WORKFORCE PARTICIPATION PATTERNS
OVER THE LIFE COURSE AND THE
ASSOCIATION WITH CHRONIC DISEASES
– A GENDERED APPROACH

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Thesis submitted for the degree of

Doctor of Philosophy (Gender and Health)

School of Medicine and Public Health

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Statement of Contribution

This is to certify that Research Higher Degree Candidate Tazeen Majeed has contributed to the following paper by her contributions in developing research question, methodology and statistical analysis of data, interpretation of results and writing of manuscript.


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Statement of Contribution

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# Abbreviations

<table>
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<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>ABS</td>
<td>Australian Bureau of Statistics</td>
</tr>
<tr>
<td>AIC</td>
<td>Akaike Information Criterion</td>
</tr>
<tr>
<td>ALSWH</td>
<td>Australian Longitudinal Study on Women’s Health</td>
</tr>
<tr>
<td>BIC</td>
<td>Bayesian Information Criterion</td>
</tr>
<tr>
<td>BMI</td>
<td>Body Mass Index</td>
</tr>
<tr>
<td>Adj. BIC</td>
<td>Adjusted Bayesian Information Criterion</td>
</tr>
<tr>
<td>FT</td>
<td>Full Time (work)</td>
</tr>
<tr>
<td>LCA</td>
<td>Latent Class Analysis</td>
</tr>
<tr>
<td>LHH</td>
<td>Life History and Health</td>
</tr>
<tr>
<td>MLR</td>
<td>Multinomial Logistic Regression</td>
</tr>
<tr>
<td>NHMRC</td>
<td>National Health and Medical Research Council</td>
</tr>
<tr>
<td>NSW</td>
<td>New South Wales</td>
</tr>
<tr>
<td>NPW</td>
<td>Not in Paid Work</td>
</tr>
<tr>
<td>PT</td>
<td>Part Time (work)</td>
</tr>
<tr>
<td>SF - 36</td>
<td>Sort Form – 36 Survey</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
</tr>
<tr>
<td>WHA</td>
<td>Women’s Health Australia</td>
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</table>
# Glossary of Terms

<table>
<thead>
<tr>
<th>Terms</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>Active ageing</td>
<td>This term adopted by WHO signifies the process of optimizing opportunities for health, participation and security in order to enhance quality of life as people age.¹</td>
</tr>
<tr>
<td>BMI</td>
<td>Body Mass Index (BMI) is a simple index of weight-for-height that is commonly used to classify underweight, overweight and obesity in adults. It is defined as the weight in kilograms divided by the square of the height in metres (kg/m²).²</td>
</tr>
<tr>
<td>Chronic diseases</td>
<td>Diseases of long duration, generally slow progression and are major cause of mortality and morbidity worldwide.³</td>
</tr>
<tr>
<td>Dependant/ Outcome or Response variable</td>
<td>The dependent variable represents the output or effect, which implies the event studied and expected to change whenever the independent variable is altered.⁴</td>
</tr>
<tr>
<td>Dependency ratio</td>
<td>The number of dependent persons per 100 working persons in a given population. Thus, a dependency ratio of 66.4 means that there are 66.4 dependent persons per 100 working age (presumably economically productive) people.⁵</td>
</tr>
<tr>
<td>Gender</td>
<td>Refers to a social construct regarding culture-bound conventions, roles, and behaviours for, as well as relations between and among, women and men and boys and girls. Gender roles vary across a continuum and both gender relations and biologic expressions of gender vary within and across societies, typically in relation to social divisions premised on power and authority (e.g., class, race/ethnicity, nationality,</td>
</tr>
<tr>
<td>Terms</td>
<td>Description</td>
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<tr>
<td>-------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Indicator variable</td>
<td>In statistics and particularly in regression analysis, indicator variable (also called dummy variable) is one that takes the value 0 or 1 to indicate the absence or presence of a categorical effect that may be expected to shift the outcome/ response.⁴</td>
</tr>
<tr>
<td>Intercept ($\beta_0$)</td>
<td>In relation to LCA with covariates, intercepts represent the odds of membership in latent class ‘c’ in relation to the reference latent class ‘C’ when effect of covariate ‘X’ is not taken into account ($X=0$).⁷ The word effect here does not indicate causality, but is used in statistical sense.</td>
</tr>
<tr>
<td>Latent variable</td>
<td>It is an unobserved, underlying and error free posited to explain a set of observed responses to indicators. The latent variables are the causes of the observed variables, but observed variables do not cause latent variables.⁸</td>
</tr>
<tr>
<td>Latent Class Analysis (LCA)</td>
<td>It is a latent variable model in which both the latent variable and its indicators are categorical. It is considered a person-oriented approach as it emphasizes on looking for subtypes of individuals exhibiting similar patterns of characteristics.⁷ Latent class models are used to identify underlying (unobserved) subgroups in a population at a particular time point.</td>
</tr>
<tr>
<td>Life course approach</td>
<td>A life course perspective focuses on understanding how early life experiences shape health across an entire life time and potentially across generations including social and physical context along with biological factors, over time.⁹</td>
</tr>
<tr>
<td>Terms</td>
<td>Description</td>
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</table>
| **Posterior probability** | Posterior probability refers to each individual’s probability of membership in each latent class, conditional of response pattern of ‘yes’ or ‘no’. Its value near ‘1’ suggested high certainty about true class membership.  
9                                                                                           |
| **Population ageing**   | It refers to a decline in the proportion of children and young people and an increase in the proportion of people aged 60 years and over.1,10                                                        |
| **SF – 36 Survey**      | The SF-36 is a multi-purpose, short-form health survey with only 36 questions. It yields an 8-scale profile of functional health and well-being scores as well as psychometrically-based physical and mental health summary measures and a preference-based health utility index.11 |
| **Work**               | In context of this thesis and research, the definitions for full time and part time work are adapted from Australian Bureau of Statistics (ABS).  
**Full time work:** Workers are considered fully employed when they work 35 hours or more with reference to working hours.12  
**Part time work:** People working less than 35 hours a week are defined as part time employees by ABS.13 |
ABSTRACT

‘Population ageing’ raises many challenges for governments, such as continued and prolonged workforce participation of men and women over their life course. This research aimed to i) identify and compare workforce participation patterns of men and women over the life course; ii) investigate the associations between workforce participation patterns, early life factors and adult life factors over the life course; iii) explore longitudinal associations between chronic diseases and workforce patterns, while considering the influence of various health and socio-demographic factors. Three different data sources – the ‘45 and Up Study’, the Australian ‘Life History and Health Survey’ and the ‘Australian Longitudinal Study on Women’s Health’ were used. Latent class analysis (LCA), LCA with classify-analyse approach, logistic regression and multinomial regression were used in five different studies to identify and explore patterns of workforce participation and its different associations over the life course, with a gendered perspective. Findings from the studies indicate that workforce participation patterns over the life course are very different for men and women. While men were found to be mostly engaged in full time paid work, women were more likely to work part time. Also, many men may decrease work after age 55, and many women had lower workforce participation over the life course. The work patterns of young women without children were very similar to men – majority working full time. Chronic diseases (diabetes, asthma, depression and arthritis) and other early and adult life factors were associated with work patterns. However, these associations varied by gender and also dependent on how men and women responded to their long term health issues and various circumstances affecting them over the life course. Therefore, it is important to consider the role of gender in shaping workforce patterns and their association with chronic diseases over the life course.
CHAPTER 1:

OVERVIEW OF THESIS
1.1 Introduction

Many countries all around the world have been experiencing and continue to experience a shift in the distribution of the country’s population proportions towards older ages – the demographic and social trend of ‘Population ageing’. The world population is ageing as a consequence of sustained decreases in fertility and increases in life expectancy. Population ageing is characterized by a shift of population age composition towards those aged 60 years and over, with a decreasing proportion of the population aged 15 years and younger.\textsuperscript{10, 14} According to global population projections, in 15 years’ time, around 1.2 billion people are expected to be aged over 60 years.\textsuperscript{1} By 2050, approximately 35 – 40\% of population in some of the fast-ageing developed countries like Germany, Italy, Japan, Korea will be aged over 60 years.\textsuperscript{15} This demographic and social change has presented a number of challenges. For instance, as people age, they are more likely to be affected from one of more long term conditions.\textsuperscript{16, 17} In turn, these conditions can limit financial and functional abilities, and cause long term loss of productivity and decreased workforce participation. As younger people (aged $< 15$ years) are projected to be outnumbered by people aged 60 years and above,\textsuperscript{18} there will be fewer younger adults in the workforce. Workforce participation by the able population becomes an increasingly important human resource issue in this scenario.\textsuperscript{15, 19–21} This issue of long term productivity and longer workforce participation of people has been a focus of much policy action and debate. While, it is critical that mature age workers continue to be a part of the workforce for a longer period of time and contribute their experience and skills, it is equally important that successive generations of younger workers are enabled to participate in workforce. However, the majority of current policies are focused on increasing the workforce participation of mature age workers by changing both the pension and superannuation eligibility ages, based on cross-sectional data.
Many nations have attempted to introduce incentives and policies to encourage people to work and continue working into older age. Despite these initiatives, many people remain out of the workforce, not only at mature and older ages, but also across the life course.

In reality, the question of whether the individuals continue to work past their 60’s and into their 70’s is influenced by many circumstances over the course of their lives, and is very different for men and women. Trajectories of workforce participation over the life course vary for men and women, and are strongly associated with their health, particularly chronic diseases, and many early and adult life course factors. In particular, for people reaching the usual perceived and traditional retirement age of 65 years, many factors are associated with work status at that stage of life and for future workforce participation. Thus, to enable people to engage in paid work and work for longer, many childhood and adult life course factors, including chronic diseases should be considered.

To date, not much research has focussed on a gendered approach to ascertain workforce participation patterns over the life course and then gone on to explore their association with chronic diseases and early and adult life factors.

1.2 RESEARCH AIMS

In context of this thesis, we aim to:

1. Identify and compare dominant patterns of workforce participation among men and women over their life course.

2. Investigate the associations between workforce participation patterns and early and adult life socio-demographic factors acting over the life course, with a gendered approach.

3. Explore longitudinal associations between chronic diseases (diabetes, asthma, depression and arthritis) and workforce participation patterns, while considering the influence of various other health and socio-demographic factors.
1.3 SYNOPSIS OF STUDIES

The aim of this thesis was to "identify patterns of workforce participation over the life course, and explore their associations with chronic diseases and various socio-economic factors among men and women".

For the purpose of analysis, three different data sets were used:

i) **Study 1**: Data from the ‘45 and Up study’, which is the largest, prospective, ongoing longitudinal study of ageing in Australia, was used to examine 41,754 men and women aged 60 – 64 years old (in 2011). Study 1 (see Chapter 4) explored association of men and women’s current employment categories and its associations with chronic diseases and socio-demographic factors. Results indicated that participants who were categorised as ‘not in paid work’ or ‘disabled/ sick’ were more likely to report chronic diseases (diabetes and arthritis). Findings of this study suggested that employment status at mature age was associated with chronic diseases and needed further exploration to identify factors influencing workforce participation over the life course.

ii) **Study 2 and Study 3**: Data from the Australian ‘Life History and Health Survey’ (a sub-study of Sax Institute’s 45 and Up Study), provided detailed retrospective information about health, living conditions and work history of 1,261 men and women over their life course. Study 2 used the novel technique of latent class analysis to identify dominant patterns of workforce participation, which were different for men and women. Further analysis (separate for men and women) indicated that these patterns had significant associations with early (number of books available during childhood for women) and late life factors (post-school qualification, marital status and informal caring), with distinct differences by gender. Study 3 was conducted to further explore and extend the knowledge about workforce patterns identified in study 2, examining associations between chronic diseases, workforce patterns and early and adult life factors with a gendered
approach. Analysis indicated that depression (among both men and women) and arthritis (among women) was associated with workforce patterns, after accounting for the early and adult life circumstances. Findings of these two studies, presented empirical evidence not only about distinctly different workforce patterns for men and women, but also about the role of gender norms and different life factors influencing men and women’s work patterns.

iii) **Study 4 and Study 5:** The ‘Australian Longitudinal Study on Women’s Health’ provided prospective data for studies 4 and 5. This study is a population cohort based longitudinal study, ongoing since 1996, and designed to study the health and well-being of Australian women over their life course. More than 11,000 women from 1946 – 51 birth cohort and more than 14,000 women from the 1973 – 78 cohort were included in studies 4 and 5 respectively. Latent class analysis identified five patterns of workforce participation in middle aged women (study 4). Further analysis using multinomial regression models suggested that women with chronic diseases (diabetes, asthma, depression and arthritis) were less likely to be in paid work. Study 5 presents the analysis using 1973 – 78 cohort of young women, stratified according to their motherhood status. Over their life course, women with children and those without children had different patterns of workforce participation. Findings of the study suggested that young mothers may face social barriers to join or re-enter paid workforce, while for women without children chronic diseases were found to be associated with decreased engagement in paid work.
1.4 Structure Of This Thesis

The following table presents the basic structure of this thesis. Chapter 2 discusses the background information and current body of literature and Chapter 3 describes the data sources, variables, and analysis techniques in details. Chapters 4 to 8 present the published and under-review papers in peer-reviewed journals. Chapter 9 is on thesis discussion, conclusion and the implications of findings of this thesis.

Table 1.1: Structure of thesis

<table>
<thead>
<tr>
<th>Chapter No.</th>
<th>Title</th>
<th>Presentation of results</th>
</tr>
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<tbody>
<tr>
<td>Chapter 2</td>
<td>Background and Literature Review</td>
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<td>Chapter 4</td>
<td><strong>Study 1</strong>: Chronic Diseases And Employment Among 60 – 64 Year Old Men and Women</td>
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<tr>
<td>Chapter 5</td>
<td><strong>Study 2</strong>: A Gendered Approach To Workforce Participation Patterns Across The Life Course</td>
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<td>Chapter 6</td>
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<td>Chapter 7</td>
<td><strong>Study 4</strong>: Women, Work And Illness: Latent Class Analysis Of Longitudinal Data For 11,551 Middle Age Women</td>
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<tr>
<td>Chapter 8</td>
<td><strong>Study 5</strong>: Health Predictors Of Workforce Participation Over Time – Longitudinal Evidence For Young Women</td>
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</tr>
<tr>
<td>Chapter 9</td>
<td>Thesis Discussion and Conclusion</td>
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</tr>
</tbody>
</table>
1.5 **NEXT CHAPTER – BACKGROUND AND LITERATURE REVIEW**

In order to establish background and context for this thesis, it is imperative to identify what is known about this topic from the current body of knowledge and research. Therefore, the next chapter of this thesis has two main sections:

1. Background provides detailed discussion of all the relevant concepts and themes which can be summed up as:

   i) Ageing population and its challenges

   ii) Workforce participation by gender and age

   iii) Chronic diseases (diabetes, asthma, depression and arthritis)

      - Burden of chronic diseases and its impact on health and workforce participation.

      - Literature focussing on the association of chronic diseases with workforce participation over the life course.

   iv) Life course impact of socio-demographic factors

2. Main literature review focussing on ‘Workforce participation patterns among men and women and their associations with chronic disease and socio-demographic factors over the life course’.
CHAPTER 2: BACKGROUND AND LITERATURE REVIEW
This chapter sets the scene for this thesis, by providing a comprehensive overview and context to main themes of studies i.e. ageing population, workforce participation of men and women across the life course, chronic diseases and in particular diabetes, asthma, depression and arthritis; a gendered perspective of associations between workforce participation patterns and chronic diseases. This chapter also reviews facts, statistical figures, reports and peer reviewed research available on the above mentioned themes. Finally, a synopsis of gaps in the literature is presented.

