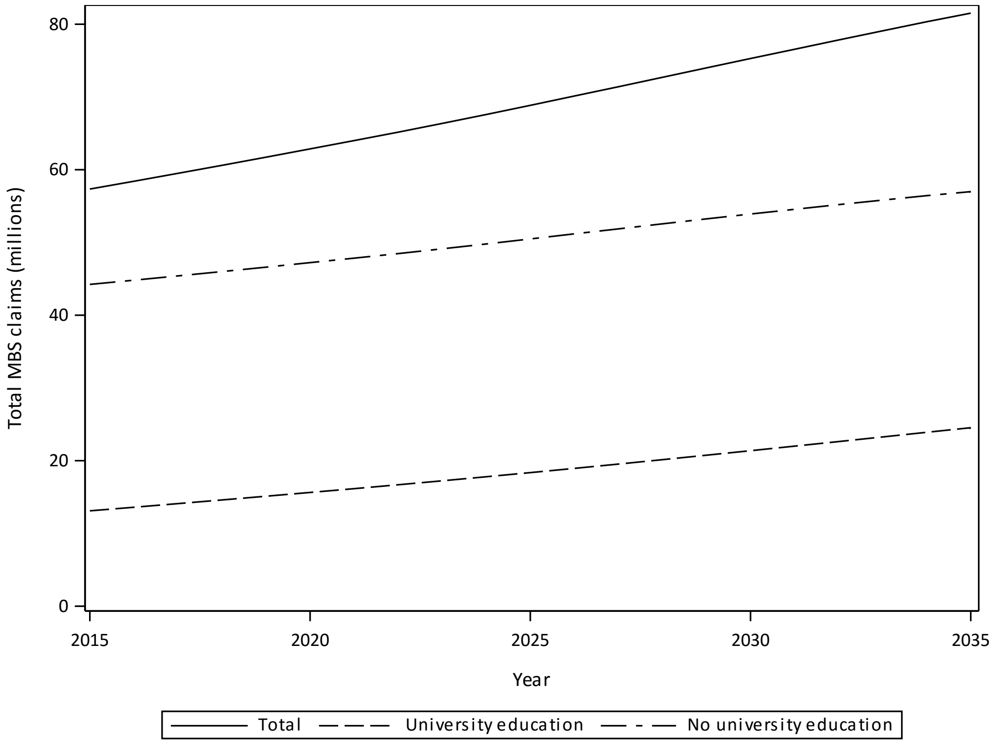

Figure 8-8: Projected total number of unreferred MBS claims for Australian women aged 20-90 from 2015 to 2035, comparing women who do or do not have a university education.

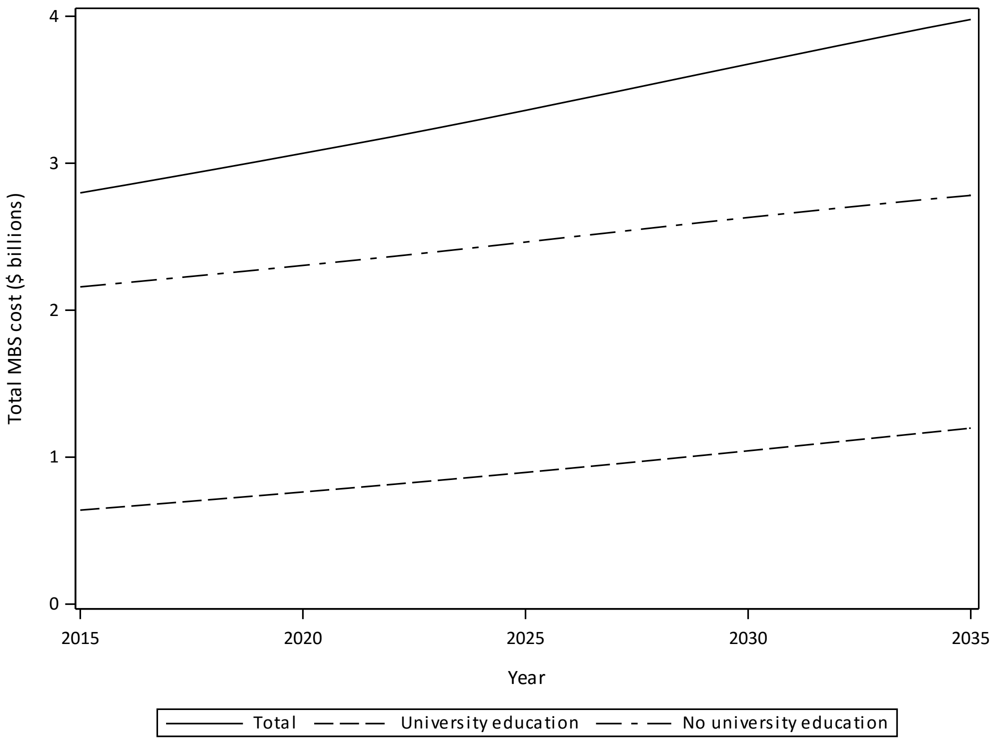

Figure 8-9: Projected total unreferred MBS cost (in 2014 Australian dollars) for Australian women aged 20-90 from 2015 to 2035, comparing women who do or do not have a university education.

8.6.2. Pharmaceutical Benefits Scheme

In 2015, the total number of PBS prescriptions filled for women with a university education was 23.7 million and for those without a university education, the total was 113.1 million (Figure 8-10). By 2035, the total PBS cost for university-educated women is predicted to be 52 million and 155 million for women without a university education.

The total PBS cost (in 2012-13 Australian dollars) was estimated to be $1.1 billion for women with a university education and $4.5 billion for women without a university education in 2015 (Figure 8-11). In 2035, total PBS cost is predicted to increase to $2.3 billion and $6.0 billion, respectively.

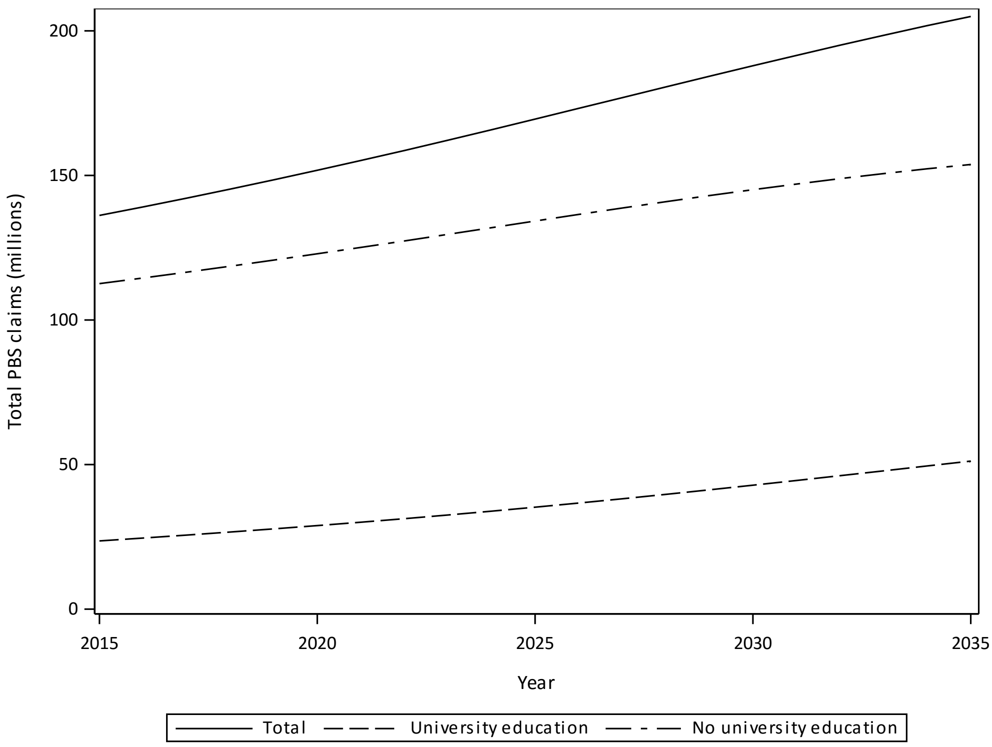

Figure 8-10: Projected total number of PBS claims for Australian women aged 20-90 from 2015 to 2035, comparing women who do or do not have a university education.

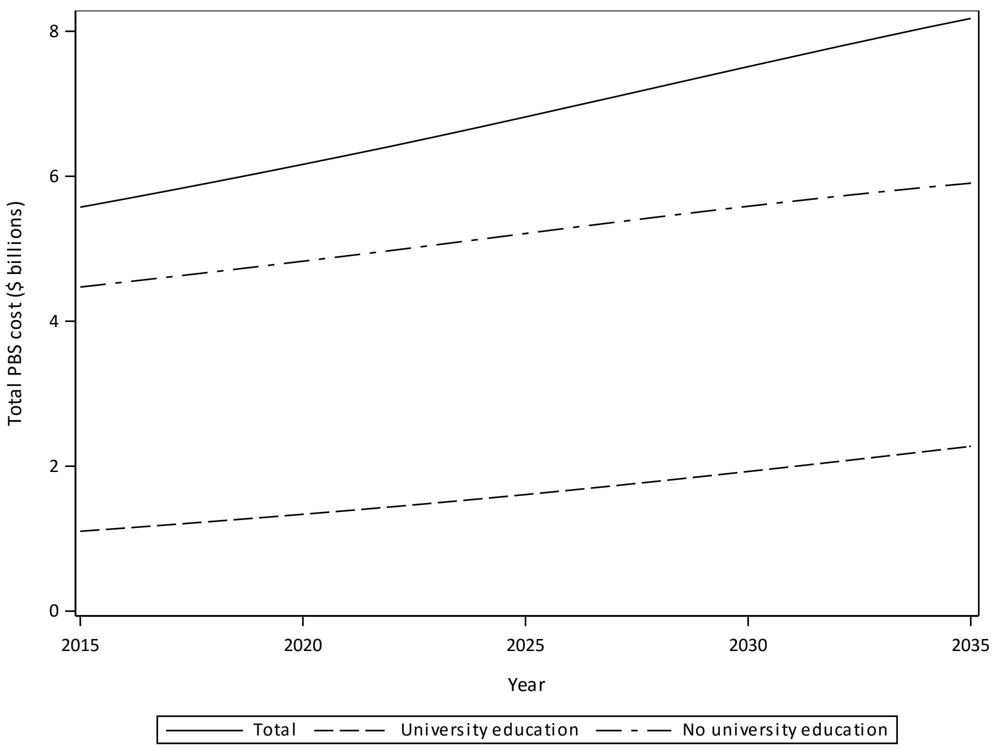

Figure 8-11: Projected total PBS cost (in 2012-13 Australian dollars) for women aged 20-90 from 2015 to 2035, comparing women who do or do not have a university education.

8.6.3. Hospital services

The total hospital cost for women with a university education was estimated to be $3.6 billion (in 2012-13 Australian dollars) in 2015 and is predicted to increase almost two fold to $6.8 billion in 2035 (Figure 8-12). This is due to increasing prevalence of university-educated women in the population (Table 8-1). In comparison, the total hospital cost for women who do not have a university education was $12.2 billion in 2015 and is projected to increase to $16 billion by 2035.

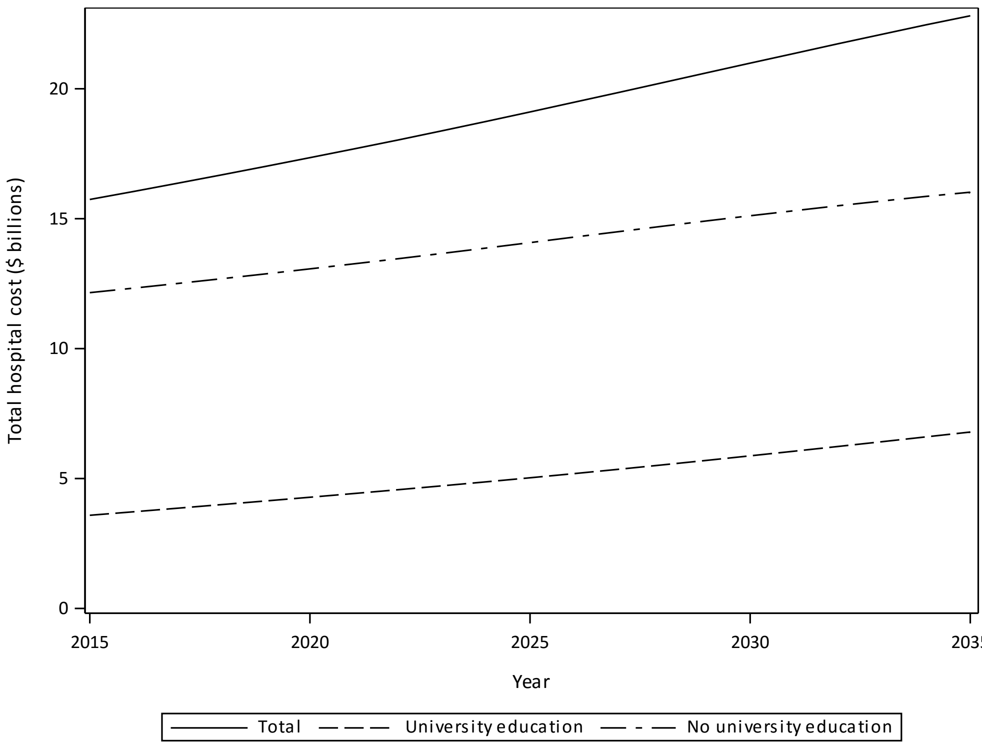

Figure 8-12: Projected total hospital cost (in 2012-13 Australian dollars) for women aged 20-90 from 2015 to 2035, comparing women who do or do not have a university education.

8.6.4. Summary points

- The prevalence of women who attain a university qualification has increased by birth cohort and with age.
- The number of women with a university education is predicted to increase from 2.6 to 4.4 million between 2015 and 2035.
- Women with university education have lower healthcare costs than women with no university education.
- While healthcare costs will increase overall, the increase in costs will be lower among more highly educated women.

9. Ability to manage on income

9.1. Background

Ability to manage on income is an individual's perception of whether or not they have sufficient money to fulfil their needs. Self-reported financial difficulty is associated with poor mental health (Laaksonen et al., 2007; Sturgeon et al., 2016) and poorer overall health (Ahnquist, Wamala & Lindstrom, 2012). Additionally, persistent financial difficulty across the lifespan is also associated with poorer overall health, more medical conditions, functional impairment, and depression in people aged over 65, regardless of their current financial situation (Kahn & Pearlin, 2006). People with poor financial resources are also more likely to undertake poor health behaviours such as smoking. The 2010 National Drug Strategy Household Survey (NDSHS) found that smoking prevalence in single-parent households was double that of coupled households (AIHW, 2011a). Additionally, research from ALSWH has demonstrated that women who reported having difficulty managing on their income in their mid-seventies were likely to be frail by their late 80s (Gardiner, Mishra & Dobson, 2016).

Despite the relationship between financial stress and poor health, no research has been conducted on the comparative healthcare cost of people according to their self-reported financial stress.

9.2. Ascertaining ability to manage on income in ALSWH

In ALSWH, the participant's ability to manage on income was determined by a single survey question.

'How do you manage on the income you have available?'

The response options were: it is impossible, it is difficult all the time, it is difficult some of the time, it is not too bad, and it is easy.

The question was asked in all surveys for all cohorts, except Survey 2 for the 1973-78 cohort (Appendix A).

9.3. Changes in ability to manage on income across the adult lifespan

The majority (60-70 per cent) of participants reported their ability to manage on income was not too bad or sometimes difficult (Figure 9-1). Between Survey 1 and 3 of the 1973-78 cohort, the percentage of women who found it easy to manage on income increased from 13 to 20 per cent. In the 1946-51 cohort, the percentage of women who found it easy or sometimes difficult to manage on income increased from Survey 1 to 6. Of all cohorts, the 1921-26 cohort had the largest percentage of women who found it easy to manage on their income. More than 80 per cent reported that it was either easy or not too bad to manage on their income.

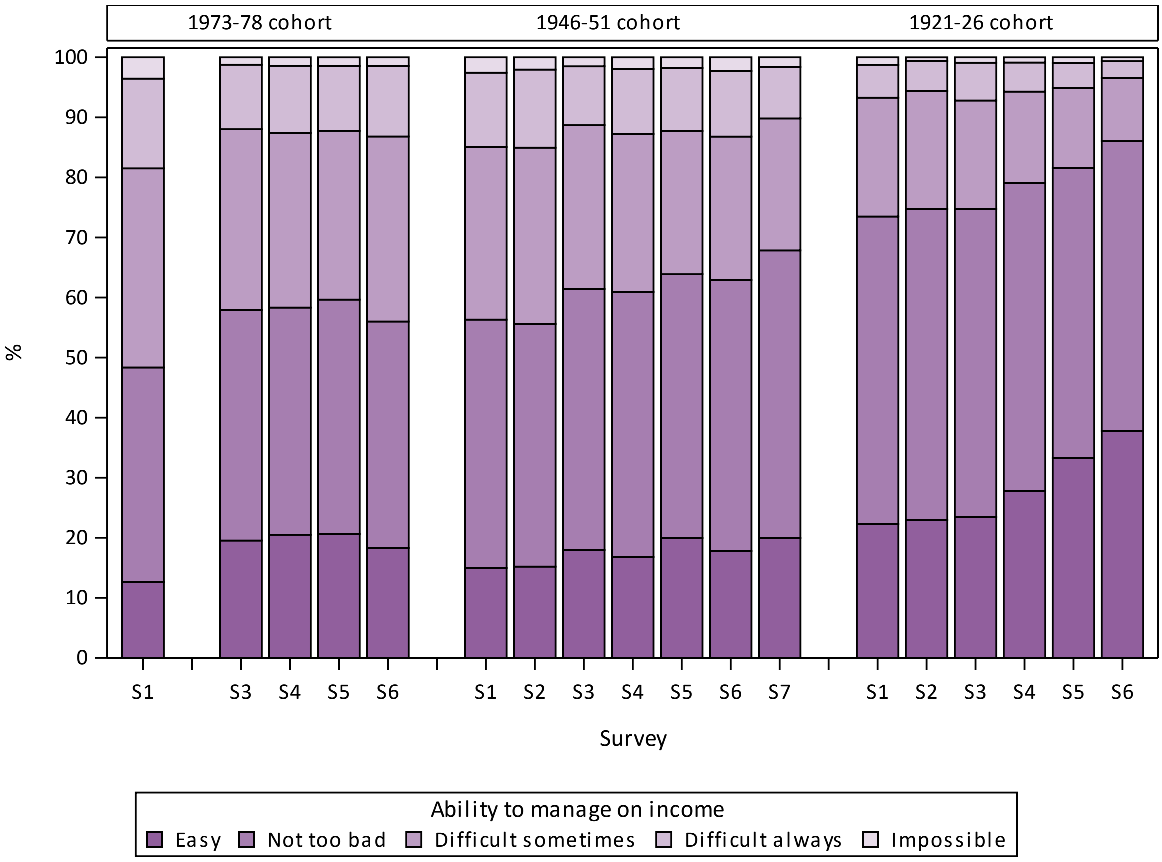

Figure 9-1: Changes in ability to manage on income at each survey for the 1973-78, 1946-51, and 1921-26 cohorts.

Corresponding to these trends, difficulty managing on income decreased with age across all cohorts (Figure 9-2). It was highest for women aged 18-23 in the 1973-78 cohort (52 per cent) and lowest for women aged 85-90 (14 per cent).

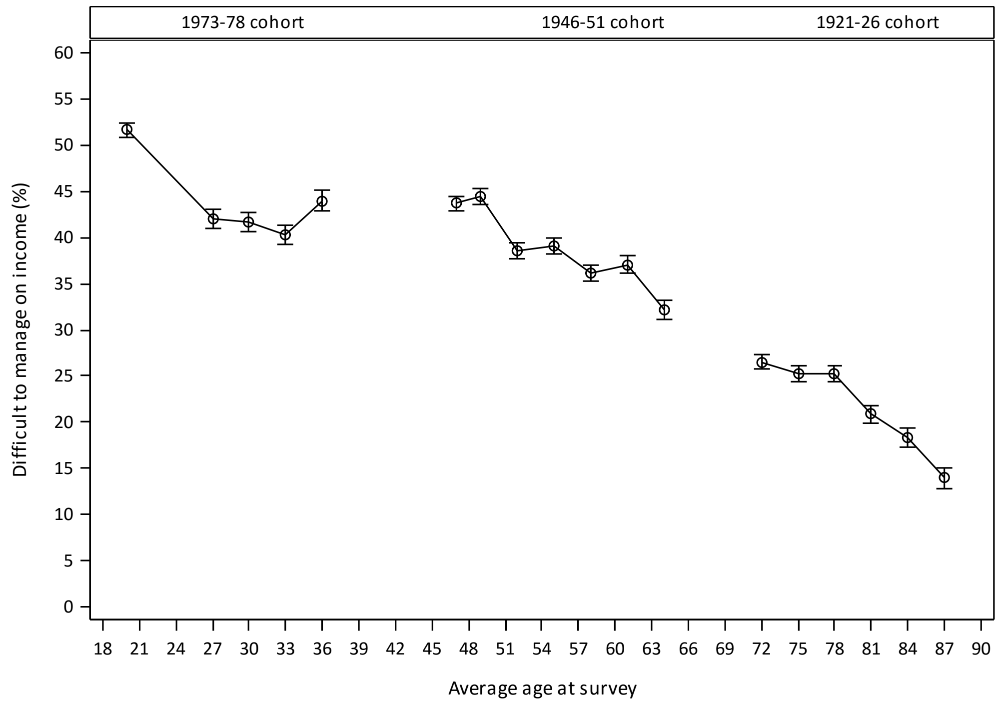

Figure 9-2: Percentage of women who found it difficult to manage on income by average age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

9.4. Projections of difficulty managing on income for the next 20 years

To forecast the prevalence of women who have difficulty managing on income over the next twenty years, we first modelled the prevalence of difficulty to manage on income by age based on trends shown in Figure 9-2.

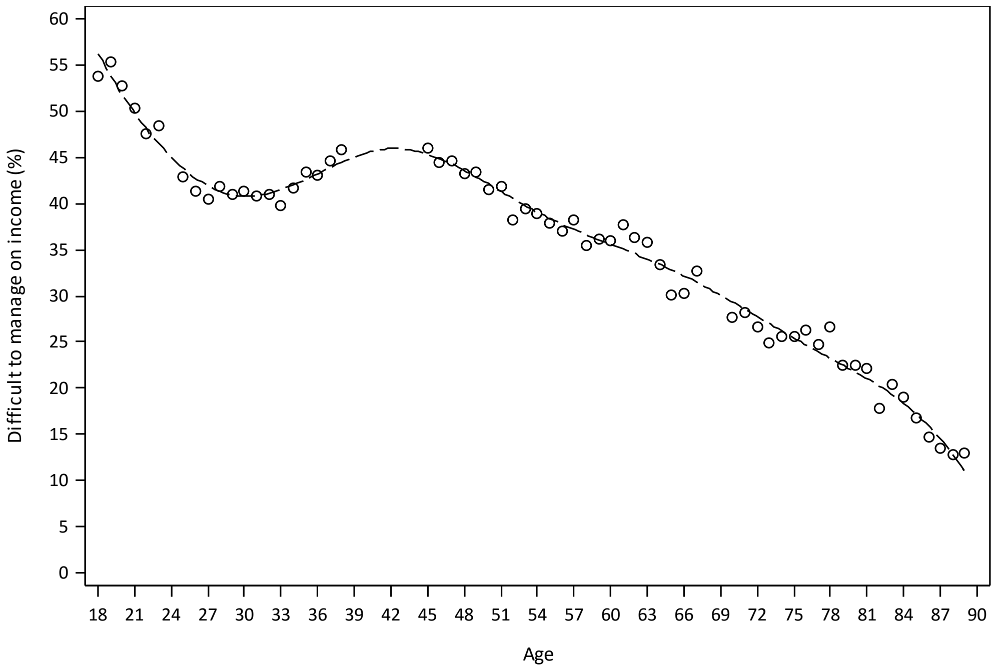

Figure 9-3: A model of the prevalence of women with difficulty managing on income by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

The graph suggests that there is an age effect, but possibly not a birth cohort effect, for whether or not a woman has difficulty managing on income. The resultant model provides estimates for the prevalence of women who have difficulty managing on income at every age from the ages of 20 to 90 years (Figure 9-3 and Appendix B, Section 13.6). The model was then used to project the prevalence of Australian women aged 20-90 years who need help from 2015 to 2035. For this purpose, we assumed that the age-specific prevalence of difficulty managing on income for women will remain the same for this twenty-year time period. The age-specific estimates for difficulty managing on income were multiplied by the projected number of women aged 20 to 90 years at every year from 2015 to 2035 to predict the number and percentage of women who experienced financial difficulty (Appendix 14). Briefly, the ABS produced three different scenarios (Series A, B, and C) for the Australian population from 2012 to 2101. Series B is based on current (at 2012) rates of fertility, life expectancy at birth, and net overseas migration. Series A assumes higher rates for all three characteristics, whereas Series C assumes lower fertility and net overseas migration rates and unchanged life expectancy.

Although the number of women aged 20-90 who have difficulty managing on income is predicted to increase from 3.5 million in 2015 to 4.8 million (Series A), 4.6 million (Series B), and 4.5 million (Series C) in 2035, the overall percentage of these women is predicted to only decrease by 1.1-1.2 per cent (Figures 9-4 and Table 9-1).

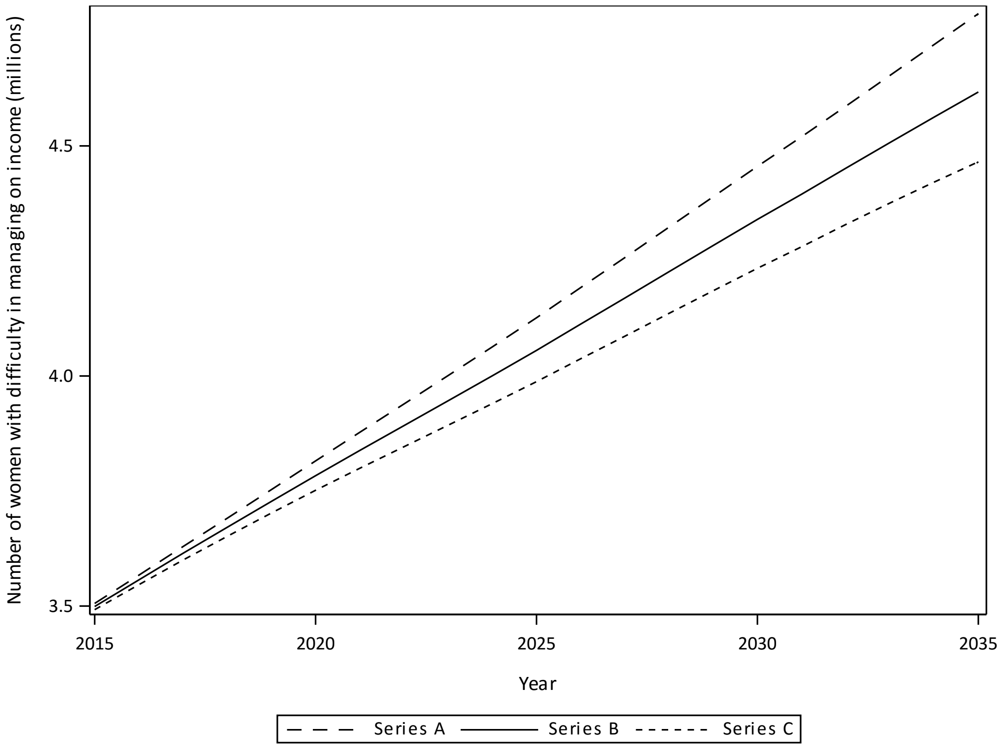

Figure 9-4: Number of Australian women who have difficulty managing on income from 2015 to 2035.

Table 9-1 provides five-yearly estimates of the total number and prevalence of Australian women projected to report difficulty managing on their income over the next twenty years for each population projection series.

Table 9-1: Projected number and prevalence of women aged 20-90 who have difficulty managing on income in Australia from 2015 to 2035.

Year	Population projection					
	Series A		Series B		Series C	
	n	%	n	%	n	%
2015	3,505,663	38.9	3,498,964	38.9	3,492,105	38.8
2020	3,815,403	38.6	3,783,264	38.6	3,751,575	38.5
2025	4,126,509	38.3	4,055,562	38.3	3,987,718	38.2
2030	4,455,579	38.1	4,340,281	38.0	4,234,066	37.9
2035	4,787,396	37.8	4,617,165	37.8	4,465,449	37.6

Population pyramids were constructed to help illustrate the changes in the numbers of Australian women aged 20 to 90 who have difficulty managing on income in 2015 and 2035 (Figures 9-5 and 9-6).

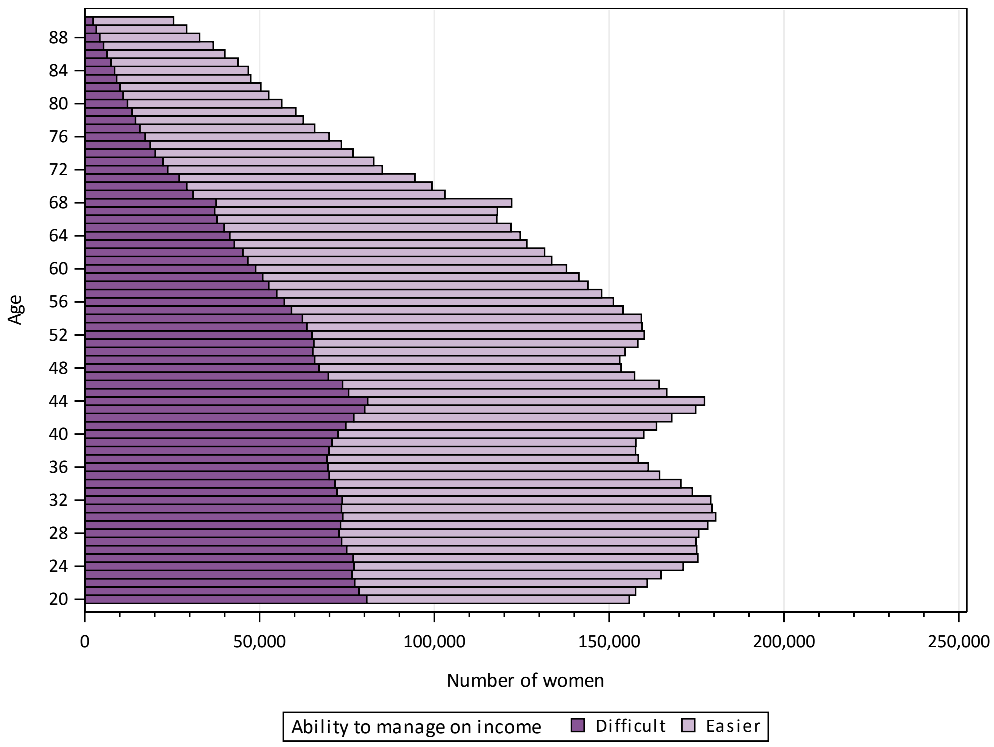

Figure 9-5: Projected numbers of women who have difficulty managing on income in Australia by age in 2015 based on current population trends (Series B).

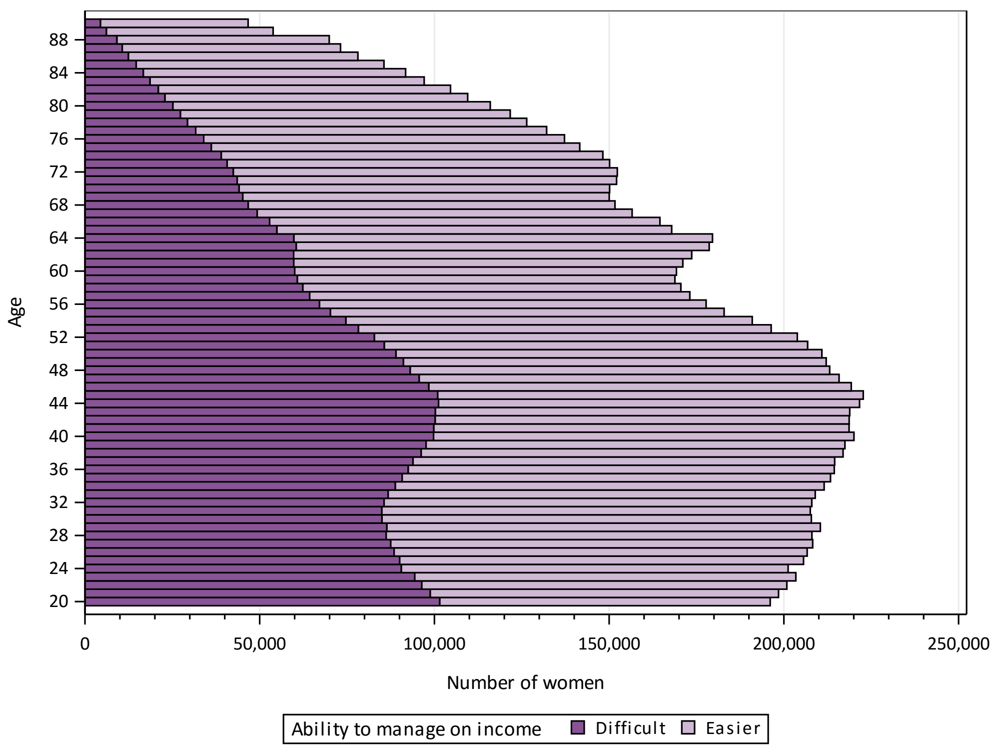

Figure 9-6: Projected numbers of women who will have difficulty managing on income in Australia by age in 2035 based on current population trends (Series B).

9.5. Impact of difficulty managing on income on healthcare use and costs

The use of healthcare services by Australian women who do or do not have difficulty managing on income was estimated by comparing the mean number of MBS claims, PBS prescriptions filled, and hospital admissions each year and the cost of accessing these services.

9.5.1. Medicare Benefits Scheme

The ALSWH survey data are linked to MBS data from 1996 to 2013. The MBS dataset allows us to determine the number of unreferred MBS claims made by each participant. 'Unreferred' means visits to a general practitioner without requiring a referral. Women who had difficulty managing on their income made, on average, 1-2 more unreferred MBS claims than women who found it easier to manage on income, for all cohorts (Figure 9-7).

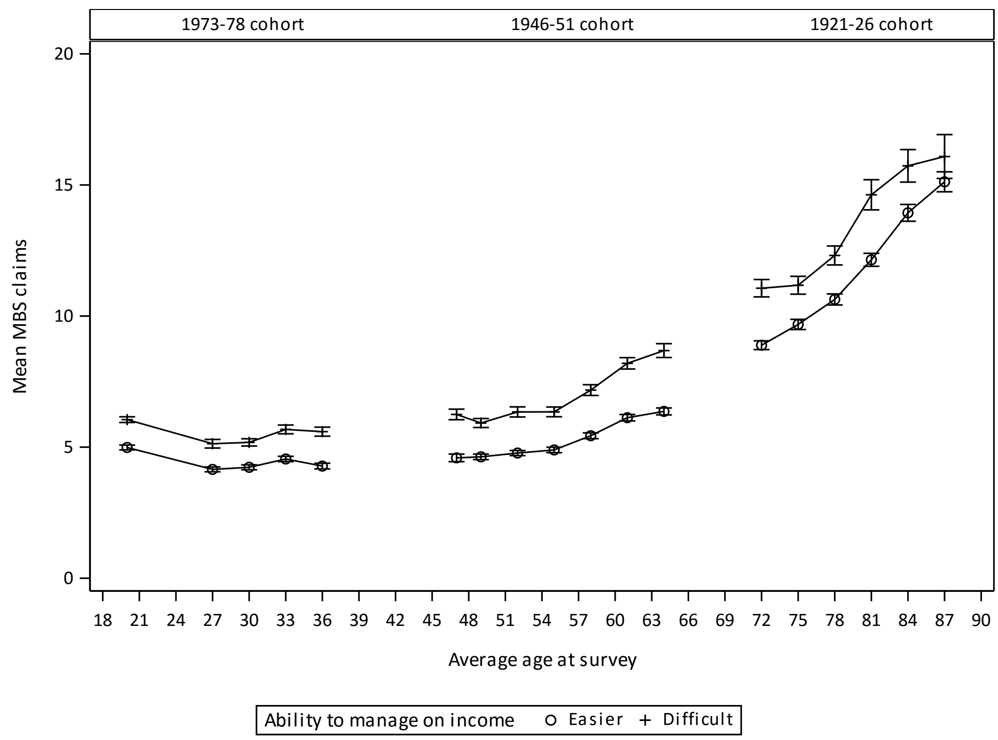

Figure 9-7: Comparison of average number of unreferred MBS claims per participant per year for the 1973-78, 1946-51, 1921-26 cohorts by ability to manage on income.

To estimate the total unreferred MBS cost, the average cost of unreferred MBS services in 2014 (in 2014 Australian dollars) was obtained from the Department of Human Services statistical reporting database (Medicare Group Reports, 2016) and was reported to be $48.80 per visit. To estimate total costs, it was assumed that this average cost was the same for women who did or did not have difficulty managing on income. The total unreferred MBS cost (in 2014 Australian dollars) for each participant for every year from 1996 to 2013 was estimated by multiplying the number of unreferred MBS claims by $48.80. Then, the annual MBS cost per participant by ability to manage on income was estimated (Appendix D, Section 15.1).

For the 1973-78 cohort, the difference in mean unreferred MBS cost was $48-65 (in 2014 Australian dollars) from Survey 1 to 6 (Figure 9-8). In the 1946-51 cohort, the difference in unreferred MBS cost was $60-85 from Survey 1 to 5 and increased to $113 by Survey 7. For the 1921-26 cohort, the difference in unreferred MBS cost declined from $121 at the highest at Survey 4 to $47 at Survey 6.

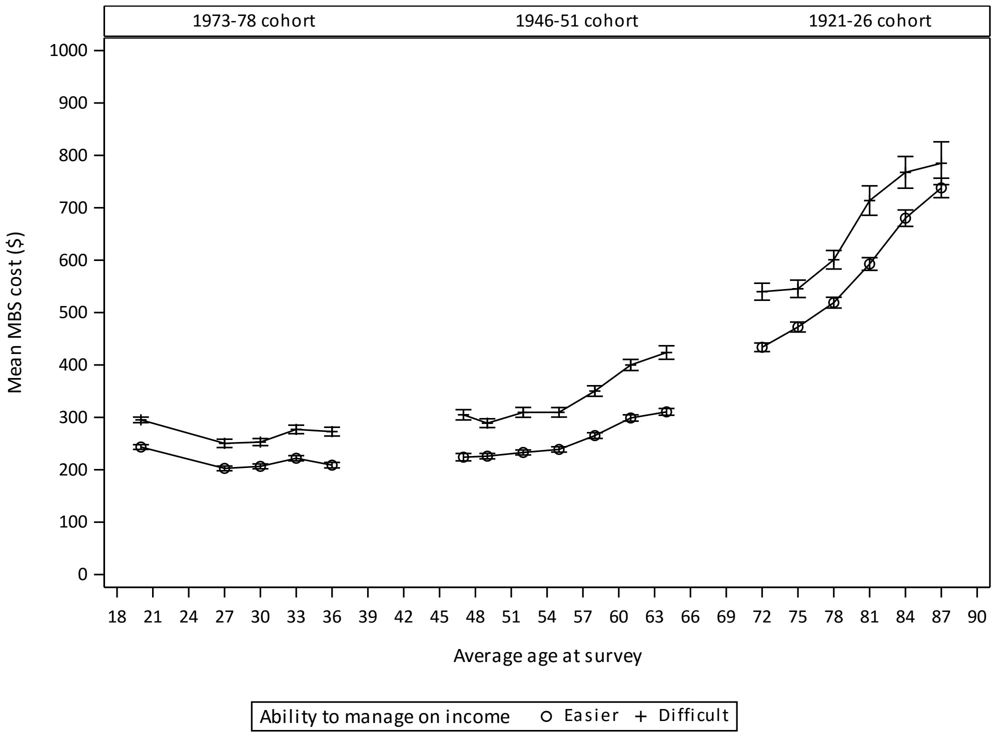

Figure 9-8: Comparison of average unreferred MBS costs (in 2014 Australian dollars) per participant per year for the 1973-78, 1946-51, and 1921-26 cohorts by ability to manage on income.