2.1 INTRODUCTION

The objective of this chapter is to present background information for the thesis and to identify what is known about chronic diseases and workforce participation from the current body of literature. The ‘Background’ considers the influences and implications of:

i) Population ageing

ii) Workforce participation

iii) Gender and its influences on workforce participation

iv) Early and adult life course factors, including chronic diseases, as well as socio-demographic factors

This is followed by a research framework which outlines the main themes of this thesis and the search strategy used to review the relevant literature. The last section of this chapter is the literature review focussed on the main themes of this thesis.

2.2 BACKGROUND

2.2.1 Population ageing

Ageing has been identified as one of the key “megatrends” that will shape the world in a few years’ time. Populations age when the median age rises, either due to longer life expectancy, declining fertility rates, or both. As a result, there has been a decline in the proportion of young people and an increase in the proportion of people aged 60 years and over. The overall median age is projected to rise in most developed countries from 29.0 in 1950 to 45.5 by 2050. According to the WHO, the proportion of people aged 60 years
and over will double from about 11% to 22% by 2050. In most countries, the proportion of people in the 60 years and older age group is growing faster than any younger age group.\textsuperscript{10} Countries such as Spain, Italy, Australia, USA, Canada, New Zealand and Japan have gained approximately 30 years of increased life expectancy since the mid to late 20\textsuperscript{th} century.\textsuperscript{19}

Until early 20th century, the main drivers of increased life expectancy were the marked decrease in infant and child mortality and deaths due to infectious diseases. The mid-1900’s saw a significant reduction in mortality rates in mid-life from cardiovascular diseases and smoking.\textsuperscript{19} This effect was followed by an unprecedented reduction in old-age mortality in the late 20\textsuperscript{th} century,\textsuperscript{19} with the probability of surviving to very old ages increasing in both men and women.\textsuperscript{19} In developed countries, (for example in Japan, Sweden and France) mortality at older ages continues to fall at a rapid pace. These trends indicate better medical knowledge, early diagnosis and better treatment options for health problems such as diabetes, hypertension, cardiovascular diseases and cancers, increased health care and services use by elderly population.\textsuperscript{19} Though these changes have led to decreased mortality, the overall incidence of diseases has not decreased and therefore, there are now longer periods of morbidity with improved functional capability.\textsuperscript{19,22} This demographic trend of low fertility and low mortality rates in past decades has also driven population ageing. Considering these trends continue, we expect to continue to have rapidly ageing population.

Australia’s age structure has also been impacted by the ‘baby boomers’. Baby boomers are the largest Australian demographic cohort (5.5 million people). They were born after World War II from 1946 – 1965 and are popularly classified as early and late baby boomers. Early baby boom started from 1946 – 1955 (people aged 60 – 69 years in 2015) and late baby boom from 1956 – 1965 (people aged 50 – 59 years). This was the time when the total fertility rate in Australia rose, with up to 3.5 average births per woman in 1960.\textsuperscript{23} According to various studies,\textsuperscript{23} around 5.5 million additional people born from the Australian baby boom significantly lowered the proportion of people in ages 50 years and
above by approximately 6.1%. As an example, see the Figure 2.1 comparing the proportion of Australian population (in %) in different age groups in 1950 and then 1965.

![Population Pyramids of Australia](http://populationpyramid.net/australia/1965/)

**Figure 2.1: Comparison of age structure of Australia in 1950 and post baby boom in 1965**

The Australian baby boomer cohort will celebrate their 60th birthday over the next two decades, with younger baby boomers (born in 1960’s) expected to survive till 2050’s when one-quarter of Australians will be aged 65 years. Thus this generation will face many of the issues related to population ageing and workforce participation.

We already know that Australia’s population is growing older, due to its declining fertility rates and increased life expectancy. In 2011, the proportion of young Australians aged 0 – 14 years old was lower than those aged 60 years and above (See Figure 2.2 below).
The figure below illustrates the age structure of Australia in 1990, 2015 and the expected changes, assuming current life expectancy and fertility rates remain constant.


Figure 2.2: Population ageing in Australia 1950 – 2100

Figure 2.3: Population pyramid – Age structure of Australia in 1990, 2014 and the estimated age structure in 2025 and 2050
The phenomenon of population ageing has many direct and indirect effects on a nation. Figure 2.4 below has been adapted from Chand and Tung\textsuperscript{15} and depicts various challenges and opportunities faced by governments in the wake of this demographic change.

![Diagram of population ageing impacts](image)

**Ageing population – Rapidly growing proportion of people aged over 60 years**

**Decline in working-age population over time (in absence of increased migration and or increased fertility)**

**Increasing prevalence of chronic diseases**

**Rising dependency ratio**

**Policy choices for governments: Higher taxes, increased pension eligibility age, reduced pension and health care benefits for older people**


Figure 2.4: Potential impacts of population ageing.

### 2.2.1.1 Challenges and impacts of an ageing population

Though population ageing is a result of socioeconomic development and the success of many public health policies,\textsuperscript{10} it also presents new and unique challenges for global economic environments and societies. One of the major and widely discussed implications is the increased dependency of older people,\textsuperscript{25} which has been related to a number of factors such as:

- increasing health problems particularly chronic diseases
- increasing disability and the need for help in daily tasks
• Decreased engagement in paid work which might be involuntary (due to age based
discrimination, up-skilling problems, unavailability of flexible working options and
other work place barriers) or voluntary (caring responsibilities, interest in leisure
activities etc.)
• All of the above factors can then give rise to increased economic problems and
financial dependency.

In addition to rising dependency ratios and financial instability, decreased workforce
participation by mature age people also has a detrimental effect on productivity and the
economy. Because of the potential loss of the skills and knowledge when mature age and
older people leave work early, the workforce loses its most skilled and experienced
members eventually leading to a skills shortage.26

Many government initiatives in response to the rising dependency ratios and the above
mentioned issues, have been targeted to retain and support mature and older workers. For
example, the United Kingdom, France, Netherland and Australia are raising retirement and
pension eligibility age, in order to encourage longer workforce participation of mature age
workers.27-29 In Australia for instance, pension eligibility age will be increased to 67 years
by 2017, designed to increase at a rate of six months every two years. In addition,
preservation age for Superannuation has been increased in Australia and some other
countries. Many OECD countries have introduced age-based anti-discrimination reforms,27,
28, 30 including retraining and re-skilling as well as job search support programmes.
Legislations such as Age Discrimination Act (2004), Fair Work Act (2009) and
programmes such as Experience+ Career Advisors in Australia have also been strengthened
to enable older people to work for longer. In Australia, along with other OECD countries,
financial incentives have also been introduced for mature age and older workers.1, 26, 31 For
example, changes in the Disability Support Pension in Australia was changed to enable
recipients to receive part time pensions while working for up to 30 hours per week.
Examples of other financial incentives in Australia include the Mature Age Worker’s Tax
Offset, Carers and Parenting Payment, Newstart allowance (for unemployed) and wage subsidies for employees hiring disabled workers.

In reality and despite all these incentives, programmes and legislations, workforce trajectories remain very heterogeneous over the life course. Traditional expectation that people will commence work when they are young, and will continue working till retirement age and then cease to work are being increasingly questioned.

2.2.2 Workforce participation by age and gender

The previous section touched upon potential challenges of ageing populations, particularly in the context of the future challenge of a declining workforce which will impact the productivity and sustainability of industry, and will raise potential problems for the economies of countries. It has been discussed that the proportion of people aged 60 years and above has significantly increased in the past few decades and continues to grow at a fast pace. However, with these demographic changes, has there been a corresponding growth in number and proportion of people participating in workforce? This section focuses on current and future trends of workforce participation and how these differ for men and women.

2.2.3 Current and future workforce participation

Over the last 50 years, the size and makeup of the workforce has evolved for the majority of countries. The figure below presents a comparative overview of labour force participation rates (calculated as the labour force divided by the total working-age population) of some of the OECD countries in 2014.
In some countries there has been growth in workforce engagement over the years. For example, Australia’s workforce participation rate was 64.7% in 2014, compared with 61.2% in 1970, while Germany’s workforce participation rate was 60.4% and 57.6% in 2014 and 1970 respectively.

In many countries, increases in these rates are mainly due to i) higher workforce participation by females and ii) higher proportion of women participating in part time work.

Figure 2.6: Labour force participation rate for Australia by age and gender in 2014
Figure 2.3 above shows the workforce participation rates for Australia by different age groups and for both men and women. It is interesting to note that while participation rates for both men and women are the same in the age group 15 – 24 years, but the difference in participation rates between men and women become apparent at the older ages. It is important therefore to discuss the differences in workforce participation by gender.

2.2.4 Workforce participation by gender

The next sub-section briefly discusses what we mean by ‘gender’, ‘gender roles’ and how gender and its related concepts has shaped the structure of the workforce, with some relevant empirical data presented.

2.2.4.1 Gender

While ‘sex’ is perceived as a biological construct, ‘gender’ is multidimensional and encapsulates various roles, expectations and limitations based on biological sex. Societies ascribe arrays of differentially constructed roles and relationships, personality traits, attitudes, behaviours, values and relative power to the two sexes, while socially labelling individuals as man, women or transgender etc. Thus, gender has been highly institutionalized, resulting in compartmentalizing day to day chores, responsibilities and expectations based on individual labels. This is the basis of gender differences and norms. Distinctly different patterns of education, employment, diseases, disabilities and mortality rates exist between men and women.

In the Australian context, 1950s and 1960s saw men as the wage earners and women were the homemakers. Women usually married young and could not work in public service after their marriage. There were legally sanctioned discriminations against women, barring them from some jobs and paying them less than men for the same job till 1960’s. The post World War I and II periods also saw a rise in women’s employment when the governments (in Australia and other countries as well) were acutely short of labour. For example, married Australian women formed 19.8% and 42% of the female workforce in 1947 and
1961 respectively. Yet, the ideology that women should stay at home and perform household tasks and care for babies during peace times did not change. Women were widely discouraged to even think about retaining their industrial positions when war ended. However, after World War II, many more women stayed in or joined the paid work. Post baby boom, fertility rates dropped to 2.9 babies per women in 1969 and by the early 1970’s, the female labour force participation rate was 38.6% in Australia.36 This was possible partly due to increased education opportunities for women, removal of the marriage bar from Public Service in all states of Australia by 1966 and various equal pay cases calling for 'equal pay for work of equal value'.36 When baby boomer women – daughters of homemaker women of the 1950s to 1960s entered the workforce in 1970s, employment options had expanded for women. From the 1980s the equality for working women was recognised through various governments legislations and policies such as equal opportunity legislation, work and family policies and equal pay inquiries.36 Also, the liberal feminism movements (originally initiated in 1920’s) aimed at removing political, social, educational and economic obstacles and to enable women to have equitable rights with their male counterparts.

While the gender differences were stronger in the past, they still exist to some extent today.36 Women are paid less than men, men are more likely to do certain jobs, and men still largely carry a traditional role as the breadwinner, while women undertake most of household tasks and caring for children.33 For example, according to the Australian Government’s Workplace Gender Equality Agency, women working full-time were earning approximately 17.5% less than men working full-time in 2014.38

Over recent decades, women began to question their stereotypical and conventional gender roles, dichotomy, and behaviours, and started to look for other life trajectories. By embracing more egalitarian gender beliefs and challenging the traditional femininity beliefs and social norms, many women moved from being housewives and home makers and into paid work in offices and factories.39
As women’s work became more of a norm, the difference in wages between men and women declined over time. Before the 1960’s, real wages were substantially higher for men, compared with women who were doing the same kind and level of job. According to the ‘Neoclassical economic theory’, women will only start paid work if their labour market wage is greater than reservation wage (minimum wage for labour market entry). This decision also depends upon unearned income. For example, husband’s income might impact wife’s decision to work. Other non-labour market activities and life factors such as their caring responsibilities, level of education, children and other household responsibilities also affect women’s workforce participation.

Focussing on the first factor – ‘differences in wages’ played an important role in women’s decisions to participate in the workforce in the past. Practical changes were initiated by governments as a result of liberal and feminism movements, which supported and encouraged women’s participation in the workforce (e.g. the Equal Pay Act in United Kingdom in 1970’s). However, the declining difference in wages among men and women is partly driven by the fact that the growth in real wages of men over time has been less than the growth in wages for women.

Women and particularly married women may also have entered the paid work due to higher living costs, and in order to maintain living standards.

Another factor which impacted women’s participation in labour force was the offering of incentives for working women. For instance, parental payments and paid parental leave schemes were introduced in Australia in 2011 and gave people and especially women freedom to juggle their family roles with flexible work options. These reforms drew many married women and mothers into work and retained more women in the workforce.

Changes in education status, continued erosion of gender bias in society with societies being more accepting of the changed outlook on work of both men and women, have
shaped workforce participation of women and men in many countries. However, divergent paths of work for men and women still exist, as well as many ‘within gender’ differences. The next section describes some facts and figures relating to workforce participation by men and women.

2.2.4.2 Workforce participation by gender – differences between men and women

In Australia, the participation of women in the labour force has almost doubled from 34% in 1961 to 59% in 2012, while for men workforce participation rates show significant decline – 82% in 1961 to 72% in 2012). Though workforce participation rates have markedly improved for women in all age groups, the most noticeable change has been seen in women aged 45 years and above. For example, since 2001-02 the workforce participation rate for women aged 65 – 74 years almost doubled from 6% to 13%.

Another important change has been the increasing trend of part time jobs for men and women. Part time work and flexible work choices evolved over recent decades and now many men and women engage in part time work options. According to gender indicators of employment by the Australian Bureau of Statistics there has been a gradual, long term trend towards part-time jobs for both men and women. However, participation in part time work markedly increased among women – 45.7% women of all ages engaged in part time work, compared with 16.3% of men of all ages in 2012. Among women, the part time participation rate increases as they age. For instance, among those who were employed, 69% of women aged 65-74 years worked part time, compared with 49% of women aged 55 – 64 years. In contrast, 43% of the men employed and aged 65-74 years worked part time.

There are many factors which influence men and women’s workforce participation at various stages of their life and in their decision to engage in paid work. The question of whether individuals continue to be employed past the conventional retirement age of 60
years is dependent on a number of circumstances over the life course. These factors act throughout the life of people and affect their work choices and life circumstances, thus enabling them to join the workforce, change their workforce participation and make decisions about when they want to leave workforce.

The next two sections – ‘Chronic diseases’ and ‘Life course factors’ focus on the factors which might influence workforce participation of men and women over the course of their lives. In the context of this thesis, background information on chronic diseases and in particular diabetes, asthma, depression and arthritis is presented.

The rationale of selecting these four chronic diseases and why are they important for men and women is presented along with their impact on workforce participation.

2.2.5 Chronic diseases

2.2.5.1 Global burden of chronic diseases

According to the WHO,\textsuperscript{45} “\textit{For every 10 deaths, 6 are due to non-communicable diseases, 3 due to communicable, reproductive or nutritional conditions and 1 is due to injury}”. Chronic diseases currently cause more deaths than all other causes combined, with their numbers projected to increase from 38 million in 2012, to 52 million by 2030.\textsuperscript{46} In 2004, chronic diseases were identified as major contributors of the global burden of disease as seen in Table 2.1. The most widely used measure of the burden of chronic disease is the Disability Adjusted Life Year (or DALY). The DALYs combines the number of years of healthy life lost to premature death with time spent in less than full health. One DALY can be thought of as equivalent of one year of healthy life lost. The DALYs attributed to chronic diseases are expected to rise over the next two decades, with a corresponding increase in prevalence as populations age. WHO reports have claimed that chronic non-communicable diseases (NCDs) are one of the major health and development challenges of the 21st century,\textsuperscript{46} resulting in human suffering, and adversely impacting nations’ socioeconomic conditions.
Table 2.1: Global burden of diseases by broad cause groups in 2004 and future projections

<table>
<thead>
<tr>
<th>% of Total DALYs in 2004</th>
<th>Overall mortality figures (2004)</th>
<th>Future projections</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group I diseases</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communicable disease</td>
<td>Lower respiratory tract infection – 6.2%</td>
<td>Group I diseases caused 29.9% of total deaths in men and 31.4% of total deaths in women</td>
</tr>
<tr>
<td>Reproductive conditions</td>
<td>Diarrhoeal diseases – 4.8%</td>
<td></td>
</tr>
<tr>
<td>Nutritional conditions</td>
<td>HIV / AIDS – 3.8%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Neonatal infection – 2.7%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Prematurity / low birth weight – 2.9%</td>
<td></td>
</tr>
<tr>
<td><strong>Group II diseases</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chronic diseases</td>
<td>Ischaemic heart disease – 4.1%</td>
<td>Chronic diseases accounted for 61.5% deaths in women and 57.9% deaths in men (2004). 59.6% of total deaths in 2008 due to this group.</td>
</tr>
<tr>
<td></td>
<td>Cerebrovascular disease – 3.1%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>COPD – 2.0%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diabetes – 1.3%</td>
<td></td>
</tr>
<tr>
<td><strong>Group III diseases</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unintentional injuries</td>
<td>Road traffic accidents (RTA) – 2.7%</td>
<td>Injuries accounted for 12.3% of total DALYs and 2.2% of worldwide mortality. 7.1% of women and 12.3% of males died due to this group.</td>
</tr>
<tr>
<td>Intentional injuries</td>
<td>Violence – 1.4%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Self-inflicted injuries – 1.3%</td>
<td></td>
</tr>
</tbody>
</table>


According to the WHO’s report on global status chronic diseases (2014), approximately 42% of all deaths due to chronic diseases in 2012 occurred before the age of 70 years (also called premature deaths). Figure 2.7 presents the proportion of premature deaths in 2012, attributable to chronic diseases. Cardiovascular diseases were responsible for 37% of total burden of deaths before 70 years of age, while cancers (27%), chronic respiratory diseases (8%), and diabetes was responsible for 4% of burden of deaths before 70 years of age (also called premature deaths).
The burden of chronic disease is not similar for all countries. The common belief is that chronic diseases mostly affect people of rich or high income countries, however according to WHO, it is low and middle income countries that are hardest hit by the burden of chronic diseases. Figure 2.8 shows that the majority of burden of mortality was attributable to chronic diseases and injuries according to level of income of countries.
2.2.5.2 Modifiable and non-modifiable risk factors of chronic diseases

Epidemiologists and researchers have contributed to the understanding of the risk factors, causes and determinants of chronic diseases, highlighting the inequalities in mortality and morbidity and relative contributions of characteristics of individuals (for example: age, sex, income, race, ethnicity, education and geographic location).  

As seen in Figure 2.9, certain behavioural and biological factors which are preventable and modifiable have strong relationships with the onset of chronic diseases. These modifiable factors such as obesity, physical inactivity, diet and smoking have been strongly linked with Type II diabetes, arthritis and asthma. A number of non-modifiable and underlying risk factors such as ageing, urbanization and related risks, sex, genetic susceptibility, familial history, and ethnicity also play their role in the disease process. The modifiable risk factors in conjunction with non-modifiable factors are the underlying causes of the majority of chronic diseases, especially diabetes, asthma and cardiovascular diseases. Similarly, risk factors such as social and environmental triggers (for example: age, sex, familial history) may influence underlying causes of depression and other mental health issues.
Among health and behavioural risk factors, alcohol consumption, tobacco and obesity are very important. Risky and excessive alcohol consumption has been found to be associated with a higher risk of developing chronic diseases, mental and behavioural disorders.\textsuperscript{46} According to WHO figures, of total worldwide deaths in 2012, 5.9% were attributable to alcohol consumption and more than 50% of these were due to chronic diseases.\textsuperscript{46}

Smoking or tobacco use is also one of the major behavioural and health risk factors associated with increased prevalence of diabetes, chronic obstructive pulmonary disease and cardiovascular disease.\textsuperscript{3}

Research has established links between unhealthy (overweight and obese) Body Mass Index (BMI) and an increased likelihood of diabetes, arthritis and depression. The risk of additional comorbidities increases when people have a BMI in the range 25.0–29.9 kg/m\textsuperscript{2} (overweight), with a greater risk when BMI is more than 30 kg/m\textsuperscript{2} (obese).\textsuperscript{46} Unhealthy BMI becomes a major health problem when examining global figures – the worldwide prevalence of obesity nearly doubled between 1980 and 2014. In 2014, 11% of men and 15% of women (i.e. more than half a billion adults worldwide) were categorized as being obese, with increased likelihood of developing various chronic diseases.\textsuperscript{46}
2.2.5.3 Age, gender and chronic diseases

As mentioned earlier in the Section 2.2.1 - Population ageing, one of the implications of ageing populations is an increase in the incidence and prevalence of chronic diseases. In older age groups, particularly after 60 years, chronic diseases are the leading cause of morbidity and mortality in all regions of world.\textsuperscript{1} According to WHO, the number of DALYs attributable to chronic disease are greatest in adults aged 30–59 years (estimated 163 million and 143 million in men and women respectively in 2005), and these rates increase with age. According to WHO’s future projections, total number of deaths from chronic disease will rise from 35 million in 2005 to 41 million deaths in 2015. Among 60 – 69 year old people worldwide, four million men and three million women reportedly died due to chronic diseases in 2005, with this figure increasing to 9 and 10 million deaths for men and women respectively among those aged 70 years and over. Examples of some major chronic diseases which increase in prevalence as people age are diabetes, chronic obstructive pulmonary diseases, cardiovascular diseases, musculoskeletal diseases (such as arthritis and particularly osteoarthritis) and depression.\textsuperscript{1}

Chronic diseases affect women and men differently. Compared to men, women with chronic disease tend to live longer, but their health and quality of life is affected more than men.\textsuperscript{47} For example, women report higher prevalence of chronic obstructive pulmonary disease in older age, but men in older age have higher mortality rates from it. However, these differences are not solely due to biological differences. Rather, various gender roles and identities impact how men and women manage their health problems over the life course. For instance, there are a number of barriers associated with uptake of health services by women, such as increased costs of health care, women’s financial problems and dependency due to their lower wages, their caring responsibilities or residence in areas where health care is not easily accessible. Also, men and women are sometimes predisposed to develop certain diseases earlier or with more severity due to biological and or social differences in their circumstances.\textsuperscript{46}
The next sections focuses on chronic disease burden in Australia and the rationale for choosing diabetes, asthma, depression and arthritis as the focus chronic diseases for this thesis. The prevalence of these diseases is discussed, along with their association with age and gender and their impact on workforce participation.

2.2.5.4 Chronic disease burden in Australia

In Australia, non-communicable (mostly chronic) diseases accounted for 85% of total burden of disease and 90% of all deaths in 2011. According to a report by the Australian Institute of Health and Welfare (2014), one-third of the population – approximately 7 million people, reported having at least one of these chronic diseases: asthma, type 2 diabetes, coronary heart disease, cerebrovascular disease, arthritis, osteoporosis, COPD, depression or high blood pressure. The proportion of people with chronic diseases significantly increases with age, as do the proportions of people reporting more than one chronic condition. For instance, 41% of people aged less than 15 years reported a chronic condition, while this proportion was 95% for those aged 45 years and older in 2011 – 2012.

The increasing prevalence of chronic diseases in Australia is a reflection of worldwide changes in industrialization and urbanization which has affected various life patterns such as dietary habits, physical activity levels. According to the WHO, cardiovascular diseases, diabetes, cancer and chronic respiratory diseases share the greatest burden of non-communicable disease related deaths and disease burden in Australia (also see Figure 2.10 below – the proportion of mortality according to major chronic disease groups). These conditions have also been identified as The National Health Priority Areas (NHPA) by Commonwealth, State and Territory governments of Australia. An NHPA initiative was formed in response to the WHO’s ‘Health For all’ strategy. This programme aims to focus public attention and health policy on the following areas (in the order of their inclusion in NHPA): cancer, cardiovascular health, injury prevention and control, mental health (focus
on depression), diabetes, asthma, arthritis and musculoskeletal conditions, obesity and dementia. Together, these health areas are responsible for approximately three quarters of the total burden of disease in Australia. While musculoskeletal diseases do not contribute greatly to the burden of deaths (7% of mortality burden is due to the musculoskeletal diseases), they substantially affect lifestyle, quality of life and cause considerable economic burden particularly for older people.


Figure 2.10: Burden of mortality in Australia attributable to chronic diseases and communicable diseases

Diabetes, asthma, depression and arthritis were chosen as focus chronic diseases for studies presented in this thesis. These conditions are four of the chronic conditions identified as the National Public Health priority areas. Though these conditions are responsible for a significant burden in terms of morbidity, mortality, disability and health care costs in Australia, they are amenable and receptive to preventive interventions.
The rationale for choosing these conditions, along with the natural history and prevalence of each condition by gender, their early and late determinants and their impact on workforce participation, is detailed in next section.

2.2.5.5 Diabetes

Diabetes mellitus is characterized by metabolic disorder of multiple aetiology; caused by defects in insulin secretion, insulin action, or both and resulting in hyperglycaemia, carbohydrate, fat and protein metabolism dysfunction.55

**Type 1 diabetes**

Previously known as insulin-dependent, juvenile or childhood-onset, Type 1 diabetes is characterized by deficient insulin production. It is more common in children or young adults, with more than half of all new cases occurring before 18 years and peak age of onset at 10 – 14 years. The incidence of Type 1 diabetes is much higher among males than females – 12 compared to 9 / 100,000 population in 2013.56

![Incidence (new cases) of Type 1 Diabetes by age and gender](image)

*Source: Australia Institute of Health and Welfare’s analysis of 2013 National (insulin treated) Diabetes Register (NDR).56*

Figure 2.11: Incidence (new cases) of Type 1 Diabetes by age and gender

**Type 2 diabetes** *(Type of diabetes referred to in this thesis)*

Type 2 diabetes or non-insulin dependent, adult onset diabetes is characterized by insufficient production or inability of the body to effectively use insulin.57 While initially
manageable by diet, exercise and oral glucose lowering medicine, Type 2 diabetes may progress to an insulin dependent stage. It is the most common form of diabetes, comprising 90% of people with diabetes around the world and predominantly affecting adults (and usually after the age of 50 years). Although uncommon in childhood, Type 2 diabetes is becoming increasingly diagnosed in younger people. In Australia, 87% of all people with diabetes have Type 2 diabetes, although this figure may be an underestimate as some cases may remain unreported.56

**Why is diabetes important?**

According to WHO’s factsheet on Diabetes55, more than 346 million people have diabetes around the globe, with an estimated 1.5 million deaths directly attributable to diabetes in 2012.57 The mortality figures attributable to diabetes have been projected by WHO to double by 2030,55 with diabetes projected be the 7th leading cause of death by 2030.58

According to a recent report by the Australian Institute of Health and Welfare (AIHW)56 there were about 1 million Australians with diabetes in 2012. Prevalence of diabetes increases with age. About 72% of people with diabetes in Australia (2011-12) were aged 55 years or above and 50% were aged 65 years and above.56 As seen in Figure 2.12, the prevalence of diabetes has more than doubled since 1990 and continues to rise.56
Figure 2.12: Prevalence of diabetes in Australia

Diabetes is more common among men than women. The Australian Institute of Health and Welfare in their 2014 report, indicated age-standardized rate of 6% for men, compared with 4% for women aged 18 years and over. However, the prevalence of diabetes increases in women as they age. The prevalence of diabetes among women has more than doubled from 1989 to 2012, mainly due to the rise in the incidence of Type 2 diabetes, better reporting, detection and treatment of diabetes.

Figure 2.13: Proportion of people with diabetes in Australia 2011 - 12, by age and gender
**Determinants and risk factors for diabetes**

Poor diet – lack of fruit and vegetables, high saturated fat diets and high glycaemic index foods, overweight and obesity, tobacco smoking and excessive alcohol consumption have been linked with increased risk for Type 2 diabetes. Physical inactivity, high blood pressure, high blood cholesterol, impaired glucose regulation has also been found to increase the risk of Type 2 diabetes. The majority of Australian men and women (66%) have three or more of these risk factors at one time and 10% report 5 – 6 risk factors at one time.

These risk factors for diabetes are very common in Australia and therefore result in increasing prevalence over the years. As reported by the latest Australian Institute of Health and Welfare report (2014), 95% of Australians had poor dietary habits; 63% were either overweight or obese; 63% had high cholesterol; 56% were physically inactive; 32% had high blood pressure; 20% consumed excessive alcohol (as per lifetime alcohol risk guideline) and 16% were daily smokers in 2011 - 2012.

**Impact of diabetes on health**

Diabetes *per se* is not a highly fatal condition, but it gives rise to other conditions and is associated with, or exacerbates the presence of other health conditions, leading to a high burden of disability and mortality. Diabetes is associated with a myriad of complications affecting the feet, eyes, kidneys, and cardiovascular health, resulting in long–term damage to human body, dysfunction and failure of various organs. Diabetic retinopathy (affecting approximately 15% Australians with diabetes), neuropathy (affecting 15% of Australians with diabetes), and nephropathy (affecting 20-30% Australians with diabetes) are some of the diabetes specific complications which not only decrease life expectancy but also impact quality of life. Nerve damage in the lower limbs affects around 13% of Australians with diabetes. It is also associated with a many fold increased risk of ischaemic heart diseases, cardiovascular vascular disease and stroke. Diabetes is a risk factor for atherosclerosis and
people with diabetes usually have high blood pressure and higher cholesterol which are major risk factors for cardiovascular disease.\textsuperscript{59} Cardiovascular disease is the primary cause of death in people with diabetes.\textsuperscript{59} Diabetes is also the leading cause of End Stage Kidney Disease (ESKD) in Australia, being the underlying cause of 1 in 3 new cases of ESKD.\textsuperscript{59}

Furthermore, diabetes is highly associated with mental health issues such as poor psychological well-being, anxiety, stress, and depression, affecting at least 41\% of people with diabetes in Australia.\textsuperscript{53}

\textbf{Impact of diabetes on workforce participation}

Diabetes has been identified as a major constraint on workforce participation of men and women, influencing them to make adaptations to their work.\textsuperscript{67-72} This impact is more pronounced for men and women who are older, more susceptible to complications, have low socioeconomic status and as a result have lower access to quality healthcare.\textsuperscript{69, 73, 74} As discussed in the previous section, complications of diabetes have a significant impact on overall quality of life and act as a major barrier to work. This effect becomes more pronounced in mature age and greatly influences men and women’s decision to work.\textsuperscript{73, 75-79}

The existing body of literature on diabetes and workforce participation is discussed in detail in Section 2.4.2 – Literature Review.