9.5.2. Pharmaceutical Benefits Scheme

ALSWH data were linked to the latest available PBS dataset (2012-13 financial year), which provided a record of each PBS script that was filled and its associated cost for each participant. The average number of scripts filled and cost (in 2012-13 Australian dollars) was then determined by women's self-reported ability to manage on income (Appendix D, Section 15.2). Because the 2012-13 period corresponded to one survey per cohort, there are only three sets of data points.

In the 1973-78 and 1946-51 cohort, women who had difficulty managing on their income had more PBS prescriptions filled and higher mean PBS costs than women who found it easier to manage on their income (Table 9-2). However, in the 1921-26 cohort, there was little difference between the two groups.

Table 9-2: Mean PBS claims and costs (in 2012-13 Australian dollars) per participant in the 1973-78, 1946-51, and 1921-26 cohorts, categorised by ability to manage on income.

		ALSWH Cohort		
		1973-78	**1946-51**	**1921-26**
Group	**Corresponding survey** **year** **average age (years)**	Survey 6 2012 36	Survey 7 2013 64	Survey 6 2011 87
Difficulty managing on income	Mean number of PBS claims per participant	7.5	29.8	53.2
	Mean PBS cost per participant ($)	367	1204	1936
Easier to manage on income	Mean number of PBS claims per participant	4.7	19.8	59.3
	Mean PBS cost per participant ($)	239	790	1985

9.5.3. Hospital costs

The survey data for participants living in NSW were linked to NSW Admitted Patient Data Collection. The dataset provides a record of the patient's diagnosis using Australian Refined Diagnosis Related Group (AR-DRG) codes. Each AR-DRG represents a group of similar conditions and that require similar hospital services. Public hospital costs are available through the National Hospital Cost Data Collection (NHCDC) provided by the Independent Hospital Pricing Authority. The NHCDC lists the average cost for all AR-DRG codes. For each participant, a hospital cost (in 2012-13 Australian dollars) was determined for every admission using AR-DRG from the hospital record and matching it to the average cost of AR-DRG from the NHCDC. Then hospital cost for each admission was summed to obtain the annual cost for each person (Appendix D, Section 15.3).

In the 1973-78 cohort, the difference in hospital costs (in 2012-13 Australian dollars) between women who did and did not have difficulty managing on income was $300-390 from age 27 to 36 (Figure 9-9). In the 1946-51 cohort, the difference in mean hospital costs was greater than that observed for the 1973-78 cohort and ranged between $470 (at age 58) and $870 (at age 64). In the 1921-26 cohort, the difference increased from $790 at age 78 to $980 at age 84. There was little difference in hospital costs between the two groups at age 87.

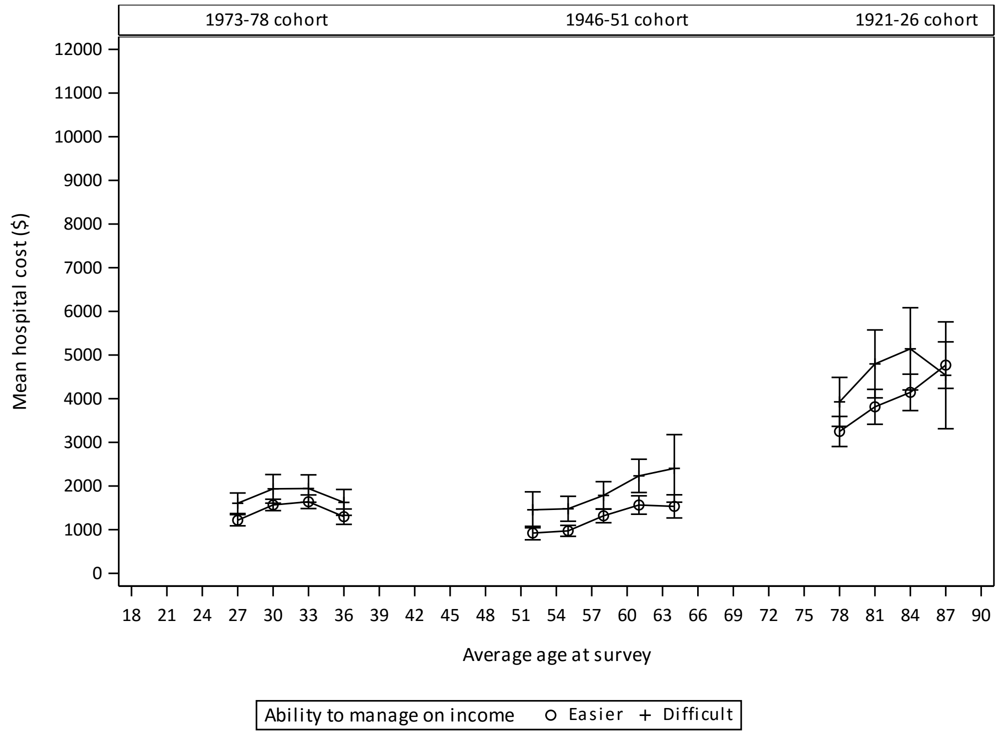

Figure 9-9: Comparison of average hospital costs (in 2012-13 Australian dollars) per participant per year for the 1973-78, 1946-51, and 1921-26 cohorts by ability to manage on income.

9.6. Projected impact of ability to manage on income on healthcare utilisation

Based on the trends identified in section 9.5, the impact of increasing numbers of women who had difficulty managing on their income on healthcare utilisation from 2015 to 2035 was examined. We compared the use of MBS, PBS, and hospital services for (a) the total population of women aged 20-90, (b) women who had difficulty managing on their income, and (c) women who found it easier to manage on their income. For MBS, PBS, and hospital projections, models were generated for the number of claims and cost of each service for women at every age between 20 and 90, inclusive (Appendix E). The major assumption is that the number of MBS claims and cost (in 2014 Australian dollars), PBS claims and cost (in 2012-13 Australian dollars), and hospital costs (in 2012-13 Australian dollars) vary with age in the same way for every year between 2015 and 2035. The age-specific estimates for the number of claims and cost of each service were multiplied by the projected number of women aged

20 to 90 years at every year from 2015 to 2035, as well as by the prevalence of women who did or did not have difficulty managing on income, to predict the total number of claims and cost for MBS, PBS, and hospital services over the next twenty years (Appendix F).

9.6.1. Medicare Benefits Scheme

In 2015, the total number of unreferred MBS claims made by women who had difficulty managing on their income was estimated at 23.8 million at a total cost of $1.2 billion (in 2012-13 Australian dollars; Figures 9-10 and 9-11). It is predicted that these will increase to 32.7 million and $1.6 billion by 2035. In comparison, the total number of unreferred MBS claims made by women who found it easier to manage on income was estimated at 32.8 million at a cost of $1.6 billion in 2015. By 2035, these are predicted to increase by 15.8 million unreferred MBS claims and $2.4 billion (in 2012-13 Australian dollars).

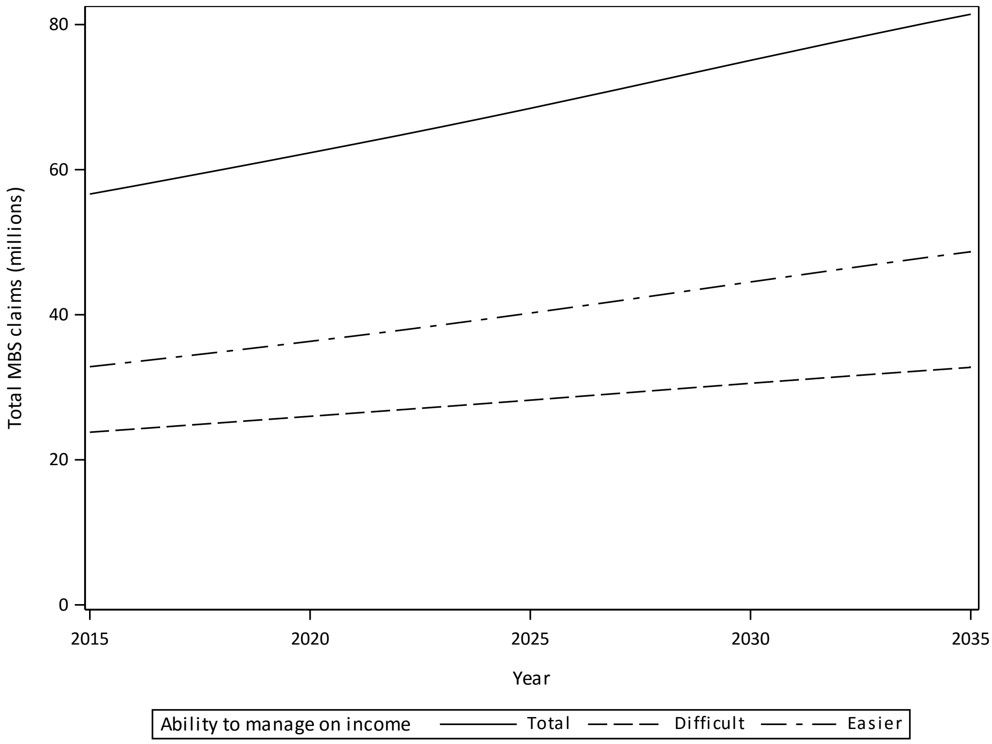

Figure 9-10: Projected number of unreferred MBS claims for Australian women aged 20-90 from 2015 to 2035 by ability to manage on income.

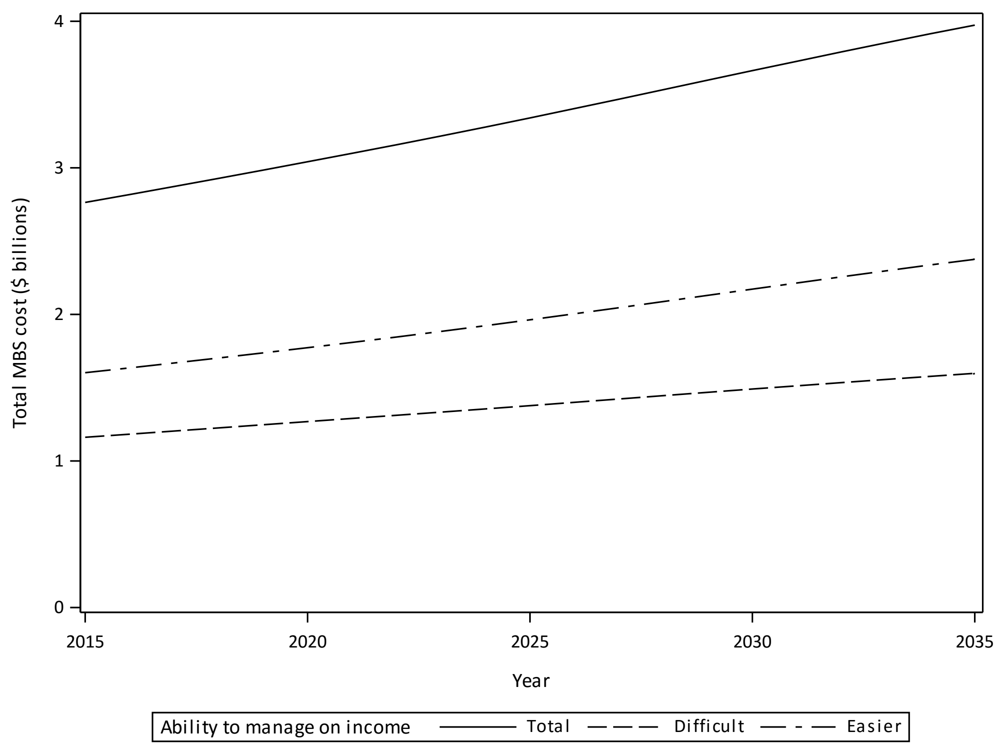

Figure 9-11: Projected total unreferred MBS cost (in 2014 Australian dollars) for Australian women aged 20-90 from 2015 to 2035 by ability to manage on income.

9.6.2. Pharmaceutical Benefits Scheme

Women who had difficulty managing on their income are estimated to have had 54.7 million PBS prescriptions filled in 2015 at a cost of $2.4 billion (in 2012-13 Australian dollars; Figure 9-12 and 9-13). It is predicted that these numbers will increase to 79.2 million prescriptions and $3.4 billion in 2035. For women who found it easier to manage on their income, the total PBS prescriptions filled was estimated to be 79.1 million and the total PBS cost was $3.2 billion in 2015. These numbers are predicted to increase to 128 million and $4.9 billion in 2035.

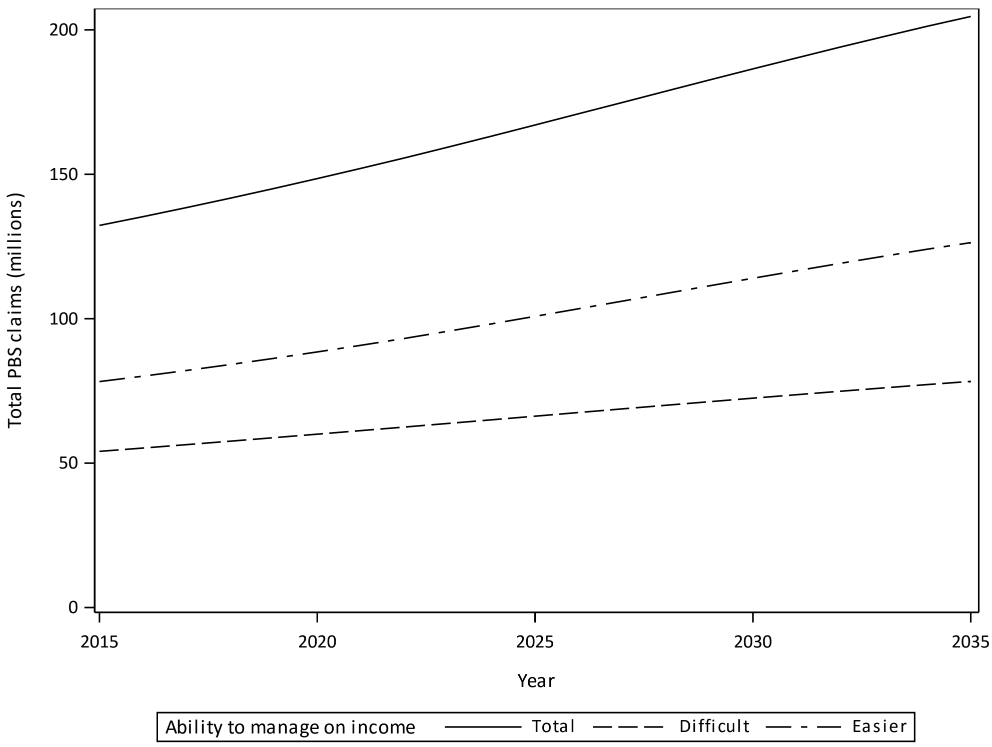

Figure 9-12: Projected number of PBS claims for Australian women aged 20-90 from 2015 to 2035 by ability to manage on income.

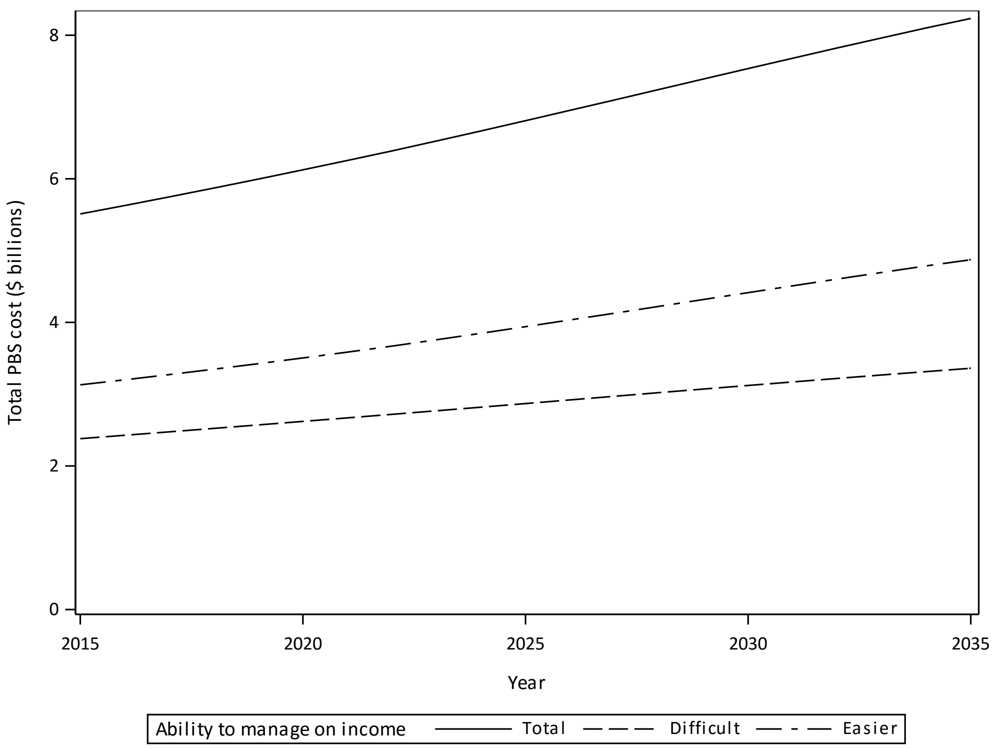

Figure 9-13: Projected total PBS cost (in 2012-13 Australian dollars) for Australian women aged 20-90 from 2015 to 2035 by ability to manage on income.

9.6.3. Hospital costs

Total hospital cost for women who had difficulty managing on their income is predicted to increase from $7.1 billion in 2015 to $9.8 billion (in 2012-13 Australian dollars) in 2035 (Figure 9-14). For women who found it easier to manage on income, the total hospital cost was $8.7 billion in 2015 and is predicted to be $13.1 billion (in 2012-13 Australian dollars) by 2035.

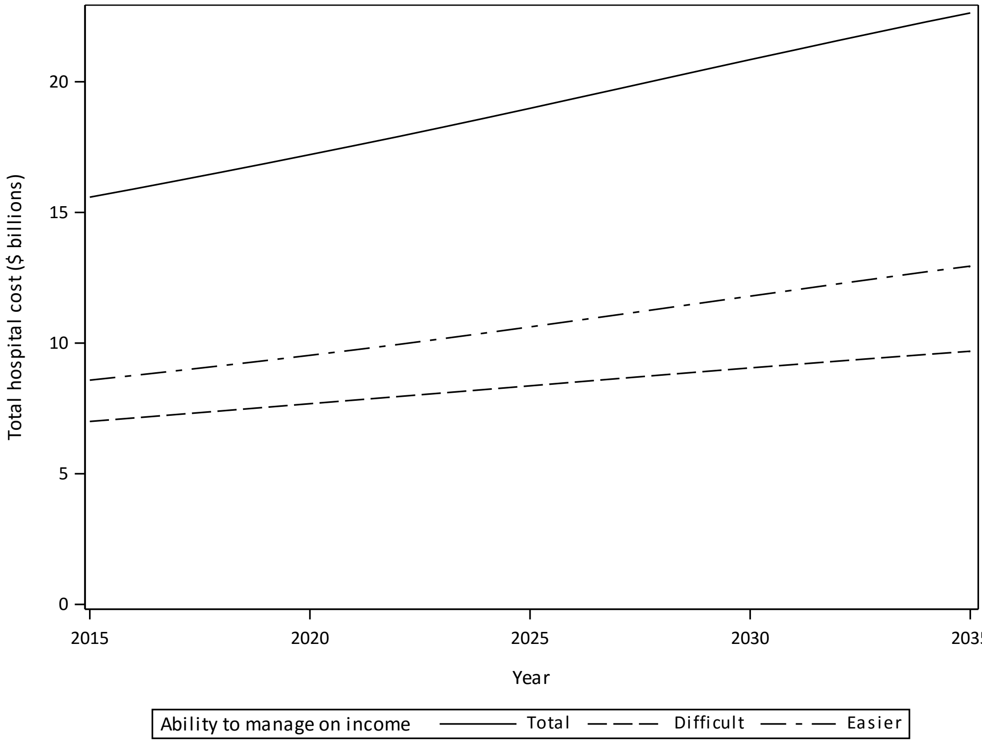

Figure 9-14: Projected hospital costs (in 2012-13 Australian dollars) for Australian women aged 20-90 from 2015 to 2035 by ability to manage on income.

9.7. Summary points

- Younger women found it most difficult to manage on income, however managing on income became easier with age.
- Based on population projection series B, the number of women aged 20-90 who have difficulty managing on income is predicted to increase from 3.5 million to 4.6 million between 2015 and 2035, however prevalence will decrease by 1 per cent.
- Women who have difficulty managing on income have more MBS, PBS, and hospital costs overall.
- Women who have difficulty managing on income are predicted to have a total of $1.6 billion in MBS costs, $3.4 billion of PBS prescriptions filled, and $9.8 billion in hospital costs in 2035.

10. Marital status

10.1. Background

Marital status is an important measure of sociodemographic status because it is an indicator of available emotional support, access to a wider social network, and potentially more economic resources. It has many similarities to another measure of sociodemographic status, living arrangement, as partnership and co-habitation have similar health effects (Wu & Hart, 2002). Married individuals are at lower risk of alcohol abuse (Hatch et al., 2011), depression (Scarinci et al., 2002), and mortality (Manzoli et al., 2007) compared to unmarried and divorced/separated people. Similarly, elderly people living without a partner were more likely to experience functional impairment (Hajek & Konig, 2016).

In Australia, the number of registered marriages has increased from 111,174 in 1994 to 121,197 in 2014, however the number of marriages per 1,000 estimated residents has decreased from 6.2 to 5.2 over that same period (ABS, 2015d). Corresponding to this, the percentage of family households (including de facto couples) decreased from 75.4 per cent in 1991 to 71.5 per cent in 2011 and lone-person households increased from 20.0 per cent to 24.3 per cent over that time period (Qu & Weston, 2013). De facto relationships are also on the rise, increasing from 10 per cent of all social marriages (comprising both registered marriages and de facto relationships) in 1996 to 15 per cent in 2006 (ABS, 2012e).

10.2. Ascertainment of marital status

Marital status was determined by one of the following questions in all surveys for all cohorts:

'What is your present marital status?'

'What is your formal registered marital status?'

The response options were: never married/single, married, de facto, separated, divorced, and widowed. In some surveys, de facto relationships were further defined by de facto (opposite sex) and de facto (same sex). For the purpose of this analysis, the responses were grouped into married/de facto, separated/divorced, widowed, and never married (Appendix A).

10.3. Changes in marital status across the adult lifespan

In the 1989-95 and 1973-78 cohorts, the percentage of women who had a partner, i.e. who were married or in a de facto relationship, increased at each survey (Figure 10-1). In both cohorts, approximately 23 per cent of women aged 18-23 had a partner. From Survey 1 to 3 for the 1989-95 cohort, this percentage increased to 31 per cent. In the 1973-78 cohort, the greatest increase in the percentage of women who had a partner was from Survey 1 to 4. By Survey 4 in 2006, this cohort of women were aged 28-33 and 72 per cent had partners. At Survey 6 of the 1973-78 cohort, 79 per cent of women had a partner. For both cohorts, the majority of women who did not have a partner were never married/single and those who were separated/divorced or widowed only accounted for a small percentage. In the 1973-78 cohort, it can be seen that the percentage of women who were separated or divorced increased from 1 per cent at Survey 1 to 7 per cent at Survey 6.

In the 1946-51 cohort, the percentage of women who had a partner was relatively stable at 80-83 per cent from Survey 1 to 4, however it gradually declined to 75 per cent by Survey 7 (Figure 10-1). The percentages of women who were never married or separated/divorced were relatively constant at approximately 3 and 12 per cent, respectively, whereas the percentage of women who were widowed increased from 2 to 8 per cent from Survey 1 to 7.

In the 1921-26 cohort, 57 per cent of women aged 70-75 at Survey 1 had a partner and 35 per cent were widowed (Figure 10-1). From Survey 1 to 6, as the percentage of women with partners decreased, the percentage of widows increased. By age 85-90, 72 per cent were widowed.

A similar pattern was observed in the 2006 Australian Census where the percentage of people in a married or de facto relationship increased from age 18-24 until 35-44 where the percentage remained relatively stable and then declined after 65-74 years of age (ABS, 2009).

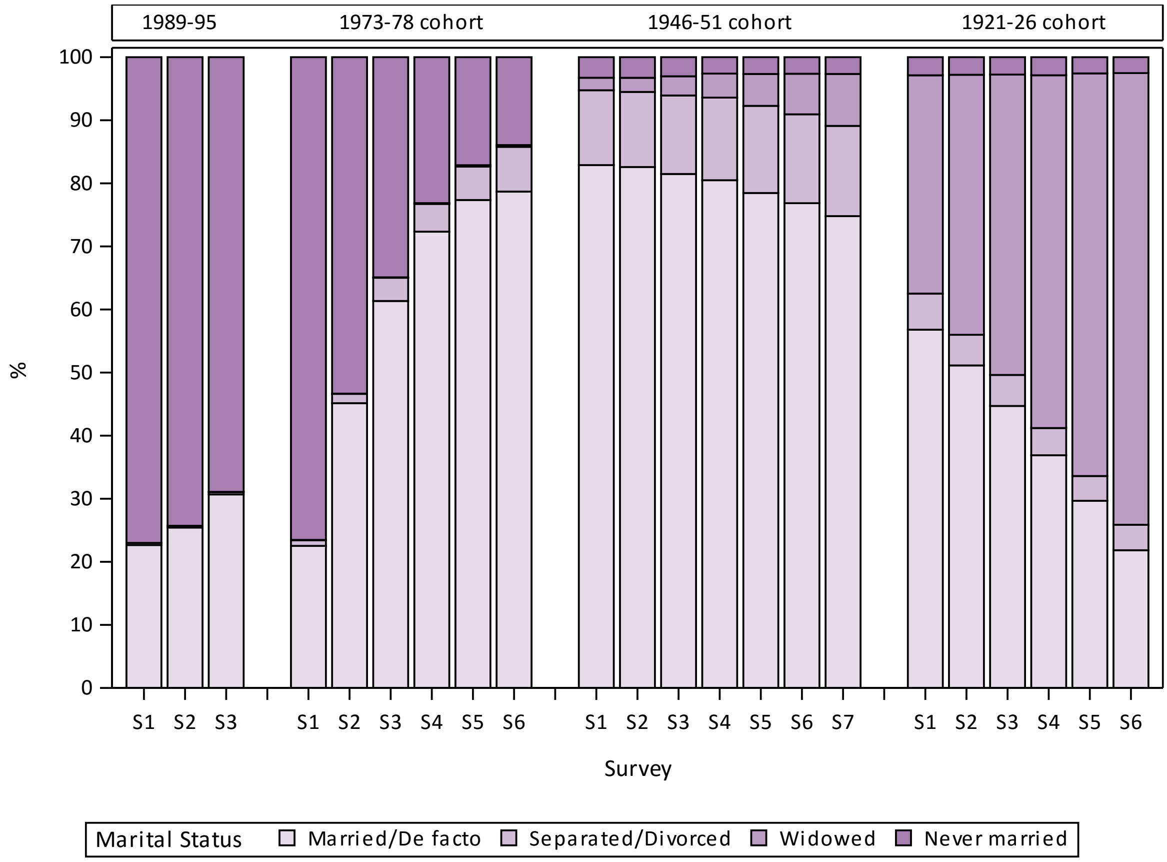

Figure 10-1: Percentage of women in each category for marital status at each survey for all cohorts (1989-95, 1973-78, 1946-51, and 1921-26).

10.4. Projection of marital trends for Australian women over the next 20 years

To project the prevalence of women who are married or in a de facto relationship over the next twenty years, the prevalence of women who were partnered was modelled by age based on the trends identified in Section 10.3 (Figure 10-2 and Appendix B, Section 13.7).

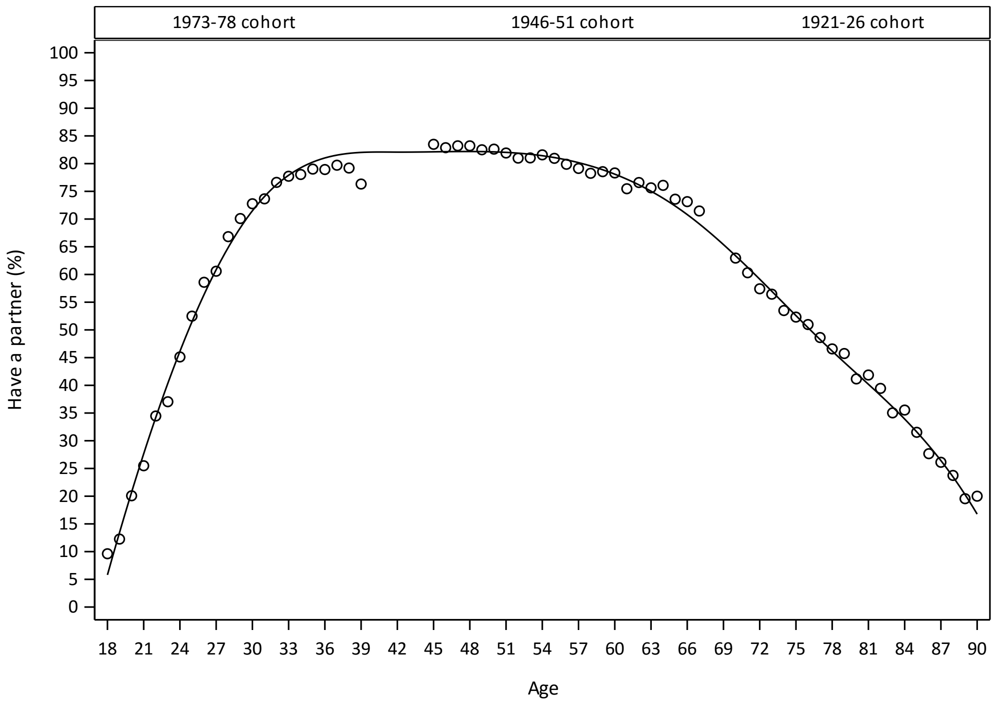

Figure 10-2: A model of the prevalence of women who have a partner by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

The model was then used to project the prevalence of Australian women aged 20-90 with a partner from 2015 to 2035. We assumed that the age-specific percentages of women who have partners were the same over the next twenty years. The age-specific estimates of partnership were then multiplied by the projected number of women aged 20-90 at every year from 2015 to 2035 to predict the number and percentage of women who had partners (Appendix C). For the population projections, we used data from the ABS (ABS, 2013). Briefly, the ABS produced three different scenarios (Series A, B, and C) for the Australian population from 2012 to 2011. Series B is based on current (at 2012) rates of fertility, life expectancy at birth, and net overseas migration. Series A assumes higher rates for all three characteristics, whereas Series C assumes lower fertility and net overseas migration rates and unchanged life expectancy.

Figure 10-3 shows that an estimated 6.2 million Australian women had a partner in 2015 and the number is projected to increase to 8.5 million (Series A), 8.2 million (Series B), and 8.0 million (Series C) by 2035. The percentage of women who have a partner does not differ much between the Population Projection Series and is expected to decrease very slightly over the next twenty years (Table 10-1).

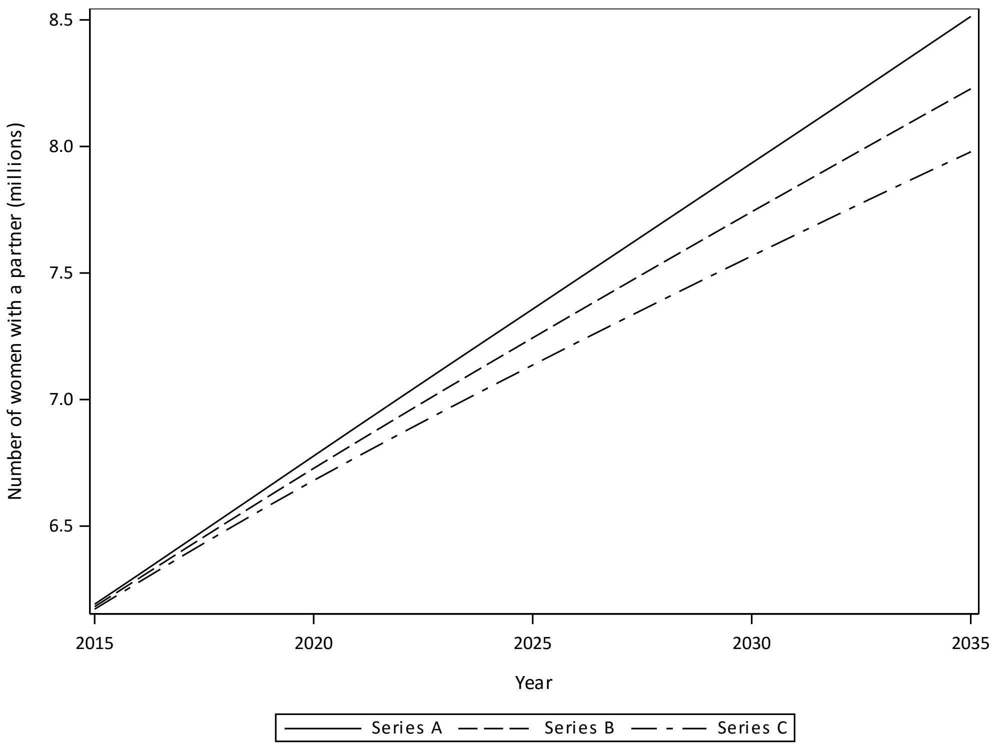

Figure 10-3: Number of Australian women aged 20-90 who have a partner (married or de facto) from 2015 to 2035.

Table 10-1: Projected number and prevalence of women with partners in Australia from 2015 to 2035.

Year	Population projection					
	Series A		Series B		Series C	
	n	%	n	%	n	%
2015	6,191,490	68.6	6,181,856	68.6	6,171,992	68.6
2020	6,777,032	68.6	6,728,203	68.6	6,680,351	68.6
2025	7,357,326	68.3	7,243,641	68.4	7,136,245	68.4
2030	7,934,331	67.8	7,741,746	67.8	7,567,320	67.7
2035	8,513,535	67.2	8,227,698	67.3	7,978,526	67.2

Figure 10-4 and 10-5 shows population pyramids of the estimated number of women aged 20-90 who are married or in a de facto relationship in the general population in 2015 and 2035, respectively.

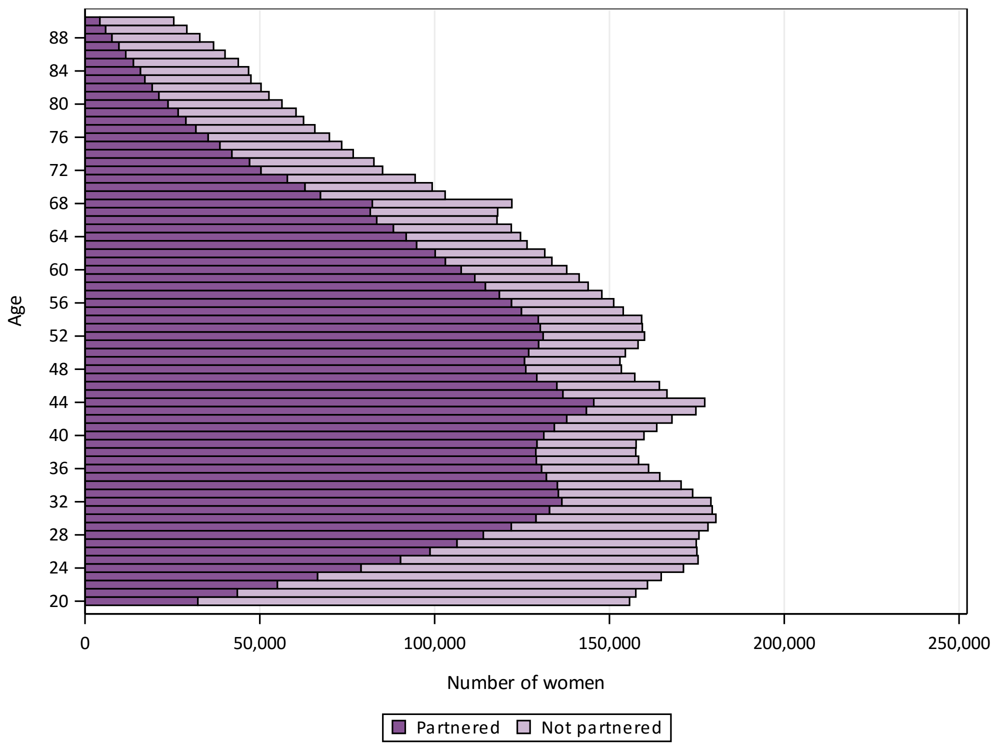

Figure 10-4: Projected numbers of partnered women in Australia by age in 2015 based on current population trends (Series B).

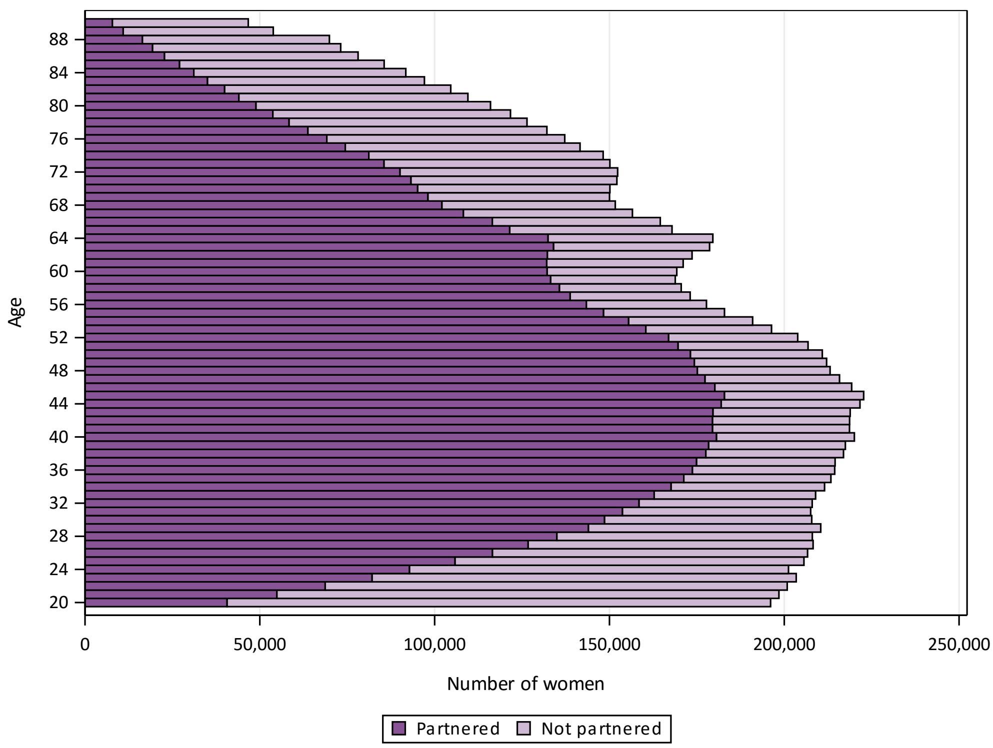

Figure 10-5: Projected numbers of partnered women in Australia by age in 2035 based on current population trends (Series B).