2.2.5.6 Asthma

Asthma is a chronic respiratory disease, characterized by chronic inflammation and hyper-responsiveness of airways, resulting in air-flow obstruction of airways.\textsuperscript{54} This causes intermittent episodes of bronchospasm, breathlessness, wheezing, and coughing. Asthma is very common in young and old people.\textsuperscript{80} The condition is easily diagnosed at a young age, but its diagnosis and management becomes very difficult in old age.\textsuperscript{54}
Why is asthma important?

Approximately 334 million people of all ages have asthma around the world according to the latest Global Burden of Disease Study (GBD) undertaken in 2008-2010. Globally, around 255,000 deaths were attributable to this disease in 2005.\textsuperscript{81-83} Overall, prevalence of asthma varies with age and gender, with two broad patterns:

i) a younger pattern, affecting younger age groups (up to 15 years) and is more common among boys.\textsuperscript{84}

ii) an older pattern starting around 40 years of age, when asthma becomes more common among women.\textsuperscript{84}

In terms of global prevalence; childhood asthma has decreased globally over time but in age groups 75 years and older, the prevalence has increased from 7\% in 2001 to 10\% in 2007.\textsuperscript{80} The older population (65 years and older) still remains the worst affected with asthma associated mortality rates increasing to 10 per 100,000 population in females and 6.8 per 100,000 population in males.\textsuperscript{80}

According to Global Asthma Report 2014,\textsuperscript{85} and seen in Figure 2.14, Australia is among the few countries with highest prevalence of asthma among adults (18 – 45 years old).

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{asthma-prevalence-world.png}
\caption{Prevalence of asthma among 18 – 45 year old people in 70 countries according to Global Asthma Report.}
\end{figure}

\textit{Source: Global Asthma Report, 2014.}\textsuperscript{85}
According to the Australian Institute of Health and Welfare (AIHW) report on ‘Asthma in Australia’, one in ten Australians, that is over two million people of all ages had reported asthma in 2015. Similar to the global asthma prevalence, the prevalence of asthma in Australia is higher in females over 15 years of age, with 13.4% of females aged 75 years and over having asthma as compared with 7% in males aged 75 years and over (See Figure 2.15).

Gender differences in asthma prevalence are of special importance from a public health perspective. Asthma is more commonly reported among females than males, with much higher prevalence in older ages. The majority of deaths attributable to asthma also occurs in the population aged 65 years and over, and are more common among women, when compared with men (See Figure 2.16). Among older people, asthma remains an underdiagnosed and undertreated problem, with less than 15% of men and women aged 45 years and above having any treatment plan for asthma.
**Determinants and risk factors for asthma**

While some risk factors associated with asthma have been identified, the fundamental determinants or causal factors have not been completely understood. A combination of genetic factors, along with environmental and lifestyle factors may provoke allergic reactions or irritate the airways. These triggers are: respiratory infections; exercise; environmental irritants such as tobacco smoke or air pollutants, cold or dry air, irritation with specific allergens such as pollens, mites, dust, animals, fumes etc., food or chemicals; medicines such as aspirin or non-steroidal anti-inflammatory drugs.

Demographic factors such as age and gender also play an important role in the aetiology of asthma. Ageing is associated with deterioration and calcification of ribs causing stiffening and restriction of the chest or thoracic wall and as a result there is loss of compliance of the chest. Also, with age related changes, the diaphragm (dome-shaped muscular portions that separate the abdominal and thoracic cavities and aids in normal breathing movements) loses...
Its contractile properties. These changes put an additional risk on the ageing population for asthma development.

**Impact of asthma on health**

Global statistics for morbidity and mortality suggest that the burden of asthma disproportionately impacts adults, with high mortality rates for people aged over 55 years. Many mature age and older people have asthma coexisting with other health issues such as obesity, gastro-oesophageal disease, obstructive sleep apnoea, sleep disorders, osteoporosis and cardiovascular disease. This results in asthma being a major cause of disability, health resource utilization, complex disease management and poor quality of life for those who are affected. For instance, hospitalization rates and longer stays are much higher for older people with asthma, with reduced quality of life. Adults with asthma and particularly women, also face increased limitation of daily activities and have increased likelihood of coexisting depression.

**Impact of asthma on workforce participation**

Asthma may have a varying impact on workforce participation, with more pronounced affects in people with severe disease and those who are older in age. It greatly impacts the overall quality of life, and thus can affect an individual’s ability to participate productively in the workforce, causing forced adjustments in employment or job responsibilities, and may result in loss of work. In 2011 – 12, daily living of approximately 34% of Australians with asthma was affected. When co-existing with other health conditions such as depression, men and particularly women are more likely to leave the workforce early in their 50’s. According to the Australian Institute of Health and Welfare’s 2014 report, asthma was the fourth highest condition causing at least 18.4% people with asthma to take time off work or studies.
Figure 2.17: Proportion of people who had time off work or study due to their chronic conditions in 2011-12

Detailed discussion regarding literature on asthma and its impact on workforce participation is given in Section 2.4.2 – Literature Review.

**2.2.5.7 Depression**

The word ‘depression’ can describe various overlapping experiences. It is usually characterized by sadness, loss of interest or pleasure, feelings of guilt or low self-worth, disturbed sleep or appetite, feelings of tiredness, and poor concentration. Depression is a complex disease and due to its wide range of symptoms and usual lack of identifiable physical signs and symptoms, depression can remain undiagnosed, and may be chronic and recurrent. A person may be clinically diagnosed with depression if they have experienced sadness for two or more weeks, were miserable for most of this time and lost interest in daily activities. Clinical depression is an emotional, physical and cognitive state that is intense, long-lasting, with marked effects on a person's normal routine and behaviour.

*Why is depression important?*

Depression is a very common mental illness, is pervasive and affects people of all ages and gender worldwide. Globally, almost one in six people (one in five women and one in eight
men) will experience at least one episode of clinical depression in their lifetime. The burden of depression and other mental health conditions is on the rise globally, affecting more than 350 million people of all ages.\textsuperscript{95} Depression is one of the leading cause of disability and loss of quality of life in both men and women. According to WHO, the burden of depression in both high-income and low- and middle-income countries is 50\% higher for women than men.\textsuperscript{95}

In Australia, it is estimated that 45\% (~7.3 million) of people will experience a mental health condition in their lifetime, with 13\% having diagnosed depression at least once.\textsuperscript{97} In any one year, around one million Australian adults have depression, making it a chronic condition with the third highest burden of disease. It is of concern that in Australia, depression is the number one cause of non-fatal disability.\textsuperscript{97}

**Determinants and risk factors for depression**

Depression is a result of complex interactions of numerous social, psychological and biological factors.\textsuperscript{95} There are interrelationships between depression and physical health, with studies reporting that depression can occur with other chronic diseases such as diabetes and arthritis.\textsuperscript{68, 98}

Even though exact causal factors associated with depression are not known, a number of factors have been identified as playing an important role in the development of depression. Depression is not a result of a single acute event, it is due to the culmination of past and recent events, impacted by personal, societal and environmental factors.\textsuperscript{95} Life events such as job problems, unemployment and relationship problems can trigger depression in people who may be at risk because of past factors. These past factors include previous or family history of depression and anxiety, trauma, abuse and previous illnesses. Biochemical changes, in particular mood regulating neurotransmitters can also affect the mood and predispose towards depression.\textsuperscript{95, 96}
**Impact of depression on health**

Depression can substantially impair an individual’s ability to function at work, at school or to cope with daily life. At its most severe, depression may lead to suicide, causing almost 1 million people to take their lives each year. Depression also impacts the life of their family and loved ones. When compared with other diseases, depression produces the greatest decrement in health. When depression occurs concurrently with other conditions such as diabetes or arthritis, health worsens more when compared with depression alone, with any of the chronic diseases alone, or with any combination of chronic diseases without depression.

**Impact of depression on workforce participation**

The economic impact of depression is long lasting and huge, imposing various costs on individuals, families and communities as a whole. Due to its chronic nature, depression greatly influences workforce participation and productivity due to lower concentration, reduced motivation, higher fatigue and poor judgement in decision making. This results in an increased economic burden faced by individuals, families and governments on the whole. Section 2.4.2 – Literature Review discusses the literature on depression and workforce participation in detail.

**2.2.5.8 Arthritis**

Rheumatic or musculoskeletal conditions are a large group of disorders associated with pain and physical disability, giving rise to increased health care costs and loss of work. The most common conditions are “osteoarthritis” and “rheumatoid arthritis”, affecting one or more joints, resulting in inflammation, stiffness, disability, deformity and pain in affected areas. Osteoarthritis is a progressive, degenerative joint condition affecting weight-bearing joints such as the hips, knees and ankles as well as the hands and spine. Rheumatoid arthritis is an auto-immune disease which causes chronic inflammation of the (mostly) hand joints and may result in deformities of the hands.
In this thesis, the focus is on osteoarthritis or degenerative arthritis as it is associated with ageing – commonly affecting people after 45 years of age, with women being affected more and developing severe disease as compared to men.\textsuperscript{105, 106, 109}

\textbf{Why is Arthritis important?}

According to WHO fact sheet on chronic rheumatic conditions (2015),\textsuperscript{105} osteoarthritis is one of the ten most disabling diseases in developed countries affecting at least 151 million individuals worldwide.\textsuperscript{110} Noticeable symptoms occur in 9.6\% of men and 18\% of women above 60 years of age; of them 80\% have movement limitation and 25\% are not able to perform main daily routines.\textsuperscript{105}

According to 2011 – 12 estimates in Australia, approximately 28\% of the total population (that is. 6.1 million Australians) suffered from arthritis and other musculoskeletal conditions.\textsuperscript{87, 108} Approximately 4.3 million had other musculoskeletal problems (back pain, osteoporosis, rheumatoid arthritis) and 1.8 million reported having osteoarthritis.\textsuperscript{108} Osteoarthritis occurs predominantly among women – two in three people who have osteoarthritis are females. \textbf{Error! Reference source not found.} below presents the prevalence of arthritis in Australia for specific age groups.\textsuperscript{111} This figure illustrates that the prevalence of arthritis increases with age and is more predominant in females after 44 years of age.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{prevalence_of_osteoarthritis_in_australia.png}
\caption{Prevalence of osteoarthritis in Australia (2011 – 12) according to age groups and gender.}
\end{figure}

\textsuperscript{Source: Australian Institute of Health and Welfare, Musculoskeletal fact sheet on Osteoarthritis.}\textsuperscript{111}
**Determinants and risk factors for arthritis**

Hereditary factors, gender and increasing age are dominant risk factors for developing osteoarthritis.\(^{108}\) Obesity or being overweight also increases an individual’s risk of osteoarthritis, notably in the knees and hands. It also increases the risk of rapid progression and severity of disease. In the United States, the prevalence of osteoarthritis in obese people is twice as much as in healthy weight individuals.\(^{112}\)

Occupational or leisure time activities involving excessive and repetitive physical activities such as kneeling/squatting, climbing and heavy lifting are added risk factors for knee osteoarthritis, especially as people age.\(^{113}\)

Osteoarthritis predominantly increases in prevalence and incidence after menopause. Studies have suggested that loss of oestrogen after menopause could possibly increase the risk of osteoarthritis among women.\(^{114}\)

**Impact of arthritis on health and workforce participation**

This group of diseases not only causes pain and disability but also gives rise to other problems such as mobility issues and limitations to perform daily activities. This limitation in physical activity and mobility can negatively impact a person’s self-esteem and cause depression, anxiety and helplessness and negative self-image.\(^{108}\) According to the Australian Institute of Health and Welfare,\(^{108}\) when compared to people without osteoarthritis, those with osteoarthritis are 3.5 time more likely to report higher levels of psychological distress. These health effects result in inability to meet the physical and emotional demands of a job and cause loss of job or forced adaptation in work such as working from home or being employed part time rather than full time.\(^{115}\) Arthritis is among the leading causes of work restrictions and decreased productivity in Australia.\(^{108, 111, 115}\)

Among those with some kind of employment restriction, 41% reported permanent disability to work, and 47% of them had arthritis. The pain and physical limitation associated with arthritis are strongly associated with mental health problems.\(^{115}\) As arthritis predominantly
impacts women over 45 years, it also influences their decisions regarding work, by greatly limiting their activities and functional capability. Literature about arthritis and workforce participation is discussed in detail in Section 2.4.2 – Literature Review.

The last section of ‘Background’ describes the life course approach and briefly introduces some of the early and late life socio-demographic factors used in this thesis.

2.2.6 Life course impact of socio-demographic factors

2.2.6.1 Concept of life course approach

The social pathways of human lives in the context of life histories and future trajectories, were not given much importance by researchers before the 1950’s. Little was known about how people lived their lives from childhood to old age, and even less about the influence of these factors on the course of their development and aging. Still less importance was given to the historical and geographic contexts affecting people’s lives. The concept of life course evolved from the 1950’s and subsequent research considered life course to be the prevailing model of health in the first half of the 21st century.

2.2.6.2 What is life course approach?

Life course approach can be defined as the ‘the study of long term effects of physical or social exposures during childhood or early life on later and adult life health and life circumstances’. Conventionally, life course models integrate biological, behavioural and psychological pathways to conceptualize the inter-relations between these mechanisms, which operate across the life course of an individual, therefore influencing chronic diseases and other late life circumstances. Life course approach focuses on studying how early life factors (such as education and socio-economic conditions) integrate and contribute jointly with later life factors (such as smoking, obesity and marital status) to influence adult disease risks and
later life circumstances such as employment, socio-economic conditions. Ben-Shlomo and Kuh have discussed two conceptual life course models as seen below:

<table>
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<th>Critical period model</th>
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<tr>
<td>with or without later life risk factors</td>
</tr>
<tr>
<td>with later life effect modifiers</td>
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<table>
<thead>
<tr>
<th>Accumulation of risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>with independent and uncorrelated insults</td>
</tr>
<tr>
<td>with correlated insults</td>
</tr>
<tr>
<td>'risk clustering'</td>
</tr>
<tr>
<td>'chains of risk' with additive or trigger effects</td>
</tr>
</tbody>
</table>


Figure 2.19: Conceptual life course models

According to the ‘critical period model’, when an exposure acts during a specific and limited time period when the human body is vulnerable, it can positively or adversely impact the body and cause or prevent late life disease outcome. For example, genetic predisposition to develop asthma, infant respiratory infections, poor lung development, low childhood socio-economic status or childhood chest infections may or may not act along with late life factors such as a particular occupation, medicines, air pollution etc. to impact the functional capacity of lungs, and also causing asthma in adult life.

The second model – ‘accumulation of risk’ can be defined as the gradual accumulation of disease risk factors, environmental exposures, adverse life events and health behaviours over the life of an individual and the resultant cumulative damage in adult life (see Figure 2.20).
In the context of this thesis, it can be inferred that, as the risk of chronic diseases increases with age, ageing is an important marker for the accumulation of risk factors for chronic disease progression over the life course. While gender can act as a predisposing factor to develop certain chronic diseases (for example arthritis is more prevalent among women), other factors such as ageing, employment, physical activity and obesity accumulate over the life course to impact the development of disease and its progression. This results in diverse associations between chronic disease and workforce participation, where each can impact the other.
2.3 RESEARCH FRAMEWORK

The overarching aim of this thesis is “to ascertain patterns of workforce participation over the life course and their associations with chronic diseases and various socio-economic factors among men and women”.

The basic framework for this research thesis is based on the premise that gender norms, roles and relations shape men and women’s experiences and opportunities throughout their lives, with socio-demographic factors and health over the life course associated with workforce participation patterns.

This framework has three main dimensions for exploring workforce participation patterns of men and women in terms of:

i) Chronic diseases, specifically diabetes, asthma, depression and arthritis;

ii) Gender – the social construct which reflects many family and occupational opportunities and circumstances impacting over the life span; and

iii) Life course influences – impact of early life factors on later or adult life circumstances

The next section discusses the existing body of literature on workforce participation and its various associations with chronic diseases (diabetes, asthma, depression and arthritis) and socio-demographic factors among men and women over the life course.
2.4 LITERATURE REVIEW

The literature describing the impact of chronic diseases on workforce participation is burgeoning. However, the aim of this research was to ascertain gender specific associations between chronic diseases (diabetes, asthma, depression and arthritis), various early and adult life factors and workforce participation over the life course.

To thoroughly synthesize the existing research evidence on the thesis topic, a systematic approach was taken to identify published and peer-reviewed research and other literature, as presented below.

2.4.1.1 Literature search and selection strategy

The first step in this literature review was to systematically search relevant databases to ensure necessary broad coverage of all areas of interest- including sociological, public health related and medical literature. Three databases – MEDLINE, EMBASE and PROQUEST were more relevant to this search. The following topic areas were reviewed:

i) workforce OR labo*r force OR employment OR work

ii) chronic disease* OR chronic illness*

iii) diabetes

iv) asthma

v) depression

vi) arthritis

vii) gender

viii) men OR women OR gender

ix) life*course

The detailed search strategies, limiting terms, searched data bases and the initial results are summarized in Table 2.2.
Table 2.2: Search and limiting terms used in databases and the number of initial literature found.

<table>
<thead>
<tr>
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<th>Search terms</th>
<th>Limiting terms</th>
<th>Results</th>
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</tr>
<tr>
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<td>(Abstracts, humans)</td>
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<td>(abstracts AND human AND (adult &lt;18 to 64 years&gt; OR aged &lt;65+ years&gt;))</td>
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<td>(Abstracts, humans)</td>
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</tr>
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<td>Search terms</td>
<td>Limiting terms</td>
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<tr>
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<tr>
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<tr>
<td>PROQUEST</td>
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<td>(abstracts, human)</td>
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<tr>
<td>SCOPUS</td>
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<td>(abstracts, human)</td>
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</tr>
</tbody>
</table>
In addition to published and peer-reviewed literature, other reputable websites, additional unpublished grey literature and policy papers were searched. See the PRISMA flow diagram below illustrating the systematic approach used to select literature for review.

Figure 2.21: Flow diagram presenting the systematic approach to the literature review.
2.4.2 Literature Review – Workforce Participation of Men and Women over the Life course and their Association with Chronic Diseases (Diabetes, Asthma, Depression and Arthritis)

Globally, research has indicated that despite governments’ targeted initiatives and policy changes to retain and encourage older people to continue working for longer, not all older people are working. Previous research within workforce participation has established the significant role of health and particularly long standing chronic conditions on employment in older or mature ages.\textsuperscript{17, 25, 31, 67, 77, 127-144}

Several Australian and international studies have noted that various chronic conditions significantly affect workforce participation, with variations across age groups and gender. For example, Schofield et al.\textsuperscript{67} examined 45-64 year old unemployed Australians in a retrospective cross-sectional study and reported that the majority of men and women were not working because of chronic conditions. Cai and Kalb\textsuperscript{132}, Cai and Cong\textsuperscript{131} and Harris\textsuperscript{130} also reported in their cross-sectional studies that health status and chronic diseases negatively impacted labour force participation of adult men and women in Australia. In another cross-sectional, organization based study in United Kingdom, Munir and colleagues\textsuperscript{137} found that chronically ill employees had to make various work adjustments and had many physical, social and cognitive work limitations.

In addition to cross-sectional studies, there have been some longitudinal studies, which have focussed on exploring the dynamic relationship between poor health, labour market and workforce participation. For example, Peter and Michal\textsuperscript{138} reported that poor health was a strong determinant of workforce participation among 30 – 59 year old German men, particularly when aged over 50 years. Another study by Schuring et al.\textsuperscript{141} reported an association between poor health and transitions to and from unemployed work status in
Germany, Denmark, Netherlands, Belgium, France, UK, Ireland, Italy, Greece, Spain and Portugal. Two studies conducted in Canada by Smith et al.\textsuperscript{143} and Au et al.\textsuperscript{127} also found that the decision to work by individuals was influenced by their health, with a lower probability of being in paid work for those with some chronic health conditions and self-reported poor health.

In Australia, a number of longitudinal studies suggested strong associations between health, chronic diseases and work participation of both men and women. For example, Pit and Byles\textsuperscript{139} studied mid-age women over a period of approximately 12 years and reported lower odds of employment among women with deteriorating mental and physical health and various chronic conditions. A study of 55 – 64 year old Australian men suggested that men with poor health in some particular occupations such as trades and labour, may remain out of paid work for years.\textsuperscript{136} Zhang, Zhao and Harris\textsuperscript{17} reported that men and women aged above 50 years who reported one or more chronic diseases were more likely to drop out of the labour force, when compared with their young counterparts, with this effect more pronounced for men than women.

Some studies have also indicated that long standing health conditions impact an individual’s decision to exit the workforce prematurely. For instance, Shultz and colleagues\textsuperscript{142} indicated that poor health acted as a major ‘pushing’ factor towards early and involuntary exit from the workforce in the United States. Some European studies\textsuperscript{140, 145-147} also reported an increased likelihood of early exit from work for individuals with chronic diseases. For example, Rice et al.\textsuperscript{140} found over a four year follow-up period, that poor health was a main factor influencing employed men and women aged 50 years and over to exit from the workforce early. Buckley et al.\textsuperscript{144} examined the role of health as a mediator of labour force participation among baby boomers (1946-1965) in Australia in 2013, and found that those with poor health and particular chronic conditions were more likely to retire or were unable to continue working for a longer time period.
Various reports by government institutions have also outlined the role of health in workforce participation. For instance, a working paper by the Australian Government Productivity Commission\textsuperscript{148}, reports by the Australian Bureau of Statistics\textsuperscript{37, 43, 107, 149} and the Australian Institute of Health and Welfare\textsuperscript{16, 60} as well as the Intergenerational Reports by Australian Treasury\textsuperscript{150} have all highlighted the fact that chronic disease and poor health status are one of the most important factors negatively affecting workforce participation. According to these reports, men and women with poor health status and chronic health conditions were less likely to be working, especially in mature or older age. Similarly, various reports by National Seniors, Australia and the Australian Department of Health and Ageing,\textsuperscript{26, 31, 151, 152} also focussed on the negative impact of poor health on mature age employment challenge.

The existing literature above has established that a relationship exists between health, particularly chronic diseases, and workforce participation in mature and older ages. However, not all people in younger age groups are in the workforce and financially independent,\textsuperscript{5} with health status and long standing illnesses also adversely affecting their chances of being in paid work as they age.\textsuperscript{77}

The previous Section 2.2.5 - Chronic diseases discussed the importance of diabetes, asthma, depression and arthritis in terms of prevalence, risk factors, impacts on health and workforce participation. Past studies have explored these particular diseases, either as part of a large group of chronic diseases or as individual conditions, predicting a range of workforce participation outcomes.

\textit{‘Diabetes’}, has been identified as a major constraint on workforce participation and productivity of men and women, influencing them to make adaptations to their work or forcing them to exit the workforce.\textsuperscript{67-76, 78, 79, 130, 153, 154} This impact is more pronounced for men and women who are older, more susceptible to complications, have low socioeconomic status and as a result have low access to quality healthcare.\textsuperscript{69, 73, 74} However, there is disagreement among studies regarding the associations between diabetes and
workforce participation by gender. For instance, Tunceli et al.\textsuperscript{75} found that the absolute probability of working was less for men having diabetes, when compared with women having diabetes, but loss of work days and work limitations to kind or amount of paid work were more pronounced for women who remained in workforce. In contrast, two cross-sectional studies in United States\textsuperscript{71,154} reported that diabetes negatively impacted the employment probability of men, but had no impact on women with diabetes, apart from some loss of earnings. Another cross-sectional study in Australia by Harris\textsuperscript{130} showed similar findings of diabetes (along with cardiovascular disease) significantly impacting employment of men aged 25 years and over, when compared with women. Kahn\textsuperscript{70} however reported in a study conducted in United States, that women with diabetes increased their workforce participation, while among men, the probability of work decreased. Some research did not report separate findings for men and women. For example, Eléonore et al.\textsuperscript{74} in their cross-sectional study of French employees, reported that ‘subjects’ (without any mention of gender) with diabetes had a decreased employment rate, early exit from workforce, increased transition to disability and death, resulting in profound social and economic consequences. Other studies conducted in United States\textsuperscript{73,78} indicated that diabetes was associated with work disability, unemployment and significant income and productivity losses. Apart from diabetes directly affecting individuals’ ability to engage in paid work, workplace discrimination can also be a problem faced by people with diabetes.\textsuperscript{73} Moreover, comorbidities such as depression, cardiovascular disease and complications of diabetes (retinopathy, nephropathy etc.) can constitute additional barriers to employment.\textsuperscript{73,76,137,139}

The literature search on ‘asthma’ and workforce participation patterns and their differences among men and women did not yield many results. Much of the research on asthma is cross-sectional in nature, with asthma included with other chronic conditions or chronic respiratory conditions and focussed more on work ability and occupational exposures.\textsuperscript{17,76,90-94,137,140,155,156} In terms of work ability, the published evidence is conflicting. For
example, Yelin et al.\textsuperscript{155, 156} found in their two separate studies in the United States, that asthma was not a substantially impediment to work ability of their sample population. In contrast, other researchers such as Balder et al.,\textsuperscript{91} Blanc et al.,\textsuperscript{90, 92, 93} Eisner et al.,\textsuperscript{94} indicated that asthma was associated with work disability, decreased job effectiveness and change in duties. However, in many cases, even though people with asthma continued to work,\textsuperscript{155} their type of occupation, and quality of work depended on the severity of disease. For example, loss of time due to severity, or decreased work productivity can be problems while men and women with asthma were still employed.\textsuperscript{90, 93}

‘Depression’ can directly affect an individual’s engagement in the workforce by acting as a barrier to obtain and retain work. It can also occur as a comorbid condition resulting in many adverse social and economic consequences.\textsuperscript{17, 67, 100, 102, 104, 127, 139, 140} Wang et al.\textsuperscript{104} examined the impact of depression and mental health status on job loss and turnover in China and reported that people with depression and especially those with a comorbid condition were more likely to be unemployed, with a high chance of job turnover. Likewise, Zhang and colleagues\textsuperscript{17} found labour force participation to be worst affected among 50 – 65 year old Australian men with depression and mental health problems. Similar findings of an inability to retain work and / or an early transition out of paid work were also reported by other researchers who indicated that men and women with depressive symptoms were more likely to exit out of paid work due to depression affecting their health and job performance.\textsuperscript{68, 99-103, 140, 157}

Musculoskeletal disorders and in particular ‘arthritis’\textsuperscript{*} have been identified by previous research as a major cause of disability, increased health care costs and loss of productivity due to decreased participation in workforce. Work disability and costs related to arthritis have been a major theme for research conducted on arthritis and employment. For instance, DiBonaventura et al.\textsuperscript{158} and Barret et al.\textsuperscript{159} examined economically active participants with arthritis in the United States. They reported that arthritis negatively impacted work productivity among their participants by forcing them to make adaptations in their work or
resulting in an inability to perform work. Another study on the impact of arthritis in the United States by Yelin\textsuperscript{116} reported activity limitations and low labour participation, which were more pronounced among 18 – 64 year old and elderly women, compared with men. Other studies have also reported arthritis as a major limiting and constraining factor for continued workforce participation in older ages, particularly affecting women and also resulting in increased costs related to work disability.\textsuperscript{137,159-162} Some studies examined the impact of arthritis on workforce participation along with other chronic diseases. For example, Schofield et al.\textsuperscript{67} found that arthritis was part of group of disorders causing premature exit from the workforce participation among 45 – 64 year old Australian women. Similar findings were reported by Smith et al.\textsuperscript{143} and Pit and Byles\textsuperscript{139} in their studies.

Although the literature discussed above examined the impact and associations of health and particular chronic diseases (diabetes, asthma, depression and arthritis) with work or labour force participation and employment, few studies accounted for gender roles or the presence of other social and demographic factors in an individual’s life. It is important to realise that health status or chronic diseases do not affect workforce participation alone, rather they act along with various sociodemographic and economic circumstances prevailing across the life course of men and women.\textsuperscript{163-165} While, some early or adult life factors have a greater impact on women due to their different gender roles and expectations, men will be affected by different factors. This notion is also supported by previous literature which shows that workforce participation is highly gendered pertaining mostly to a male breadwinner role.\textsuperscript{33,38,166,167}

It has already been discussed in Section 2.2.2 - Workforce participation by age and gender in ‘Background’, that when compared with men, women’s working lives are likely to be more fragmented, combining family and caring roles with full or part time work at different life stages.

This variation in workforce participation among men and women can be explained by different trajectories and natural courses of chronic diseases and various early and adult life
factors acting along with varying roles, attitudes and life patterns of men and women.

However, it is interesting to note that studies have reported contrasting findings on gender differences in health and chronic diseases. For example, Macintyre and colleagues\(^{168}\) and Arber and Cooper\(^{169}\) indicated that there were no significant gender differences in reporting of some general health symptoms and chronic diseases. However, researchers such as Malmusi et al.\(^ {170}\) and Yelin E\(^ {116}\) reported gender differences in terms of workforce participation by those who have chronic musculoskeletal problems (particularly arthritis), with women more likely than men to be affected negatively due to arthritis.

Although many questions regarding the influence of gender on health in general have been analysed in past few decades,\(^ {6, 167, 169, 171-173}\) few have investigated the importance of gender, when examining the associations between chronic diseases and workforce participation.

‘Early and adult life socio-demographic factors’, such as parent’s social status and childhood socio-economic conditions and their role in work and employment engagement for women and men in later life has been discussed in literature.\(^ {163, 165, 174-178}\) Case et al.,\(^ {163}\) Currie\(^ {174}\) and Currie et al.\(^ {175}\) are among various researchers who found that the better the educational background of the family, the better are the chances of children attaining better employment later in life. They also found that children whose fathers had a higher level of occupation and thus more income, were more likely to be better employed.\(^ {163, 174, 177}\)

Among other factors which might influence an individual’s decision to work, education is of vital importance. It is not only highly associated with employment prospects, it is also related to work patterns and is especially important from the gendered perspective. For instance, women who have higher education have better options to work for higher wages and are more likely to continue working into older age.\(^ {165, 179, 180}\) Men, however will work for much of their adult lives regardless of their education status.

Some life course factors such as marital status and caring responsibilities have been considered as stereotypical roles impacting employment choices of women more than that
of men. However, with time, women became more educated and career oriented.\textsuperscript{39, 181} Previous research has presented conflicting results. According to some such as Dahl et al.\textsuperscript{182}, Larsen & Pedersen\textsuperscript{135} and Ruhm,\textsuperscript{183} in contrast to partnered men, married or partnered women were more likely to cease work at an older age. Li et al\textsuperscript{25} and Haider & Loughran\textsuperscript{184} however reported that regardless of gender, marriage or civil partnership had a protective effect on underemployment.