10.5. Association between having a partner and healthcare use and expenditure

The association between having a partner and healthcare utilisation was examined by comparing the mean number of MBS claims, PBS prescriptions filled, and hospital admissions accrued by women each year, and the cost of these services by married/de facto and unpartnered ALSWH participants.

10.5.1. Medicare Benefits Scheme

ALSWH survey data were linked to MBS data from 1996 to 2013 and this allowed us to determine the number of unreferred MBS claims made by each participant. 'Unreferred' means visits to a general practitioner without requiring a referral. To estimate the total unreferred MBS cost, the average cost of unreferred MBS services in 2014 (in 2014 Australian dollars) was obtained from the Department of Human Services statistical reporting database (Medicare Group Reports, 2016) and was reported to be $48.80. To estimate total costs, it was assumed that this average cost was the same for women who had a partner and those who were unmarried/single. The total unreferred MBS cost (in 2014 Australian dollars) for each participant for every year from 1996 to 2013 was calculated by multiplying the number of unreferred MBS claims by $48.80. Then, the annual unreferred MBS cost per woman by marital status was estimate (Appendix D, Section 15.1).

In the 1973-78 cohort, women who were married or in a de facto relationship made more unreferred MBS claims than unpartnered women at age 20, however there was little difference in claims from age 24 to 30 (Figure 10-6). At age 33 and 36, unpartnered women made 1 unreferred MBS claim more than partnered women.

In the 1946-51 cohort, unpartnered women made more unreferred MBS claims than partnered women across the study period, from age 47 to 64 (Figure 10-6). In contrast, there was little difference between the two groups in the 1921-26 cohort.

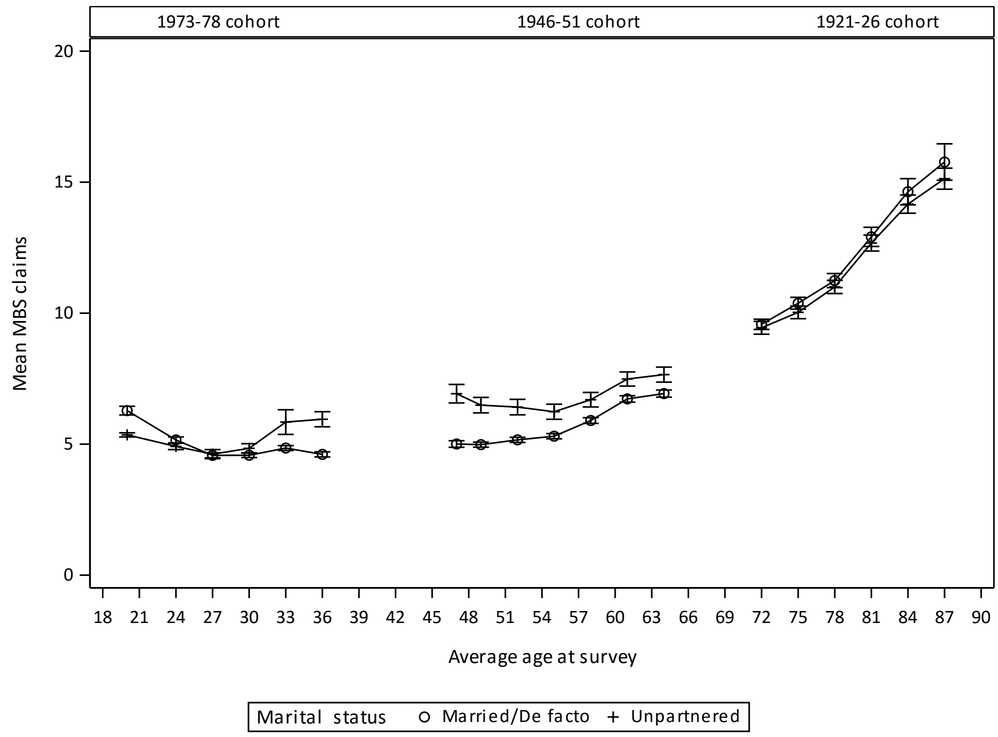

Figure 10-6: Comparison of average number of unreferred MBS claims per participant per year for the 1973-78, 1946-51, and 1921-26 cohorts by marital status.

10.5.2. Pharmaceutical Benefits Scheme

ALSWH data were linked to the latest available PBS dataset (2012-13 financial year), which provided a record for each PBS script that was filled and its associated cost for each participant. The average number of scripts filled and cost (in 2012-13 Australian dollars) was then determined by marital status (Appendix D, Section 15.2). Because the 2012-13 period corresponded to one survey per cohort, there are only three sets of data points.

In the 1973-78 cohort, unpartnered women aged 36 had almost double the number of PBS prescriptions filled compared with partnered women (Table 10-2). As a result, women who were unpartnered had a mean PBS cost of $461 (in 2012-13 Australian dollars) compared with $251 for women who were married or in a de factor relationship. There was little difference in PBS claims in the 1946-51 and 1921-26 cohorts. Unpartnered women aged 64 had $145 more PBS costs than partnered women whereas at age 87, partnered women had $309 more PBS costs than unpartnered women (although the number of PBS scripts filled did not differ much).

Table 10-2: Mean PBS claims and cost (in 2012-13 Australian dollars) per participant for the 1973-78, 1946-51, and 1921-26 cohorts by marital status.

		ALSWH Cohort		
		1973-78	**1946-51**	**1921-26**
Group	**Corresponding survey** **year** **average age (years)**	Survey 6 2012 36	Survey 7 2013 64	Survey 6 2011 87
Married/ de facto	Mean number of PBS claims per participant	5.0	22.4	55.5
	Mean PBS cost per participant ($)	251	890	2173
Unpartnered	Mean number of PBS claims per participant	9.5	24.9	54.0
	Mean PBS cost per participant ($)	461	1035	1864

10.5.3. Hospital costs

Due to the limitations of the hospital datasets available, the number of ALSWH participants who were hospitalised in NSW were used to determine differences in hospital admission and cost accrued by partnered and unpartnered women (Appendix D, Section 15.3). The NSW Admitted Patients dataset provided hospital admission of participants by Australian Refined Diagnosis Related Group (AR-DRG) codes that were then matched to the AR-DRG costs reported by the Independent Hospital Pricing Authority (IHPA).

In the 1973-78 cohort, partnered women accounted for approximately $1100 more in hospital cost per person (in 2012-13 Australian dollars) than unpartnered women, except at age 36 when the difference is reduced to $580 (Figure 10-7). This coincides with the peak child-bearing age for Australian women; 60 per cent of mothers who gave birth in 2012 were aged 25-34 (Hilder et al., 2014).

There was little difference in hospital cost for these two groups was found in the 1921-26 and 1946-51 cohorts.

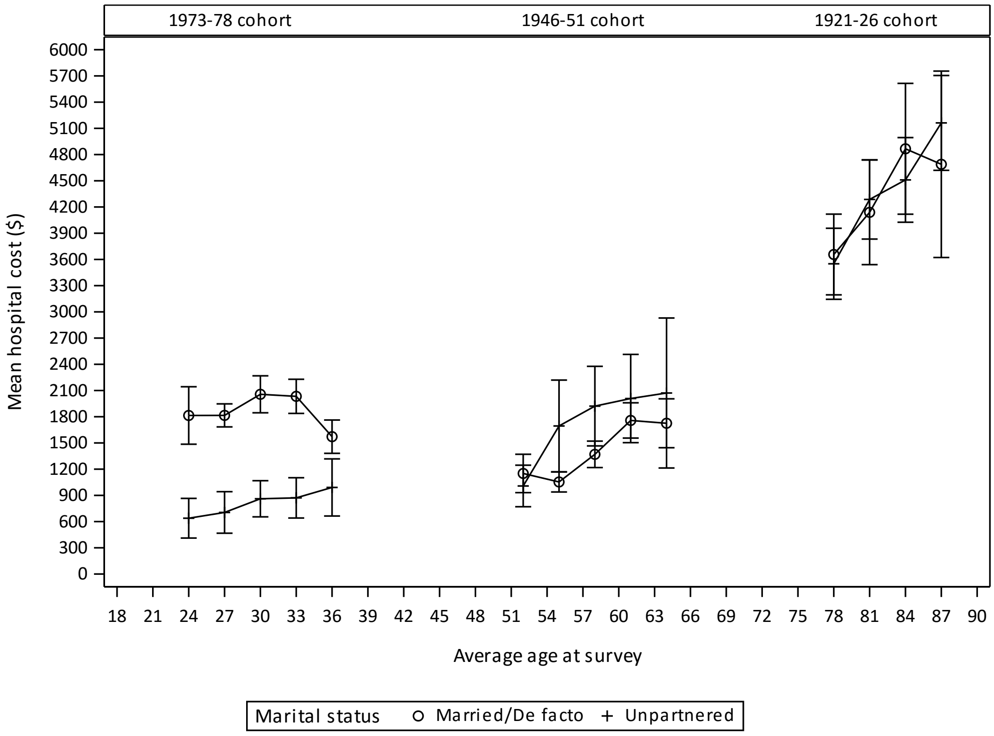

Figure 10-7: Comparison of average hospital costs in 2012-13 Australian dollars per participant per year for the 1973-78, 1946-51, and 1921-26 cohorts living in NSW by marital status.

10.6. Projected association between having a partner and healthcare utilisation

The association between having a partner and healthcare utilisation from 2015 to 2035 was examined. We compared the number of MBS claims, PBS prescriptions filled, and hospital admissions accrued by women each year and the cost of accessing these services for (a) the total population of women aged 20-90, (b) women who have a partner, and (c) women who do not have a partner. For MBS, PBS, and hospital projections, models were fitted to the data to estimate the number of claims and cost of each service for women at every age between 20 and 90, inclusive (Appendix E). The major assumption is that the number of MBS claims and cost (in 2014 Australian dollars), PBS claims and cost (in 2012-13 Australian dollars), and hospital costs (in 2012-13 Australian dollars) vary with age in the same way for every year between 2015 and 2035. The age-specific estimates for the number of claims and cost of each service were multiplied by the projected number of women aged 20 to 90 years at every year from 2015 to 2035, as well as by the prevalence of partnered and unpartnered women to predict the total number of claims and cost for MBS, PBS, and hospital services over the next twenty years (Appendix F).

10.6.1. Medicare Benefits Scheme

Women with a partner made an estimated 36.5 million unreferred MBS claims in 2015 at a cost of $1.8 billion (in 2014 Australian dollars) (Figure 10-8 and 10-9). By 2035, their unreferred MBS claims are predicted to increase to 50.6 million at a cost of $2.5 billion. For women who are unpartnered, the total unreferred MBS claims made in 2015 were estimated to be 21.1 million at a cost of $1.0 billion, which are predicted to increase to 32.1 million unreferred MBS claims and $1.6 billion in 2035.

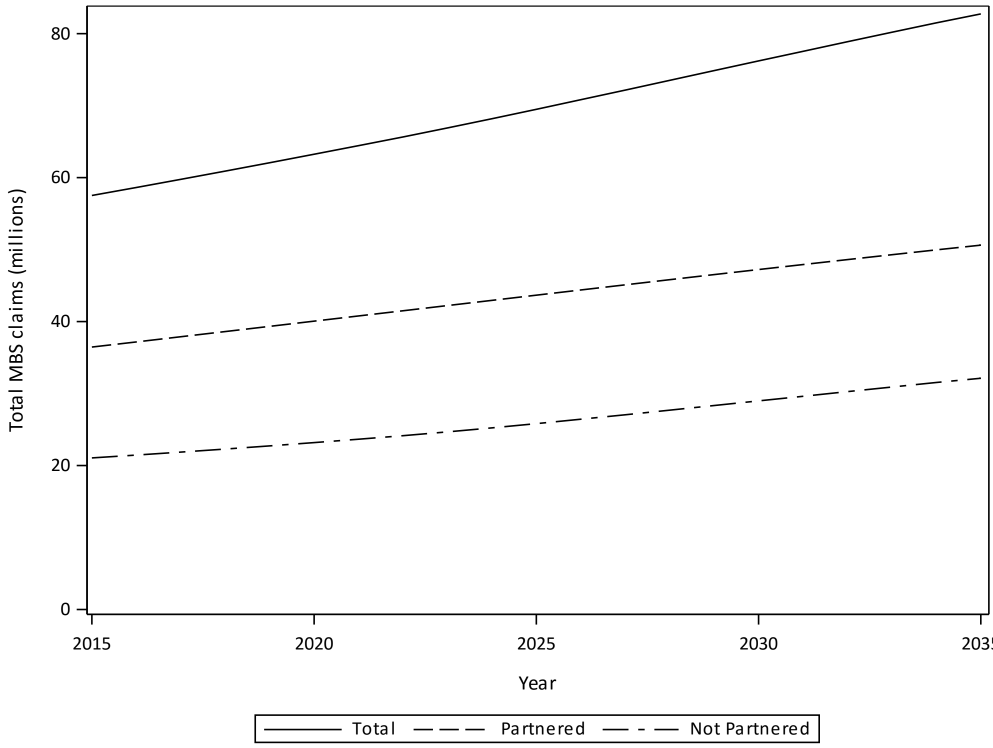

Figure 10-8: Projected number of unreferred MBS claims for Australian women aged 20-90 from 2015 to 2035, comparing women who have a partner with women who are unpartnered.

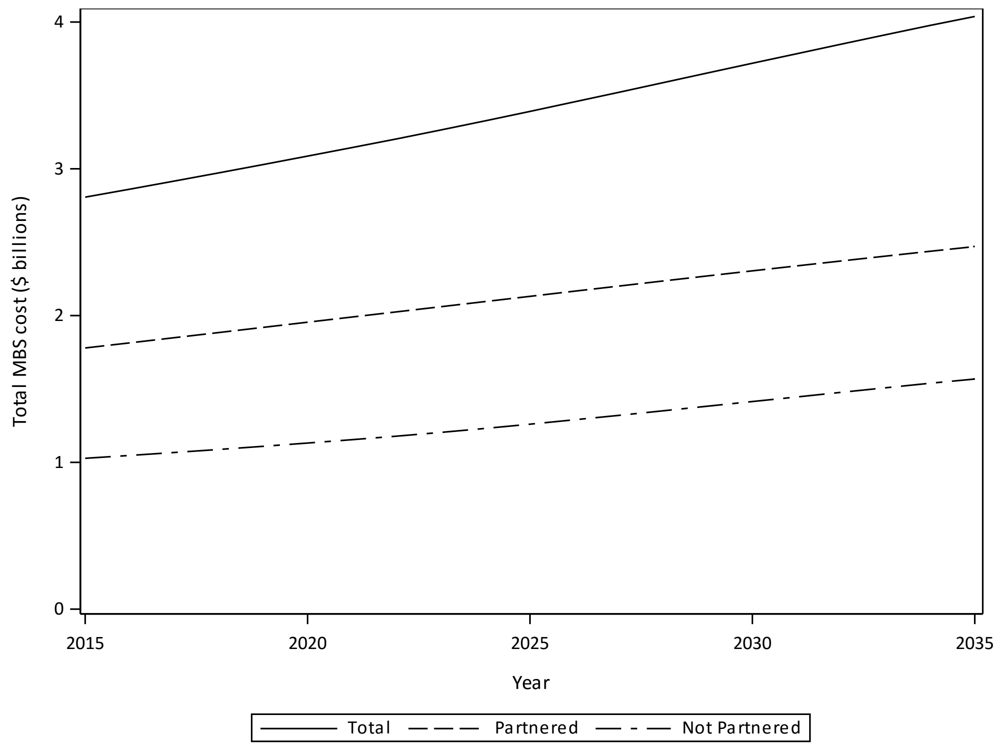

Figure 10-9: Projected total unreferred MBS cost (in 2014 Australian dollars) for women aged 20-90 from 2015 to 2035 for women who have a partner or are unpartnered.

10.6.2. Pharmaceutical Benefits Scheme

The total number of PBS prescriptions filled was estimated at 77 million for women with a partner and 56 million for women who were unpartnered in 2015 (Figure 10-10 and 10-11). This is predicted to increase to 114 million and 92 million in 2035, respectively. The estimated total PBS cost in 2015 was $3.3 billion (in 2012-13 Australian dollars) for women who had a partner and $2.3 billion for women who did not have a partner. The projections show that in 2035, these costs are expected to increase to $4.7 billion (in 2012-13 Australian dollars) and $3.6 billion, respectively.

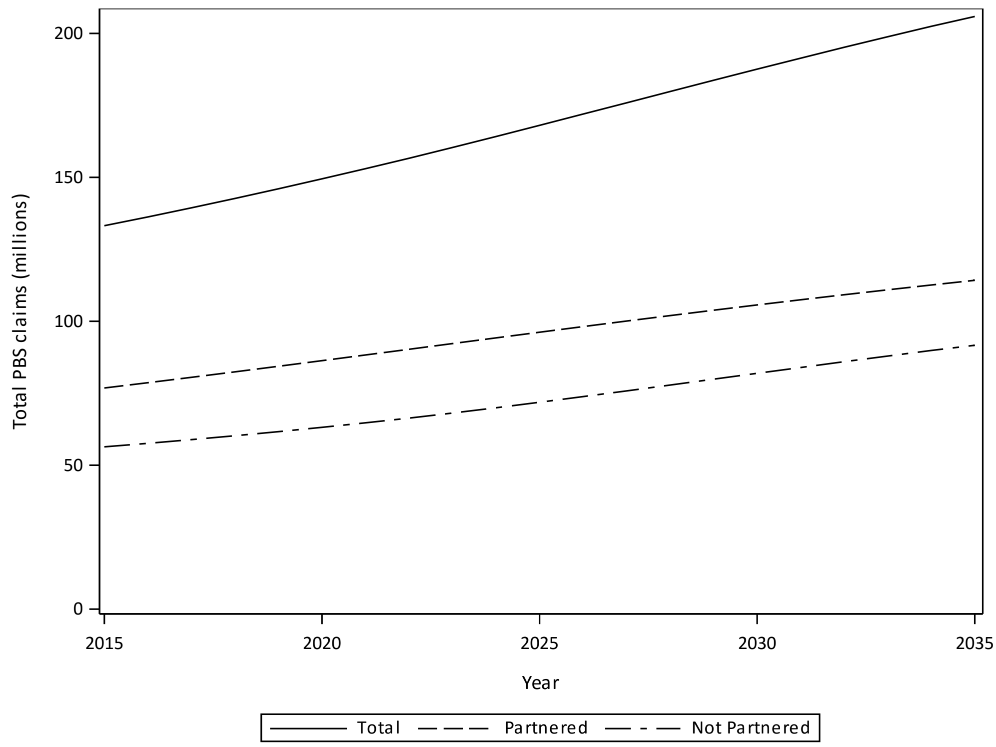

Figure 10-10: Projected total number of PBS claims for Australian women aged 20-90 from 2015 to 2035 for women with and without a partner.

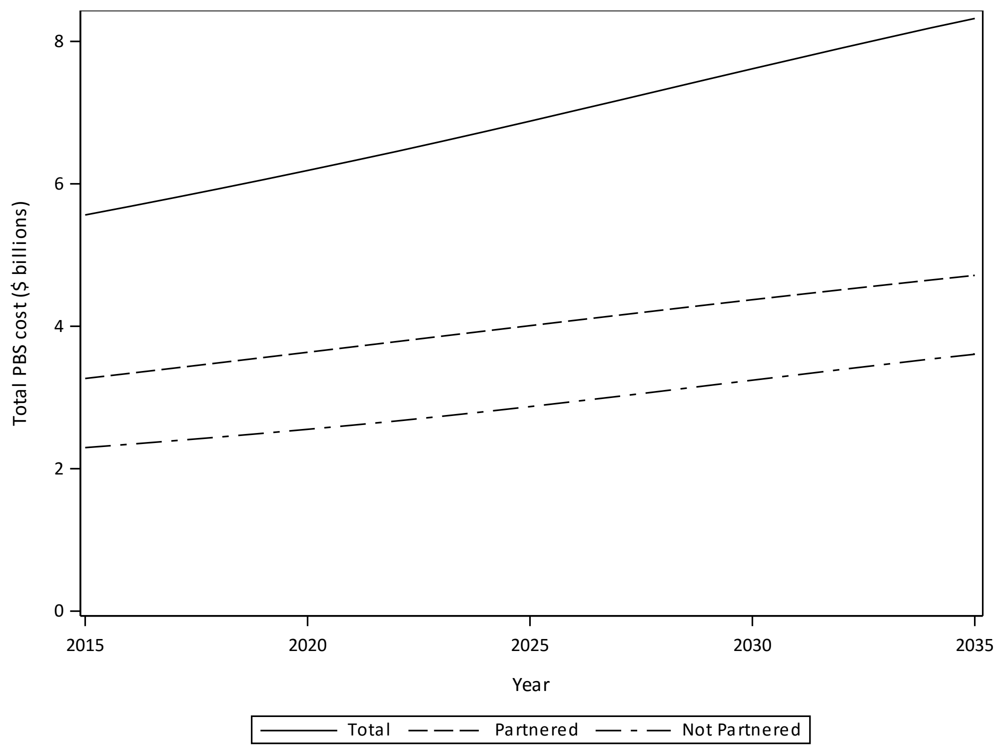

Figure 10-11: Projected total PBS cost (in 2012-13 Australian dollars) for women aged 20-90 from 2015 to 2035 for women with and without a partner.

10.6.3. Hospital costs

Women who have a partner were estimated to have $10.2 billion (in 2012-13 Australian dollars) in total hospital costs in 2015 and by 2035, this is predicted to increase to $14.2 billion (Figure 10-12). In comparison, women who do not have a partner were estimated to have $5.1 billion in hospital costs in 2015 and this is projected to increase to $8.2 billion in 2035.

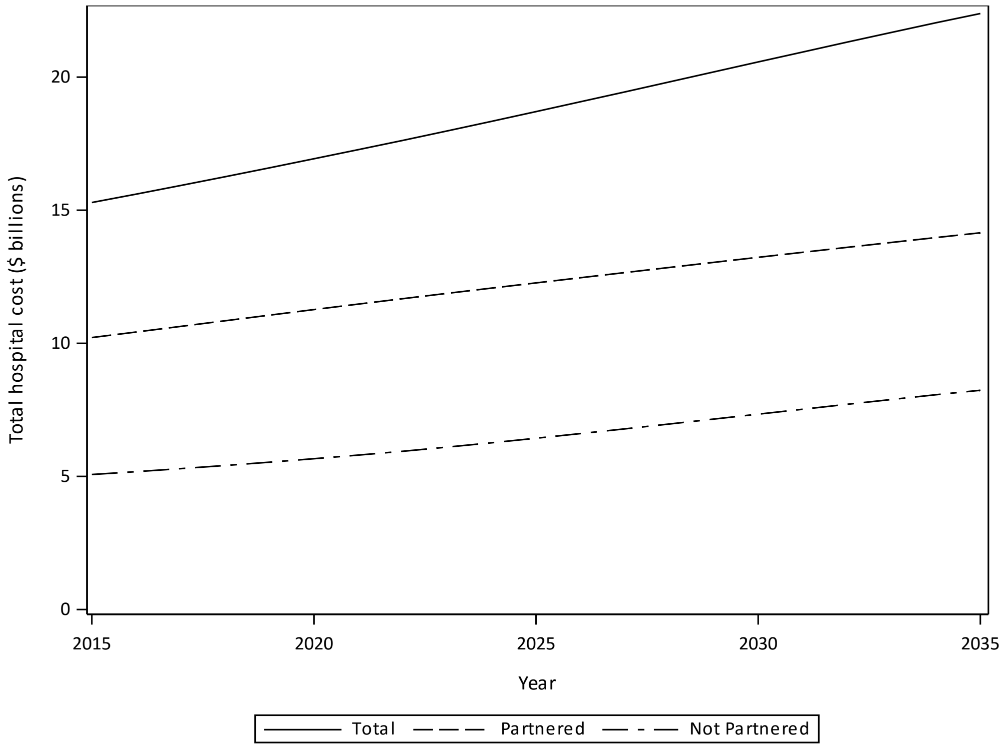

Figure 10-12: Projected total hospital cost in 2012-13 Australian dollars for women aged 20-90 from 2015 to 2035, comparing women with and without a partner.

10.7. Summary points

- The prevalence of women who have a partner increased from early adulthood until the late thirties.
- By middle age, approximately 80 per cent of women were married or were in a de facto relationship.
- The percentage of women who are divorced increases with age in the 1946-51 cohort, and the percentage of women who are widowed increases in the 1921-26 cohort.
- The number of women aged 20-90 who have partners is projected to increase from 6.2 million in 2015 to 8.2 million in 2035, however the prevalence will remain stable at approximately 67 per cent.
- There were some differences for MBS, PBS, and hospital claims and cost between partnered and unpartnered women, but these decreased with age.

- In 2035, the MBS, PBS, and hospital costs for women with a partner will be \$1.6 billion, \$4.8 billion, and \$14.2 billion, respectively.

11. Area of residence

11.1. Background

In this chapter, area of residence was determined using the Accessibility/Remoteness Index of Australia (ARIA+) system that was released in 2003 by the National Key Centre for Social Applications of Geographic Information Systems (GISCA). It allows categorisation of participants by major city, inner regional, outer regional, and remote areas of Australia.

It is clear that there are disparities in health and access to health services between people living in major cities and those who live in rural areas. People living in rural and remote areas have a higher risk of heart failure (Sahle et al., 2016) and mortality from chronic diseases (Chondur et al., 2014). Research from ALSWH has also demonstrated that women in rural or remote areas had a higher risk of mortality (Dobson et al., 2010; Vagenas, McLaughlin & Dobson, 2009), and of being overweight or obese (Brown et al., 2000) whereas women living in major cities reported higher levels of stress (Brown, Young & Byles, 1999). However, women in rural areas also reported having fewer visits to the general practitioner and medical specialists (Vagenas, McLaughlin & Dobson, 2009). This may also explain why people in rural areas were more likely to be diagnosed with advanced stage cancer compared to those who live in metropolitan areas (Baade et al., 2015; Nguyen-Pham, Leung & McLaughlin, 2014).

11.2. Characteristics of ALSWH participants by area of residence

ALSWH was designed to have proportionately more women living in rural and remote areas than in capital cities, in order to obtain reliable estimates of their health and service needs. For the three cohorts surveyed in 1996, women in rural and remote areas were purposely sampled at twice the rate of women in urban areas (Lee et al., 2005). However, participants in the 1989-95 cohort were recruited by a different method and are more geographically representative of the Australian population in their age group (Mishra et al., 2014). The percentages of ALSWH participants classified by area of residence using the ARIA+ classification is shown in Figure 11-1.

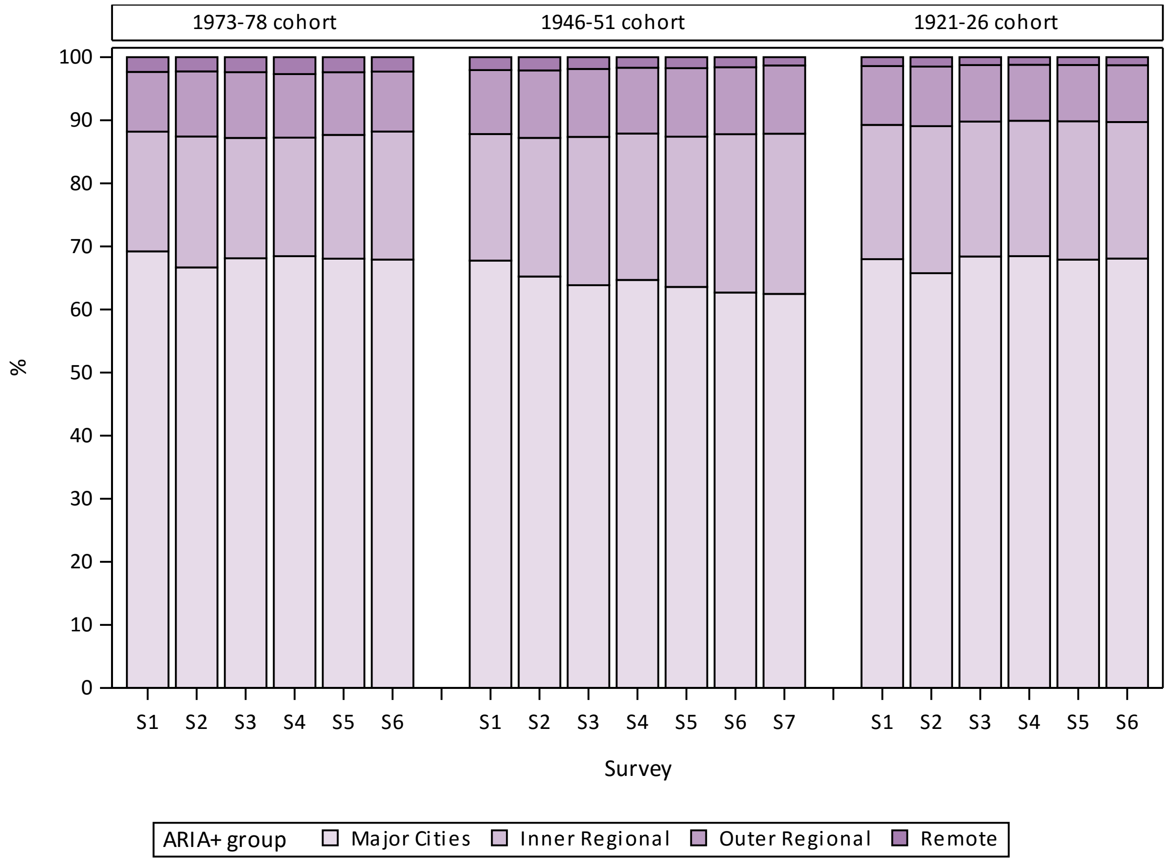

Figure 11-1: Percentage of women in each ARIA+ category at each survey for the 1973-78, 1946-51, and 1921-26 cohorts.

Although the ALSWH study covers the majority of an adult lifespan, there are no data for two age ranges, 36-47 years and 64-72 years. Due to the oversampling of women from rural and remote areas at the start of the study, for this report another resource was used to characterise area of residence for Australian women throughout adulthood.

11.3. Population characteristics by area of residence

Data from the 2011 Australian Census data were used to determine the percentages of women aged 20-90 living in different areas of residence (Appendix A). Table 11-1 shows that almost three-quarters of Australian women aged 20-90 live in a major city and one-fifth reside in an inner regional area.

Table 11-1: Data from the 2011 Australian Census: Australian women aged 20-90 categorised by area of residence.

Category	Number	Per cent
Major Cities	5,721,729	70.6
Inner Regional	1,493,418	18.4
Outer Regional	711,212	8.8
Remote	159,594	2.0
Other	17,207	0.2

Figure 11-2 shows that approximately 75 per cent of young women aged up to 30 years lived in a major city and this gradually decreased to 65 per cent at the age of 69 years when the percentage increased again.

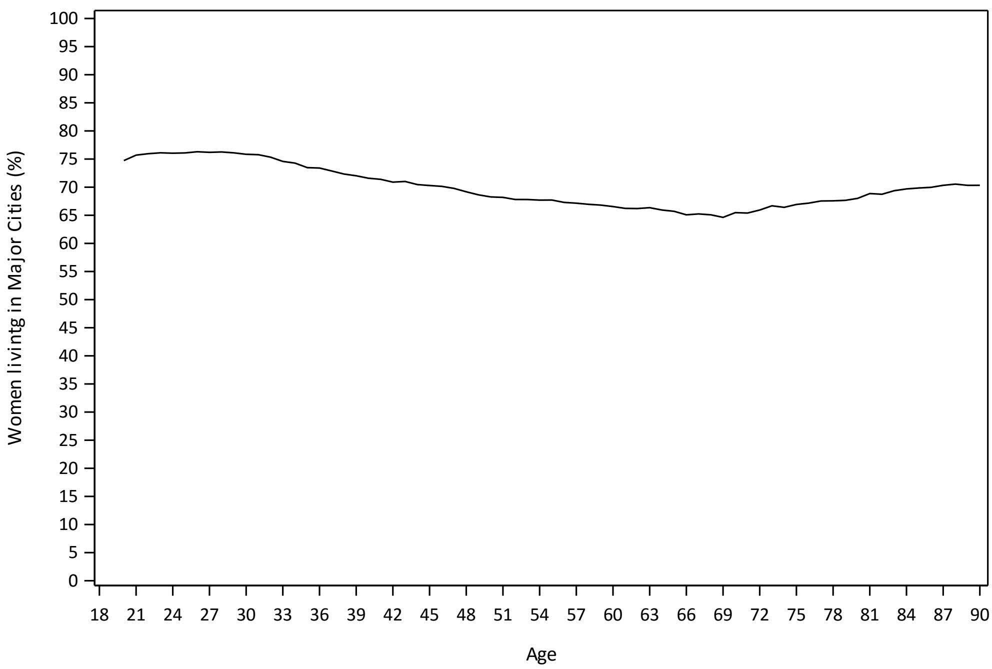

Figure 11-2: Data from the 2011 Australian Census: Prevalence of Australian women aged 20-90 who lived in a major city.

11.4. Projections of prevalence of city living over the next 20 years

Assuming that the age-specific prevalence of women living in a major city remained the same over the next 20 years, the number and percentage of Australian women aged 20-90 who live in a major city was projected from 2015 to 2035. The age-specific estimates for women living in the city were multiplied by the projected number of women aged 20 to 90 years at every year from 2015 to 2035 to predict the number and percentage of women who lived in a major city (Appendix C). Briefly, the ABS produced three different scenarios (Series A, B, and C) for the Australian population from 2012 to 2011. Series B is based on current (at 2012) rates of fertility, life expectancy at birth, and net overseas migration. Series A assumes higher rates for all three characteristics, whereas Series C assumes lower fertility and net overseas migration rates and unchanged life expectancy.

Figure 11-3 and Table 11-2 show that an estimated 6.3 million women lived in a major city in 2015 and this is predicted to increase to 8.9 million (series A), 8.6 million (series B), and 8.3 million (series C) by 2035. The prevalence of women living in a major city is predicted to remain relatively constant from 2015 to 2035 at approximately 70.3-70.6 per cent (Figure 11-4, Table 11-2).

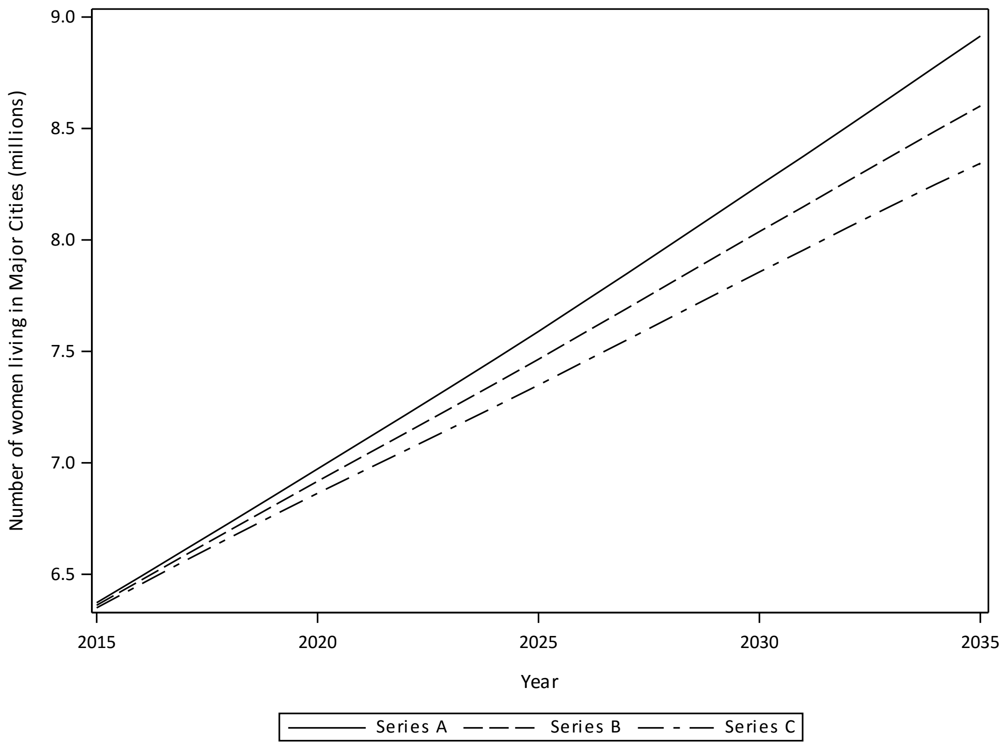

Figure 11-3: Projected number of Australian women aged 20-90 who live in a major city from 2015 to 2035

Table 11-2: Projected number and prevalence of women in Australia who live in a major city from 2015 to 2035.

Year	Population projection					
	Series A		Series B		Series C	
	n	%	n	%	n	%
2015	6,372,529	70.6	6,361,196	70.6	6,349,592	70.6
2020	6,972,809	70.6	6,917,460	70.5	6,863,533	70.5
2025	7,589,514	70.5	7,464,751	70.4	7,348,955	70.4
2030	8,245,172	70.4	8,037,394	70.4	7,856,239	70.3
2035	8,914,410	70.4	8,600,945	70.4	8,343,655	70.3

Figures 11-4 and 11-5 show population pyramids for Australian women aged 20-90 and the numbers of women who live in a major city and those who do not, in 2015 and 2035.

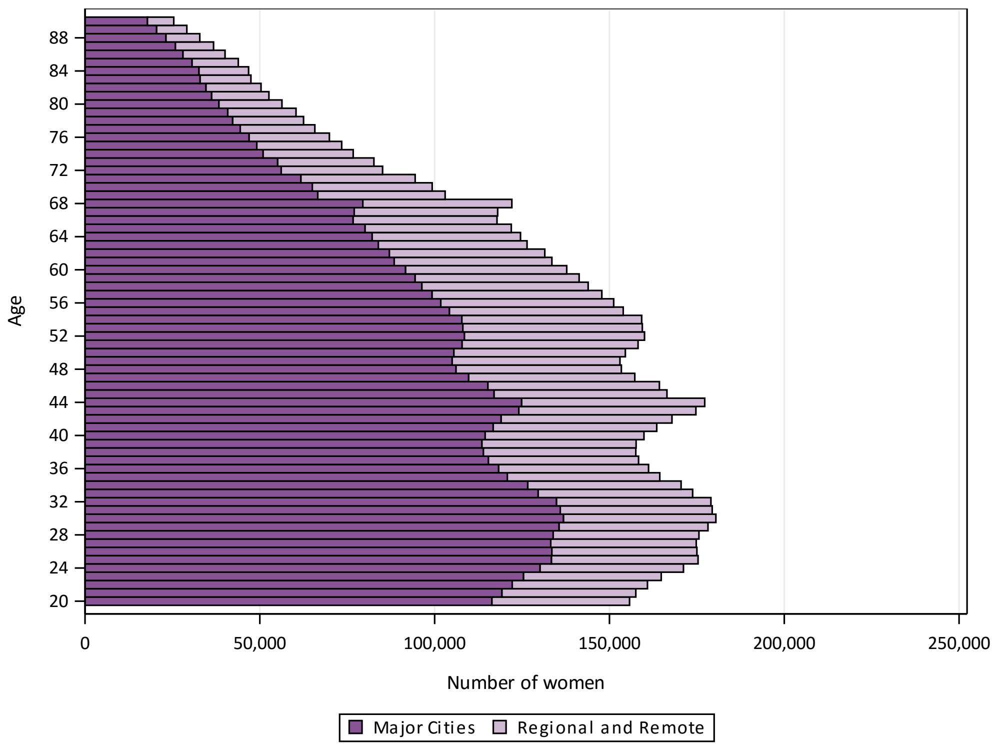

Figure 11-4: Projected numbers of Australian women aged 20-90 who live in a major city in 2015 based on current population data (Series B).