Caring for a sick or disabled family member or friend has also been identified as a particular issue affecting women and their engagement in the workforce. Bittman et al.\textsuperscript{185}, Gray et al.\textsuperscript{186} and Spoehr et al.\textsuperscript{31} reported that women were often the primary care givers and this role was more likely to impact their participation in workforce. On the other hand, there were some studies, for example, one by Lee and Gramotnev\textsuperscript{187} that suggested that often women are carers because they are not in workforce. Despite the discordance of these findings, past studies report that adult life factors like marital status and caring responsibilities do impact men and women’s decisions to work at older ages and need further investigation to establish if these impacts differ by gender and age cohorts.

Over the past two decades, a range of outcomes and predictors have been studied using the life course approach, but a recurring theme has been on conceptualizing disease aetiology and the effect of socioeconomic status and its differentials on adult morbidity and mortality rates.\textsuperscript{124, 125, 188-193} For example, the interactions of socioeconomic factors and occupation with chronic diseases were studied by Bartley et al.,\textsuperscript{189} while Blane\textsuperscript{188} proposed a social pattern model of health whereby changes in income, education or social class are directly proportional to variations in health status. Smith and colleagues\textsuperscript{190} and Lidfeldt\textsuperscript{194} found that low socioeconomic status of women during childhood (suggested by their father’s occupation) was associated with an increased risk of developing Type 2 diabetes.

However, there has been little work conceptualizing how the differences in employment probabilities of mature age men and women reflect the continuation of their earlier life employment patterns, and other earlier life circumstances.\textsuperscript{183}
Another limitation of some existing life course studies is their restricted scope when examining exposures, with many studies examining overlapping age groups in a single data set. Moreover, information about other periods or life events (e.g. education, marital status, employment history throughout life) were usually not tested.\(^{188, 190, 191, 195}\)

It is important to understand how gender roles and gender differences impact various early and adult life factors such as childhood socio-economic status (analysed by father’s and mother’s occupation, availability of books, etc.), educational qualifications, marital status etc. and shape employment trajectories over the life course. In order to investigate various patterns of workforce participation over the life course, it is necessary to take into account what and how these early and adult life factors effect men and women differently. There is a lack of recent studies that focus on all of these issues. These life influences have gained much more importance in the current demographic trend of an ageing population, when governments are trying to encourage mature age workers to continue working. This policy objective can only be achieved if policies and practices are tailored to specific requirements and roles by gender, while accounting for various life course factors in an ageing population.

There are further gaps in the existing literature which need to be highlighted in order to emphasize the importance of this thesis. Several studies investigating the impact of health on employment were cross-sectional,\(^{31, 131, 132, 142, 144}\) limiting their overall scope. Health status or particular chronic conditions were evaluated at a particular point in time and therefore, a life course approach is not taken into account. Though a number of studies\(^{74, 127, 130, 138, 139, 168}\) used chronic diseases as the instrumental variable of health status, they did not identify different employment patterns in regard to particular chronic diseases. Self-reported poor health and self-reported employment or unemployment status were used to calculate the labour market risks while understating or overstating the actual health and work capability.\(^{77, 127, 136, 138, 141, 142, 144}\) Some studies used a wide age range; for example,
Harris had people 25 years and older in his sample where the number of people in youngest and older age groups were too small to present reliable results.

Moreover, in some studies the sample/ participants were chosen from clinics or surveys for particular diseases. Results in these cases could be biased and an accurate comparison of disease prevalence among those with disease and without disease could not be possible. A number of studies included both men and women and in some cases were gender specific, but none identified distinct patterns of workforce participation with a comparison of different outcomes of specific chronic diseases in men and women and their association with employment and work. Many studies included work status as employed versus unemployed, while other studies restricted their sample to those in paid work only.

Thus some major gaps in existing literature can be summed up as follows:

- Different patterns of workforce participation over the life course for men and women separately, have not been identified.
- Associations between workforce participation patterns and early and adult life socio-economic factors over the life course, were not examined for men and women separately.
- Association between particular chronic diseases (diabetes, asthma, depression and arthritis) and workforce patterns were not examined according to gender while accounting for impact of early and adult life socio-demographic factors.

An attempt to address these gaps is presented in this thesis in the form of peer-reviewed published and submitted manuscripts. The focus is the association between chronic disease and workforce participation patterns, and examining how these differ among men and women, according to their early and adult life course factors.
This thesis therefore, aims to “to ascertain patterns of workforce participation over the life course and their associations with chronic diseases and various socio-economic factors among men and women.”

2.5 NEXT CHAPTER – METHODS AND ANALYSIS STRATEGY

The next chapter provides detailed discussion of data sources, variable descriptions and analysis strategies used in the studies of this thesis.
CHAPTER 3: METHODS AND ANALYSIS STRATEGY
This chapter provides a detailed description of the data sources, methods and analytical strategies used for the studies in this thesis. These methods will not be discussed again in detail, as this chapter is intended as a reference chapter for each study for data sources, methods and analysis strategies for each study.

### 3.1 Introduction

This thesis has five studies using three different data sources. Each study title, data source and analysis strategy is outlined in Table 3.1.

<table>
<thead>
<tr>
<th>Study</th>
<th>Title</th>
<th>Data Source</th>
<th>Analysis Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Employment status and chronic diseases – A cross-sectional study among the 60 – 64 year old men and women</td>
<td>NSW 45 and Up Study</td>
<td>Logistic regression</td>
</tr>
<tr>
<td>2</td>
<td>A gendered approach to workforce participation patterns across the life course</td>
<td>Australian Life History &amp; Health (LHH) Survey</td>
<td>Latent Class Analysis, Multinomial regression</td>
</tr>
<tr>
<td>3</td>
<td>Exploring workforce participation patterns and chronic diseases among mid-age Australian men and women over the life course</td>
<td>Australian Life History &amp; Health (LHH) Survey</td>
<td>Latent Class Analysis, Multinomial regression</td>
</tr>
<tr>
<td>4</td>
<td>Women, work and illness: Latent class analysis of longitudinal data for 11,551 middle age women</td>
<td>Australian Longitudinal Study on Women’s Health (ALSWH)</td>
<td>Latent class analysis with distal outcome - Classify – Analyse approach, Multinomial Regression</td>
</tr>
<tr>
<td>5</td>
<td>Health predictors of workforce participation over time – Longitudinal evidence for young women</td>
<td>Australian Longitudinal Study on Women’s Health (ALSWH)</td>
<td>Latent class analysis, Logistic Regression</td>
</tr>
</tbody>
</table>

### 3.2 Data Sources Description

To achieve the main objectives of this thesis, three main data sources were used.

1. The 45 and Up Study.
2. The Life History and Health (LHH) Survey.
3. The Australian Longitudinal Study on Women’s Health (ALSWH)
### 3.2.1 The 45 and Up Study

The ‘45 and Up Study’ is a large collaborative research project – the largest, prospective and on-going longitudinal study of ageing in Australia with both self-reported data and linked administrative records. The main aims of the ‘45 and Up Study’ are to address the public health importance of an ageing population by emphasizing determinants of healthy ageing and assessment of disease risks, quality of life, social and psychological factors affecting men and women aged 45 years and above.

Priority areas for this study are:

i) Social and economic determinants of healthy ageing, including income, education, ethnicity, work and retirement, social capital and rurality.

ii) Health effects of obesity, overweight and physical activity.

iii) The impact of environmental factors on healthy ageing.

iv) Risk factors for, and the detection and management of cancer, cardiovascular disease and mental health problems, including depression.

v) Use of health services in relation to ageing, including the determinants of use of residential aged care.

vi) Health in people aged 80 years and over (the ‘old old’).

In order to achieve the main aims, data collection started in February 2006 and 266,848 men and women aged 45 years and older were recruited from 2006 – 2008. Random sampling was done from the general population of New South Wales (see Figure 3.1) through Medicare Australia’s data base (99.5%), although volunteers were also included (0.05%). Medicare is Australia’s national healthcare provision database and has records of all citizens, permanent and temporary residents. People aged above 80 years and those who lived in rural areas were over-sampled by a factor of two. This sample represents one in ten people of NSW. Participants who were found to be eligible were mailed an
invitation to take part in study, an information leaflet, a gender specific study questionnaire and consent form (See Appendix 1.1, Appendix 1.2 and Appendix 1.3).

Figure 3.1: Map of Australia with location of ’45 and Up Study’ – New South Wales (NSW) highlighted

Participants gave their consent for the baseline questionnaire and to be followed up with a 5 year and 10 year survey. The ‘45 and Up Study’ is managed by the Sax Institute and receives funding from its major partner: Cancer council NSW. Other partners are: The National Heart Foundation of Australia (NSW Division); NSW Ministry of Health; NSW Government Family & Community Services – Carers, Ageing and Disability Inclusion; and the Australian Red Cross Blood Service. Details of the ‘45 and Up Study’ are given elsewhere,197 and can be found at http://www.saxinstitute.org.au/our-work/45-up-study/.

Questionnaire data from the ‘45 and Up Study’ has also been linked retrospectively and prospectively with various routinely collected population databases and registers such as Medicare Australia (use of prescription medicine, general practice service use) and New South Wales Centre for Health Record Linkage (for national deaths and cancer registers and hospitalizations).197
3.2.1.1 Baseline questionnaire

The gender specific, self-reported questionnaires are given in Appendix 1.2 and Appendix 1.3. A summary of the main themes covered in the baseline questionnaire is presented below in Table 3.2.

Table 3.2: Main theme and questions for NSW 45 and Up Study questionnaire.

<table>
<thead>
<tr>
<th>Main theme</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demography</td>
<td>Age</td>
</tr>
<tr>
<td></td>
<td>Postcode</td>
</tr>
<tr>
<td></td>
<td>Ethnicity, country of birth</td>
</tr>
<tr>
<td></td>
<td>Ancestry</td>
</tr>
<tr>
<td></td>
<td>Housing</td>
</tr>
<tr>
<td>Lifestyle and</td>
<td>Physical activity</td>
</tr>
<tr>
<td>Habits</td>
<td>Smoking</td>
</tr>
<tr>
<td></td>
<td>Alcoholism</td>
</tr>
<tr>
<td></td>
<td>Education</td>
</tr>
<tr>
<td>Family</td>
<td>Diseases in family (parents and siblings)</td>
</tr>
<tr>
<td></td>
<td>No. of children</td>
</tr>
<tr>
<td></td>
<td>Marital status</td>
</tr>
<tr>
<td>Health</td>
<td>Health problems:</td>
</tr>
<tr>
<td></td>
<td>Has doctor ever told you have…..?</td>
</tr>
<tr>
<td></td>
<td>In last month have you been treated for…?</td>
</tr>
<tr>
<td></td>
<td>Current important illness</td>
</tr>
<tr>
<td></td>
<td>Current medications</td>
</tr>
<tr>
<td></td>
<td>Surgical procedures</td>
</tr>
<tr>
<td></td>
<td>Self-rated health</td>
</tr>
<tr>
<td></td>
<td>Any falls</td>
</tr>
<tr>
<td>Diet</td>
<td>Fruit and vegetable consumption</td>
</tr>
<tr>
<td>Time and work</td>
<td>Household income before tax</td>
</tr>
<tr>
<td></td>
<td>Current work status</td>
</tr>
<tr>
<td></td>
<td>Age when retired (complete or partial)</td>
</tr>
<tr>
<td></td>
<td>Hours spent in paid work</td>
</tr>
<tr>
<td></td>
<td>Hours spent in unpaid/ voluntary work</td>
</tr>
<tr>
<td></td>
<td>Activities recently done.</td>
</tr>
</tbody>
</table>

With the most recent baseline questionnaire update in 2011, there were 267,153 participants, 46.4% of whom were males. This study may not be representative of all Australians, as data was collected from New South Wales only, however, this data has been used in over 100 studies. For the Study 1 (see Table 3.1), eligibility was restricted to participants who were near the conventional retirement age (around 61 - 65 years in Australia). Using the ‘45 and Up Study’ data, this resulted in 41,754 men and women aged 60 – 64 years. From the six main themes within the ‘45 and Up Study’, the questions related
to health and work were used. Baseline characteristics of these participants are presented below in Table 3.3.

Table 3.3: Baseline characteristics of participants of the '45 and Up Study' (N=41,754)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Men (n=19,499)</th>
<th>Women (n=22,255)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td><strong>Country of birth</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>72.3</td>
<td>75.1</td>
</tr>
<tr>
<td>Other</td>
<td>27.7</td>
<td>24.9</td>
</tr>
<tr>
<td><strong>Chronic diseases</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>11.5</td>
<td>7.5</td>
</tr>
<tr>
<td>Asthma</td>
<td>8.1</td>
<td>11.8</td>
</tr>
<tr>
<td>Arthritis</td>
<td>4.5</td>
<td>10.2</td>
</tr>
<tr>
<td><strong>Current work Status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full time</td>
<td>25.9</td>
<td>13.3</td>
</tr>
<tr>
<td>Part time</td>
<td>11.2</td>
<td>18.3</td>
</tr>
<tr>
<td>Self-employed</td>
<td>20.5</td>
<td>9.3</td>
</tr>
<tr>
<td>Disabled/ sick</td>
<td>9.2</td>
<td>6.0</td>
</tr>
<tr>
<td><strong>Educational qualification</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No qualification</td>
<td>9.9</td>
<td>11.2</td>
</tr>
<tr>
<td>School and higher school</td>
<td>26.1</td>
<td>41.4</td>
</tr>
<tr>
<td>Trade /apprenticeship</td>
<td>16.8</td>
<td>4.3</td>
</tr>
<tr>
<td>Certificate/ diploma</td>
<td>20.1</td>
<td>21.6</td>
</tr>
<tr>
<td>University or higher degree</td>
<td>25.8</td>
<td>20.2</td>
</tr>
<tr>
<td>Missing</td>
<td>1.3</td>
<td>1.3</td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>6.0</td>
<td>5.1</td>
</tr>
<tr>
<td>Married</td>
<td>79.2</td>
<td>72.8</td>
</tr>
<tr>
<td>De facto</td>
<td>6.0</td>
<td>4.4</td>
</tr>
<tr>
<td>Widowed</td>
<td>1.8</td>
<td>6.1</td>
</tr>
<tr>
<td>Divorced &amp; separated</td>
<td>7.0</td>
<td>11.6</td>
</tr>
<tr>
<td><strong>Body Mass Index (BMI)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underweight</td>
<td>5.6</td>
<td>8.1</td>
</tr>
<tr>
<td>Healthy weight</td>
<td>25.1</td>
<td>35.6</td>
</tr>
<tr>
<td>Overweight</td>
<td>44.8</td>
<td>31.6</td>
</tr>
<tr>
<td>Obese</td>
<td>23.4</td>
<td>23.6</td>
</tr>
<tr>
<td>Missing</td>
<td>1.2</td>
<td>1.1</td>
</tr>
<tr>
<td><strong>Smoking status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current smoker</td>
<td>8.0</td>
<td>6.8</td>
</tr>
<tr>
<td>Ex-smoker</td>
<td>46.4</td>
<td>31.4</td>
</tr>
<tr>
<td>Never smoked</td>
<td>45.5</td>
<td>61.7</td>
</tr>
<tr>
<td><strong>Alcohol consumption</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 drinks/ week</td>
<td>20.3</td>
<td>38.6</td>
</tr>
<tr>
<td>1 – 7 drinks / week</td>
<td>30.7</td>
<td>36.6</td>
</tr>
<tr>
<td>8 or more drinks/ week</td>
<td>47.9</td>
<td>22.9</td>
</tr>
<tr>
<td>Missing</td>
<td>1.1</td>
<td>1.9</td>
</tr>
</tbody>
</table>

* = not all response options shown here
3.2.1.2 Variable Descriptions

The variables used in the analysis of Study 1 can be defined in five broad categories: Employment status; Chronic conditions; Socio-demographic factors; Health risk factors and Health capacity factors. The survey questions included in these categories and their use in Study 1 are described below.