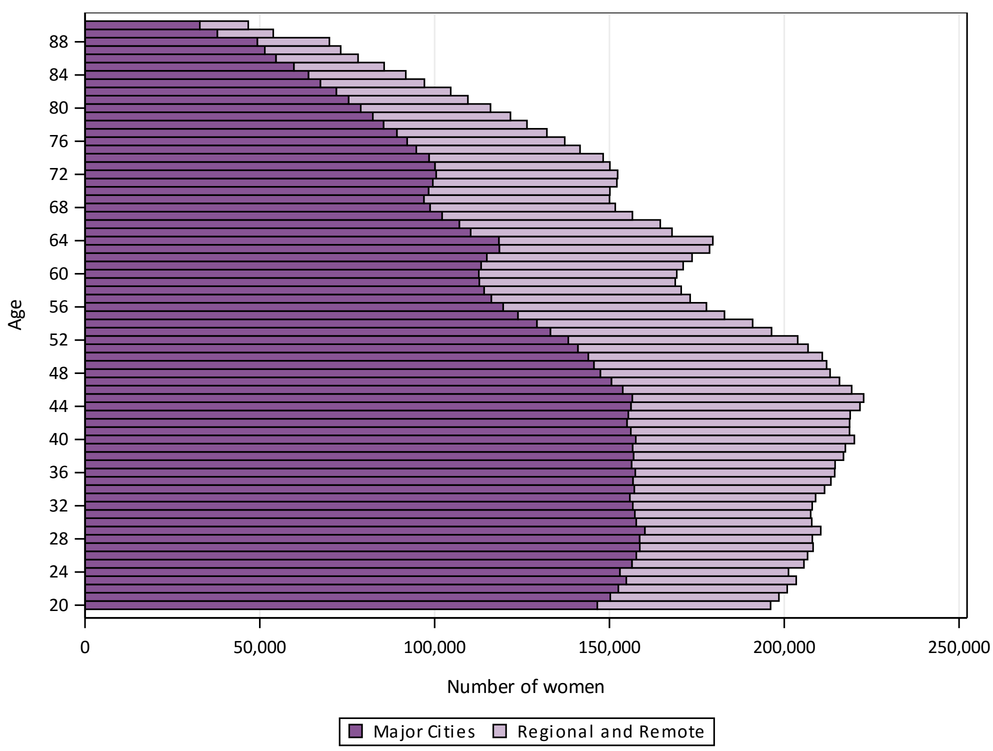

Figure 11-5: Projected numbers of Australian women aged 20-90 who live in a major city by age in 2035 based on current population data (Series B).

11.5. Association between area of residence and healthcare use and expenditure

The association between area of residence and healthcare utilisation was examined by comparing the mean number of MBS claims, PBS prescriptions filled, and hospital admissions accrued by women each year and the cost of these services by area of residence in ALSWH participants.

11.5.1. Medicare Benefits Scheme

Survey data were linked to MBS data from 1996 to 2013 and this allowed us to estimate the number of unreferred MBS claims made by each participant. 'Unreferred' means visits to a general practitioner without requiring a referral. To estimate the total unreferred MBS cost, the average cost of unreferred MBS services in 2014 (in 2014 Australian dollars) was obtained from the Department of Human Services statistical reporting database (Medicare Group Reports, 2016) and was reported to be \$48.80 per visit. The total unreferred MBS cost (in 2014 Australian dollars) for each participant for every year from 1996 to 2013 was estimated by multiplying the number of unreferred MBS claims by \$48.80. Then, the annual MBS cost per participant by area of residence was estimated (Appendix D, Section 15.1).

For all cohorts, women who lived in a major city made 1-2 more MBS claims than women who lived in a regional or remote area (Figure 11-6). This is in agreement with previous research from ALSWH that showed, for example, older women in regional or remote areas were less likely to consult a general practitioner than women who live in a major city (Byles et al., 2006).

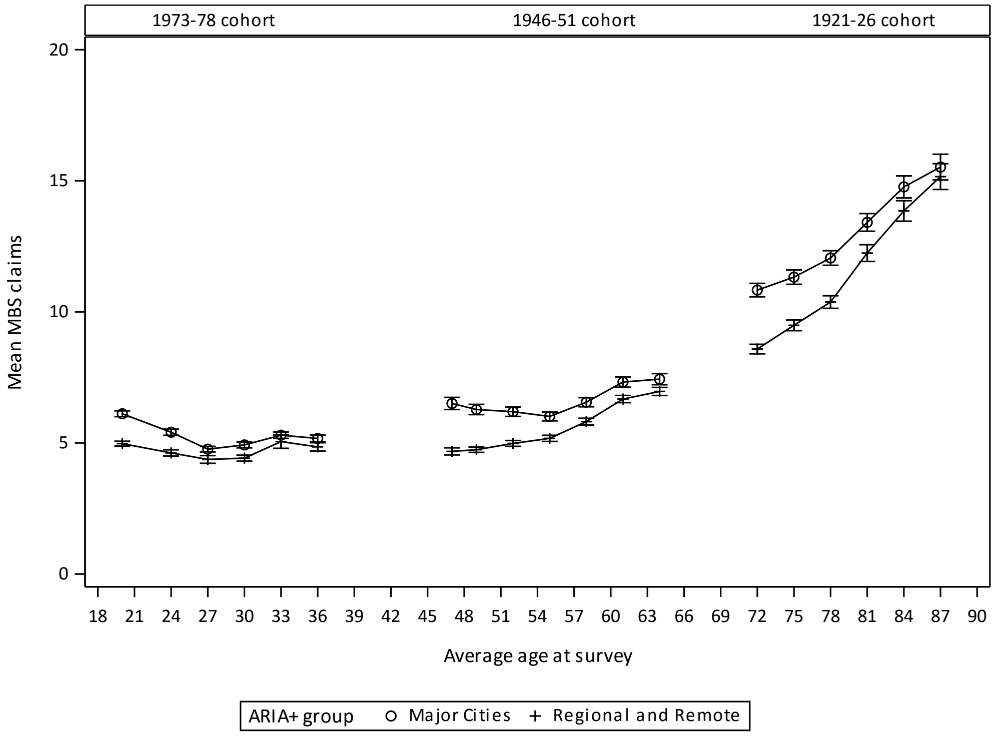

Figure 11-6: The mean number of unreferred MBS claims per year by average age at survey and categorised by area of residence for all cohorts (1973-78, 1946-51, and 1921-26).

11.5.2. Pharmaceutical Benefits Scheme

ALSWH data were linked to the latest available PBS dataset (2012-13 financial year), which provided a record for each PBS script that was filled and its associated cost for each participant. The average number of scripts filled and cost (in 2012-13 Australian dollars) was then determined by area of residence (Appendix D, Section 15.2). Because the 2012-13 period corresponded to one survey per cohort, there are only three sets of data points.

There is little difference in the number of PBS prescriptions filled between women who lived in a major city and those who lived in regional and remote areas for all cohorts (Table 11-3). Women who lived in the city had $50-107 more in PBS cost (in 2012-13 Australian dollars) than women who lived in regional and remote areas.

Table 11-3: Mean PBS claims and cost (in 2012-13 Australian dollars) per participant for the 1973-78, 1946-51, and 1921-26 cohorts by area of residence.

		ALSWH Cohort		
		1973-78	**1946-51**	**1921-26**
Group	**Corresponding survey**	Survey 6	Survey 7	Survey 6
	Year	2012	2013	2011
	Average age (years)	36	64	87
Major city	Mean number of PBS claims per participant	5.8	22.2	56.0
	Mean PBS cost per participant ($)	337	994	1975
Regional and remote	Mean number of PBS claims per participant	6.5	23.7	53
	Mean PBS cost per participant ($)	263	887	1925

11.5.3. Hospital services

Due to the limitations of the hospital datasets available, the numbers of ALSWH participants who were hospitalised in NSW were used to determine differences in hospital admission and cost accrued by area of residence (Appendix D, Section 15.3). The NSW Admitted Patients dataset provided hospital admission of participants by Australian Refined Diagnosis Related Group (AR-DRG) codes that were then matched to the AR-DRG costs reported by the Independent Hospital Pricing Authority (IHPA).

There was little difference in hospital costs between women who lived in a major city and those who lived in regional and remote areas for the 1973-78 and 1946-51 cohorts (Figure 11-7). In the 1921-26 cohort, women who lived in major cities had higher hospital costs than women who lived in regional and remote areas; the difference was $225-920 (in 2012-13 Australian dollars).

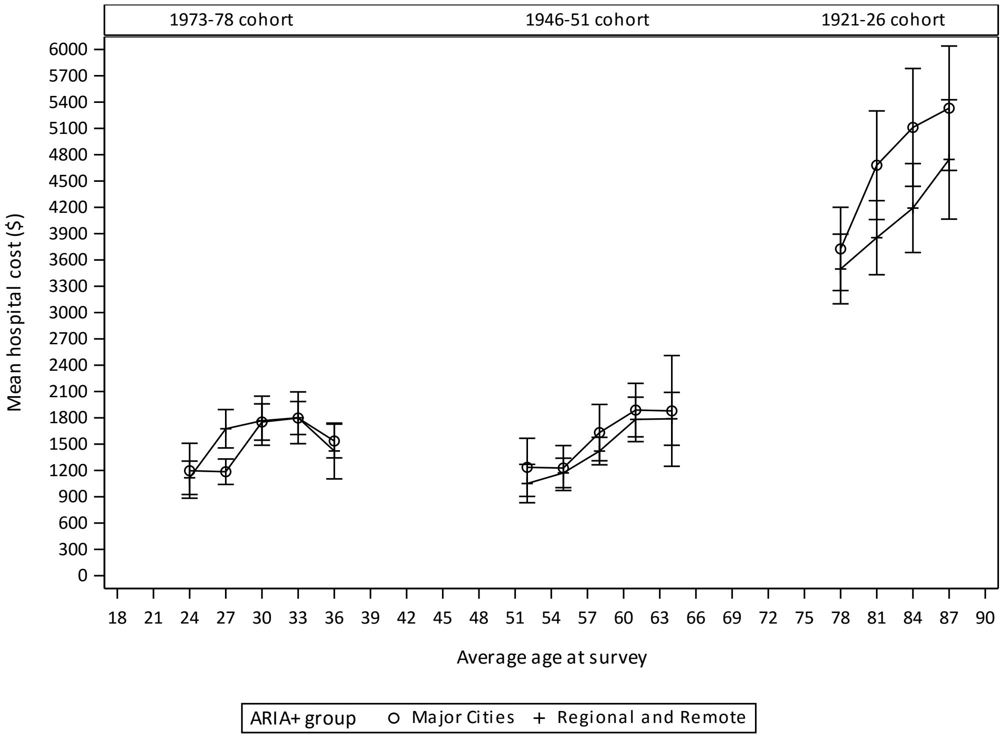

Figure 11-7: The mean hospital cost (in 2012-13 Australian dollars) by average age at survey and categorised by area of residence for all cohorts (1973-78, 1946-51, and 1921-26).

AIHW examined age-standardised per person health expenditure in 2006-07 by remoteness, focussing on admitted patient (i.e. hospital) services, MBS, and PBS (AIHW, 2011b). They reported that people living in a major city had the highest MBS and PBS expenses and lowest hospital cost, however the opposite was true for people living in remote and very remote areas. They noted that it is difficult to compare health expenditure by remoteness due to differences in healthcare services, e.g. nurse and community centres tend to be the first point of contact for general medical issues, equivalent to GPs in major cities.

11.6. Projected healthcare utilisation by area of residence.

Based on the trends identified in section 11.5, the association between area of residence and healthcare utilisation from 2015 to 2035 was examined. We compared the number of MBS claims, PBS prescriptions filled, and hospital admissions accrued by women each year and the cost of these services for (a) the total population of women aged 20-90, (b) women who lived in a major city, and (c) women who lived in regional and remote areas. For MBS, PBS, and hospital projections, models were fitted to the ALSWH data to estimate the number of claims and cost of each service for women at every age between 20 and 90, inclusive (Appendix E). These estimates were then multiplied by the population distribution shown in Figure 11-2 from the 2011 Australian Census. The major assumption is that the number of MBS claims and cost (in 2014 Australian dollars), PBS claims and cost (in 2012-13 Australian dollars), and hospital costs (in 2012-13 Australian dollars) that vary with age in the same way for every year between 2015 and 2035. The age-specific estimates for the number of claims and cost of each service were multiplied by the projected number of women aged 20 to 90 years at every year from 2015 to 2035, as well as by the prevalence of women who live in a major city and those who live in a regional or remote area to predict the total number of claims and cost for MBS, PBS, and hospital services over the next twenty years (Appendix F).

11.6.1. Medicare Benefits Scheme

For women who live in a major city, the total number of unreferred MBS claims is predicted to increase from 40.5 million in 2015 to 58.3 million in 2035; this corresponds to a total unreferred MBS cost of $2.0 billion increasing to $2.8 billion (in 2014 Australian dollars), respectively (Figure 11-8 and 11-9). Women who live in regional or remote areas are calculated to have a total of 16.3 million unreferred MBS claims in 2015 and this is predicted to increase to 23.7 million in 2035. The total unreferred MBS cost for these women is projected to increase from $0.8 billion to $1.2 billion from 2015 to 2035.

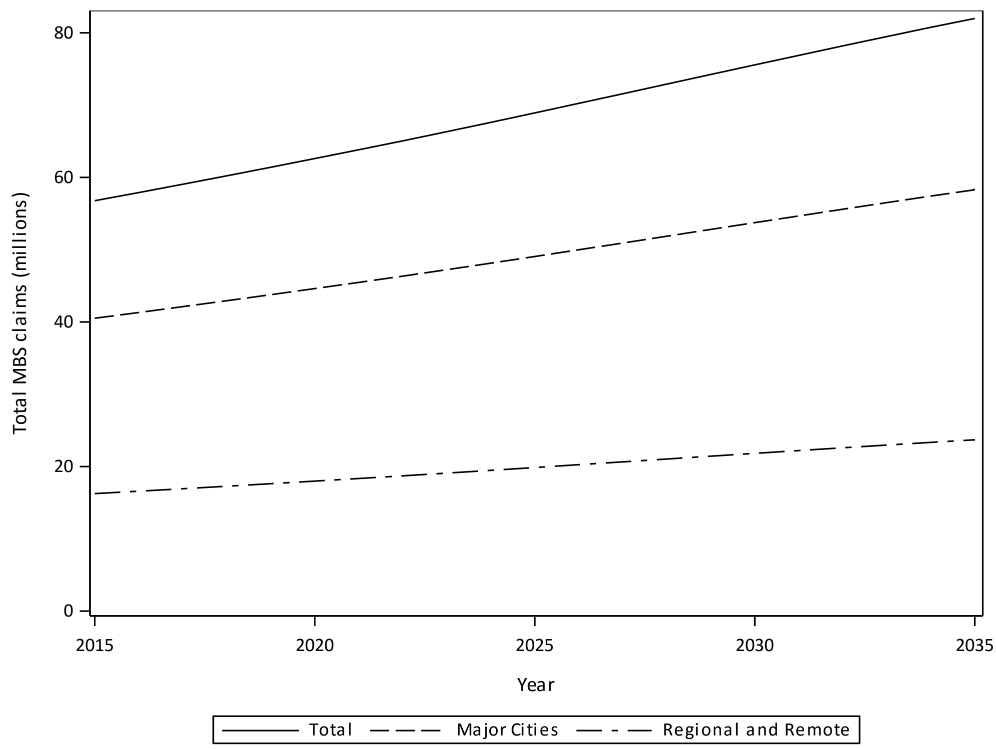

Figure 11-8: Projected total number of unreferred MBS claims for Australian women aged 20-90 from 2015 to 2035 by area of residence.

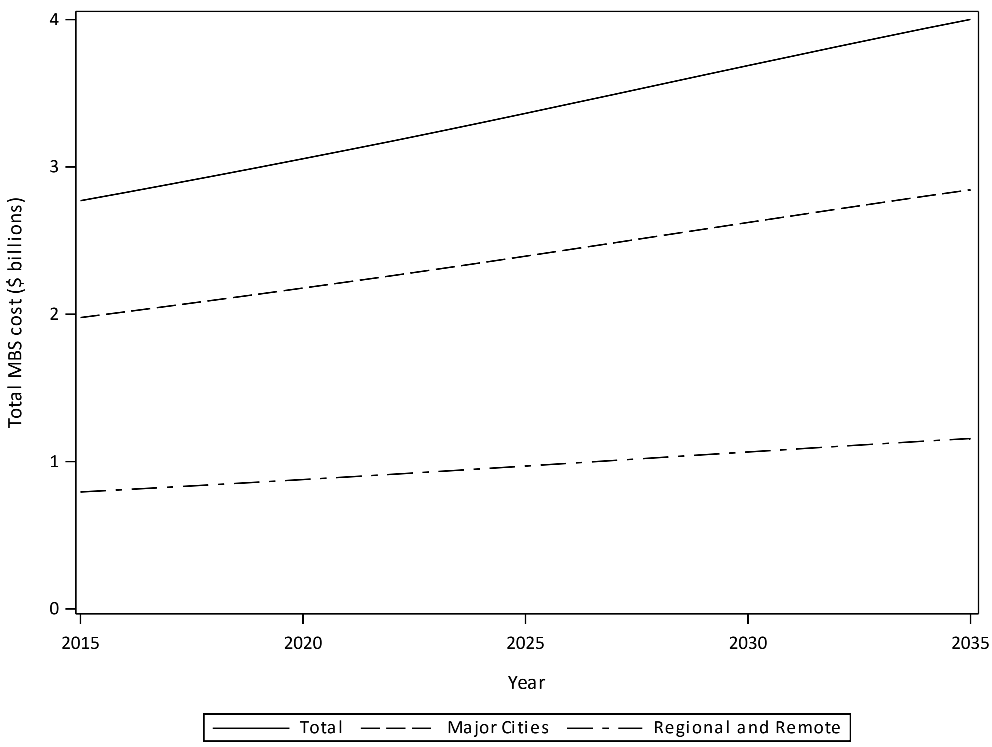

Figure 11-9: Projected total unreferred MBS cost (in 2014 Australian dollars) for Australian women aged 20-90 from 2015 to 2035 by area of residence.

11.6.2. Pharmaceutical Benefits Scheme

The total PBS claims made by women who live in a major city is predicted to increase from 90.5 million to 138.4 million from 2015 to 2035 (Figures 11-10 and 11-11). As a result, the total PBS cost is estimated to be $4.1 billion in 2015 and $6.1 billion in 2035 (in 2012-13 Australian dollars), respectively. For women who live in regional and remote areas, the total number of PBS claims was estimated to be 42.2 million in 2015 at a cost of $1.6 billion (in 2012-13 Australian dollars); this is predicted to increase to 66.0 million PBS claims and $2.5 billion in 2035.

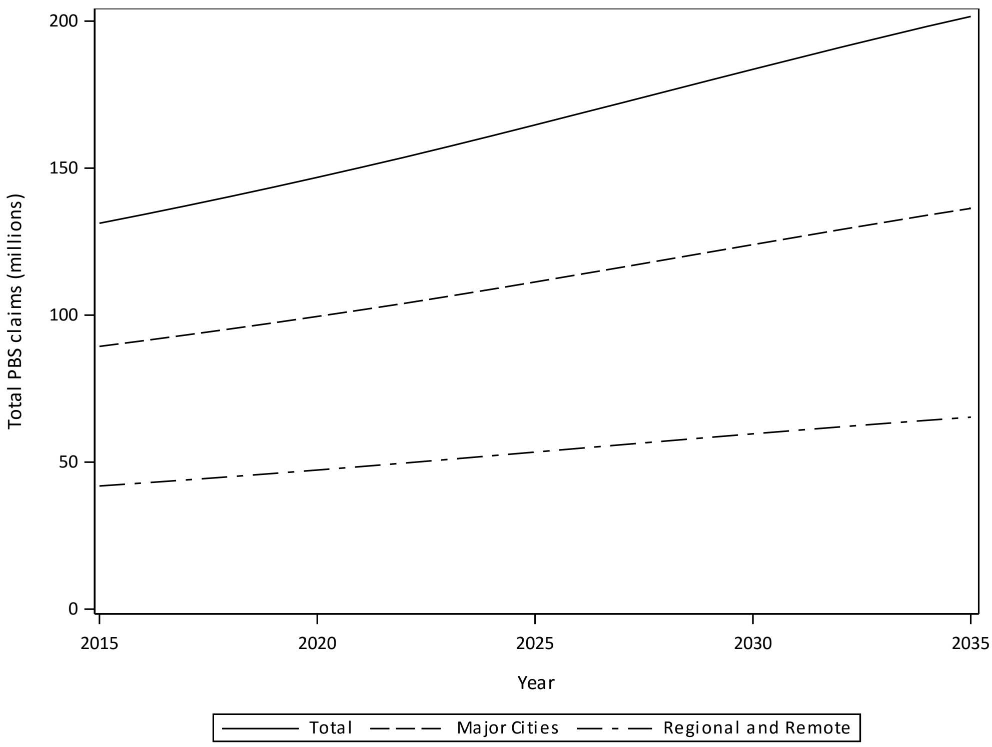

Figure 11-10: Projected number of PBS claims for Australian women aged 20-90 from 2015 to 2035 by area of residence.

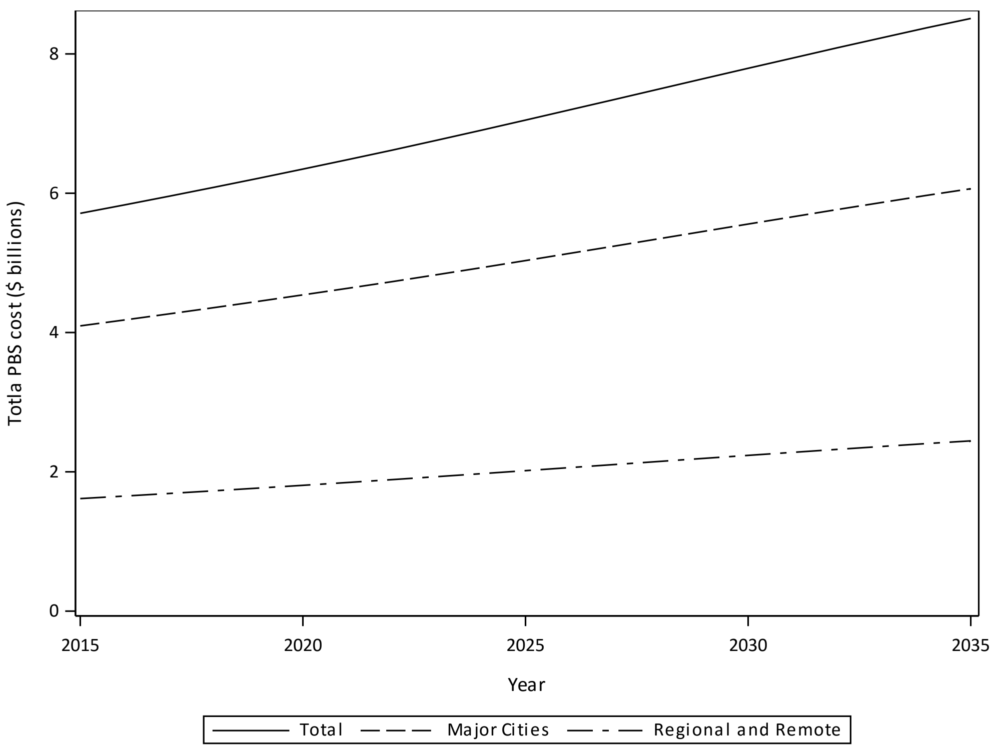

Figure 11-11: Projected total PBS cost (in 2012-13 Australian dollars) for Australian women aged 20-90 from 2015 to 2035 by area of residence.

11.6.3. Hospital services

The total hospital costs are predicted to increase from $11.7 billion in 2015 to $17.1 billion (in 2012-13 Australian dollars) in 2035 for women who live in a major city (Figure 11-12). In comparison, the total hospital cost for women who live in a regional or remote area is estimated to be $4.6 billion in 2015 and $6.7 billion in 2035.

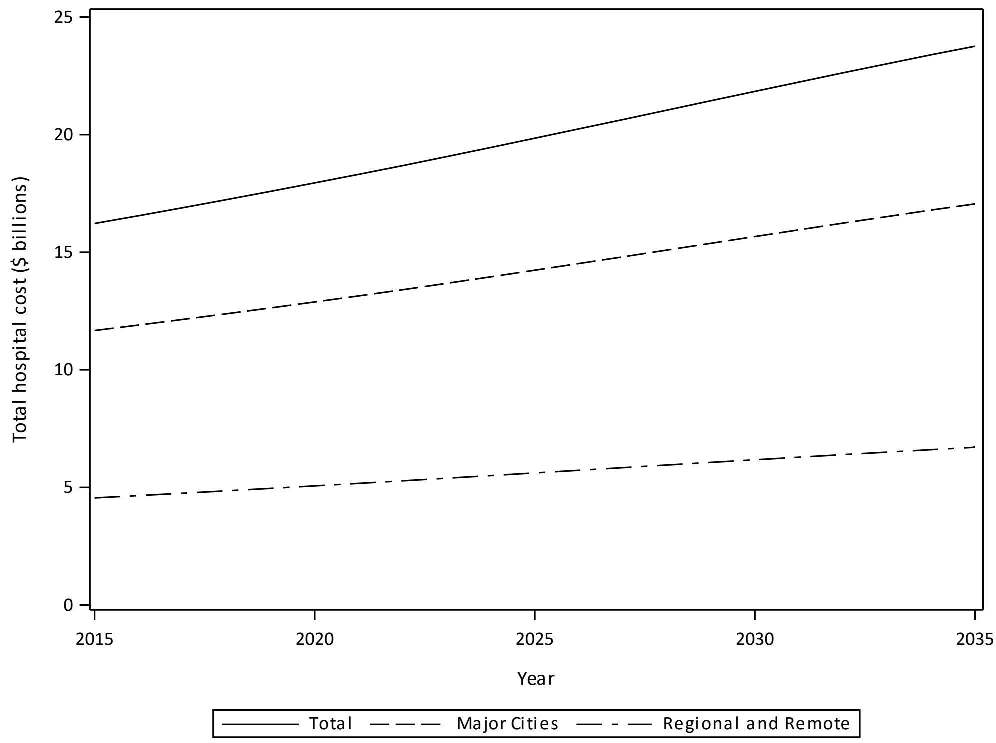

Figure 11-12: Projected total hospital cost (in 2012-13 Australian dollars) for Australian women aged 20-90 from 2015 to 2035 by area of residence.

11.7. Summary points

- The prevalence of women who live in a major city (approximately 70 per cent), inner regional areas (20 per cent), and outer region and remote areas (10 per cent) are relatively stable across the lifespan.
- Between the age of 45 and 65, the prevalence of women living in a major city decreased as the prevalence of women living in an inner regional area increased.
- Although the number of women who live in a major city will increase from 6.3 million in 2015 to 8.6 million in 2035, the prevalence of women who live in a major city will remain stable at 70 per cent.
- There was little difference in MBS and PBS claims and cost between women who live in a major city and those who lived in a regional or remote area.

- Hospital costs were higher for older women living in a major city than those who live in a regional or remote area.
- The projected MBS, PBS, and hospital costs in 2035 will be \$0.8 billion, \$2.0 billion, and \$5.4 billion more than that of 2015.

12. Appendix A: Survey questions and participation numbers

The survey questions used in this report and the number of participants whose data was used in each chapter for modelling the health condition of interest across the lifespan is presented in Appendix A.

12.1. Physical function and needing help with activities of daily living

As described in Section 3.2, the SF-36 instrument from which a Physical Functioning (PF) score was derived was included in all surveys for all cohorts. There were ten items used to construct this subscale (Table 12-1). The response options were ‘Yes, limited a lot’, ‘Yes, limited a little’, and ‘No, not limited at all’.

Table 12-1: Survey items from SF-36 used to calculate PF scores.

PF item	PF activity
PF1	VIGOROUS activities such as running, lifting heavy objects, participating in strenuous sports
PF2	MODERATE activities such as moving a table, pushing a vacuum cleaner, bowling or playing golf
PF3	Lifting or carrying groceries
PF4	Climbing SEVERAL flights of stairs
PF5	Climbing ONE flight of stairs
PF6	Bending, kneeling or stooping
PF7	Walking MORE THAN ONE kilometre
PF8	Walking HALF a kilometre
PF9	Walking 100 metres
PF10	Bathing or dressing yourself

Missing items were recoded as follows:

Sets of related items within the physical functioning subscale establish the level of function for particular activities: overall activity level (PF1 to PF3), climbing (PF4 and PF5) and walking (PF7 to PF9). Where a higher level of functioning in each set is ‘Not limited’ but an item for a lower level of the related function is ‘missing’, the lower level of functioning is recoded to ‘Not limited’. Conversely, where a lower level of functioning is ‘Limited a lot’ and the item for a higher level of the related function is 'missing', the higher level of functioning is recoded to 'Limited a lot'. An example of this is shown in Table 17-2.

Table 12-2: Recoding of missing items for PF scoring.

Overall activity level			
Vigorous activity	**Moderate activity**	**Lifting/carrying groceries**	**Recode**
Not limited at all	Missing		Moderate activity = Not limited at all
Missing	Limited a lot		Vigorous activity = Limited a lot
Missing		Limited a lot	Vigorous activity = Limited a lot
Climbing			
Climbing SEVERAL flights of stairs	**Climbing ONE flight of stairs**		**Recode**
Not limited at all	Missing		Climbing ONE flight of stairs = Not limited at all
Missing	Limited a lot		Climbing SEVERAL flights of stairs = Limited a lot
Walking			
Walking more than 1 kilometre	**Walking half a kilometer**	**Walking 100 metres**	**Recode**
Not limited at all	Missing		Walking half a kilometer = Not limited at all
	Not limited at all	Missing	Walking 100 metres = Not limited at all
Not limited at all		Missing	Walking 100 metres = Not limited at all
Missing	Limited a lot		Walking more than 1 kilometre = Limited a lot
	Missing	Limited a lot	Walking half a kilometre = Limited a lot
Missing		Limited a lot	Walking more than 1 kilometre = Limited a lot

Raw scores were calculated as the sum of (recoded) scale items and transformed to a 0 to 100 scale according to the formula:

$$\text{Transformed score} = \frac{\text{Raw score} - \text{Minimum possible raw score}}{\text{Possible raw score range}} \times 100$$

All scores are positively scored so that higher scores represent better physical functioning.

The need for help was determined in all surveys for all cohorts using the following questions:

'Do you regularly need help with daily tasks because of long-term illness, disability or frailty (eg personal care, getting around, preparing meals etc)?' (1921-26 and 1946-51 cohorts)

'Do you regularly need help with daily tasks because of a long-term illness or disability (eg help with personal care, getting around, preparing meals etc)?' (1973-78 cohort)

The response options for these question is 'yes' or 'no'.

Table 12-3 shows the number of participants aged 20 to 90 years who had available data for the question on needing help with daily tasks regardless of whether or not they answered this question for subsequent surveys.

Table 12-3: The number of ALSWH participants with data on needing help with daily tasks that was used in projection modelling.

	S1	S2	S3	S4	S5	S6	S7
1921-26 cohort	11476	10146	8397	6760	5321	3911	
1946-51 cohort	13473	11479	11161	10827	10567	9969	9112
1973-78 cohort	13956	9552	9038	9121	8169	7874	

12.2. Obesity

In ALSWH, participants are asked to record their height and weight in every survey. Table 12-4 shows the surveys from which these data were obtained for use in this report and the number of participants with complete data. At each survey, BMI was derived for all participants who recorded these measurements and used in our analyses, regardless of whether or not they continued to participate in subsequent surveys.

$$\text{body mass index (BMI)} = \frac{\text{weight (kg)}}{[\text{height (m)}]^2}$$

Table 12-4: The number of ALSWH participants with height and weight data that was used in projection modelling.

	S1	S2	S3	S4	S5	S6	S7
1921-26 cohort	11378	9223	7824	6246	4627	3304	
1946-51 cohort	13176	10812	10477	10247	10342	9747	8818
1973-78 cohort	12415	8847	8104	8926	8055	7850	
1989-95 cohort	16278	10718	8488				

This report utilises a classification system recommended by the World Health Organization (WHO, 2000): Underweight BMI < 18.5 kg/m^2, Normal weight BMI 18.5 – 24.99 kg/m^2, Overweight BMI 25 – 29.99 kg/m^2, and Obese BMI ≥ 30 kg/m^2. Any reference to BMI categories in this report is related to this classification system.

A dataset containing the following variables was created: age at survey, birth year, BMI, and WHO BMI category. Data were then linked to the Medicare Benefits Scheme (data from 1996 to 2013), Pharmaceutical Benefits Scheme (2003 to 2012), and NSW Admitted Patients Data Collection (2001 to 2012).

12.3. Tobacco use

In ALSWH, tobacco use was determined in all surveys of the 1973-78 and 1946-51 cohorts, and Surveys 1, 2, and 6 of the 1921-26 cohort. The smoking status of participants were ascertained from the questions and response options shown in Table 12-5.

Table 12-5: Survey questions for tobacco use in ALSWH.

Survey question	Response options
'How often do you currently smoke cigarettes or any tobacco products?'	Daily At least weekly (but not daily) Less often than weekly Not at all
'In your lifetime, would you have smoked at least 100 cigarettes (or equivalent)?	Yes No

Smoking status was also determined in Survey 1 of the 1989-95 cohort using the following questions:

‘Do you currently smoke tobacco?’

‘On a day when you smoke, how many cigarettes do you usually smoke?’

‘In the past, have you smoked tobacco?’

From these responses to these questions, the participant was classified as never smoker, ex-smoker, and current smoker according to Table 12-6.

Table 12-6: Definition of smoking classifications in ALSWH.

Category	Definition
Never smoker	A person who does not smoke now and has smoked fewer than 100 cigarettes or similar amount of other tobacco products in their lifetime
Ex-smoker	A person who does not smoke at all now, but has smoked at least 100 cigarettes or a similar amount of other tobacco products in their lifetime
Current smoker	A person who currently smokes tobacco.

The number of participants whose smoking status data was using in projection modelling is shown in Table 12-7.

Table 12-7: The number of ALSWH participants with data on smoking status that was used in projection modelling.

	S1	S2	S3	S4	S5	S6	S7
1921-26 cohort	11574	9653				3986	
1946-51 cohort	13268	11566	11179	10867	10592	9976	9144
1973-78 cohort	13629	9608	9048	9098	8182	7949	

12.4. Mental health

As described in Section 6.2, the SF-36 instrument from which a Mental Health (MH) score was derived was included in all surveys for all cohorts. There were five items used to construct this subscale (Table 12-8).

Table 12-8: Survey items from SF-36 used to calculate MH scores.

MH item	MH activity
MH1	Have you been a very nervous person
MH2	Have you felt so down in the dumps that nothing could cheer you up
MH3	Have you felt calm and peaceful
MH4	Have you felt down
MH5	Have you been a happy person

The response options and coding are shown in Table 12-9.

Table 12-9: Response options for survey items from SF-36 used to calculate MH3 and MH5 scores.

Code	Recode for MH3 and MH5	Response
1	6	all of the time
2	5	most of the time
3	4	a good bit of the time
4	3	some of the time
5	2	a little of the time
6	1	none of the time

Raw scores were calculated as the sum of (recoded) scale items and transformed to a 0 to 100 scale according to the formula:

$$\text{Transformed score} = \frac{\text{Raw score} - \text{Minimum possible raw score}}{\text{Possible raw score range}} \times 100$$

All scores are positively scored so that higher scores represent better mental health.

Table 12-10 shows the number of ALSWH participants with a mental health score that was used in the analyses.

Table 12-10: The number of ALSWH participants with a mental health score that was used in projection modelling.

	S1	S2	S3	S4	S5	S6	S7
1921-26 cohort	12019	10253	8138	6861	5379	3902	
1946-51 cohort	13581	12298	11143	10849	10592	9988	9125
1973-78 cohort	14205	9656	9063	9133	8194	7883	

12.5. Highest educational attainment

Highest educational attainment was determined from the following questions in ALSWH.

'What is the highest qualification you have completed?'

Table 12-11 shows the response options and groupings for analyses for this question.

Table 12-11: Response options for highest educational attainment in the 1973-78, 1946-51, and 1921-26 cohorts.

Response options	Analytical groups
No formal qualifications	Less than Year 12
School or Intermediate Certificate (or equivalent)	
Higher School or Leaving Certificate (or equivalent)	Year 12 or equivalent
Trade/apprenticeship	Certificate/diploma
Certificate/diploma	
University degree	University
High University degree	

This question was asked in Survey 1 for the 1921-26 cohort, Surveys 1 and 6 of the 1946-51 cohort, and all surveys of the 1973-78 cohort.

'What is the highest level of education you have completed?'

Table 12-12 shows the response options and groupings for analyses for this question.

Table 12-12: Response options for highest educational attainment in the 1989-95 cohort.

Response options	Analytical groups
Year 10 or below	Less than Year 12
Year 11 or equivalent	
Year 12 or equivalent	Year 12 or equivalent
Certificate I/II	Certificate/diploma
Certificate III/IV	
Advanced Diploma/Diploma	
Bachelor degree	University
Graduate diploma/Graduate certificate	
Postgraduate degree	

This question was asked in all surveys for the 1989-95 cohort.

Table 12-13 shows the number of ALSWH participants with data on highest educational attainment that was used in the analyses.

Table 12-13: The number of ALSWH participants with data on highest educational attainment.

	S1	S2	S3	S4	S5	S6	S7
1921-26 cohort	11768						
1946-51 cohort	13576					9473	
1973-78 cohort	14166	9338	8867	9111	8022	7859	
1989-95 cohort	16830	11146	8674				

12.6. Ability to manage on income

In ALSWH, the participant's ability to manage on income was determined by a single survey question.

'How do you manage on the income you have available?'

Table 12-14 shows the response options and how they were divided into two groups: difficult and easier.

Table 12-14: Response options for ability to manage on income in the 1989-95, 1973-78, 1946-51, and 1921-26 cohorts.

Response options	Groupings for analysis
It is impossible	Difficult
It is difficult all the time	
It is difficult some of the time	
It is not too bad	Easier
It is easy	

The question was asked in all surveys for all cohorts.

Table 12-15 shows the number of ALSWH participants with data on ability to manage on income that was used in the analyses.

Table 12-15: The number of ALSWH participants with data on ability to manage on income.

	S1	S2	S3	S4	S5	S6	S7
1921-26 cohort	12127	9399	8582	7066	5500	4010	
1946-51 cohort	13618	11498	11085	10823	10571	9921	9021
1973-78 cohort	14185		9034	9104	8165	7873	

12.7. Marital status

Marital status was determined by one of the following questions in all surveys for all cohorts:

‘What is your present marital status?’

‘What is your formal registered marital status?’

Table 12-16 shows the response options and how they were grouped for analysis.

Table 12-16: Response options for marital in the 1989-95, 1973-78, 1946-51, and 1921-26 cohorts.

Response options	Grouping
never married/single	never married
married	married/de facto
de facto	
separated	separated/divorced
divorced	
widowed	widowed

The response options were never married/single, married, de facto, separated, divorced, and widowed. In some surveys, de facto relationships were further defined by de facto (opposite sex) and de facto (same sex).

For the purpose of this analysis, the responses were grouped into married/de facto, separated/divorced, widowed, and never married. Table 12-17 shows the number of ALSWH participants with data on ability to manage on income that was used in the analyses.

Table 12-17: The number of ALSWH participants with data on marital status.

	S1	S2	S3	S4	S5	S6	S7
1921-26 cohort	12208	10393	8609	7113	5524	4039	
1946-51 cohort	13646	12258	11173	10748	10548	9937	9061
1973-78 cohort	4177	9639	9045	9106	8170	7908	
1989-95 cohort	16830	11140	8670				

12.8. Area of residence

The Accessibility/Remoteness Index of Australia, 2003 version (ARIA+) was developed by the National Key Centre for Social Applications of Geographic Information Systems (GISCA) to measure the remoteness of a location based on road distances to service centres (DoHAC, 2001). ARIA+ scores range from 0 to 15, from which five categories are defined (Table 12-18).

Table 12-18: Remoteness Areas for Australia and corresponding ARIA+ scores.

Category	**ARIA+ score**
Major Cities of Australia	0 – 0.20
Inner Regional Australia	>0.20 – 2.40
Outer Regional Australia	>2.40 – 5.95
Remote Australia	>5.92 – 10.53
Very Remote Australia (other)	>10.53

In ALSWH, participant addresses are coded to ARIA+; the Study's implementation of the earlier version of ARIA+, known as ARIA, is reported in the 2000 ALSWH Technical Report (ALSWH, 2000).

Where only four ARIA+ categories are used, Remote refers to Remote Australia and Very Remote Australia.

Area of residence was estimated from one question in the Census:

'Where does the person usually live?'

The Place of Usual Residence is defined by the Census as 'the place where a person lived or intended to live for a total of six months or more in 2011' (ABS, 2012c). The respondent provides their full address, indicates 'none' for no usual address, or 'Other country'.

Table 12-19 shows the number of ALSWH participants with data on area of residence.

Table 12-19: The number of ALSWH participants with data on area of residence.

	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**
1921-26 cohort	12386	10353	8621	7162	5454	4091	
1946-51 cohort	13704	12239	11002	10707	10509	9913	9033
1973-78 cohort	14218	9653	9013	8984	8019	7702	

13. Appendix B: Methodology for modelling longitudinal trends of health and related conditions across the lifespan

The trends for each health condition of interest were first examined for age, birth cohort, and period effects. The condition of interest (e.g. the prevalence of women needing help with daily tasks) was plotted by age using data from all cohorts. If the pattern appeared to change smoothly with age across all cohorts (as in Figure 13-1 below), the trajectory was assumed to be affected only by age. For some conditions (e.g. prevalence of obesity), there were clear differences across the cohorts, with each following its own trajectory; in these cases where age and cohort effects were apparent, the models needed to take both effects into account. Another possibility is that all cohorts might have been affected simultaneously, e.g. by a policy change that affected access to health services; this is a ‘period effect’ so the time of the change also had to be taken into account.

13.1. Physical function and needing help with daily tasks

The percentage of women needing help with daily tasks increased steadily with age. This trajectory was estimated using a smooth curve across all ages using data from all cohorts, in this case, a penalised B-Spline model (Figure 13-1).

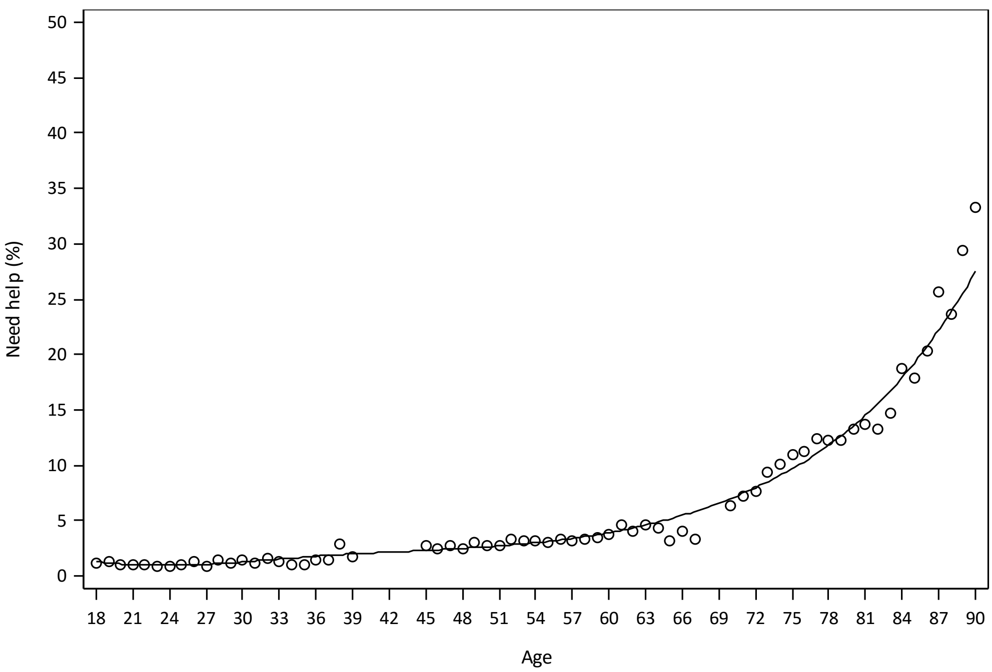

Figure 13-1: A model of the prevalence of women who reported needing help with daily tasks by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

13.2. BMI and obesity

The data on mean BMI showed different trajectories for each cohort; each cohort appears to have higher BMI than the preceding generation and to be gaining weight more rapidly (Figure 13-2 and 13-3).

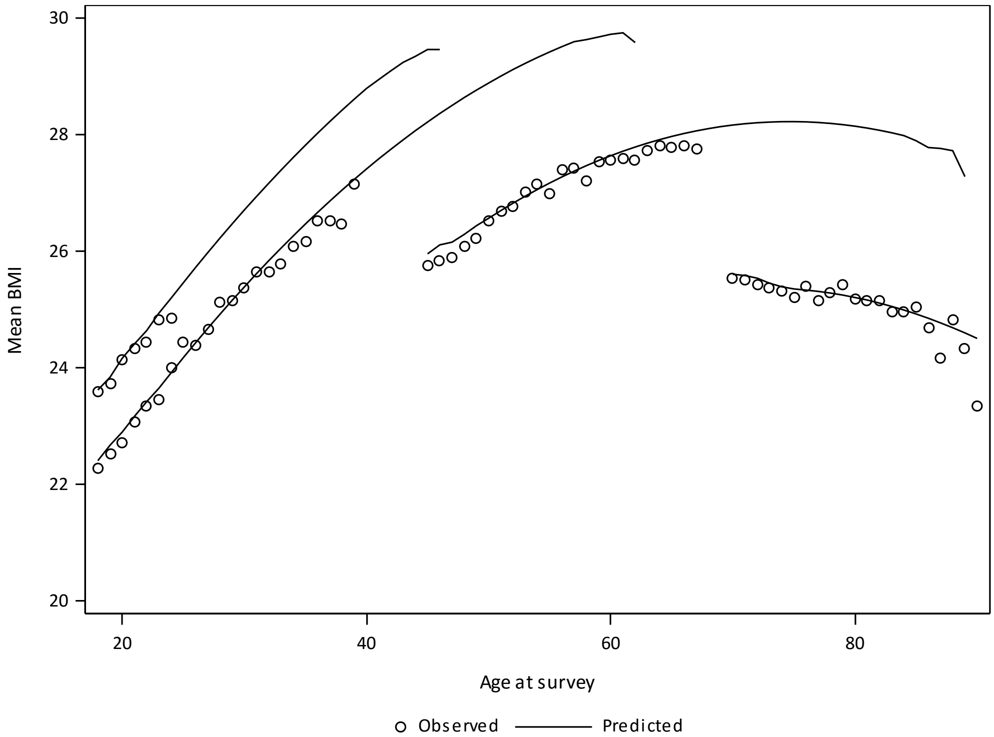

Figure 13-2: Average BMI projections from 2015 to 2035 for each cohort (1989-95, 1973-78, 1946-51, and 1921-26). The circles represent actual data from ALSWH and the line represent the predicted change in mean BMI for each cohort separately for the next 20 years.

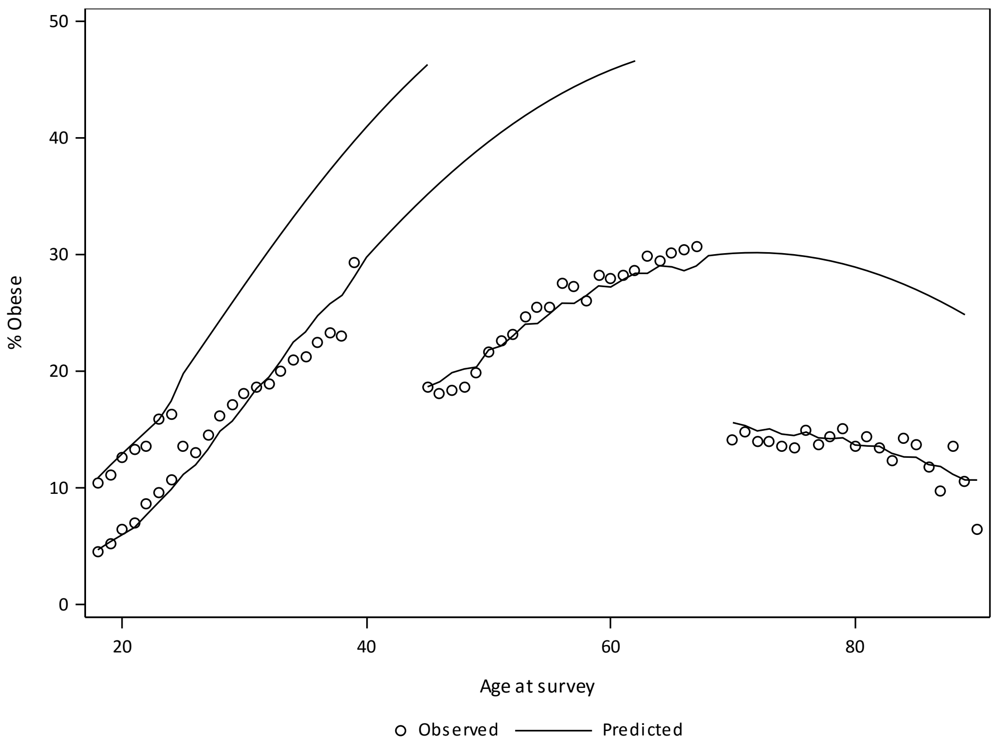

Figure 13-3: A model of the projected prevalence of obese women from 2015 to 2035 for each cohort (1989-95, 1973-78, 1946-51, and 1921-26).

To account for these age- and cohort-specific effects, a linear mixed model with random slopes and intercepts was used to model BMI trajectory for each ALSWH cohort from 2015 to 2035.

$$\text{BMI(Age,Birthyear)} = \alpha + \beta_1\text{Birthyear} + \beta_2\text{Age} + \beta_3\text{Age}^2 + \gamma$$

where BMI(Age,Birthyear) is the mean BMI by Age and Birth year (i.e. where 'Birthyear' are terms characterising the different cohorts) and γ represents random effects.

A similar model was then constructed for the prevalence of obese women at each age and birth year. A generalised linear mixed model was fitted to the prevalence of obese women by age using a log-log link function:

$$\log\left[-\log\left(\pi(\text{Age,Birthyear})\right)\right] = \alpha + \beta_1\text{Birthyear} + \beta_2\text{Age} + \beta_3\text{Age}^2 + \gamma$$

where π(Age,Birthyear) is the probability of being obese by Age and Birth year and γ represents random effects.

13.3. Tobacco use

The data on smoking prevalence showed different trajectories for each cohort; the prevalence of women who are smokers has declined in all cohorts and the uptake of smoking amongst women in their early twenties in the 1989-95 cohort is lower than that of women of the same age in the 1973-78 cohort (Figure 13-4).

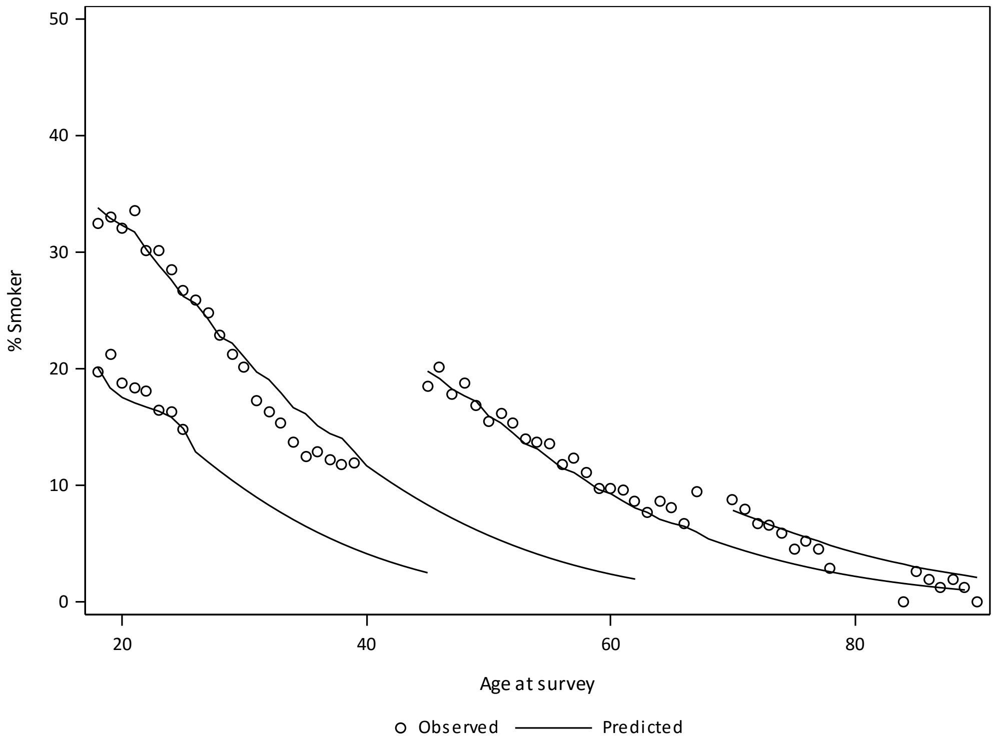

Figure 13-4: Projections of smoking prevalence from 2015 to 2035 for each cohort (1989-95, 1973-78, 1946-51, and 1921-26).

The projected smoking prevalence for each ALSWH cohort was modelled using generalised linear mixed model with a log-log link function:

$$\log\left[-\log\left(\pi(\text{Age},\text{Birthyear})\right)\right] = \alpha + \beta_1\text{Birthyear} + \beta_2\text{Birthyear}^2 + \beta_3\text{Age} + \beta_4\text{Age}^2 + \gamma$$

where $\pi(\text{Age},\text{Birthyear})$ is the probability of being current smoking by Age and Birth year and γ represents random effects.

13.4. Mental health

The percentage of women with psychological distress by age was estimated using a smooth curve across all ages, in this case, a penalised B-spline model (Figure 13-5).

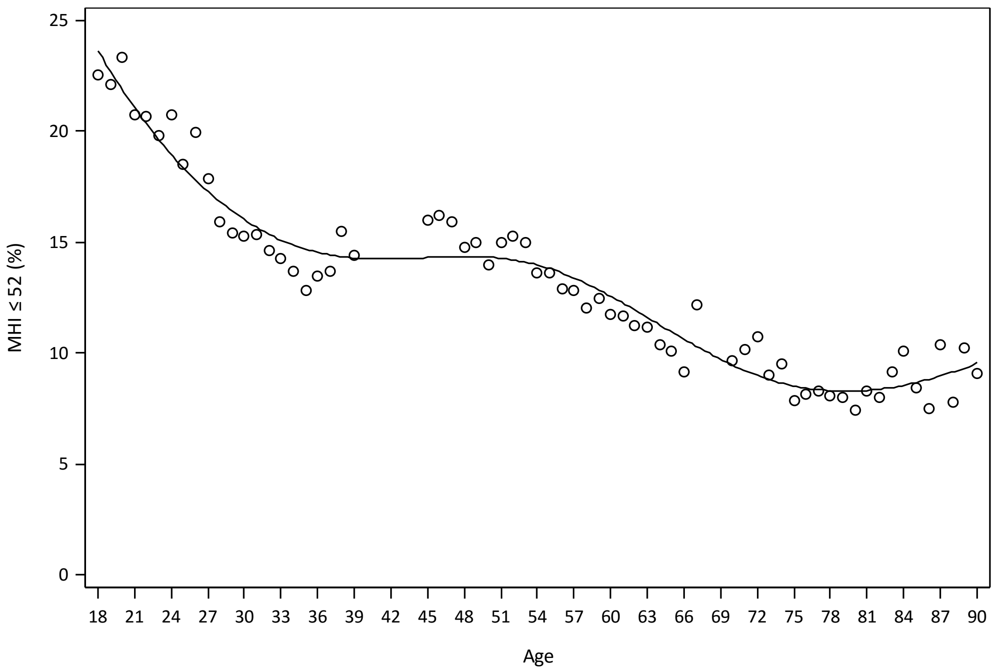

Figure 13-5: A model of the prevalence of women with psychological distress (MHI≤52) by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

13.5. Highest educational attainment

ALSWH participants are more highly educated than women of the same age group in the general population. Therefore, ALSWH data are not suitable for age-specific estimates (e.g. of the prevalence of university-educated women). Instead, data from the annual ABS Survey of Education and Work for 2005 to 2015 (ABS, 2015c) were used for modelling. The key assumption used in the model was that the prevalence of university-educated women would remain constant up to the 30-34 age group because these percentages have remained relatively constant for the past 5 years (Table 13-1). For ages greater than 30-34 years, a cohort approach was used where the prevalence of women with a university education in one age group was carried forward to the next age group over time (Figure 13-6). The prevalence of women with psychological distress by age was estimated using smooth curves (penalised B-splines) across all ages. The reason for using a cohort effect was because the trends in ALSWH showed that there was a pronounced cohort effect with women in the 1989-95 and 1973-78 cohorts having much higher levels of education than the earlier generations (Figure 8-1).

Table 13-1: Prevalence of women with a university education from 2010 to 2015 from the ABS Survey of Education and Work.

Age group	2011	2012	2013	2014	2015
20-24	18.7	19.2	21.4	20.4	22.5
25-29	41.0	39.2	41.1	42.0	39.6
30-34	39.7	41.9	40.6	43.3	44.0

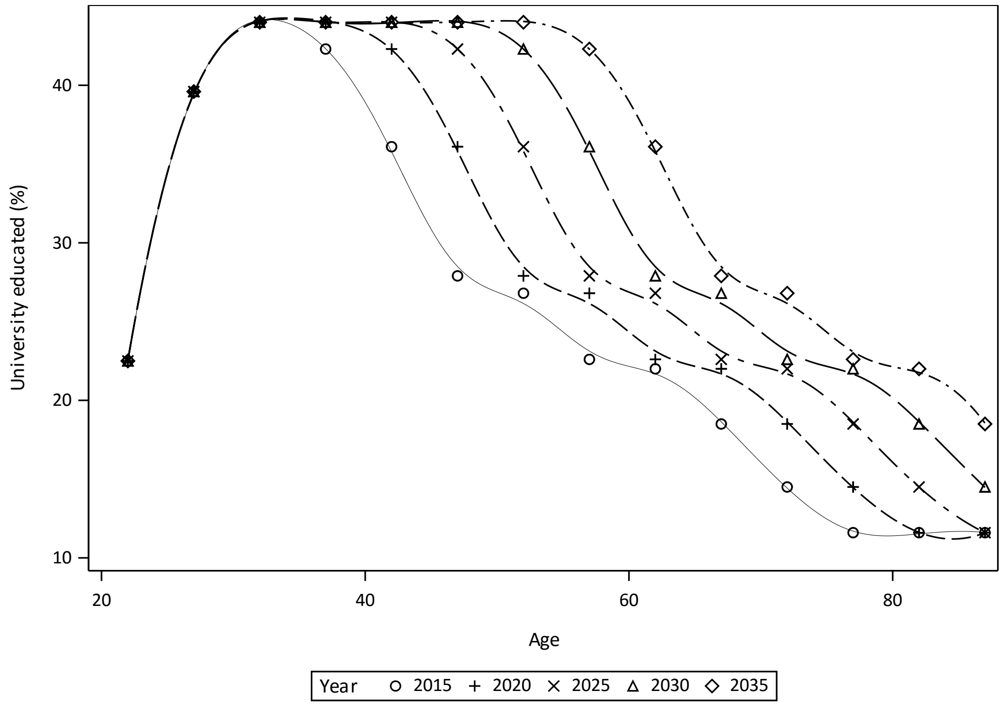

Figure 13-6: Model of the prevalence of university-educated Australian women aged 20-90 then projected forward from 2015 to 2035, based on data from the annual ABS Survey of Education and Work.

The model for the age-specific prevalence of university-educated women in 2015 was then projected forward in five-year steps to 2035 as shown in Figure 13-6.

13.6. Ability to manage on income

The data for percentage of women reporting difficulty managing on income by age was complicated. Women in the 1973-78 cohort (and the 1989-95 cohort) were more likely to report difficulty managing on their income when they were still studying, then their situations improved during their late twenties and early thirties. In their late thirties, higher percentages of women in the 1973-78 cohort experienced difficulties managing on their income, but these were quite similar to the percentages in the 1946-51 cohort when they were in their midforties. However, from the late forties onwards, fewer women reported difficulty managing on their income. This pattern was consistent with other data sources, so we concluded it was a real, if somewhat complicated, age effect (rather than a cohort or period effect). Nevertheless, changes in employment associated with the global financial crisis cannot be ruled out as they would have impacted most on the 1973-78 cohort. Accordingly, we used a penalised B-spline model, which only involved age, but allowed for a more complicated trajectory (Figure 13-7).

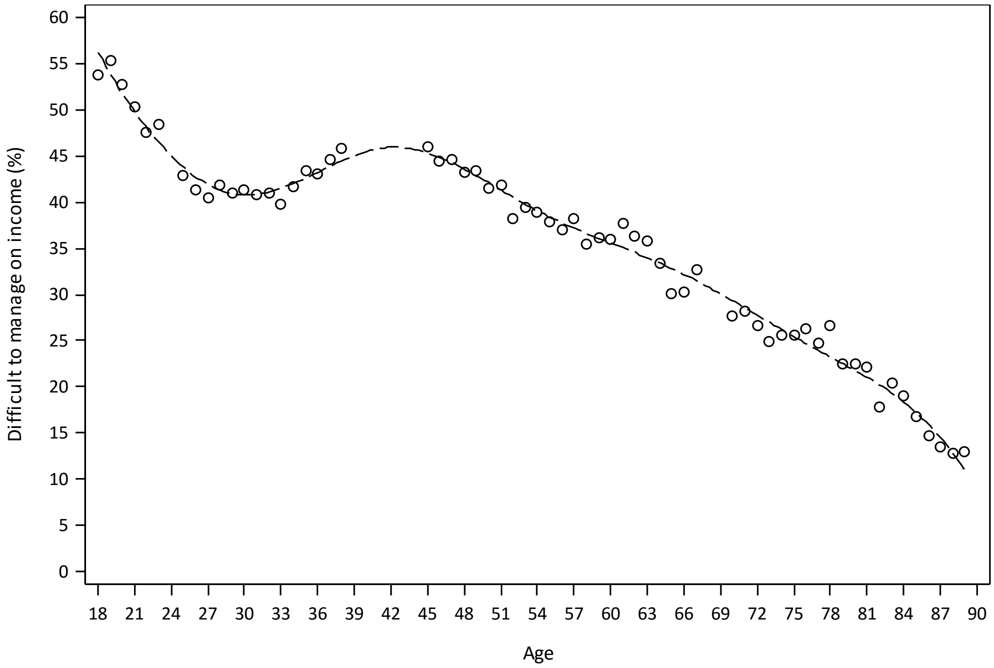

Figure 13-7: A model of the prevalence of women with difficulty managing on income by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

13.7. Marital status

The percentage of women who have a partner through marriage or a de facto relationship by age showed a smooth trajectory across all the cohorts (Figure 10-1). This trajectory, depending only on age (not cohort), was modelled using a penalised B-Spline model (Figure 13-8).

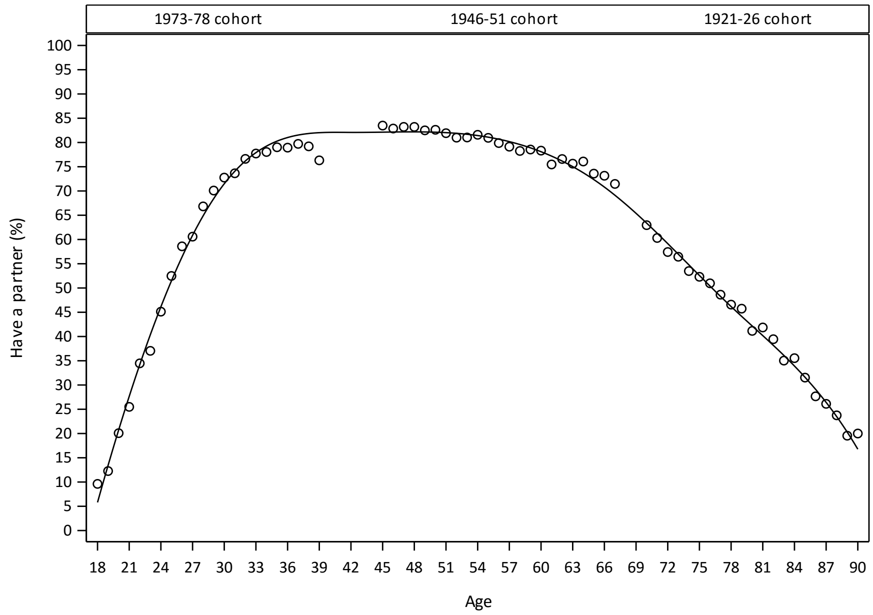

Figure 13-8: A model of the prevalence of women who have a partner by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

13.8. Area of residence

During the participant recruitment to ALSWH in 1995, there was an oversampling of women living in rural and remote areas to ensure that their health and health service use was adequately captured. Therefore, the ALSWH data are not suitable for providing age estimates for women living in a major city. Instead, data from the 2011 Australian Census data were used to characterise the percentage of women living in a major city across the lifespan (Figure 13-9).

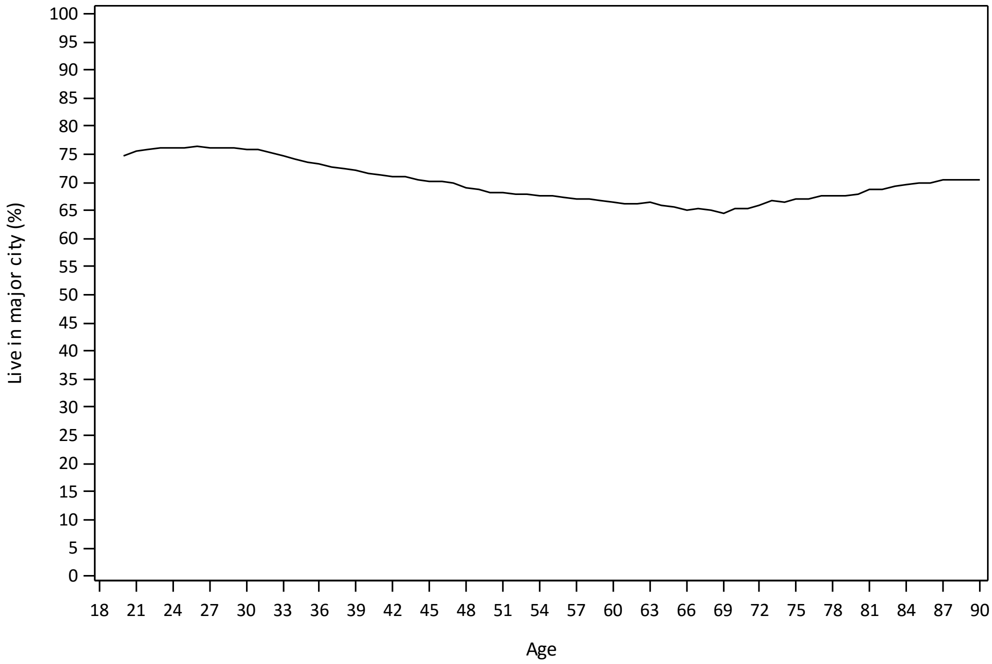

Figure 13-9: Data from the 2011 Australian Census: Prevalence of Australian women aged 20-90 who lived in a major city.

14. Appendix C: Methods for projecting prevalence of health and related conditions from 2015 to 2035

For each of the models described in Appendix B (Chapter 13), predicted percentages of women in various groups (e.g. obese and non-obese) were estimated for every age between 20 to 90 years and for each year of birth for each year from 2015 to 2035. These predicted percentages were then applied to the ABS population projections for the same time period.

$$N_y(t) = \sum_{x=20}^{90} \left[P(x) \times S_y(x,t)\right]$$

$$y = A, B, C$$
$$x = 20, 21, \ldots., 90$$
$$t = 2015, 2016, \ldots., 2035$$

where $N_y(t)$ is the total number of women aged 20-90 in the category in year t based on the ABS population projection series y, $P(x)$ is the prevalence (%) of women aged x years in the category, $S_y(x,t)$ is the projected number of women at age x in year t in population projection series y, and y indicates population projection series A, B, or C.

To calculate the percentage of women aged 20-90 in the category in Australia from 2015 to 2035, the following equation was used.

$$F_y(t) = \frac{N_y(t)}{S_y(t)}$$

$$S_y(t) = \sum_{x=20}^{90} S_y(x,t)$$

where $F_y(t)$ is the percentage of women aged 20-90 in the category in year t based on the ABS population projection series y, $S_y(t)$ is the projected number of women aged 20-90 in year t in population projection series y, and y indicates population projection series A, B, or C.

15. Appendix D: Trends of health service use and expenditure by age and health condition

15.1. Medicare Benefits Scheme

Data linkage to the MBS allows us to determine number and cost of unreferred MBS claims made by each participant for each year from 1996 to 2013. The mean unreferred MBS claims by year and by group was calculated as follows:

$$\text{Mean unreferred MBS claims} = \frac{\text{Sum of total MBS claims for all participants in a group}}{\text{Number of participants in a group}}$$

To calculate the total unreferred MBS cost, the average cost of unreferred MBS services (including the scheduled fee set by the Commonwealth Government and patient co-payment) in 2014 (in 2014 Australian dollars) was obtained from the Department of Human Services statistical reporting database (Medicare Group Reports, 2016) and was reported to be $48.80. The limitation of reporting MBS expenditure is that the effects of general inflation and health inflation are not accounted for.

The total unreferred MBS cost (in 2014 Australian dollars) for each participant for every year from 1996 to 2013 was calculated as follows:

$$\text{Total unreferred MBS cost} = \text{Number of unreferred MBS claims} \times 48.80$$

The mean unreferred MBS cost (in 2014 Australian dollars) by group for each year from 1996 to 2013 was calculated as follows:

$$\text{Mean unreferred MBS cost} = \frac{\text{Sum of total MBS cost for all participants in a group}}{\text{Number of participants in a group}}$$

The number of claims and costs were estimated for each year of age.

15.2. Pharmaceutical Benefits Scheme

Data linkage to the PBS allowed us to determine the number and cost of PBS prescriptions that were filled by each participant. Complete data on all prescriptions filled (as opposed to all involving government subsidy) are only available single July 2012. Note that there are only three sets of data points for these graphs because the 2012-13 period only corresponded to one survey per cohort.

The price of prescriptions is determined by a range of factors that are difficult to forecast, such as the five-yearly Australian government pharmacy agreements, and manufacturing costs of pharmaceutical drugs. Therefore, using the historical cost of prescriptions to forecast future PBS expenditure introduces significant error. Instead, this report uses the latest available PBS data for one financial year (in this case, 2012-13) to determine the total number of claims and cost of PBS scripts obtained by the ALSWH participants. This means that the cost of PBS is reported in 2012-13 Australian dollars for all relevant graphs. The limitation of reporting PBS expenditure is that the effect of general inflation and health inflation are not accounted for.

The mean PBS cost (in 2012-13 Australian dollars) for each participant for 2012 to 2013 was calculated as follows:

$$\text{Mean PBS claims (by group)} = \frac{\text{Sum of PBS claims for all participants in a group}}{\text{Number of participants in a group}}$$

The mean PBS cost (in 2012-13 Australian dollars) by group for every year was calculated as follows:

$$\text{Mean PBS cost (by group)} = \frac{\text{Sum of total PBS cost for all participants in a group}}{\text{Number of participants in a group}}$$

15.3. Hospital costs

Public hospital costs are available through the National Hospital Cost Data Collection (NHCDC) provided by the Independent Hospital Pricing Authority. The NHCDC lists the average cost for all Australian Refined Diagnosis Related Group (AR-DRG) codes. Each AR-DRG represents a group of patients with similar conditions and who require similar hospital services. In this report, the average cost of AR-DRGs (in 2012-13 Australian dollars) in the NHCDC Australian Public Hospitals Cost Report 2012-2013, Round 17 was used. The data of ALSWH participants are linked to Admitted Patient Data Collections for NSW, QLD, WA, SA, and ACT. Only the NSW and ACT Patient Data Collections record diagnosis using AR-DRG codes. Because a large percentage of ALSWH participants reside in NSW (30.5 per cent), the hospital cost analysis was performed using data from these participants to represent the whole ALSWH cohort. Table 15-1 and 15-2 shows a comparison of characteristics between the NSW participants and participants who do not live in NSW at Survey 1. There is a higher prevalence of unpartnered women and city residents amongst women in the 1989-95 cohort who live in NSW compared with the rest of the ALSWH cohort. In the 1973-78 cohort, there is a higher percentage of women who have difficulty managing on income in NSW than in all other states and territories. In the 1921-26 cohort, there is a lower prevalence of women living in the city amongst NSW participants compared with the rest of the participants in this cohort.

Table 15-1: Comparison of ALSWH participants in the 1989-95 and 1973-78 cohorts residing in NSW and those not living in NSW at Survey 1 (column percentages).

Characteristic	1989-95 cohort		1973-78 cohort	
	NSW	Not NSW	NSW	Not NSW
BMI				
Not obese, BMI<30	88	87	94	93
Obese, BMI≥30	12	13	6	7
Smoking status				
Non-smoker	81	81	68	67
Current smoker	19	18	32	33
Marital status				
Married/de facto	21	23[a]	22	23
Unpartnered	79	77[a]	78	77
Area of residence				
Major city	77	74[a]	53	51
Regional/remote	23	26[a]	47	49
Highest educational attainment				
Not university	77	77	90	88
University	23	23	10	12
Mental health				
No psychological distress			78	78
Psychological distress			22	22
Need help with daily activities				
No			99	99
Yes			1	1
Ability to manage on income				
Difficult			53	51[a]
Easy			47	49[a]

[a]$p < 0.01$

Table 15-2: Comparison of ALSWH participants in the 1946-51 and 1921-26 cohorts residing in NSW and those not living in NSW at Survey 1 (column percentages).

Characteristic	1946-51 cohort		1921-26 cohort	
	NSW	Not NSW	NSW	Not NSW
BMI				
Not obese, BMI<30	82	81	87	86
Obese, BMI≥30	18	19	13	14
Smoking status				
Non-smoker	81	82	92	92
Current smoker	19	18	8	8
Marital status				
Married/de facto	82	83	56	57
Unpartnered	18	16	44	43
Area of residence				
Major city	36	37	40	43[a]
Regional/remote	64	63	60	57[a]
Highest educational attainment				
Not university	85	86	97	96
University	15	14	3	4
Mental health				
No psychological distress	85	85	90	90
Psychological distress	15	15	10	10
Need help with daily activities				
No	97	97	92	91
Yes	3	3	8	9
Ability to manage on income				
Difficult	45	43	28	26
Easy	55	27	72	74

[a]$p < 0.01$

The NSW Admitted Patient Data Collection contains records for all hospitalisations in NSW from 2000 to 2014, including admissions of participants who were not permanent residents of this state. However, because there is low migration between states, the percentage of hospital admissions in NSW by non-residents of NSW is low. For each participant, a hospital cost was determined for every admission using the AR-DRG code from the hospital record and matching it to the average cost of that AR-DRG from the NHCDC Public Hospitals Cost Report 2012-2013, Round 17. Then hospital cost (in 2012-13 Australian dollars) for every admission were summed to obtain the annual cost for each person. The average annual hospital cost was determined at each age and group.

The mean hospital cost (in 2012-13 Australian dollars) for each participant for 2012 to 2013 was calculated as follows:

$$\text{Mean hospital cost (by group)} = \frac{\text{Sum of hospital cost for all participants in a group}}{\text{Number of participants in a group}}$$

16. Appendix E: Modelling health service use and expenditure by age and health condition

16.1. Medicare Benefits Scheme

The graphs for unreferred MBS claims for each group of interest were plotted by age using data for each year of age. As age and group of interest were the strong determinants of MBS claims, the mean number per year were modelled using penalised B-splines separately for each group of interest.

As the numbers of women needing help with daily tasks were small for the cohorts born in 1989-95 and 1973-78, for this condition (reported in Chapter 3), only the age range 45-90 was considered (Figure 16-1). For all other conditions or groups of interest (all other Chapters), models were fitted for the age range 20-90 (Figures 16-2 to 16-8)

Needing help with daily tasks

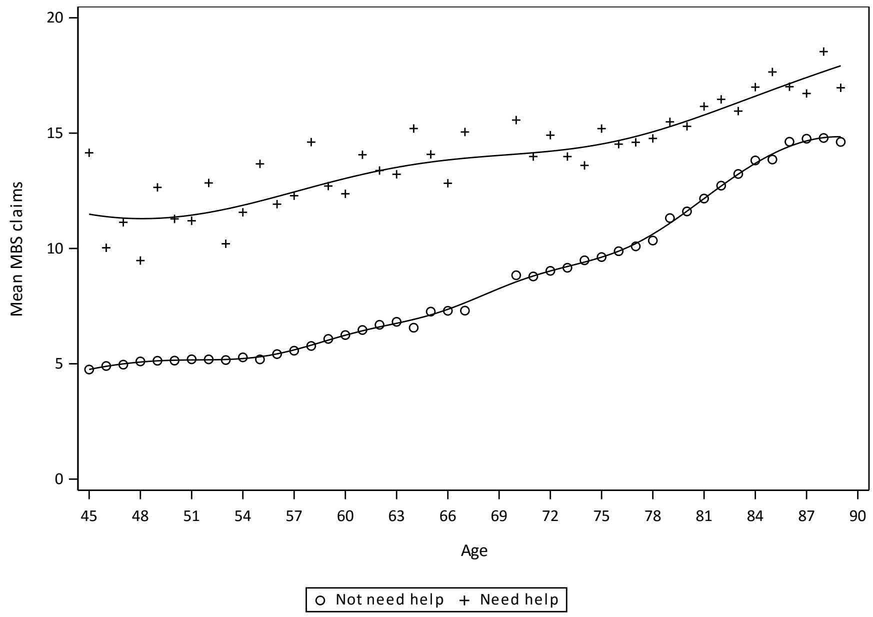

Figure 16-1: A model of the mean number of unreferred MBS claims made by women who reported needing or not needing help with daily tasks, by actual age at survey for the 1946-51 and 1921-26 cohorts.