I. Employment Status

Participants answered the following question “What is your current work status?” The response options included: full time paid work; part time paid work; completely retired/pensioner; partially retired; disabled / sick; self-employed; doing unpaid work; studying; looking after home/family; unemployed; and other.

For the purpose of this analysis, participation in the workforce was prioritized into five groups: Full time paid work; Part time paid work; Self-employed; Disabled/ sick; Not in paid work. As the question “What is your current work status?” allowed multiple responses, the categories were made mutually exclusive by conditional statements for each of these categories. Participants who answered ‘Yes’ to working full time were categorized as ‘Fulltime employed’; those who responded ‘Yes’ to working part time, but ‘No’ to full time were categorized as ‘Part time employed’. Participants who responded ‘Yes’ to working self-employed, but ‘No’ to full time and part time were marked as ‘Self-employed’ and those who said ‘Yes’ to disabled or sick and indicated ‘No’ to either full time, part time or self-employed were categorized as ‘Disabled / Sick’. Participants who gave an affirmative response to questions of ‘unpaid work’ , study only’, ‘looking after home and family’, ‘unemployed’ and ‘other work’ were categorized as ‘Not in paid work’. Partially retired and fully retired participants were included in the ‘not in paid work’ category, unless they indicated ‘Yes’ to any employment option.
II. **Chronic diseases**

In the baseline questionnaire, participants answered questions relating to doctor diagnosed health conditions. The questions “Has a doctor ever told you that you have...?” and “In the last month have you been treated for....?” were selected to identify the chronic conditions of diabetes, asthma, arthritis, heart disease, hypertension, stroke, thrombosis, enlarged prostate, depression, anxiety, Parkinson’s disease, osteoporosis, skin cancer, breast cancer, melanoma, prostate cancer and other cancer for the preliminary analysis.

III. **Socio-demographic factors**

**Marital Status**

The baseline questionnaire included questions regarding the current relationship status, where the response options included: currently single; married; with partner; widowed; divorced; and separated. For simplicity, participants who were married or had a partner were categorized as ‘partnered’, while remaining response options were classified as ‘not partnered’.

**Education**

The participants were asked to indicate their highest educational qualification. The options included: No qualification; School / Intermediate; Higher school; Trade/Apprenticeship; Certificate/Diploma; and University / higher degree. The categories of School and Higher school were combined into one and called ‘School’. Invalid values were set to missing.

**Country of Birth**

The baseline data included a question regarding the country of birth of participants and these were classified according to the SACC (Standard Australian Classification of Countries). Apart of Australia (and Norfolk Island), all the other countries were recoded as ‘Others’.
Caring for Sick/ Disabled

The data included an indicator variable for whether participants provide regular care for a sick or disabled person.

IV. Health risk factors

Body Mass Index (BMI)

BMI was calculated using the height and weight of the participants and was provided with the baseline data set. All invalid values were set to missing. As it was a continuous variable, it was categorized according to the WHO criteria as follows:

- Underweight: BMI ≤ 18.5
- Healthy: 18.5 < BMI ≤ 25.0
- Overweight: 25.0 < BMI ≤ 30.0
- Obese: BMI > 30

Smoking Status

A number of questions about smoking habits of participants were asked, “Have you ever been a regular smoker?”, “How old were you when you started smoking?”, “Are you a regular smoker now?”, “How many cigarettes or pipes and cigars do you smoke on average each day?” A new variable “Current smoking status” was created using these questions, this variable had 3 categories: ‘Never smoked’; ‘Former smoker’; and ‘Current smoker’.

Alcohol consumption groups

Participants were asked about the number of alcoholic drinks they have each week. One drink was defined as a glass of wine, a middy of beer or a nip of spirits. They were asked to report ‘0’ if they had less than one drink per week. The number of drinks per week reported by participants was used to create a categorical variable with four groups to describe alcohol consumption: 0 drinks coded as ‘0’; 1 – 7 drinks/week coded as ‘1’; 8 – 14 drinks/week coded as ‘2’; 15+ drinks/week coded as ‘3’.
week coded as ‘2’; 15 – 20 drinks / week coded as ‘3’ and 21 or more drinks / week coded as ‘4’.

V. Health capacity factors

Needing help with daily tasks
Participants were asked if they needed help due to long term illness with daily tasks such as personal care, getting around or food preparation. This was used as a variable to describe the participants’ physical functioning.

SF-36 Physical function scores
Participants were asked about a number of physical activities such as vigorous or moderate activities done in the last week, walking 1km, half km or 100 m, limited physical activity while dressing up or lifting things etc. These variables were used to calculate the SF-36 physical function score.\textsuperscript{11} The SF-36 physical function score is one of the eight health subscales from ‘36 item Short-form’, designed to measure the dimensions of physical health that are most affected by disease and treatment.\textsuperscript{200} The SF-3 Physical function scale asks questions about ability to perform various activities, as mentioned above.\textsuperscript{11,200,201} This scale is one of the widely used and valid scoring measures which have yielded concurrent evidence of validity in many studies.\textsuperscript{201}
3.2.2 The Australian Life History and Health (LHH) Survey

The Australian ‘Life History and Health Survey (LHH)’ was based on two large ongoing cohort studies: the Sax Institute’s ‘45 and Up Study’ and ‘English Longitudinal Study on Ageing (ELSA)’. The ‘LHH’ was a sub-study of the ‘45 and Up Study’, and was a collaborative project between the Universities of Newcastle and Sydney, funded by the Australian Research Council (ARC). The ‘45 and Up Study’ has already been discussed in detail in previous Section 3.2.1. ‘ELSA’ is a nationally representative cohort of English people aged 50 years and over, collecting information about mental and physical health and socioeconomic life circumstances since 2002.

The ‘LHH survey’ was designed to examine life experiences of the leading edge of post-World War II baby boom cohort (born 1947-1951) and how they influence health, productivity, well-being, pension and service use when aged 60-64 years. The aim of the ‘LHH Survey’ was to collect retrospective data on social and health circumstances from birth and throughout adulthood, to investigate how early life experiences influenced the health and experiences of people across the life course and how changing social structures might affect health, well-being and productivity outcomes in later life. As the ‘LHH Survey’ adapted and redesigned data collection procedures from ELSA (described in detail elsewhere), a ‘feasibility study’ was conducted in 2008 to investigate viability of life course data collection methods. This was followed by a ‘pretest study’ in 2010 and a ‘pilot study’ in early 2011 to evaluate data collection instruments.

For the main study, eligible participants of the ‘45 and Up Study’, who were born between 1947 and 1951 (i.e. baby boomers aged 60–64 in 2011) were invited to take part in the ‘LHH Survey’, if they had completed the baseline ‘NSW 45 and Up Study’ questionnaire in 2008, but had not taken part in a prior substudy. Thus 2,800 randomly selected eligible participants (according to gender and UK migrants’ status, based on pilot study responses) were invited to participate, with a deliberate oversampling of UK migrants. Data collection
was done from October 2011 to February 2012. Participants were asked to sign a consent form, complete a questionnaire, fill in a ‘life grid calendar’ and participate in a telephone interview with “personal histories” as the main focus for both the questionnaire and the interview. Of these 2,800 participants, completed questionnaires and consent forms were returned by 1,508 men and women. The final data set included 1,261 participants who provided consent, completed questionnaires, life grid calendars and participated in follow-up telephone interviews with a response rate of approximately 45%.202

3.2.2.1 LHH Survey Questionnaire

The questionnaire comprised 54 questions with the main themes outlined in Table 3.4.

Table 3.4: Main themes and questions for LHH project questionnaire.

<table>
<thead>
<tr>
<th>Main Themes:</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>General questions</td>
<td>Date</td>
</tr>
<tr>
<td></td>
<td>Gender</td>
</tr>
<tr>
<td></td>
<td>Date of birth</td>
</tr>
<tr>
<td></td>
<td>Current relationship status</td>
</tr>
<tr>
<td>Health as a child (until 16 years)</td>
<td>Health during childhood</td>
</tr>
<tr>
<td></td>
<td>Experienced particular conditions and age at which it occurred</td>
</tr>
<tr>
<td></td>
<td>Weight at birth, 18 years, 40 years and today.</td>
</tr>
<tr>
<td>Health since childhood</td>
<td>Has doctor ever told you had (Health conditions) and age at which first occurred.</td>
</tr>
<tr>
<td></td>
<td>Any long standing illness, disability or infirmity and age at which it occurred.</td>
</tr>
<tr>
<td>Health now</td>
<td>Pain</td>
</tr>
<tr>
<td></td>
<td>Difficulty in doing activities.</td>
</tr>
<tr>
<td></td>
<td>Emotional problems in past week.</td>
</tr>
<tr>
<td></td>
<td>Self-rated health – SF 36</td>
</tr>
<tr>
<td>Parents</td>
<td>Date of birth of parents, their occupation, attitudes and behaviours, deaths of parents and the reasons for death.</td>
</tr>
<tr>
<td>Home at age 10</td>
<td>Living arrangements and housing environment</td>
</tr>
<tr>
<td>Education</td>
<td>Education at age 16.</td>
</tr>
<tr>
<td></td>
<td>Post school qualifications and highest qualifications.</td>
</tr>
<tr>
<td>Family</td>
<td>Number of children, their qualifications and any disability.</td>
</tr>
<tr>
<td>Major events in life</td>
<td>Ever experienced certain events and age at which they happened.</td>
</tr>
<tr>
<td>Interests and activities</td>
<td>Time given to different activities like clubs, organizations, television, computer.</td>
</tr>
<tr>
<td></td>
<td>Caring responsibilities and time spent in it.</td>
</tr>
<tr>
<td></td>
<td>Describing their life and how they feel about it.</td>
</tr>
<tr>
<td></td>
<td>Income in last 12 months.</td>
</tr>
<tr>
<td></td>
<td>Social standing of participants, represented by placement on the ‘ladder of life’</td>
</tr>
<tr>
<td></td>
<td>Major influences on health and their details.</td>
</tr>
</tbody>
</table>

3.2.2.2 Life Grid Calendar

Participants were provided with a life grid calendar along with the questionnaire and were asked to complete it in preparation for the telephone interview. This instrument was
intended to be a memory aid so that participants had the opportunity to recall the timing of events in their life (e.g. marriage/relationships, children, work history, when they moved to different places, etc.) prior to the telephone interview.

The life grid was divided into different life stages: early childhood, teenage years, young adulthood, adulthood, late adulthood, and the previous six years. In each of these time periods, participants were prompted to write down details about various events such as when they started a new job or a new relationship or when they moved to a new residence. See Figure 3.2 for an example of the layout used with the life grid calendar. Once completed, the calendar became a detailed reference document for participants to use during the telephone interview.

3.2.2.3 Computer Assisted Telephone Interviews (CATI):

During the follow up telephone interviews, participants were asked detailed questions about various aspects of their life and were able to use the completed life grid calendar to help them answer.

The interview script can be divided into broad sections:

i) Details about early life: birth date, country of birth, country of residence etc.

ii) Living arrangements and housing tenures

iii) Relationships (marriages and defacto partnerships)

iv) Employment details about partner

v) Paid work: detailed job and work history

vi) Non-paid work: details concerning periods when not in the paid work force

Questions from various sections of the interview and questionnaire were used for the analysis of Study 2 and 3. These data provided information about participants’ past and
current life events. The details about particular variables which were used in Study 2 and 3 are detailed below.

3.2.2.4 Variable Description

Work Status

Participants responded to detailed telephone interview questions about their lifetime work, employment history with a focus on paid jobs with a duration of 6 months or more. For
each job, the commencement and finish year was obtained, as well as any relevant attributes of the position (e.g. whether it was shift work, physically demanding work, dangerous work or had an injury risk, full-time or part-time, etc.).

Participants also provided details about the periods that they were out of paid work. Questions included the number and dates of unemployment periods and activities undertaken during that time. After the interviews, each job title was matched to 3-digit code from the Australian and New Zealand Standard Classification of Occupations (ANZSCO).

Based on the retrospective life course data, longitudinal data was established with observations of workforce participation at five year intervals over the life course (e.g. at age 20, 25, up to age 65). At each time point, work status (‘full time’, ‘part time’ or ‘not in paid work’) was determined. If participants had more than one job, it was assumed that they were working equivalent to full time. These indicator variables (five yearly work status from age 20 to 65) were used to measure the patterns of workforce participation (as a latent variable).

**Number of books available when aged 10 years**

Participants were asked about the number of books in their home when they were 10 years old. The response categories were none/few, enough to fill one book shelf, enough to fill one book case, enough to fill two book cases, enough to fill three or more book cases. After recoding, a binary variable (‘having books’ and ‘not having any books’), was included in our data set.

**Father’s occupation**

Participants provided their father’s significant occupation which provided the most substantial financial contribution and these were matched to ANZSCO codes. The eight occupation categories identified (managers, professionals, technicians, personal services, clerical / administration, machinery and labourers) were then re-coded to three main
categories: ‘managerial / administration, office occupations, ‘technical and personal
services occupations and ‘physical labour occupations.

Current qualification
The response categories for question about current highest qualifications were: no
qualification, junior school certificate, senior school certificate, certificate/diploma, degree
and higher degree (masters or PhD). This variable was recoded, such that participants with
a certificate or diploma or less were categorized together and those with graduate or higher
degree were was coded as ‘graduate or higher’. The final variable had two categories:
‘certificate/ diploma or less’ and ‘graduate or higher degree’. Since only 18 people had no
educational qualification, they were included in ‘certificate/ diploma or less’.

Marital status
Participants indicated their marital status according to the response categories: single,
marrried, defacto/ partner, divorced/ separated and widowed. Participants responding yes to
being single, divorced/ separated and widowed were classified as ‘not partnered’ and
participants who were married or lived in a defacto/ partnered relationship were classified
as ‘partnered’.

Informal care for friend or family
Participants responded ‘yes’ if they provided long term care to a disabled / sick friend or
family member. This dichotomous variable was included as informal care.

Chronic diseases
Participants were asked about various chronic diseases, the age that they were first
diagnosed with the particular condition and if they received any treatment for that
condition. In previous sections, the reasons for choosing diabetes, asthma, depression and
arthritis as our focus chronic diseases for this thesis have been discussed.

Figure 3.3 presents the comparison between 60 – 64 year old participants of the LHH
survey, 45 and Up Study and general Australian population of the same age range. Though
current employment status of LHH participants was comparable to the general Australian population, the LHH participants were more highly educated, with better self-reported health.