Obesity

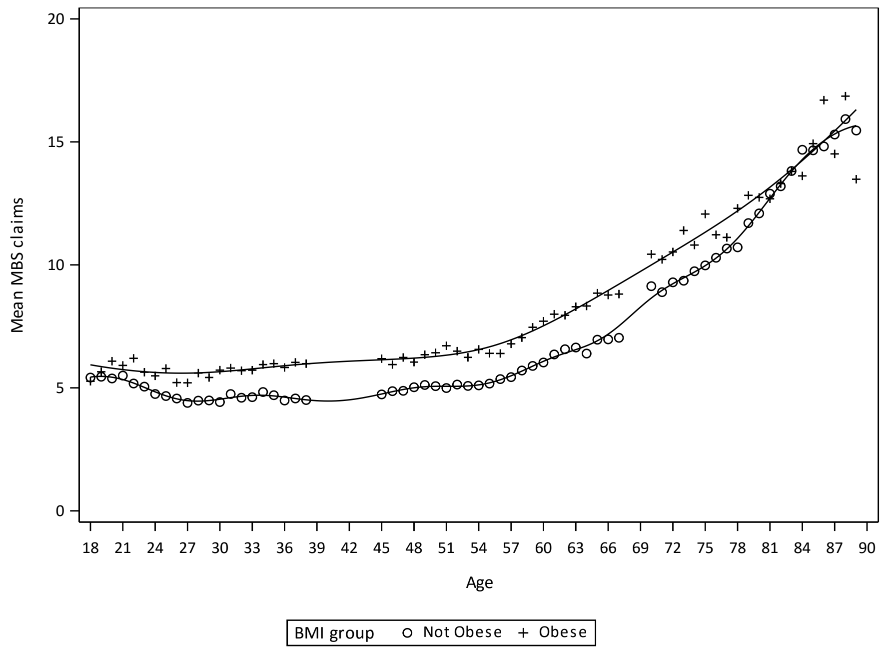

Figure 16-2: A model of the mean number of unreferred MBS claims made by women who are obese or not obese, by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

Tobacco use

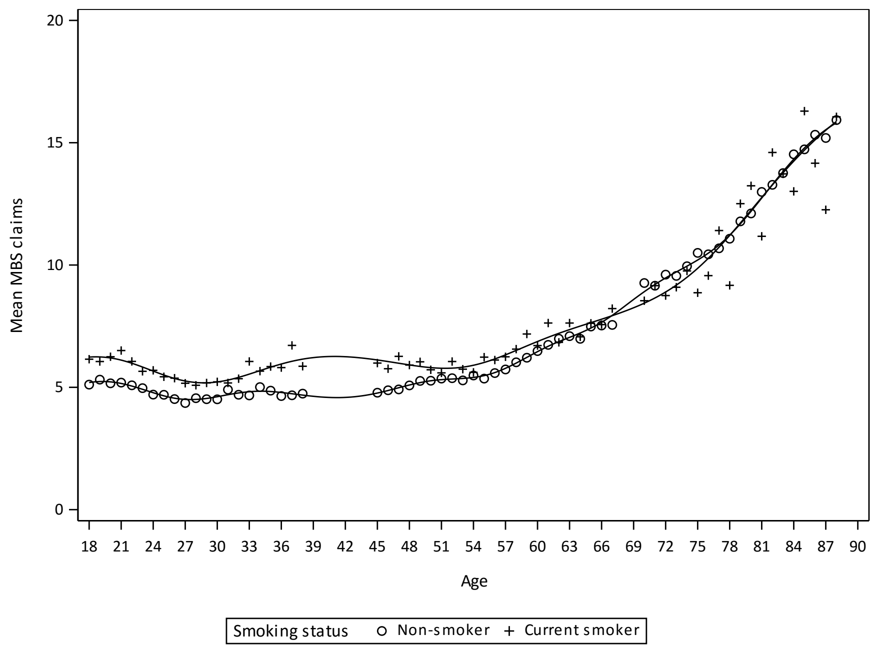

Figure 16-3: A model of the mean number of unreferred MBS claims made by women who are smokers or not current smokers, by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

Mental health

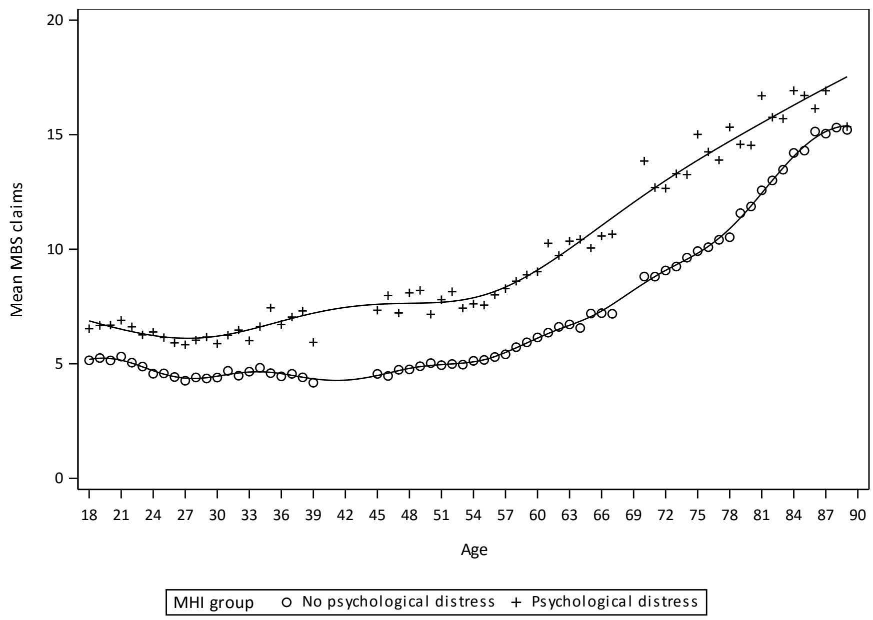

Figure 16-4: A model of the mean number of unreferred MBS claims made by women who do or do not have psychological distress, by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

Highest educational attainment

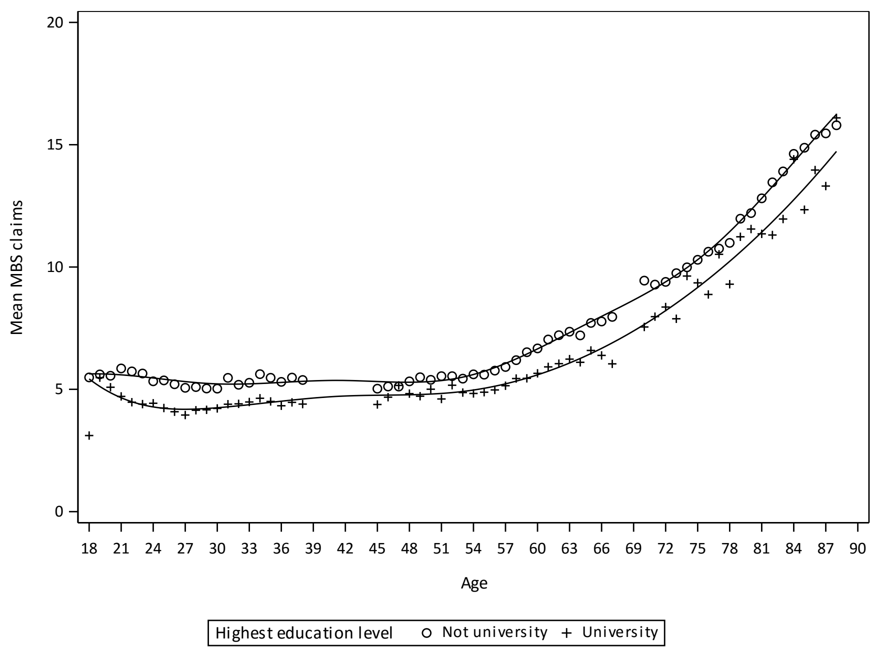

Figure 16-5: A model of the mean number of unreferred MBS claims made by women who do or do not have a university education, by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

Ability to manage on income

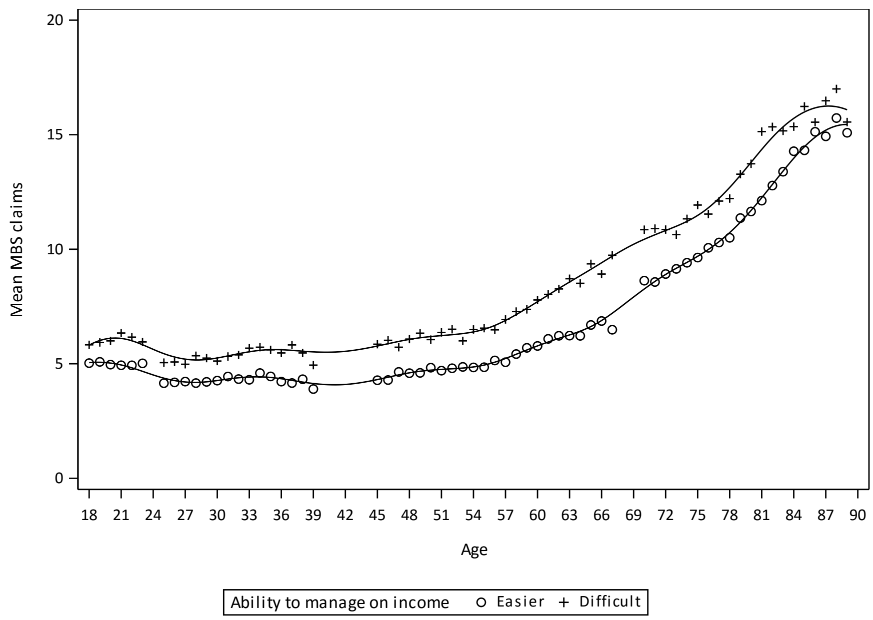

Figure 16-6: A model of the mean number of unreferred MBS claims made by women who found it easier or difficult to manage on income, by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

Marital status

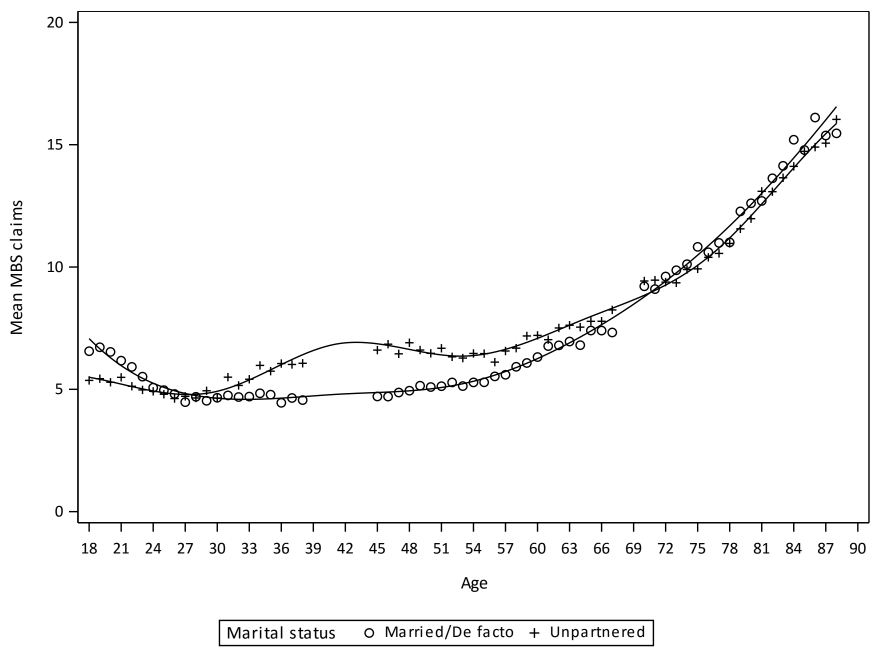

Figure 16-7: A model of the mean number of unreferred MBS claims made by women who have a partner or are unpartnered, by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

Area of residence

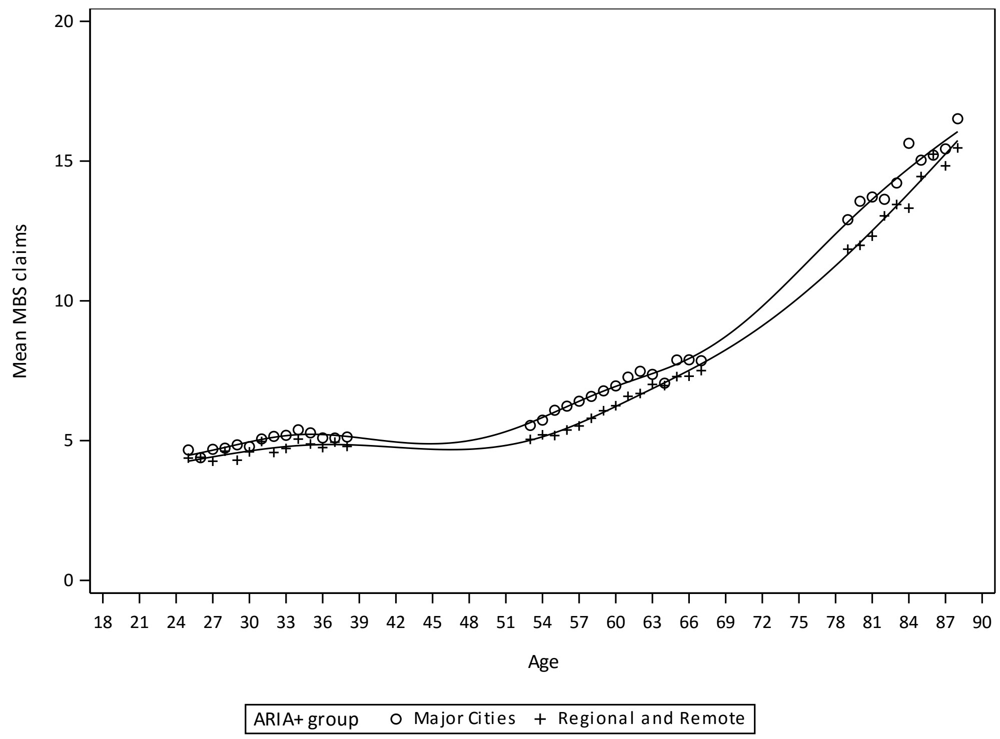

Figure 16-8: A model of the mean number of unreferred MBS claims made by women who live in a major city or in a regional/remote area by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

To calculate the mean MBS cost, the average cost of MBS services (including the scheduled fee set by the Commonwealth Government and patient co-payment) in 2014 (in 2014 Australian dollars) was obtained from the Department of Human Services statistical reporting database (Medicare Group Reports, 2016) and was reported to be $48.80 per visit. The limitation of reporting MBS expenditure is that the effect of general inflation and health inflation are not accounted for.

The total MBS cost (in 2014 Australian dollars) for each participant for every year from 1996 to 2013 was calculated by multiplying the age estimates for mean MBS claims by $48.80 (in 2014 Australian dollars) using the models shown in Figures 16-1 to 16-8.

16.2. Pharmaceutical Benefits Scheme

PBS data on all claims and costs were only available for 2012-13, which covered a narrow age range. Consequently, the models (penalised B-splines) for the groups defined by need for help with daily tasks were based on women from age 62 and for the other groups, for ages from 34 (Figures 16-9 to 16-24).

Needing help with daily tasks

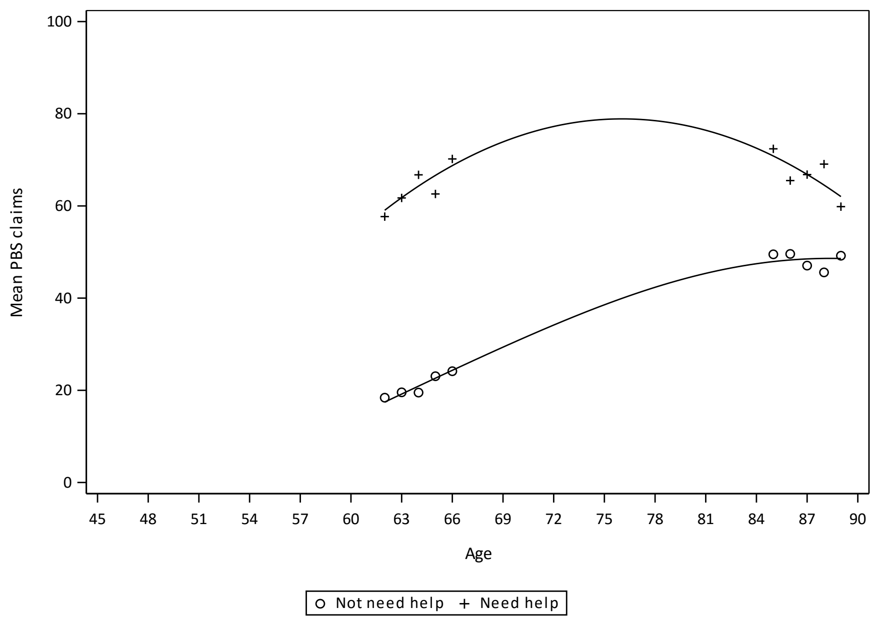

Figure 16-9: A model of the mean number of PBS claims made by women who reported needing or not needing help with daily tasks, by actual age at survey for the 1946-51 and 1921-26 cohorts.

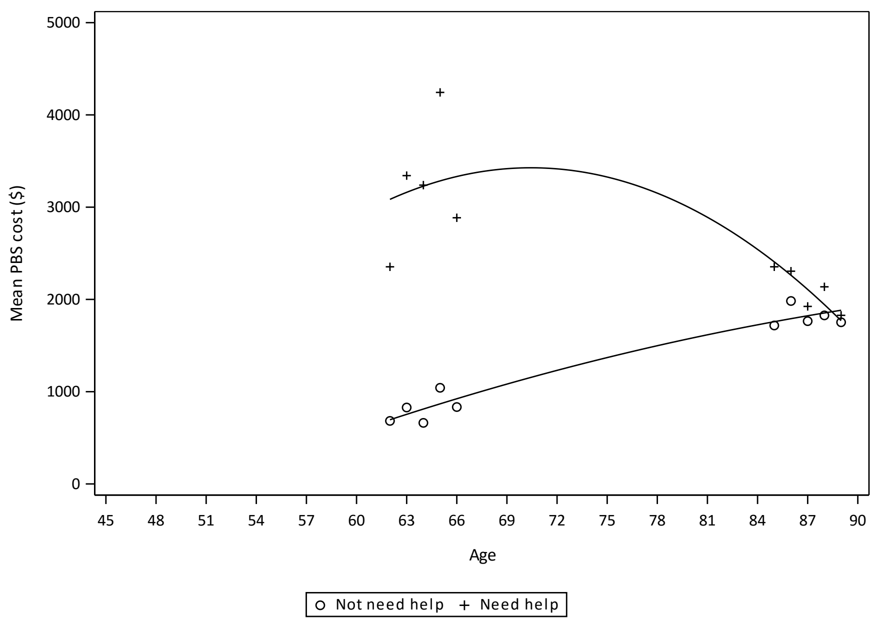

Figure 16-10: A model of the PBS cost (in 2012-13 Australian dollars) for women who reported needing or not needing help with daily tasks, by actual age at survey for the 1946-51 and 1921-26 cohorts.

Obesity

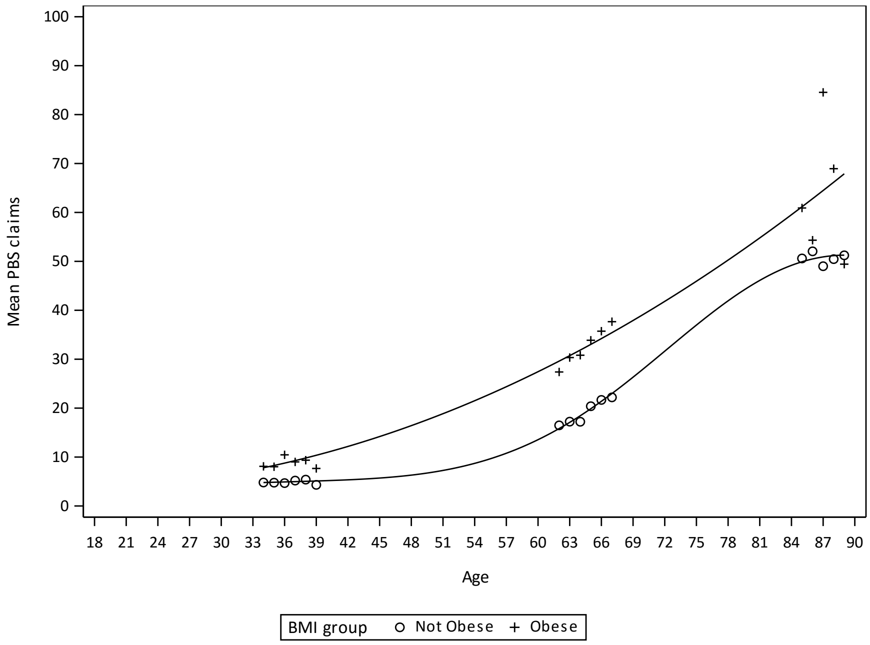

Figure 16-11: A model of the mean number of PBS claims made by women who are obese or not obese, by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

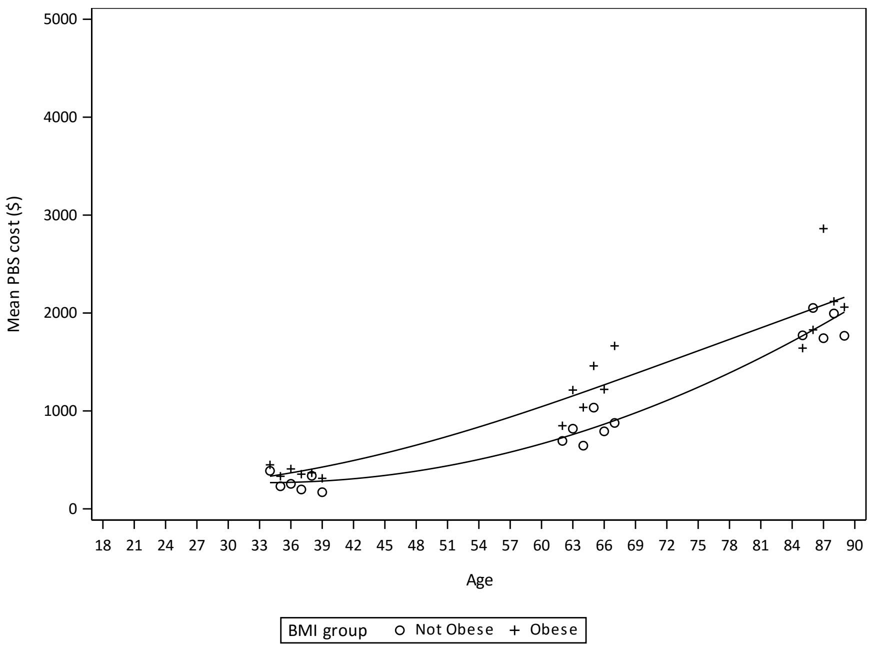

Figure 16-12: A model of the mean PBS cost (in 2012-13 Australian dollars) for women who are obese or not obese, by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

Tobacco use

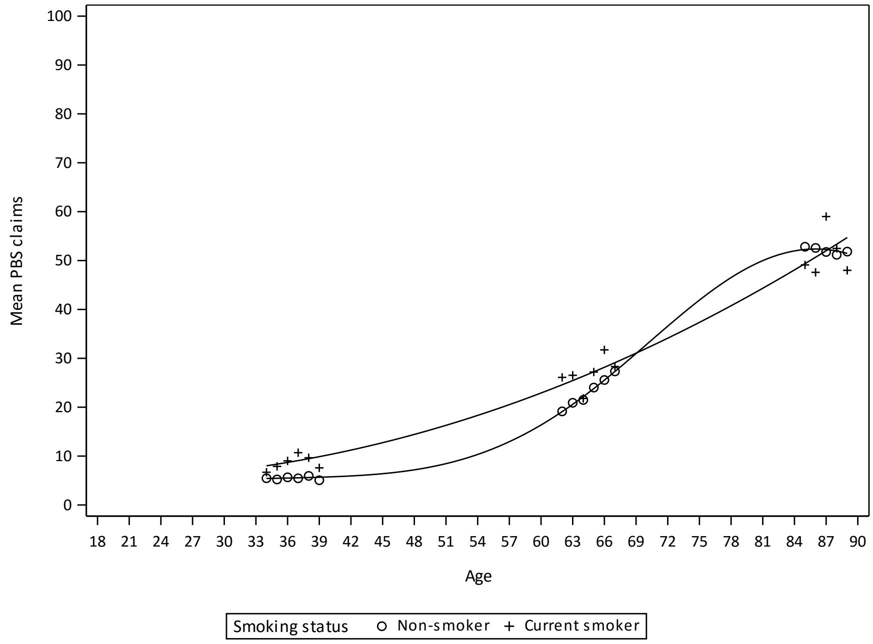

Figure 16-13: A model of the mean number of PBS claims made by women who are smokers or not current smokers, by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

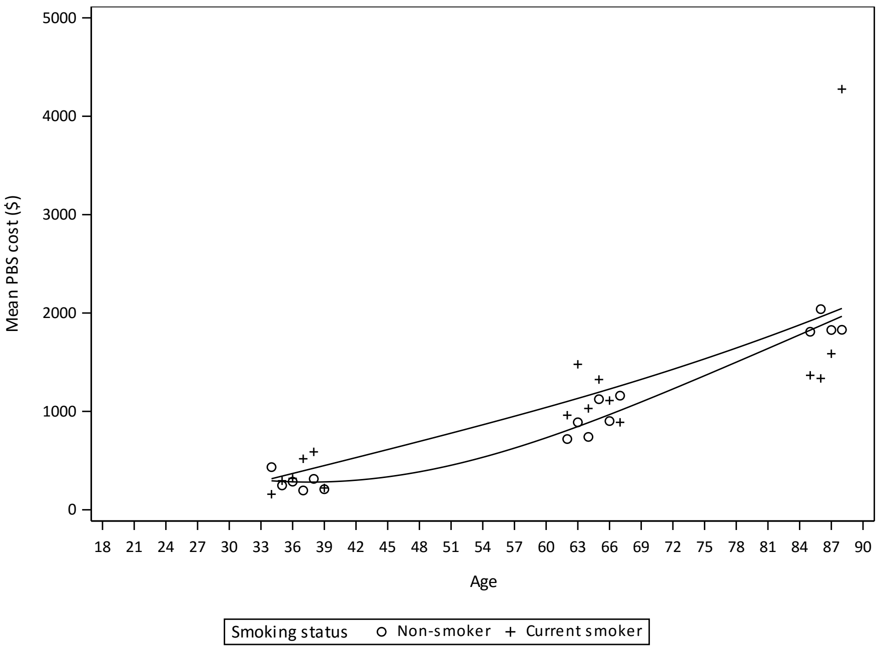

Figure 16-14: A model of the mean PBS cost (in 2012-13 Australian dollars) for women who are smokers or not current smokers, by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

Mental health

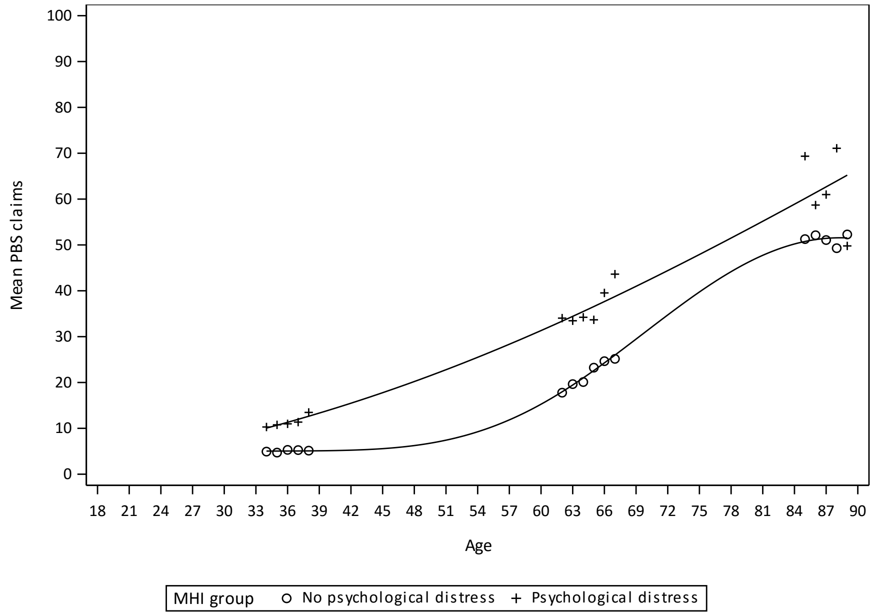

Figure 16-15: A model of the mean number of PBS claims made by women who do or do not have psychological distress, by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

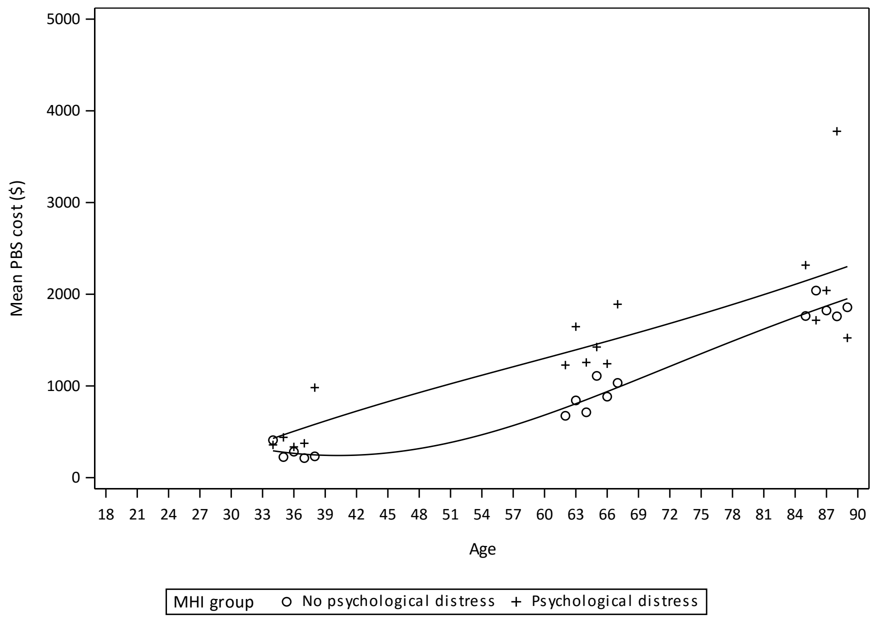

Figure 16-16: A model of the mean PBS cost (in 2012-13 Australian dollars) for women who do or do not have psychological distress, by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

Highest educational attainment

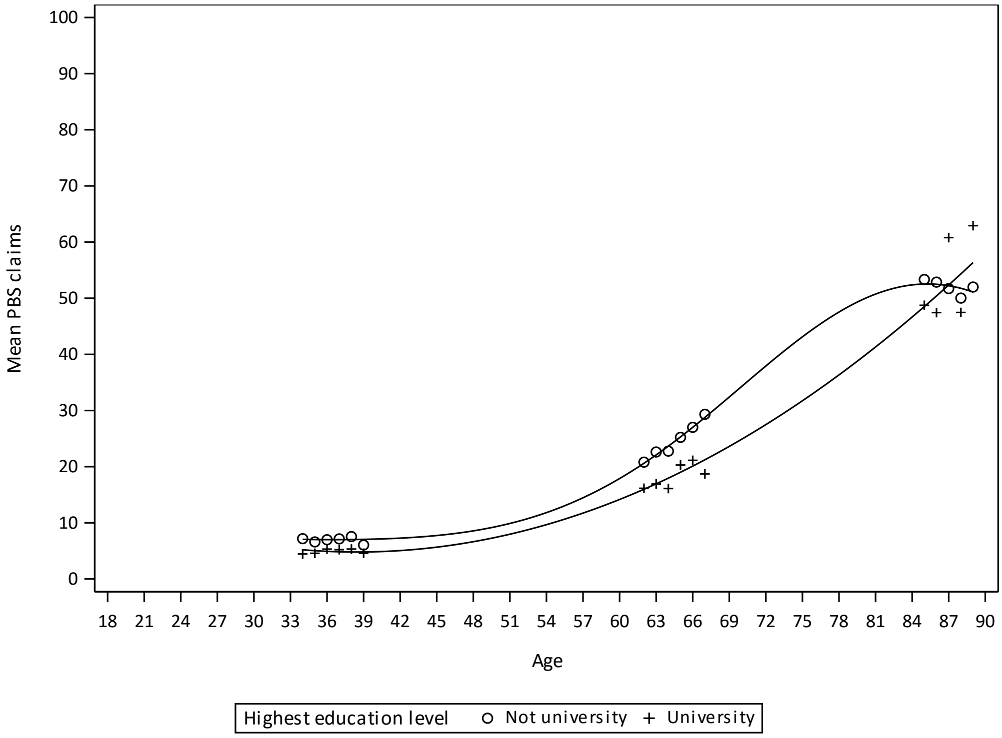

Figure 16-17: A model of the mean number of PBS claims made by women who do or do not have a university education, by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

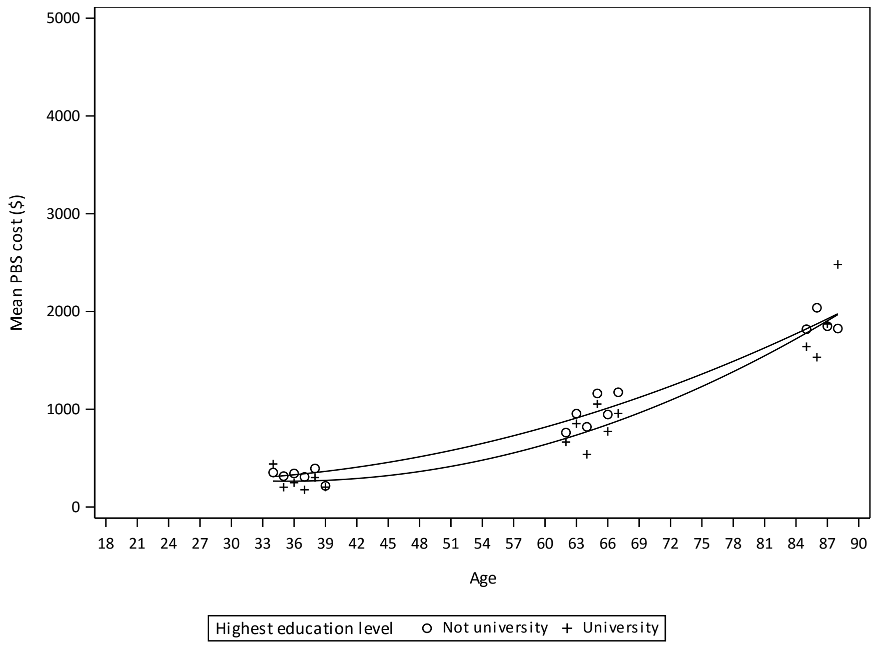

Figure 16-18: A model of the mean PBS cost (in 2012-13 Australian dollars) for women who do or do not have a university education, by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

Ability to manage on income

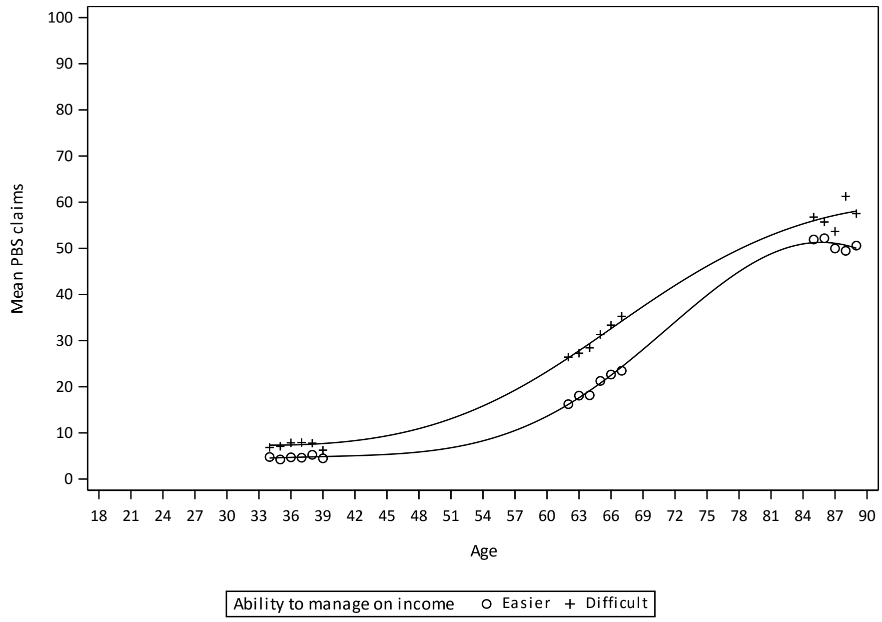

Figure 16-19: A model of the mean number of PBS claims made by women who found it easier or difficult to manage on income, by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

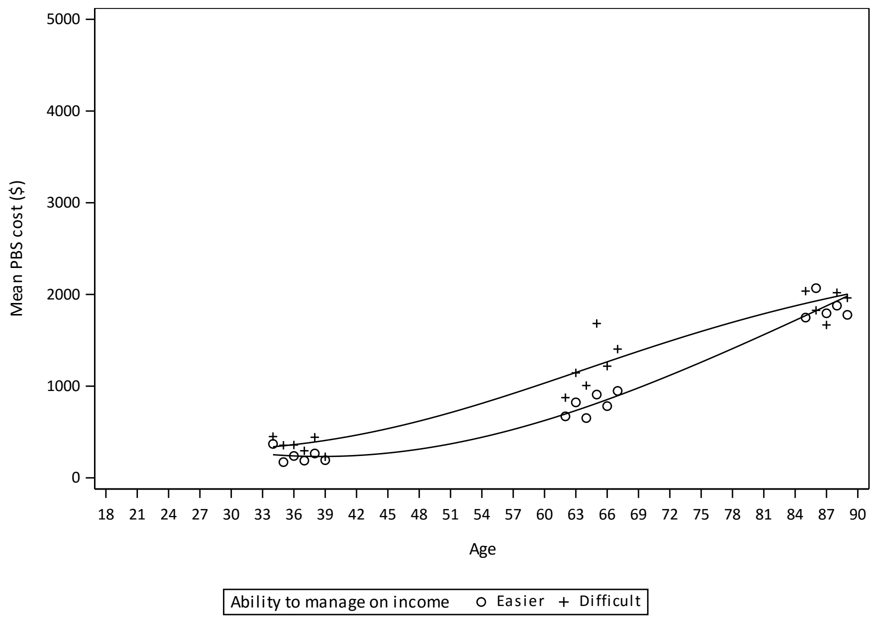

Figure 16-20: A model of the mean PBS cost (in 2012-13 Australian dollars) for women who found it easier or difficult to manage on income, by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

Marital status

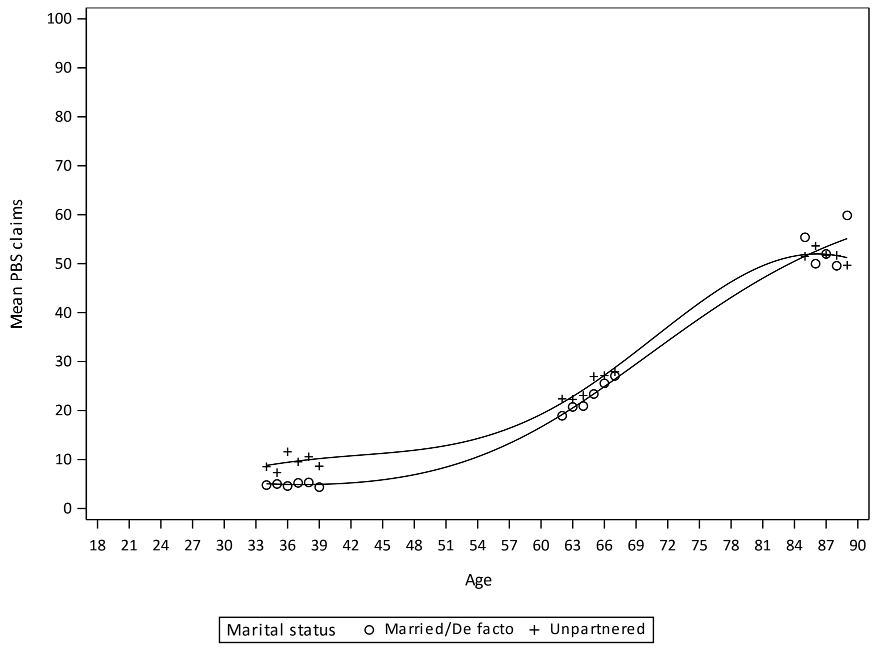

Figure 16-21: A model of the mean number of PBS claims made by women who have a partner or are unpartnered, by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

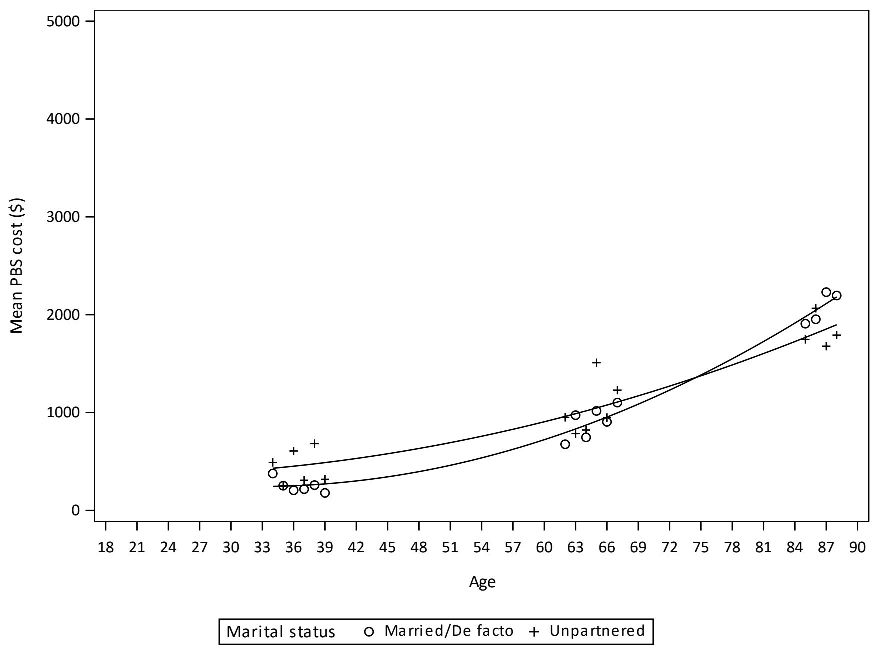

Figure 16-22: A model of the mean PBS cost (in 2012-13 Australian dollars) for women who have a partner or are unpartnered, by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

Area of residence

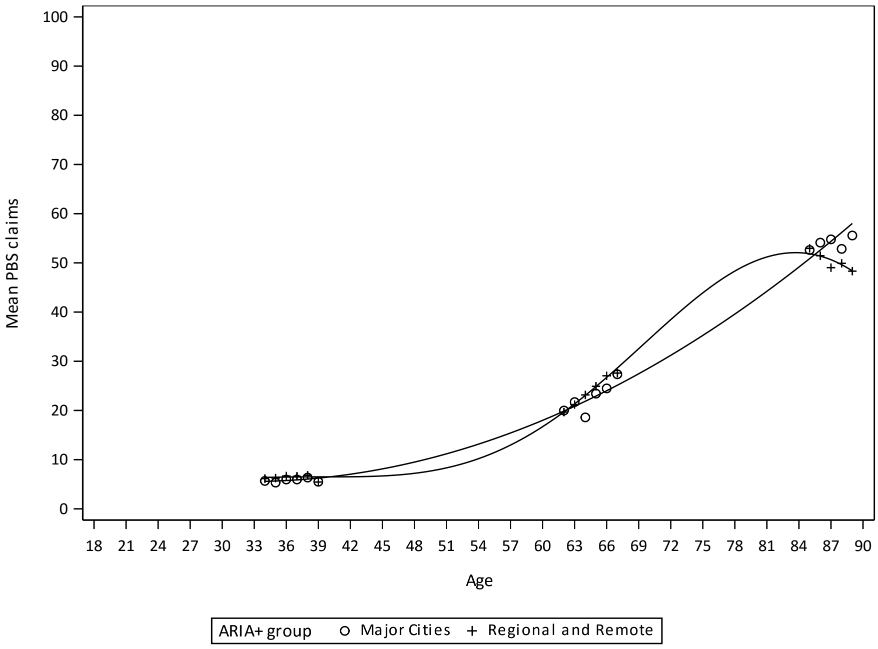

Figure 16-23: A model of the mean number of PBS claims made by women who live in a major city or in a regional/remote area, by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

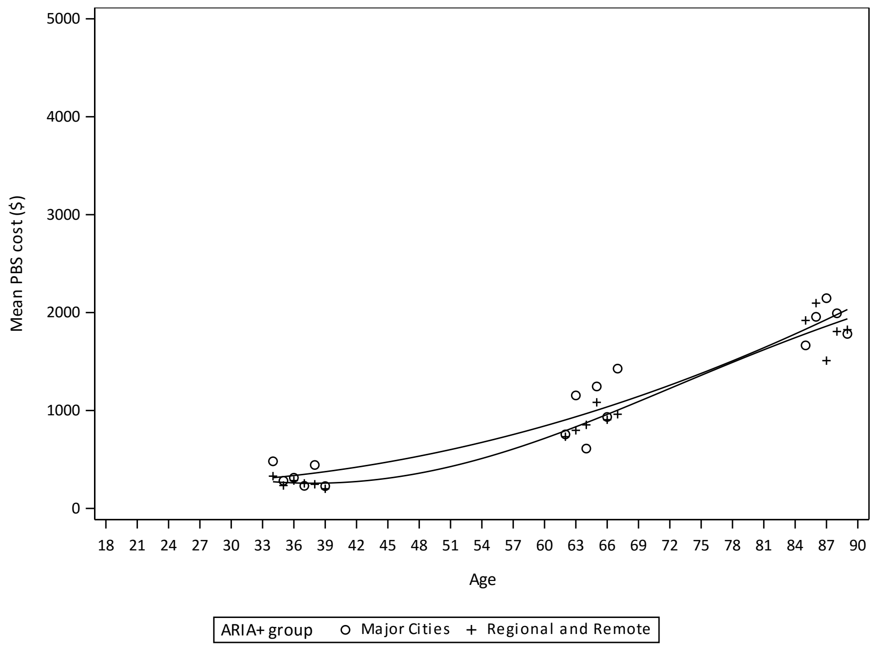

Figure 16-24: A model of the mean PBS cost (in 2012-13 Australian dollars) for women who live in a major city or in a regional/remote area, by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

16.3. Hospital costs

A penalised B-spline was fitted to the mean hospital cost (in 2012-13 Australian dollars) by age at survey to provide age-specific estimates for 45-90 years (for Chapter 3) or 20-90 years (for all other chapters). The model assumes that the age-specific trends for total hospital cost (in 2012-13 Australian dollars) for women with or without the conditions of interest remain the same from 2015 to 2035.

Needing help with daily tasks

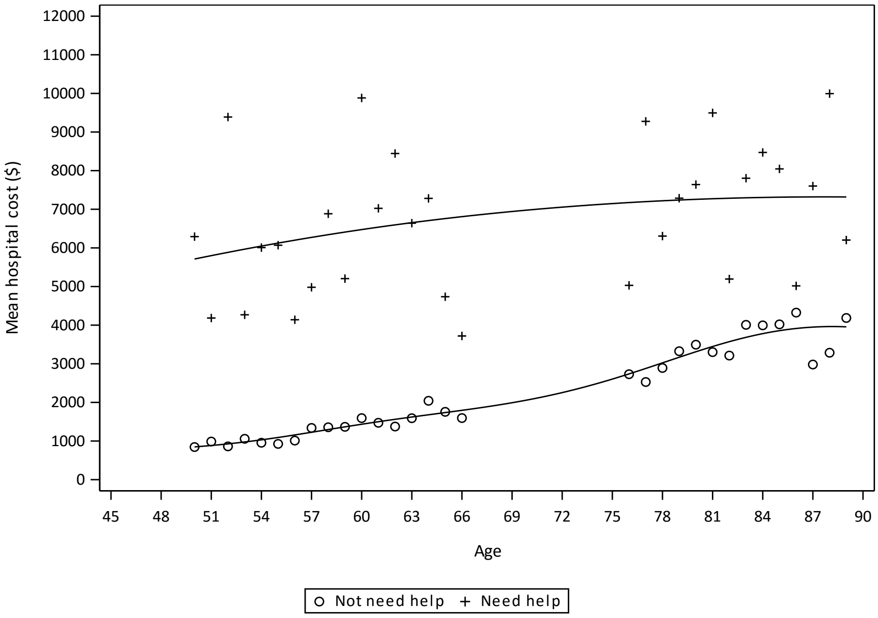

Figure 16-25: A model of the mean hospital costs (in 2012-13 Australian dollars) for women who reported needing or not needing help with daily tasks, by actual age at survey for the 1946-51 and 1921-26 cohorts.

Obesity

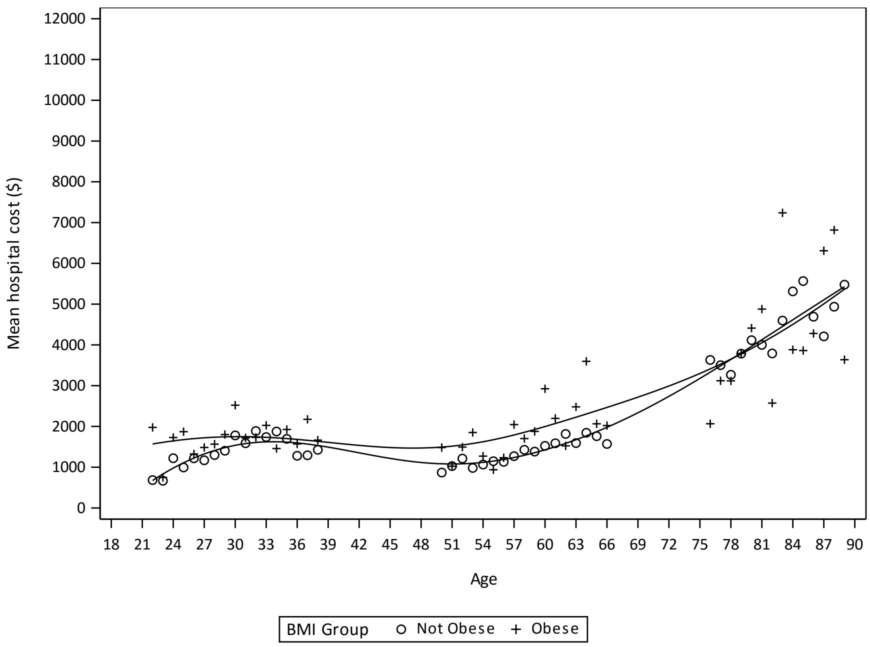

Figure 16-26: A model of the mean hospital costs (in 2012-13 Australian dollars) for women who are obese or not obese, by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

Tobacco use

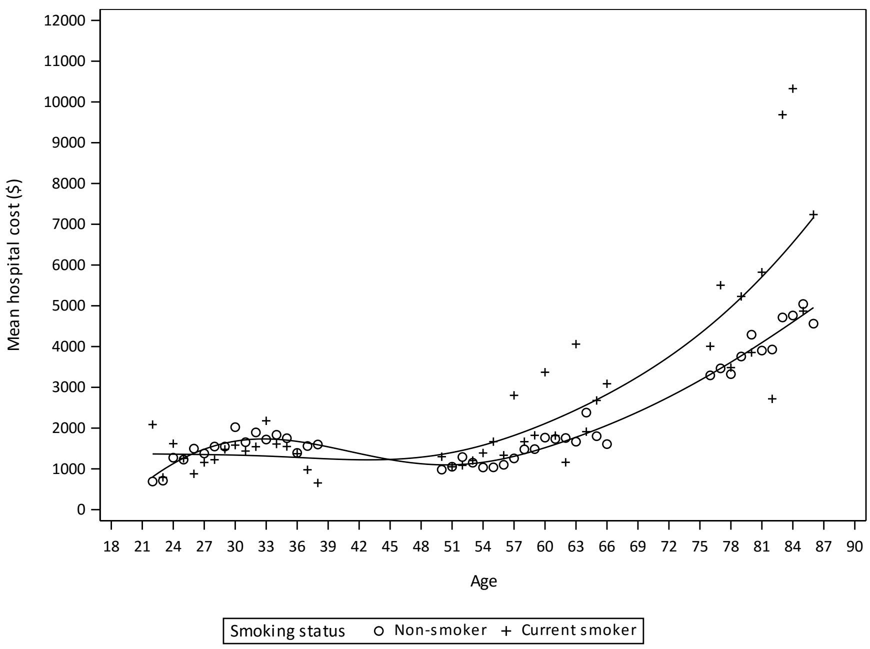

Figure 16-27: A model of the mean hospital costs (in 2012-13 Australian dollars) for women who are smokers or not current smokers, by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

Mental health

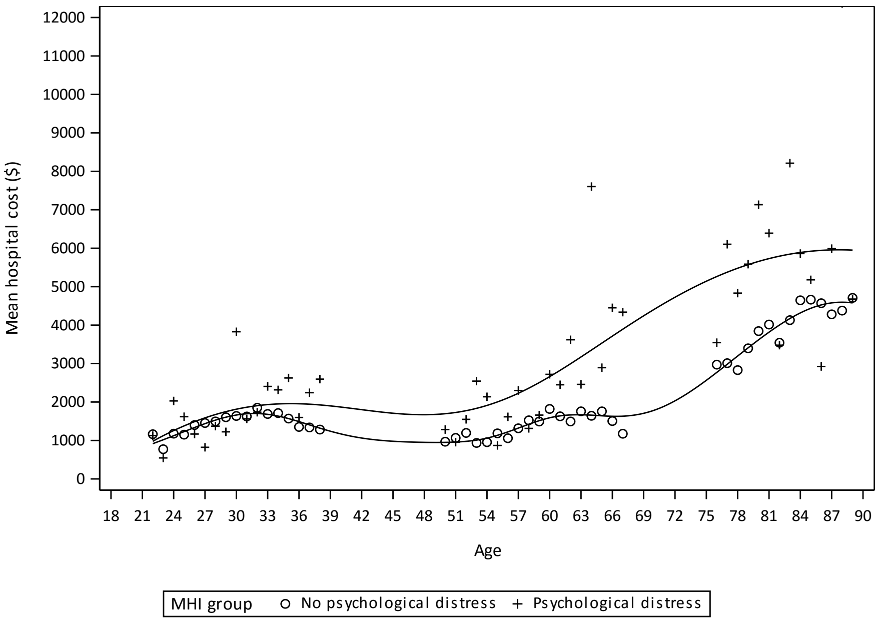

Figure 16-28: A model of the mean hospital costs (in 2012-13 Australian dollars) for women who do or do not have psychological distress, by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

Highest educational attainment

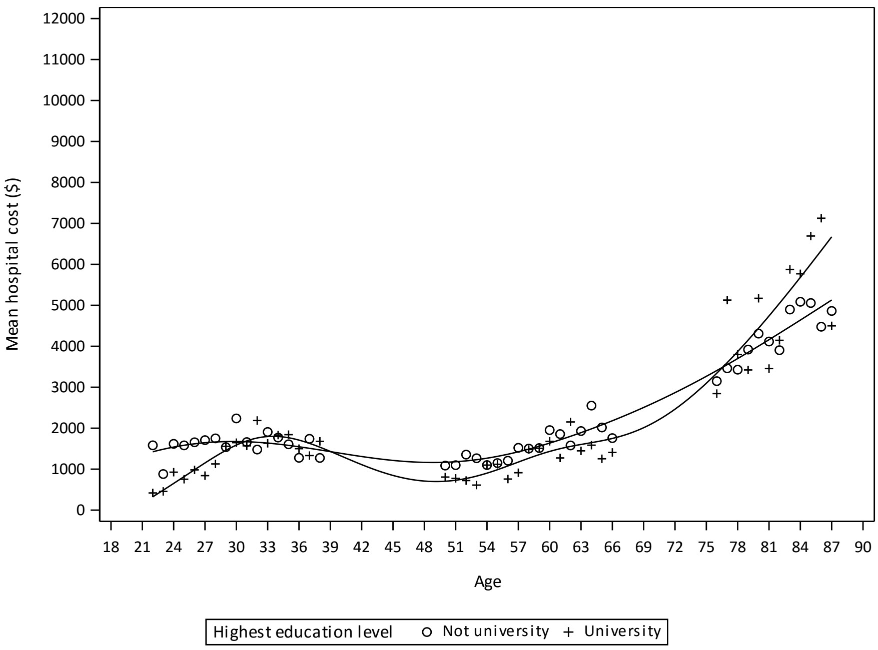

Figure 16-29: A model of the mean hospital costs (in 2012-13 Australian dollars) for women who do or do not have a university education, by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

Ability to manage on income

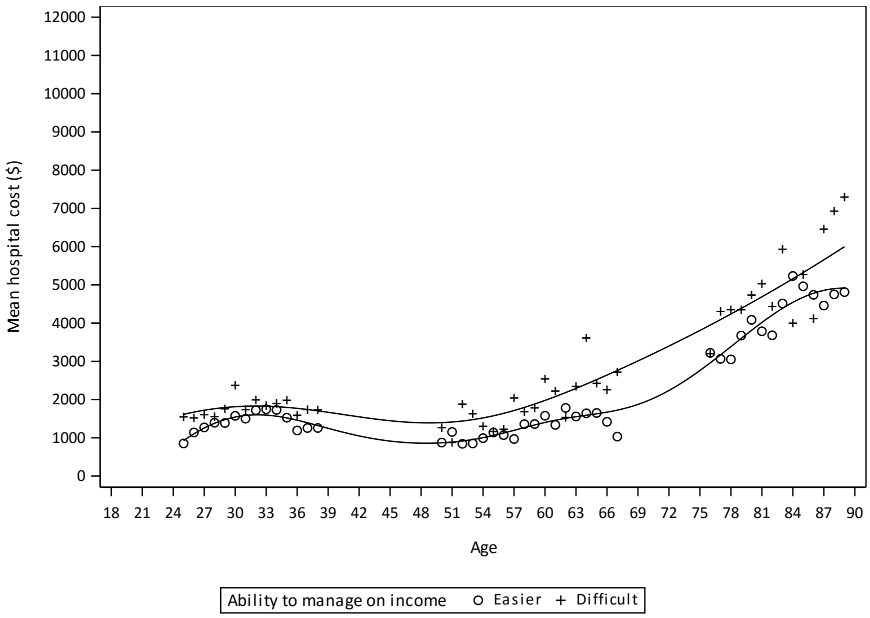

Figure 16-30: A model of the mean hospital costs (in 2012-13 Australian dollars) for women who found it easier or difficult to manage on income, by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

Marital status

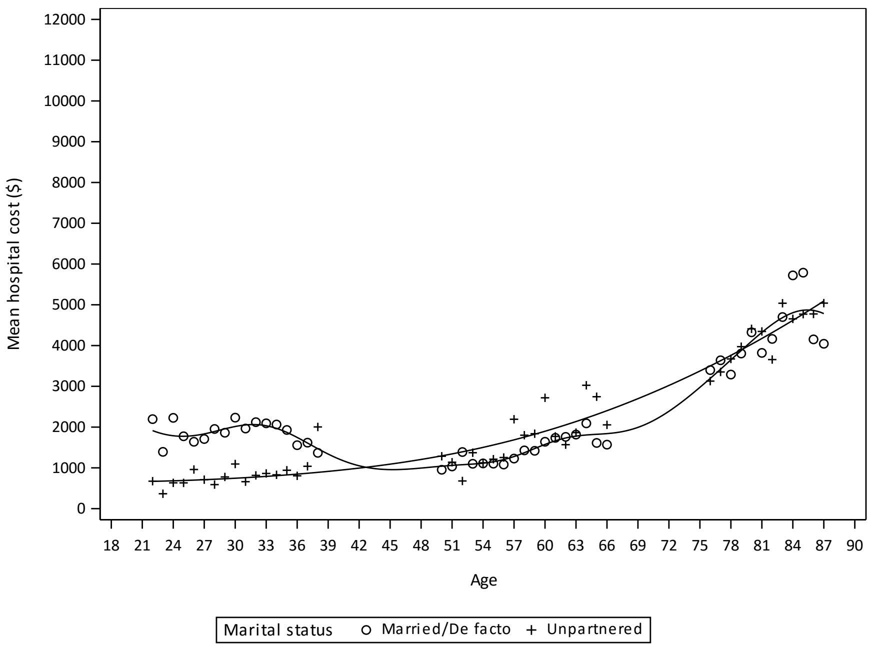

Figure 16-31: A model of the mean hospital costs (in 2012-13 Australian dollars) for women who have a partner or are unpartnered, by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

Area of residence

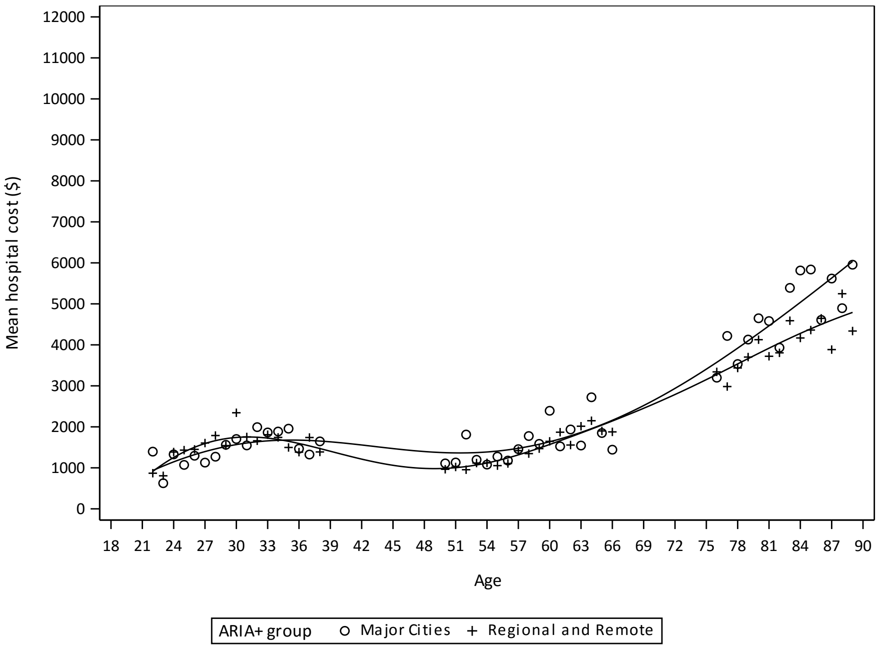

Figure 16-32: A model of the mean hospital costs (in 2012-13 Australian dollars) for women who live in a major city or in a regional/remote area, by actual age at survey for the 1973-78, 1946-51, and 1921-26 cohorts.

17. Appendix F: Method for projecting healthcare use and expenditure from 2015 to 2035

17.1. Medicare Benefits Scheme

To project the total number of unreferred MBS claims and costs from 2015 to 2035, we assumed that the age-specific trends for number of MBS claims and costs (in 2014 Australian dollars) for women in each group remained the same over the next 20-year time period. The total number of MBS claims and total MBS costs (in 2014 Australian dollars) were projected using the following equations:

Total number of projected MBS claims in year t:

$$N_{MBS}(z,t) = \sum_{x=20}^{90} [C(x,z) \times P(x,z) \times S_B(x,t)]$$

Total MBS cost in year t for women in group z:

$$T_{MBS}(z,t) = \sum_{x=20}^{90} [C(x,z) \times 48.80 \times P(x,z) \times S_B(x,t)]$$

where:

$N_{MBS}(t)$ is the total number of MBS claims in year t for women in group z,

$T_{MBS}(t)$ is the total MBS cost in year t for the group z,

$C(x,z)$ is the mean number of MBS claims made by women aged x years in group z (based on the model shown in Appendix E Section 16.1),

$P(x,z)$ is the prevalence (%) of women aged x years in group z, and

$S_B(x,t)$ is the projected number of women at age x in year t in ABS population projection series B.

The total number of MBS claims and cost were calculated by summing the values for the two groups (z=1,2).

17.2. Pharmaceutical Benefits Scheme

To project the total number of PBS prescriptions filled and cost from 2015 to 2035, we assumed that the age-specific trends for number of PBS prescriptions filled and cost (in 2012-13 Australian dollars) for women in each group remained the same over the next 20-year time period. The total number of PBS claims and total PBS cost (in 2012-13 Australian dollars) were projected using the following equations:

Total number of projected PBS claims in year t:

$$N_{PBS}(z,t) = \sum_{x=20}^{90} [C(x,z) \times P(x,z) \times S_B(x,t)]$$

Total PBS cost in year t for women by the presence or absence of condition z:

$$T_{PBS}(z,t) = \sum_{x=20}^{90} [D(x,z) \times P(x,z) \times S_B(x,t)]$$

where:

$N_{PBS}(z)$ is the total number of PBS claims in year t,

$T_{PBS}(z)$ is the total PBS cost in year t,

$C(x,z)$ is the mean number of PBS claims made by women aged x years in group z (z=1,2 for women with or without the condition based on the model shown in Appendix E Section 16.2),

$D(x,z)$ is the mean PBS cost made by women aged x years with or without condition z in the sample (based on the penalised B-spline model shown in Appendix E Section 16.2),

$P(x,z)$ is the prevalence (%) of women aged x years in group z, and

$S_B(x,t)$ is the projected number of women at age x in year t in ABS population projection series B.

The total number of PBS claims and cost is calculated by summing the values for the two groups.

17.3. Hospital costs

To project the total hospital cost from 2015 to 2035, we assumed that the age-specific trends for hospital cost (in 2012-13 Australian dollars) for women in each group remained the same over the next 20-year time period. The total hospital cost (in 2012-13 Australian dollars) was projected using the following equation:

Total hospital cost in year t for women by the presence or absence of condition z:

$$T_{hosp}(z,t) = \sum_{x=20}^{90} [D(x,z) \times P(x,z) \times S_B(x,t)]$$

where:

$T_{hosp}(z)$ is the total hospital cost in year t,

$D(x,z)$ is the mean hospital cost made by women aged x years with or without condition z (based on the model shown in Appendix E Section 16.3),

$P(x,z)$ is the prevalence (%) of women aged x years in group z, and

$S_B(x,t)$ is the projected number of women at age x in year t in population projection series B.

The total hospital cost was calculated by summing the values for the two groups.

18. Appendix G: Reference tables for dementia

Table 18-1: Demographic characteristics by source of data on dementia.

	Self-reported survey	**Aged care data**	**Causes of death**	**Pharmaceutical /prescription**	**Hospital Data**
Total identified cases	A	B	C	D	E
N=2534	N=468	N=2010	N=786	N=877	N=983
% of identified cases †	18.5%	79.3%	31.0%	34.6%	55.8%
Median age in years (quartiles)*	83.2 (79.9, 86.2)	85.1 (83.1, 86.8)	85.0 (82.8, 86.8)	82.7 (80.4, 85.2)	84.3 (81.8, 86.6)
Age (years)*	n (%)	n (%)	n (%)	n (%)	n (%)
<75	18 (3.8)	0	7 (0.9)	0	1 (0.1)
75-79	108 (23.1)	85 (4.2)	55 (7.0)	172 (19.6)	155 (15.8)
80-84	174 (37.2)	889 (44.2)	326 (41.5)	440 (50.2)	404 (41.1)
85-89	164 (35.0)	1009 (50.2)	379 (48.2)	259 (29.5)	403 (41.0)
≥90	4 (0.9)	26 (1.3)	11 (1.4)	6 (0.7)	20 (2.0)
Unknown		1 (0.05)	8 (1.0)		
Location					
Major cities	211 (45.1)	935 (46.5)	343 (43.6)	408 (46.5)	459 (46.7)
Inner regional	162 (34.6)	727 (36.2)	300 (38.2)	321 (36.6)	367 (37.3)
Outer regional	86 (18.4)	325 (16.2)	133 (16.9)	134 (15.3)	148 (15.1)
Remote	8 (1.7)	20 (1.0)	8 (1.0)	12 (1.4)	8 (0.8)
Very remote	1 (0.2)	3 (0.1)	2 (0.3)	2 (0.2)	1 (0.1)

A = Self-reported survey data

B = Aged care data

C = Death certificate data

D = Prescription data

E = Hospital admission patients data (only for States, Queensland, New South Wales, South Australia Total n=7750)

*: Age dementia recorded

†: Row percentages do not add up to 100% because cases can be identified from more than one source.

Table 18-2: Dementia incidence estimates used in projections.

Age	Sourced incidence %	Source	Fitted incidence %	Notes
60			0.04	Linear regression
61			0.07	between 60-74
62	0.11	(Gao, Hendrie & Hall, 1998)	0.10	
63			0.12	
64			0.15	
65			0.18	
66			0.21	
67	0.21	(Gao, Hendrie & Hall, 1998)	0.24	
68			0.26	
69			0.29	
70			0.32	
71			0.35	
72	0.39	(Fratiglioni et al., 2000)	0.38	
73			0.40	
74			0.43	
75			0.64	Spline regression
76			0.88	between 75-98
77	1.72	(Fratiglioni et al., 2000)	1.16	
78			1.47	
79			1.83	
80	1.84	ALSWH	2.22	
81	2.72		2.65	
82	2.92		3.12	
83	4.19		3.63	
84	4.13		4.19	
85	5.67		4.78	
86	5.32		5.42	
87	8.18		6.11	

88	7.32		6.84	
89	6.15		7.62	
90	4.33		8.44	
91			9.31	
92	10.32	(Corrada et al., 2010)	10.23	
93			11.20	
94			12.22	
95			13.29	
96			14.41	
97	17.20	(Corrada et al., 2010)	15.57	
98			17.60	
99			19.99	Linear regression
100			21.38	between 99-100

Correction factors applied to convert rates per person-years to percentages: 70-74=$\times\ 0.83$, 75-79=$\times\ 0.98$, 80-84=$\times\ 0.97$, 85-100=$\times\ 0.80$

Table 18-3: Dementia prevalence rates used in projections based on Access Economics (Economics, 2005) and ALSWH estimates.

Age	Sourced prevalence % (Economics, 2005)	Fitted prevalence %	Notes
60		0	Linear regression
61		0.11	between 60-74
62	0.60	0.38	
63		0.65	
64		0.92	
65		1.19	
66		1.46	
67	1.30	1.73	
68		2.00	
69		2.27	
70		2.54	
71		2.81	
72	3.30	3.08	
73		3.35	
74		3.62	
75		4.55	Spline regression
76		5.53	between 75-89
77	6.30	6.63	
78		7.88	
79		9.26	
80		10.79	
81		12.45	
82	12.60	14.24	
83		16.14	

84		18.14	
85	18.56	20.21	
86	21.40	22.32	
87	21.94	24.45	
88	29.48	26.56	
89	31.99	28.63	
90	32.38	30.82	Linear regression
91		32.31	between 90-100
92	33.33	33.79	
93		35.28	
94		36.76	
95		38.25	
96		39.73	
97	40.30	41.21	
98		42.70	
99		44.18	
100		45.67	

Sourced ALSWH estimates for ages 85-90

19. References

ABS. 1996. Australian Social Trends, 1996. Canberra: ABS.

ABS. 1998. Australian Social Trends, 1998. Canberra: ABS.

ABS. 1999. Disability, Ageing and Carers: Summary of Findings 1998. Canberra: ABS.

ABS. 2004a. Australian Social Trends, 2004. Canberra: ABS.

ABS. 2004b. Disability, Ageing, and Carers, Australia: Summary of Findings, 2003. Canberra: ABS.

ABS. 2008. Australian Social Trends, 2008. Canberra: ABS.

ABS. 2009. Australian Social Trends, March 2009. Australian Social Trends. 4102.0. Canberra: ABS.

ABS. 2010a. Australian Social Trends 2010. Australian Social Trends 4102.0. Canberra: ABS.

ABS. 2010b. Disability, Ageing and Carers: Summary of Findings 2009. Canberra: ABS.

ABS. 2011. Education and Work, Australia, May 2011. Education and Work, Australia. 6227.0. Canberra: ABS.

ABS. 2012a. 4430.0 Disability, Ageing and Carers, Australia: Summary of Findings, 2012. Canberra: ABS.

ABS. 2012b. Australian Health Survey: First Results, 2011-12. Canberra: Commonwealth of Australia.

ABS 2012c. Place of Usual Residence, Canberra: ABS. Available: http://www.abs.gov.au/websitedbs/censushome.nsf/home/statementspersonpurp?opendocument&navpos=430 [Accessed 24 March 2016]

ABS. 2012d. Reflecting a Nation: Stories from the 2011 Census, 2012-2013. Canberra: Australian Government.

ABS. 2012e. Year Book Australia, 2012. Year Book Australia. 1301.0. Canberra: ABS.

ABS. 2013. 3220.0 Population Projections, Australia, 2012 to 2101. Canberra: ABS.

ABS. 2015a. Animated Population Pyramids. Canberra: ABS. Available: http://www.abs.gov.au/websitedbs/d3310114.nsf/home/Population%20Pyramid%20-%20Australia [Accessed 24 March 2016].

ABS. 2015b. Data from the National Health Survey: First Results, 2014-15. Canberra: ABS

ABS. 2015c. Education and Work, Australia, May 2015. Education and Work, Australia. 6227.0. Canberra: Australian Bureau of Statistics.

ABS. 2015d. Marriages and Divorces, Australia, 2014 Marriages and Divorces, Australia. 3310.0. Canberra: Australian Bureau of Statistics.

ABS. 2015e. National Health Survey: First Results, 2014-15. 4364.0.55.001. Canberra: Commonwealth of Australia.

ABS. 2016. Causes of Death, Australia, 2014. Causes of Death, Australia. Cat. no. 3303.0. Canberra: Australian Bureau of Statistics.

AHNQUIST, J., WAMALA, S.P. & LINDSTROM, M. 2012. Social determinants of health--a question of social or economic capital? Interaction effects of socioeconomic factors on health outcomes, *Soc Sci Med*. 74, 930-9.

AIHW. 2000. 1998 National Drug Strategy Household Survey: Detailed findings. Drug Statistics Series. AIHW cat. no. PHE 276. Canberra: AIHW.

AIHW. 2006. Health inequalities in Australia: morbidity, health behaviours, risk factors and health service use. Health Inequalities Monitoring Series. 2. Canberra: AIHW.

AIHW. 2008. Rural, regional and remote health: Indicators of health status and determinants of health. Rural Health Series. Number 9. Canberra: AIHW.

AIHW. 2011a. 2010 National Drug Strategy Household Survey report. Drug statistics series. Cat. no. PHE 145. Canberra: AIHW.

AIHW. 2011b. Australian health expenditure by remoteness: A comparison of remote, regional and city health expenditure. Health and welfare expenditure series. 50. Canberra: AIHW.

AIHW. 2012. Dementia in Australia. Cat. no. AGE 70. Canberra: AIHW.

AIHW. 2013. Australia’s welfare 2013. Australia’s welfare series. Cat. no. AUS 174. Canberra: AIHW.

AIHW. 2014a. Australia's health 2014. Australia's health series. Cat. no. AUS 178. Canberra: AIHW.

AIHW. 2014b. National Drug Strategy Household Survey detailed report 2013. Drug statistics series. Cat. no. PHE 183. Canberra: AIHW.

AIHW. 2015. Australian Burden of Disease Study: Fatal burden of disease 2010. Australian Burden of Disease Study series no. 1. Cat. no. BOD 1. Canberra: AIHW.

ALMEIDA, O.P., HULSE, G.K., LAWRENCE, D. & FLICKER, L. 2002. Smoking as a risk factor for Alzheimer's disease: contrasting evidence from a systematic review of case-control and cohort studies, *Addiction*. 97, 15-28.

ALSWH. 2000. The Australian Longitudinal Study on Women's Health, Technical Reports Report Number 14, The Australian Longitudinal Study on Women's Health.

ANSTEY, K.J., BURNS, R.A., BIRRELL, C.L., STEEL, D., KIELY, K.M. & LUSZCZ, M.A. 2010. Estimates of probable dementia prevalence from population-based surveys compared with dementia prevalence estimates based on meta-analyses, *BMC Neurol*. 10, 62.

ANSTEY, K.J., VON SANDEN, C., SALIM, A. & O'KEARNEY, R. 2007. Smoking as a risk factor for dementia and cognitive decline: a meta-analysis of prospective studies, *Am J Epidemiol*. 166, 367-78.

BAADE, P.D., YU, X.Q., SMITH, D.P., DUNN, J. & CHAMBERS, S.K. 2015. Geographic disparities in prostate cancer outcomes--review of international patterns, *Asian Pac J Cancer Prev*. 16, 1259-75.

BACKHOLER, K., MANNAN, H.R., MAGLIANO, D.J., WALLS, H.L., STEVENSON, C., BEAUCHAMP, A., SHAW, J.E. & PEETERS, A. 2012. Projected socioeconomic disparities in the prevalence of obesity among Australian adults, *Aust N Z J Public Health*. 36, 557-63.

BANKS, E., JOSHY, G., WEBER, M.F., LIU, B., GRENFELL, R., EGGER, S., PAIGE, E., LOPEZ, A.D., SITAS, F. & BERAL, V. 2015. Tobacco smoking and all-cause mortality in a large Australian cohort study: findings from a mature epidemic with current low smoking prevalence, *BMC Med*. 13, 38.

BERECKI-GISOLF, J., MCKENZIE, S.J., DOBSON, A.J., MCFARLANE, A. & MCLAUGHLIN, D. 2013. A history of comorbid depression and anxiety predicts new onset of heart disease, *J Behav Med*. 36, 347-53.

BERWICK, D.M., MURPHY, J.M., GOLDMAN, P.A., WARE, J.E., JR., BARSKY, A.J. & WEINSTEIN, M.C. 1991. Performance of a five-item mental health screening test, *Med Care*. 29, 169-76.

BEYDOUN, M.A., BEYDOUN, H.A., GAMALDO, A.A., TEEL, A., ZONDERMAN, A.B. & WANG, Y. 2014. Epidemiologic studies of modifiable factors associated with cognition and dementia: systematic review and meta-analysis, *BMC Public Health*. 14, 643.

BEYDOUN, M.A., LHOTSKY, A., WANG, Y., DAL FORNO, G., AN, Y., METTER, E.J., FERRUCCI, L., O'BRIEN, R. & ZONDERMAN, A.B. 2008. Association of adiposity status and changes in early to mid-adulthood with incidence of Alzheimer's disease, *Am J Epidemiol*. 168, 1179-89.

BIHAN, H., BACKHOLER, K., PEETERS, A., STEVENSON, C.E., SHAW, J.E. & MAGLIANO, D.J. 2016. Socioeconomic Position and Premature Mortality in the AusDiab Cohort of Australian Adults, *Am J Public Health*. 106, 470-7.

BILANO, V., GILMOUR, S., MOFFIET, T., D'ESPAIGNET, E.T., STEVENS, G.A., COMMAR, A., TUYL, F., HUDSON, I. & SHIBUYA, K. 2015. Global trends and projections for tobacco use, 1990-2025: an analysis of smoking indicators from the WHO Comprehensive Information Systems for Tobacco Control, *Lancet*. 385, 966-76.

BOWRING, A.L., PEETERS, A., FREAK-POLI, R., LIM, M.S., GOUILLOU, M. & HELLARD, M. 2012. Measuring the accuracy of self-reported height and weight in a community-based sample of young people, *BMC Med Res Methodol*. 12, 175.

BROWN, W.J., MISHRA, G., KENARDY, J. & DOBSON, A. 2000. Relationships between body mass index and well-being in young Australian women, *Int J Obes Relat Metab Disord*. 24, 1360-8.

BROWN, W.J., YOUNG, A.F. & BYLES, J.E. 1999. Tyranny of distance? The health of mid-age women living in five geographical areas of Australia, *Aust J Rural Health*. 7, 148-54.

BUNKER, S.J., COLQUHOUN, D.M., ESLER, M.D., HICKIE, I.B., HUNT, D., JELINEK, V.M., OLDENBURG, B.F., PEACH, H.G., RUTH, D., TENNANT, C.C. & TONKIN, A.M. 2003. "Stress" and coronary heart disease: psychosocial risk factors, *Med J Aust*. 178, 272-6.

BURKE, H., LEONARDI-BEE, J., HASHIM, A., PINE-ABATA, H., CHEN, Y., COOK, D.G., BRITTON, J.R. & MCKEEVER, T.M. 2012. Prenatal and passive smoke exposure and incidence of asthma and wheeze: systematic review and meta-analysis, *Pediatrics*. 129, 735-44.

BURTON, N.W., BROWN, W. & DOBSON, A. 2010. Accuracy of body mass index estimated from self-reported height and weight in mid-aged Australian women, *Aust N Z J Public Health*. 34, 620-3.

BYLES, J., POWERS, J., CHOJENTA, C. & WARNER-SMITH, P. 2006. Older women in Australia: ageing in urban, rural and remote environments, *Australasian J Ageing*. 25, 6.

CAAMANO-ISORNA, F., CORRAL, M., MONTES-MARTINEZ, A. & TAKKOUCHE, B. 2006. Education and dementia: a meta-analytic study, *Neuroepidemiology*. 26, 226-32.

CAMERON, A.J., WELBORN, T.A., ZIMMET, P.Z., DUNSTAN, D.W., OWEN, N., SALMON, J., DALTON, M., JOLLEY, D. & SHAW, J.E. 2003. Overweight and obesity in Australia: the 1999-2000 Australian Diabetes, Obesity and Lifestyle Study (AusDiab), *Med J Aust*. 178, 427-32.

CARRERAS, G., GORINI, G., GALLUS, S., IANNUCCI, L. & LEVY, D.T. 2012. Predicting the future prevalence of cigarette smoking in Italy over the next three decades, *Eur J Public Health*. 22, 699-704.

CDC. 2015. Current Cigarette Smoking Among Adults — United States, 2005–2014, Morbidity and Mortality Weekly Report 44, Centers for Disease Control and Prevention.

CDPH. 2015. California Tobacco Facts and Figures 2015, California Department of Public Health, Sacramento, CA.

CHONDUR, R., LI, S.Q., GUTHRIDGE, S. & LAWTON, P. 2014. Does relative remoteness affect chronic disease outcomes? Geographic variation in chronic disease mortality in Australia, 2002-2006, *Aust N Z J Public Health*. 38, 117-21.

COLAGIURI, S., LEE, C.M., COLAGIURI, R., MAGLIANO, D., SHAW, J.E., ZIMMET, P.Z. & CATERSON, I.D. 2010. The cost of overweight and obesity in Australia, *Med J Aust*. 192, 260-4.

COLLINS, D.J. & LAPSLEY, H.M. 2008. The Costs of Tobacco, Alcohol and Illicit Drug Abuse to Australian Society in 2004/05. Canberra: Commonwealth of Australia.

CONNOR GORBER, S., TREMBLAY, M., MOHER, D. & GORBER, B. 2007. A comparison of direct vs. self-report measures for assessing height, weight and body mass index: a systematic review, *Obes Rev*. 8, 307-26.

CORRADA, M.M., BROOKMEYER, R., BERLAU, D., PAGANINI-HILL, A. & KAWAS, C.H. 2008. Prevalence of dementia after age 90: results from the 90+ study, *Neurology*. 71, 337-43.

CORRADA, M.M., BROOKMEYER, R., PAGANINI-HILL, A., BERLAU, D. & KAWAS, C.H. 2010. Dementia incidence continues to increase with age in the oldest old: the 90+ study, *Ann Neurol*. 67, 114-21.

CRIMMINS, E.M., KIM, J.K. & SOLE-AURO, A. 2011. Gender differences in health: results from SHARE, ELSA and HRS, *Eur J Public Health*. 21, 81-91.

DAHL, A.K., LOPPONEN, M., ISOAHO, R., BERG, S. & KIVELA, S.L. 2008. Overweight and obesity in old age are not associated with greater dementia risk, *J Am Geriatr Soc*. 56, 2261-6.

DAHL, A.K., REYNOLDS, C.A., FALL, T., MAGNUSSON, P.K. & PEDERSEN, N.L. 2014. Multifactorial analysis of changes in body mass index across the adult life course: a study with 65 years of follow-up, *Int J Obes (Lond)*. 38, 1133-41.

DAL GRANDE, E., GILL, T., TAYLOR, A.W., CHITTLEBOROUGH, C. & CARTER, P. 2005. Obesity in South Australian adults--prevalence, projections and generational assessment over 13 years, *Aust N Z J Public Health*. 29, 343-8.

DIEA. 1985. Review '85. Canberra: Department of Immigration and Ethnic Affairs.

DOBSON, A., MCLAUGHLIN, D., VAGENAS, D. & WONG, K.Y. 2010. Why are death rates higher in rural areas? Evidence from the Australian Longitudinal Study on Women's Health, *Aust N Z J Public Health*. 34, 624-8.

DOBSON, A.J., HOCKEY, R., BROWN, W.J., BYLES, J.E., LOXTON, D.J., MCLAUGHLIN, D., TOOTH, L.R. & MISHRA, G.D. 2015. Cohort Profile Update: Australian Longitudinal Study on Women's Health, *Int J Epidemiol*. 44,

DOHAC. 2001. Measuring Remoteness: Accessibility/Remoteness Index of Australia (ARIA). Occasional Papers. New Series Number 14. Canberra: Department of Health and Aged Care.

ECONOMICS, A. 2005. Dementia Estimates and Projections: Australian States and Territories: Report for Alzheimers Australia.

ENGLISH, D.R., VU, H.T. & KNUIMAN, M.W. 2002. The impact of smoking on use of hospital services: the Busselton study, *Aust N Z J Public Health*. 26, 225-30.

ENGSTROM, J.L., PATERSON, S.A., DOHERTY, A., TRABULSI, M. & SPEER, K.L. 2003. Accuracy of self-reported height and weight in women: an integrative review of the literature, *J Midwifery Womens Health*. 48, 338-45.

FINE, J.P. & GRAY, R.J. 1999. A proportional hazards model for the subdistribution of a competing risk, *Journal of the American Statistical Association*. 94, 496-509.

FOTENOS, A.F., MINTUN, M.A., SNYDER, A.Z., MORRIS, J.C. & BUCKNER, R.L. 2008. Brain volume decline in aging: evidence for a relation between socioeconomic status, preclinical Alzheimer disease, and reserve, *Arch Neurol*. 65, 113-20.

FRATIGLIONI, L., LAUNER, L.J., ANDERSEN, K., BRETELER, M.M., COPELAND, J.R., DARTIGUES, J.F., LOBO, A., MARTINEZ-LAGE, J., SOININEN, H. & HOFMAN, A. 2000. Incidence of dementia and major subtypes in Europe: A collaborative study of population-based cohorts. Neurologic Diseases in the Elderly Research Group, *Neurology*. 54, S10-5.

GALE, C.R., COOPER, C. & SAYER, A.A. 2015. Prevalence of frailty and disability: findings from the English Longitudinal Study of Ageing, *Age Ageing*. 44, 162-5.

GAO, S., HENDRIE, H.C. & HALL, K.S. 1998. The relationships between age, sex, and the incidence of dementia and Alzheimer disease - A meta-analysis, *Archives of General Psychiatry*. 55, 809-15.

GARDINER, P.A., MISHRA, G.D. & DOBSON, A.J. 2016. The Effect of Socioeconomic Status Across Adulthood on Trajectories of Frailty in Older Women, *J Am Med Dir Assoc*. 17, 3.

GARTNER, C.E., BARENDREGT, J.J. & HALL, W.D. 2009. Predicting the future prevalence of cigarette smoking in Australia: how low can we go and by when?, *Tob Control*. 18, 183-9.

GILL, T.M., DESAI, M.M., GAHBAUER, E.A., HOLFORD, T.R. & WILLIAMS, C.S. 2001. Restricted activity among community-living older persons: incidence, precipitants, and health care utilization, *Ann Intern Med*. 135, 313-21.

GOMERSALL, S.R., DOBSON, A.J. & BROWN, W.J. 2014. Weight Gain, Overweight, and Obesity: Determinants and Health Outcomes from the Australian Longitudinal Study on Women's Health, *Curr Obes Rep*. 3, 46-53.

GOSS, J. 2008. Projection of Australian health care expenditure by disease, 2003 to 2033. Health and Welfare Expenditure Series. 36. Canberra:

GRASSET, L., BRAYNE, C., JOLY, P., JACQMIN-GADDA, H., PERES, K., FOUBERT-SAMIER, A., DARTIGUES, J.F. & HELMER, C. 2015. Trends in dementia incidence: Evolution over a 10-year period in France, *Alzheimers Dement*. 13, 9.

HABY, M.M., MARKWICK, A., PEETERS, A., SHAW, J. & VOS, T. 2012. Future predictions of body mass index and overweight prevalence in Australia, 2005-2025, *Health Promot Int*. 27, 250-60.

HAJEK, A. & KONIG, H.H. 2016. Longitudinal Predictors of Functional Impairment in Older Adults in Europe - Evidence from the Survey of Health, Ageing and Retirement in Europe, *PLoS One*. 11, e0146967.

HATCH, S.L., FRISSA, S., VERDECCHIA, M., STEWART, R., FEAR, N.T., REICHENBERG, A., MORGAN, C., KANKULU, B., CLARK, J., GAZARD, B., MEDCALF, R., TEAM, S.E.S. & HOTOPF, M. 2011. Identifying socio-demographic and socioeconomic determinants of health inequalities in a diverse London community: the South East London Community Health (SELCoH) study, *BMC Public Health*. 11, 861.

HAYES, A., GEARON, E., BACKHOLER, K., BAUMAN, A. & PEETERS, A. 2015. Age-specific changes in BMI and BMI distribution among Australian adults using cross-sectional surveys from 1980 to 2008, *Int J Obes (Lond)*. 39, 1209-16.

HE, J., VUPPUTURI, S., ALLEN, K., PREROST, M.R., HUGHES, J. & WHELTON, P.K. 1999. Passive smoking and the risk of coronary heart disease--a meta-analysis of epidemiologic studies, *N Engl J Med*. 340, 920-6.

HENDRIE, G.A., ULLAH, S., SCOTT, J.A., GRAY, J., BERRY, N., BOOTH, S., CARTER, P., COBIAC, L. & COVENEY, J. 2015. Past and projected trends of body mass index and weight status in South Australia: 2003 to 2019, *Aust N Z J Public Health*. 39, 8.

HILDER, L., ZHICHAO, Z., PARKER, M., JAHAN, S. & CHAMBERS, G.M. 2014. Australia's mothers and babies 2012. Perinatal statistics series. no. 30. Canberra: Australian Institute of Health and Welfare.

HOFMAN, A., ROCCA, W.A., BRAYNE, C., BRETELER, M.M., CLARKE, M., COOPER, B., COPELAND, J.R., DARTIGUES, J.F., DA SILVA DROUX, A., HAGNELL, O. & ET AL. 1991. The prevalence of dementia in Europe: a collaborative study of 1980-1990 findings. Eurodem Prevalence Research Group, *Int J Epidemiol*. 20, 736-48.

HOLOWKO, N., JONES, M., TOOTH, L., KOUPIL, I. & MISHRA, G. 2014. Educational mobility and weight gain over 13 years in a longitudinal study of young women, *BMC Public Health*. 14, 1219.

HOOK, E.B. & REGAL, R.R. 1995. Capture-recapture methods in epidemiology: methods and limitations, *Epidemiol Rev*. 17, 243-64.

HOSSEINPOOR, A.R., WILLIAMS, J.S., JANN, B., KOWAL, P., OFFICER, A., POSARAC, A. & CHATTERJI, S. 2012. Social determinants of sex differences in disability among older adults: a multi-country decomposition analysis using the World Health Survey, *Int J Equity Health*. 11, 52.

HURLEY, S.F. 2006. Hospitalisation and costs attributable to tobacco smoking in Australia: 2001-2002, *Med J Aust*. 184, 45.

JAAKKOLA, M.S. & JAAKKOLA, J.J. 2002. Effects of environmental tobacco smoke on the respiratory health of adults, *Scand J Work Environ Health*. 28 Suppl 2, 52-70.

JACKSON, C.A., JONES, M. & MISHRA, G.D. 2014. Educational and homeownership inequalities in stroke incidence: a population-based longitudinal study of mid-aged women, *Eur J Public Health*. 24, 231-6.

JACKSON, C.A. & MISHRA, G.D. 2013. Depression and risk of stroke in midaged women: a prospective longitudinal study, *Stroke*. 44, 1555-60.

JAMROZIK, K., MCLAUGHLIN, D., MCCAUL, K., ALMEIDA, O.P., WONG, K.Y., VAGENAS, D. & DOBSON, A. 2011. Women who smoke like men die like men who smoke: findings from two Australian cohort studies, *Tob Control*. 20, 258-65.

JONES, L.L., HASHIM, A., MCKEEVER, T., COOK, D.G., BRITTON, J. & LEONARDI-BEE, J. 2011. Parental and household smoking and the increased risk of bronchitis, bronchiolitis and other lower respiratory infections in infancy: systematic review and meta-analysis, *Respir Res*. 12, 5.

JORM, A.F. 2000. Is depression a risk factor for dementia or cognitive decline? A review, *Gerontology*. 46, 219-27.

JORM, A.F., DEAR, K.B.G. & BURGESS, N.M. 2005. Projections of future numbers of dementia cases in Australia with and without prevention, *Australian and New Zealand Journal of Psychiatry*. 39, 959-63.

JORM, A.F., KORTEN, A.E. & HENDERSON, A.S. 1987. The prevalence of dementia: a quantitative integration of the literature, *Acta Psychiatr Scand*. 76, 465-79.

KAHN, J.R. & PEARLIN, L.I. 2006. Financial strain over the life course and health among older adults, *J Health Soc Behav*. 47, 17-31.

KAWACHI, I., SPARROW, D., VOKONAS, P.S. & WEISS, S.T. 1994. Symptoms of anxiety and risk of coronary heart disease. The Normative Aging Study, *Circulation*. 90, 2225-9.

KIM, C.H., LEE, Y.C., HUNG, R.J., MCNALLAN, S.R., COTE, M.L., LIM, W.Y., CHANG, S.C., KIM, J.H., UGOLINI, D., CHEN, Y., LILOGLOU, T., ANDREW, A.S., ONEGA, T., DUELL, E.J., FIELD, J.K., LAZARUS, P., LE MARCHAND, L., NERI, M., VINEIS, P., KIYOHARA, C., HONG, Y.C., MORGENSTERN, H., MATSUO, K., TAJIMA, K., CHRISTIANI, D.C., MCLAUGHLIN, J.R., BENCKO, V., HOLCATOVA, I., BOFFETTA, P., BRENNAN, P., FABIANOVA, E., FORETOVA, L., JANOUT, V., LISSOWSKA, J., MATES, D., RUDNAI, P., SZESZENIA-DABROWSKA, N., MUKERIA, A., ZARIDZE, D., SEOW, A., SCHWARTZ, A.G., YANG, P. & ZHANG, Z.F. 2014. Exposure to secondhand tobacco smoke and lung cancer by histological type: a pooled analysis of the International Lung Cancer Consortium (ILCCO), *Int J Cancer*. 135, 1918-30.

KORDA, R.J., JOSHY, G., PAIGE, E., BUTLER, J.R., JORM, L.R., LIU, B., BAUMAN, A.E. & BANKS, E. 2015. The relationship between body mass index and hospitalisation rates, days in hospital and costs: findings from a large prospective linked data study, *PLoS One*. 10, e0118599.

KUIPER, J.S., ZUIDERSMA, M., OUDE VOSHAAR, R.C., ZUIDEMA, S.U., VAN DEN HEUVEL, E.R., STOLK, R.P. & SMIDT, N. 2015. Social relationships and risk of dementia: A systematic review and meta-analysis of longitudinal cohort studies, *Ageing Res Rev*. 22, 39-57.

LAAKSONEN, E., MARTIKAINEN, P., LAHELMA, E., LALLUKKA, T., RAHKONEN, O., HEAD, J. & MARMOT, M. 2007. Socioeconomic circumstances and common mental disorders among Finnish and British public sector employees: evidence from the Helsinki Health Study and the Whitehall II Study, *Int J Epidemiol*. 36, 776-86.

LANGA, K.M. 2015. Is the risk of Alzheimer's disease and dementia declining?, *Alzheimers Res Ther*. 7, 34.

LEE, C., DOBSON, A.J., BROWN, W.J., BRYSON, L., BYLES, J., WARNER-SMITH, P. & YOUNG, A.F. 2005. Cohort Profile: the Australian Longitudinal Study on Women's Health, *Int J Epidemiol*. 34, 987-91.

LEE, J.M., PILLI, S., GEBREMARIAM, A., KEIRNS, C.C., DAVIS, M.M., VIJAN, S., FREED, G.L., HERMAN, W.H. & GURNEY, J.G. 2010. Getting heavier, younger: trajectories of obesity over the life course, *Int J Obes (Lond)*. 34, 614-23.

LEE, S., KAWACHI, I., BERKMAN, L.F. & GRODSTEIN, F. 2003. Education, other socioeconomic indicators, and cognitive function, *Am J Epidemiol*. 157, 712-20.

LI, G., WANG, L.Y., SHOFER, J.B., THOMPSON, M.L., PESKIND, E.R., MCCORMICK, W., BOWEN, J.D., CRANE, P.K. & LARSON, E.B. 2011. Temporal relationship between depression and dementia: findings from a large community-based 15-year follow-up study, *Arch Gen Psychiatry*. 68, 970-7.

LOBO, A., LAUNER, L.J., FRATIGLIONI, L., ANDERSEN, K., DI CARLO, A., BRETELER, M.M., COPELAND, J.R., DARTIGUES, J.F., JAGGER, C., MARTINEZ-LAGE, J., SOININEN, H. & HOFMAN,

A. 2000. Prevalence of dementia and major subtypes in Europe: A collaborative study of population-based cohorts. Neurologic Diseases in the Elderly Research Group, *Neurology*. 54, S4-9.

LOBO, A., SAZ, P., MARCOS, G., DIA, J.L., DE-LA-CAMARA, C., VENTURA, T., MONTANES, J.A., LOBO-ESCOLAR, A., AZNAR, S. & WORKGROUP, Z. 2007. Prevalence of dementia in a southern European population in two different time periods: the ZARADEMP Project, *Acta Psychiatr Scand*. 116, 299-307.

LONG, J.S. & PAVALKO, E.K. 2004. The life course of activity limitations: exploring indicators of functional limitations over time, *J Aging Health*. 16, 490-516.

LUCKE, J.C., BROWN, W., TOOTH, L., LOXTON, D., BYLES, J., SPALLEK, M., POWERS, J., HOCKEY, R., PACHANA, N.A. & DOBSON, A. 2010. Health across generations: findings from the Australian Longitudinal Study on Women's Health, *Biol Res Nurs*. 12, 162-70.

MANTON, K.C., GU, X.L. & UKRAINTSEVA, S.V. 2005. Declining prevalence of dementia in the U.S. elderly population, *Adv Gerontol*. 16, 30-7.

MANZOLI, L., VILLARI, P., G, M.P. & BOCCIA, A. 2007. Marital status and mortality in the elderly: a systematic review and meta-analysis, *Soc Sci Med*. 64, 77-94.

MATHERS, C.D., STEVENS, G.A., BOERMA, T., WHITE, R.A. & TOBIAS, M.I. 2015. Causes of international increases in older age life expectancy, *Lancet*. 385, 540-8.

MATTHEWS, F.E., ARTHUR, A., BARNES, L.E., BOND, J., JAGGER, C., ROBINSON, L., BRAYNE, C., MEDICAL RESEARCH COUNCIL COGNITIVE, F. & AGEING, C. 2013. A two-decade comparison of prevalence of dementia in individuals aged 65 years and older from three geographical areas of England: results of the Cognitive Function and Ageing Study I and II, *Lancet*. 382, 1405-12.

MCDERMOTT, L., DOBSON, A. & RUSSELL, A. 2004. Changes in smoking behaviour among young women over life stage transitions, *Aust N Z J Public Health*. 28, 330-5.

MCDERMOTT, L.J., DOBSON, A.J. & OWEN, N. 2006. From partying to parenthood: young women's perceptions of cigarette smoking across life transitions, *Health Educ Res*. 21, 428-39.

MCLAUGHLIN, D., HOCKEY, R. & MISHRA, G. 2013. Heart disease in women in remote Australia: urban-rural differences after adjusting for lifestyle behaviours and socio-demographic factors, *Aust N Z J Public Health*. 37, 90.

Medicare Group Reports. 2016. Canberra: Australian Government http://medicarestatistics.humanservices.gov.au/statistics/mbs_group.jsp [Accessed 24 March 2016].

MENCE, V., GANGELL, S. & TEBB, R. 2015. A History of the Department of Immigration: Managing Migration to Australia, Commonwealth of Australia, Canberra.

MILLER, E.A. & WEISSERT, W.G. 2000. Predicting elderly people's risk for nursing home placement, hospitalization, functional impairment, and mortality: a synthesis, *Med Care Res Rev*. 57, 259-97.

MISHRA, G.D., BALL, K., DOBSON, A.J., BYLES, J.E. & WARNER-SMITH, P. 2002. Which aspects of socio-economic status are related to health in mid-aged and older women?, *Int J Behav Med*. 9, 263-85.

MISHRA, G.D., BARKER, M.S., HERBER-GAST, G.C. & HILLARD, T. 2015. Depression and the incidence of urinary incontinence symptoms among young women: Results from a prospective cohort study, *Maturitas*. 81, 456-61.

MISHRA, G.D., HOCKEY, R. & DOBSON, A.J. 2014. A comparison of SF-36 summary measures of physical and mental health for women across the life course, *Qual Life Res*. 23, 1515-21.

MISHRA, G.D., HOCKEY, R., POWERS, J., LOXTON, D., TOOTH, L., ROWLANDS, I., BYLES, J. & DOBSON, A. 2014. Recruitment via the Internet and social networking sites: the 1989-1995 cohort of the Australian Longitudinal Study on Women's Health, *J Med Internet Res*. 16, e279.

MITCHELL, E.A. & MILERAD, J. 2006. Smoking and the sudden infant death syndrome, *Rev Environ Health*. 21, 81-103.

MORTON, R.L., SCHLACKOW, I., STAPLIN, N., GRAY, A., CASS, A., HAYNES, R., EMBERSON, J., HERRINGTON, W., LANDRAY, M.J., BAIGENT, C., MIHAYLOVA, B. & GROUP, S.C. 2016. Impact of Educational Attainment on Health Outcomes in Moderate to Severe CKD, *Am J Kidney Dis*. 67, 31-9.

NG, M., FLEMING, T., ROBINSON, M., THOMSON, B., GRAETZ, N., MARGONO, C., MULLANY, E.C., BIRYUKOV, S., ABBAFATI, C., ABERA, S.F., ABRAHAM, J.P., ABU-RMEILEH, N.M., ACHOKI, T., ALBUHAIRAN, F.S., ALEMU, Z.A., ALFONSO, R., ALI, M.K., ALI, R., GUZMAN, N.A., AMMAR, W., ANWARI, P., BANERJEE, A., BARQUERA, S., BASU, S., BENNETT, D.A., BHUTTA, Z., BLORE, J., CABRAL, N., NONATO, I.C., CHANG, J.C., CHOWDHURY, R., COURVILLE, K.J., CRIQUI, M.H., CUNDIFF, D.K., DABHADKAR, K.C., DANDONA, L., DAVIS, A., DAYAMA, A., DHARMARATNE, S.D., DING, E.L., DURRANI, A.M., ESTEGHAMATI, A., FARZADFAR, F., FAY, D.F., FEIGIN, V.L., FLAXMAN, A., FOROUZANFAR, M.H., GOTO, A., GREEN, M.A., GUPTA, R., HAFEZI-NEJAD, N., HANKEY, G.J., HAREWOOD, H.C., HAVMOELLER, R., HAY, S., HERNANDEZ, L., HUSSEINI, A., IDRISOV, B.T., IKEDA, N., ISLAMI, F., JAHANGIR, E., JASSAL, S.K., JEE, S.H., JEFFREYS, M., JONAS, J.B., KABAGAMBE, E.K., KHALIFA, S.E., KENGNE, A.P., KHADER, Y.S., KHANG, Y.H., KIM, D., KIMOKOTI, R.W., KINGE, J.M., KOKUBO, Y., KOSEN, S., KWAN, G., LAI, T., LEINSALU, M., LI, Y., LIANG, X., LIU, S., LOGROSCINO, G., LOTUFO, P.A., LU, Y., MA, J., MAINOO, N.K., MENSAH, G.A., MERRIMAN, T.R., MOKDAD, A.H., MOSCHANDREAS, J., NAGHAVI, M., NAHEED, A., NAND, D., NARAYAN, K.M., NELSON, E.L., NEUHOUSER, M.L., NISAR, M.I., OHKUBO, T., OTI, S.O., PEDROZA, A., PRABHAKARAN, D., ROY, N., SAMPSON, U., SEO, H., SEPANLOU, S.G., SHIBUYA, K., SHIRI, R., SHIUE, I., SINGH, G.M., SINGH, J.A., SKIRBEKK, V., STAPELBERG, N.J.,

STURUA, L., SYKES, B.L., TOBIAS, M., TRAN, B.X., TRASANDE, L., TOYOSHIMA, H., VAN DE VIJVER, S., VASANKARI, T.J., VEERMAN, J.L., VELASQUEZ-MELENDEZ, G., VLASSOV, V.V., VOLLSET, S.E., VOS, T., WANG, C., WANG, X., WEIDERPASS, E., WERDECKER, A., WRIGHT, J.L., YANG, Y.C., YATSUYA, H., YOON, J., YOON, S.J., ZHAO, Y., ZHOU, M., ZHU, S., LOPEZ, A.D., MURRAY, C.J. & GAKIDOU, E. 2014. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: a systematic analysis for the Global Burden of Disease Study 2013, *Lancet*. 384, 766-81.

NGUYEN-PHAM, S., LEUNG, J. & MCLAUGHLIN, D. 2014. Disparities in breast cancer stage at diagnosis in urban and rural adult women: a systematic review and meta-analysis, *Ann Epidemiol*. 24, 228-35.

O'NEIL, A., FISHER, A.J., KIBBEY, K.J., JACKA, F.N., KOTOWICZ, M.A., WILLIAMS, L.J., STUART, A.L., BERK, M., LEWANDOWSKI, P.A., TAYLOR, C.B. & PASCO, J.A. 2016. Depression is a risk factor for incident coronary heart disease in women: An 18-year longitudinal study, *J Affect Disord*. 196, 117-24.

OKSUZYAN, A., SHKOLNIKOVA, M., VAUPEL, J.W., CHRISTENSEN, K. & SHKOLNIKOV, V.M. 2014. Sex differences in health and mortality in Moscow and Denmark, *Eur J Epidemiol*. 29, 243-52.

OUTRAM, S., MURPHY, B. & COCKBURN, J. 2006. Prevalence of and factors associated with midlife women taking medicines for psychological distress, *Australian e-Journal for the Advancement of Mental Health*. 5, 1-13.

PEETERS, G., DOBSON, A.J., DEEG, D.J. & BROWN, W.J. 2013. A life-course perspective on physical functioning in women, *Bull World Health Organ*. 91, 661-70.

PRAESTEGAARD, C., KJAER, S.K., NIELSEN, T.S., JENSEN, S.M., WEBB, P.M., NAGLE, C.M., HOGDALL, E., RISCH, H.A., ROSSING, M.A., DOHERTY, J.A., WICKLUND, K.G., GOODMAN, M.T., MODUGNO, F., MOYSICH, K., NESS, R.B., EDWARDS, R.P., GOODE, E.L., WINHAM, S.J., FRIDLEY, B.L., CRAMER, D.W., TERRY, K.L., SCHILDKRAUT, J.M., BERCHUCK, A., BANDERA, E.V., PADDOCK, L., KIEMENEY, L.A., MASSUGER, L.F., WENTZENSEN, N., PHAROAH, P., SONG, H., WHITTEMORE, A.S., MCGUIRE, V., SIEH, W., ROTHSTEIN, J., ANTON-CULVER, H., ZIOGAS, A., MENON, U., GAYTHER, S.A., RAMUS, S.J., GENTRY-MAHARAJ, A., WU, A.H., PEARCE, C.L., PIKE, M.C., LEE, A.W., CHANG-CLAUDE, J., JENSEN, A. & OVARIAN CANCER ASSOCIATION, C. 2016. The association between socioeconomic status and tumour stage at diagnosis of ovarian cancer: A pooled analysis of 18 case-control studies, *Cancer Epidemiol*. 41, 71-9.

PRICEWATERHOUSECOOPER. 2015. Weighing the cost of obesity: A case for action, PriceWaterhouseCooper.

PRINCE, M., ACOSTA, D., FERRI, C.P., GUERRA, M., HUANG, Y., LLIBRE RODRIGUEZ, J.J., SALAS, A., SOSA, A.L., WILLIAMS, J.D., DEWEY, M.E., ACOSTA, I., JOTHEESWARAN, A.T. & LIU, Z. 2012. Dementia incidence and mortality in middle-income countries, and associations with indicators of cognitive reserve: a 10/66 Dementia Research Group population-based cohort study, *Lancet*. 380, 50-8.

QIU, C., VON STRAUSS, E., BACKMAN, L., WINBLAD, B. & FRATIGLIONI, L. 2013. Twenty-year changes in dementia occurrence suggest decreasing incidence in central Stockholm, Sweden, *Neurology*. 80, 1888-94.

QU, L. & WESTON, R. 2013. Australian households and families. Australian Family Trends. 4. Canberra: Australian Institute of Family Studies.

QUAIL, J.M., WOLFSON, C. & LIPPMAN, A. 2011. Unmet need for assistance to perform activities of daily living and psychological distress in community-dwelling elderly women, *Can J Aging*. 30, 591-602.

REID, J.L., HAMMOND, D., RYNARD, V.L. & BURKHALTER, R. 2015. Tobacco Use in Canada: Patterns and Trends, 2015 Edition, University of Waterloo, Waterloo, ON.

RITCHIE, K. & KILDEA, D. 1995. Is senile dementia "age-related" or "ageing-related"?--evidence from meta-analysis of dementia prevalence in the oldest old, *Lancet*. 346, 931-4.

ROCCA, W.A., PETERSEN, R.C., KNOPMAN, D.S., HEBERT, L.E., EVANS, D.A., HALL, K.S., GAO, S., UNVERZAGT, F.W., LANGA, K.M., LARSON, E.B. & WHITE, L.R. 2011. Trends in the incidence and prevalence of Alzheimer's disease, dementia, and cognitive impairment in the United States, *Alzheimers Dement*. 7, 80-93.

RUMPF, H.J., MEYER, C., HAPKE, U. & JOHN, U. 2001. Screening for mental health: validity of the MHI-5 using DSM-IV Axis I psychiatric disorders as gold standard, *Psychiatry Res*. 105, 243-53.

RUSS, T.C., BATTY, G.D., HEARNSHAW, G.F., FENTON, C. & STARR, J.M. 2012. Geographical variation in dementia: systematic review with meta-analysis, *Int J Epidemiol*. 41, 1012-32.

SAHLE, B.W., OWEN, A.J., MUTOWO, M.P., KRUM, H. & REID, C.M. 2016. Prevalence of heart failure in Australia: a systematic review, *BMC Cardiovasc Disord*. 16, 32.

SCARINCI, I.C., BEECH, B.M., NAUMANN, W., KOVACH, K.W., PUGH, L. & FAPOHUNDA, B. 2002. Depression, socioeconomic status, age, and marital status in black women: a national study, *Ethn Dis*. 12, 421-8.

SCHRIJVERS, E.M., VERHAAREN, B.F., KOUDSTAAL, P.J., HOFMAN, A., IKRAM, M.A. & BRETELER, M.M. 2012. Is dementia incidence declining?: Trends in dementia incidence since 1990 in the Rotterdam Study, *Neurology*. 78, 1456-63.

SCOLLO, M.M. & WINSTANLEY, M.H. 2012, 'Trends in the prevalence of smoking', in *Tobacco in Australia: Facts and Issues*, 4th edn, Cancer Council Victoria, Melbourne, <www.TobaccoInAustralia.org.au>.

SHEN, B.J., AVIVI, Y.E., TODARO, J.F., SPIRO, A., 3RD, LAURENCEAU, J.P., WARD, K.D. & NIAURA, R. 2008. Anxiety characteristics independently and prospectively predict myocardial infarction in men the unique contribution of anxiety among psychologic factors, *J Am Coll Cardiol*. 51, 113-9.

SILVEIRA, E., TAFT, C., SUNDH, V., WAERN, M., PALSSON, S. & STEEN, B. 2005. Performance of the SF-36 health survey in screening for depressive and anxiety disorders in an elderly female Swedish population, *Qual Life Res*. 14, 1263-74.

SLADE, T., JOHNSTON, A., TEESSON, M., WHITEFORD, H., BURGESS, P., PIRKIS, J. & SAW, S. 2009. The Mental Health of Australians 2. Report on the 2007 National Survey of Mental Health and Wellbeing. Canberra:

SOLE-AURO, A. & CRIMMINS, E.M. 2014. Who cares? A comparison of informal and formal care provision in Spain, England and the USA, *Ageing Soc*. 34, 495-517.

STURGEON, J.A., AREWASIKPORN, A., OKUN, M.A., DAVIS, M.C., ONG, A.D. & ZAUTRA, A.J. 2016. The Psychosocial Context of Financial Stress: Implications for Inflammation and Psychological Health, *Psychosom Med*. 78, 134-43.

TANAMAS, S.K., MANGLIANO, D.J., LYNCH, B., SETHI, P., WILLENBERG, L., POLKINGHORNE, K.R., CHADBAN, S., DUNSTAN, D. & SHAW, J.E. 2013. AusDiab 2012. The Australian Diabetes, Obesity and Lifestyle Study, Baker IDI Heart and Diabetes Institute, Melbourne.

THORSEN, S.V., RUGULIES, R., HJARSBECH, P.U. & BJORNER, J.B. 2013. The predictive value of mental health for long-term sickness absence: the Major Depression Inventory (MDI) and the Mental Health Inventory (MHI-5) compared, *BMC Med Res Methodol*. 13, 115.

TREASURY. 2015. 2015 Intergenerational Report. Canberra: Commonwealth of Australia.

VAGENAS, D., MCLAUGHLIN, D. & DOBSON, A. 2009. Regional variation in the survival and health of older Australian women: a prospective cohort study, *Aust N Z J Public Health*. 33, 119-25.

VAN DER DEEN, F.S., IKEDA, T., COBIAC, L., WILSON, N. & BLAKELY, T. 2014. Projecting future smoking prevalence to 2025 and beyond in New Zealand using smoking prevalence data from the 2013 Census, *N Z Med J*. 127, 71-9.

WALLS, H.L., MAGLIANO, D.J., STEVENSON, C.E., BACKHOLER, K., MANNAN, H.R., SHAW, J.E. & PEETERS, A. 2012. Projected progression of the prevalence of obesity in Australia, *Obesity (Silver Spring)*. 20, 872-8.

WANG, Y.C., COLDITZ, G.A. & KUNTZ, K.M. 2007. Forecasting the obesity epidemic in the aging U.S. population, *Obesity (Silver Spring)*. 15, 2855-65.

WARE, J.E., SNOW, K.K., KOSINSKI, M. & GANDEK, B. 1993, *SF-36 Health Survey. Manual and interpretation guide*, The Health Institute, New England Medical Center, Boston.

WHO. 2000. Obesity: preventing and managing the global epidemic: a report of a WHO consultation., WHO technical report series World Health Organization, Geneva, Switzerland.

WHO 2014. Mental health: a state of well-being (Fact file), Geneva: World Health Organization. Available: http://www.who.int/features/factfiles/mental_health/en/ [Accessed 3 March 2016]

WHOOLEY, M.A., KIP, K.E., CAULEY, J.A., ENSRUD, K.E., NEVITT, M.C. & BROWNER, W.S. 1999. Depression, falls, and risk of fracture in older women. Study of Osteoporotic Fractures Research Group, *Arch Intern Med*. 159, 484-90.

WILLIAMS, L.J., PASCO, J.A., JACKSON, H., KIROPOULOS, L., STUART, A.L., JACKA, F.N. & BERK, M. 2016. Depression as a risk factor for fracture in women: A 10 year longitudinal study, *J Affect Disord*. 192, 34-40.

WINDSOR, T.D., BURNS, R.A. & BYLES, J.E. 2013. Age, physical functioning, and affect in midlife and older adulthood, *J Gerontol B Psychol Sci Soc Sci*. 68, 395-9.

WOODWARD, S.D. 1984. Trends in cigarette consumption in Australia, *Aust N Z J Med*. 14, 405-7.

WU, Y.T., FRATIGLIONI, L., MATTHEWS, F.E., LOBO, A., BRETELER, M.M., SKOOG, I. & BRAYNE, C. 2016. Dementia in western Europe: epidemiological evidence and implications for policy making, *Lancet Neurol*. 15, 116-24.

WU, Z. & HART, R. 2002. The Effects of Marital and Nonmarital Union Transition on Health, *J Marriage Family*. 64, 13.

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