<table>
<thead>
<tr>
<th>LHH Survey (50–64 years)</th>
<th>45 and Up (60–64 years)</th>
<th>Australian census data* (60–64 years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>% (95% CI)</td>
<td>%</td>
</tr>
<tr>
<td>Male</td>
<td>694</td>
<td>54.2 (51.5 to 57.0)</td>
</tr>
<tr>
<td>Female</td>
<td>577</td>
<td>45.8 (43.0 to 48.5)</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No school certificate</td>
<td>18</td>
<td>1.4 (0.8 to 2.1)</td>
</tr>
<tr>
<td>Junior school certificate</td>
<td>179</td>
<td>14.2 (12.3 to 16.1)</td>
</tr>
<tr>
<td>Senior school certificate</td>
<td>106</td>
<td>8.4 (6.9 to 9.9)</td>
</tr>
<tr>
<td>Certificate or diploma</td>
<td>592</td>
<td>46.9 (44.2 to 49.7)</td>
</tr>
<tr>
<td>Degree, masters or PhD</td>
<td>366</td>
<td>25.0 (23.5 to 26.5)</td>
</tr>
<tr>
<td>Birth country</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>885</td>
<td>88.6 (86.0 to 91.1)</td>
</tr>
<tr>
<td>UK</td>
<td>274</td>
<td>21.7 (19.5 to 24.0)</td>
</tr>
<tr>
<td>Other</td>
<td>122</td>
<td>10.7 (8.8 to 12.3)</td>
</tr>
<tr>
<td>Current marital status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Partnered (married/do facto)</td>
<td>1028</td>
<td>81.5 (78.4 to 83.7)</td>
</tr>
<tr>
<td>Not partnered</td>
<td>227</td>
<td>18.0 (15.9 to 20.1)</td>
</tr>
<tr>
<td>Self-rated health</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent</td>
<td>190</td>
<td>15.1 (13.1 to 17.0)</td>
</tr>
<tr>
<td>Very good</td>
<td>518</td>
<td>41.1 (38.4 to 43.8)</td>
</tr>
<tr>
<td>Good</td>
<td>390</td>
<td>30.9 (28.4 to 33.5)</td>
</tr>
<tr>
<td>Fair</td>
<td>137</td>
<td>10.8 (9.1 to 12.6)</td>
</tr>
<tr>
<td>Poor</td>
<td>24</td>
<td>1.9 (1.1 to 2.7)</td>
</tr>
<tr>
<td>Missing</td>
<td>2</td>
<td>0.2 (0.0 to 3.8)</td>
</tr>
<tr>
<td>Current employment status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full time paid work</td>
<td>394</td>
<td>31.3 (28.7 to 33.8)</td>
</tr>
<tr>
<td>Part-time paid work</td>
<td>220</td>
<td>17.4 (15.4 to 19.5)</td>
</tr>
<tr>
<td>Full-time and part-time paid work</td>
<td>64</td>
<td>5.1 (3.9 to 6.3)</td>
</tr>
<tr>
<td>Not in paid work</td>
<td>583</td>
<td>46.2 (43.5 to 49.0)</td>
</tr>
<tr>
<td>Current job type</td>
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<tr>
<td>Managers</td>
<td>206</td>
<td>30.4 (28.9 to 33.8)</td>
</tr>
<tr>
<td>Professionals</td>
<td>196</td>
<td>28.9 (26.5 to 32.3)</td>
</tr>
<tr>
<td>Trade people or technicians</td>
<td>48</td>
<td>7.1 (5.1 to 9.0)</td>
</tr>
<tr>
<td>Community or personal service</td>
<td>32</td>
<td>4.7 (3.1 to 6.3)</td>
</tr>
<tr>
<td>Clerical/administrative</td>
<td>89</td>
<td>13.1 (10.6 to 15.7)</td>
</tr>
<tr>
<td>Sales</td>
<td>41</td>
<td>6.1 (4.3 to 7.8)</td>
</tr>
<tr>
<td>Machinery driver and operators</td>
<td>26</td>
<td>3.9 (2.4 to 5.3)</td>
</tr>
<tr>
<td>Labourers</td>
<td>39</td>
<td>5.8 (4.0 to 7.5)</td>
</tr>
<tr>
<td>Unable to code</td>
<td>1</td>
<td>0.1 (0.0 to 0.4)</td>
</tr>
</tbody>
</table>

*Source: 2011 Australian Census (60–64 years old).
†UK-born participants were over-sampled in the LHH Survey.
‡Source: 2011–2012 Australian Health Survey (55–64 years old).
LHH, Life Histories and Health.


Figure 3.3: Baseline characteristics of participants of the LHH survey, compared with the ‘45 and Up Study participants and general Australian population aged 60 – 64 year old
3.2.3 The Australian Longitudinal Study on Women’s Health (ALSWH)

Study 4 used the self-reported data collected prospectively from the ‘Australian Longitudinal Study on Women’s Health (ALSWH)’, also known as Women’s Health Australia. This is an ongoing population-based longitudinal cohort study designed to track the health of Australian women over their lifetime and is funded by the Australian Government Department of Health and Ageing. After the National Women’s Health Policy was launched in 1989, the idea of a national longitudinal study on women’s health emerged and was based on the premise of a social approach to health and well-being of women over the life course. Since 1996, the aim of the ‘ALSWH’ has been to examine the health of Australian women and to assess:

i) Physical and emotional health
ii) Health services use
iii) Risk factors and health behaviours
iv) Employment and use of time
v) Socio-demographic factors
vi) Life stages and key events

The initial research design was to longitudinally study and follow three birth cohorts of women over their life course. These cohorts were:

- born in 1946 – 1951 and aged 45 – 50 years in 1996
- born in 1921 – 1928 and aged 70 – 75 years in 1996.

These particular generational cohorts were selected so that the study could capture major life events of these women over at least 20 years of follow up time, for example, first pregnancy, decision to retire, or onset of chronic diseases.
After the initial ‘pilot testing’, 106,000 women were sent mailed surveys and consent forms in 1996. These women were randomly selected using the Australian national health data base ‘Medicare’ which includes all Australian citizens, permanent and temporary citizens and refugees. However, women living in remote areas were oversampled to examine their quite different health and life experiences. The estimated response rate for the first survey was, approximately 42% from 1973-78 cohort; 53 -56% from 1945-51 cohort and 37-40% from 1921-28 cohort. Therefore, in 1996, approximately 40,300 women were recruited in these three birth cohorts and completed the baseline questionnaire. There were 14,247 women in the 1973 – 1978 cohort, 13,716 women in the 1946 – 1951 cohort and 12,432 women in 1921 – 1928 cohort.

A fourth birth cohort was recruited in 2012 for women born in 1989 – 95 and aged 18 – 23 years. Their first survey was an online survey, with 17,017 valid surveys returned during 2013. Over the past 19 years, the women in the original three cohorts have been surveyed at least six times, providing a large amount of data on their life style, health conditions, social circumstances, living arrangements, education and financial conditions. The women in 1921 – 28 cohort are now in their 90’s, and since 1996 have been surveyed every six months since 2012 with a shorter survey. See Figure 3.4 for the survey schedule.
3.2.3.1 ALSWH Questionnaire

Based on the main aims of the study, the five main themes in the questionnaires are summarized in Table 3.5, customised and relevant for each cohort. More details about recruiting, questionnaires etc. concerning the ‘Australian Longitudinal Study on Women’s Health’ are published elsewhere and available in detail from http://www.alswh.org.au/for-researchers/surveys.

For this thesis, analysis of the 1946 – 1951 cohort data was used over six survey time points and is presented as Study 4 and described in Chapter 7, Section 7.2 in the form of a peer-reviewed published paper. Results from the analysis of 1973 – 78 cohort data was used for Study 5 and presented in Chapter 8, Section 8.3 as a manuscript submitted to a peer-reviewed journal. The number of participants in each cohort and their ages at respective survey points is summarized in Table 3.6 adapted from the ALSWH Major Report F produced in 2011.
Table 3.5: Five main themes for ALSWH questionnaire.

<table>
<thead>
<tr>
<th>Main theme</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of and satisfaction with health care services</td>
<td>Availability of and access to health services</td>
</tr>
<tr>
<td></td>
<td>Utilization of health services</td>
</tr>
<tr>
<td></td>
<td>Cultural appropriateness and women's perception of quality of care</td>
</tr>
<tr>
<td>Life stages and key events (identification of factors that maintain quality of life)</td>
<td>Birth of first child</td>
</tr>
<tr>
<td></td>
<td>Divorce</td>
</tr>
<tr>
<td></td>
<td>Menopause</td>
</tr>
<tr>
<td></td>
<td>Widowhood</td>
</tr>
<tr>
<td></td>
<td>Major illness</td>
</tr>
<tr>
<td></td>
<td>Changing jobs.</td>
</tr>
<tr>
<td></td>
<td>Falls and fractures in elderly.</td>
</tr>
<tr>
<td></td>
<td>Bereavement</td>
</tr>
<tr>
<td>Time use</td>
<td>Paid and unpaid work</td>
</tr>
<tr>
<td></td>
<td>Providing care for others</td>
</tr>
<tr>
<td></td>
<td>Social support</td>
</tr>
<tr>
<td></td>
<td>Overload and independence</td>
</tr>
<tr>
<td></td>
<td>Leisure activities</td>
</tr>
<tr>
<td></td>
<td>Financial resources</td>
</tr>
<tr>
<td>Weight and exercise</td>
<td>Perceptions of body image</td>
</tr>
<tr>
<td></td>
<td>General well being</td>
</tr>
<tr>
<td></td>
<td>Quality of life</td>
</tr>
<tr>
<td></td>
<td>Dieting and eating disorders</td>
</tr>
<tr>
<td></td>
<td>Weight changes</td>
</tr>
<tr>
<td>Violence</td>
<td>Physical and sexual harassment</td>
</tr>
<tr>
<td></td>
<td>Psychological and social abuse in older women</td>
</tr>
</tbody>
</table>

Source: Women’s Health Australia. Project Themes.

Among the 1946 – 51 cohort, approximately 92% of women responded to Survey 2 and 85% responded to Survey 3, 4 and 5 respectively, with low attrition rates (6 – 8% from Survey 2 to 6) due to continued and sustained follow-up with the participants. The 1973 – 78 cohort had attrition rates between 21% and 28% from Survey 2 to 6, which were mainly due to loss of contact with participant, as women in this age group are characterized by high level of mobility and changing contact details. However, this attrition has little impact on longitudinal modelling, analysis and associations.
Table 3.6: Survey schedule, age and number of participants from the 1946 – 1951 cohort and the 1973 – 1978 cohort.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>1996</td>
<td>45 – 50 years N=13,716</td>
<td>18 – 23 years N=14,247</td>
</tr>
<tr>
<td>S2</td>
<td>1998</td>
<td>47 – 52 years N=12,338</td>
<td>22 – 27 years N=9,688</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S3</td>
<td>2001</td>
<td>50 – 55 years N=11,200</td>
<td>25 – 30 years N=9,081</td>
</tr>
<tr>
<td></td>
<td>2003</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S4</td>
<td>2004</td>
<td>53 – 58 years N=10,905</td>
<td>28 – 33 years N=9,145</td>
</tr>
<tr>
<td></td>
<td>2006</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S5</td>
<td>2007</td>
<td>56 – 61 years N=10,638</td>
<td>31 – 36 years N=8,200</td>
</tr>
<tr>
<td></td>
<td>2009</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S6</td>
<td>2010</td>
<td>59 – 64 years N=9,900</td>
<td>34 – 39 years N=6,804</td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


For Study 4 (using the 1946 – 51 cohort), data from Survey 1 to Survey 6 were used in analysis. Women were eligible for this study if they had provided valid responses to their work status for at least three surveys (from survey 2 to 6).

For study 5 (using 1973 – 78 cohort), data from Survey 2 to Survey 6 were used, as these women were 18 – 23 years old at Survey 1 and were mostly studying rather than in paid work.

### 3.2.3.2 Variable Description

Details of the variables used in the study for the 1946 – 51 and 1973 – 78 cohorts are described below:
Table 3.7: Variables used in analysis of 1946-51 and 1973-78 cohorts

<table>
<thead>
<tr>
<th>Variables</th>
<th>1946 – 51 cohort Survey (S) 1 – 6</th>
<th>1973 – 78 cohort Survey (S) 2 – 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current work status</td>
<td>Paid work</td>
<td>Paid work</td>
</tr>
<tr>
<td></td>
<td>Not in paid work</td>
<td>Not in paid work</td>
</tr>
<tr>
<td>Hours in paid work/ week</td>
<td>Full time work (&gt;=35 hrs / week)</td>
<td>Part time work (1-34 hrs/ week)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not in paid work (0 hrs/ week)</td>
</tr>
<tr>
<td>Diabetes (enduring)</td>
<td>Yes (any time from S1 – S6)</td>
<td>Yes (any time from S2 – S6)</td>
</tr>
<tr>
<td></td>
<td>No (no to diabetes at each survey)</td>
<td>No (no to diabetes at each survey)</td>
</tr>
<tr>
<td>Asthma (enduring)</td>
<td>Yes (any time from S1 – S6)</td>
<td>Yes (any time from S2– S6)</td>
</tr>
<tr>
<td></td>
<td>No (no to asthma at each survey)</td>
<td>No (no to diabetes at each survey)</td>
</tr>
<tr>
<td>Depression (enduring)</td>
<td>Yes (any time from S2 – S6)</td>
<td>Yes (any time from S2– S6)</td>
</tr>
<tr>
<td></td>
<td>No (no to depression at each survey)</td>
<td>No (no to diabetes at each survey)</td>
</tr>
<tr>
<td>Arthritis (enduring)</td>
<td>Yes (any time from S3 – S6)</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>No (no to arthritis at each survey)</td>
<td>-</td>
</tr>
<tr>
<td>Marital status</td>
<td>Partnered S1, S6</td>
<td>Partnered (married/ de facto relationship)</td>
</tr>
<tr>
<td></td>
<td>Partnered at S1, not partnered at S6</td>
<td>Not partnered (single, divorced, separated, widowed)</td>
</tr>
<tr>
<td></td>
<td>Partnered at S6, not partnered at S1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not partnered at S1, S6</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>Yes (any qualification at S1, S6)</td>
<td>No education (at each survey, S2 – S6)</td>
</tr>
<tr>
<td></td>
<td>No (no education at both S1, S6)</td>
<td>Diploma/ Apprenticeship</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Higher education</td>
</tr>
<tr>
<td>Caring for sick/ disabled</td>
<td>Yes (any time from S1 – S6)</td>
<td>Yes (any time from S2 – S6)</td>
</tr>
<tr>
<td></td>
<td>No (no at each survey)</td>
<td>No (no at each survey)</td>
</tr>
<tr>
<td>Unpaid child care</td>
<td>Yes (any time from S1 – S6)</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>No (no to diabetes at each survey)</td>
<td>-</td>
</tr>
<tr>
<td>No. of children</td>
<td></td>
<td>Calculated from number of live births at each survey:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No children</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 or more children</td>
</tr>
<tr>
<td>Body Mass Index (BMI)</td>
<td>Calculated according to WHO classification(^{213}) from weight and height provided by participants, and used from the most recent survey:</td>
<td>Calculated according to WHO classification(^{213}) from Weight and height provided by participants and used from the most recent survey:</td>
</tr>
<tr>
<td></td>
<td>Underweight – BMI &lt;18.5</td>
<td>Underweight – BMI &lt;18.5</td>
</tr>
<tr>
<td></td>
<td>Healthy weight – 18.5 &lt; BMI ≤ 25</td>
<td>Healthy weight – 18.5 &lt; BMI ≤ 25</td>
</tr>
<tr>
<td></td>
<td>Overweight – 25.0 &lt; BMI ≤ 30.0</td>
<td>Overweight – 25.0 &lt; BMI ≤ 30.0</td>
</tr>
<tr>
<td></td>
<td>Obese – BMI &gt; 30.0</td>
<td>Obese – BMI &gt; 30.0</td>
</tr>
<tr>
<td>Smoking</td>
<td>Classification method according to the Australian Institute of Health and Welfare.(^{214})</td>
<td>Classification method according to the Australian Institute of Health and Welfare.(^{214})</td>
</tr>
<tr>
<td></td>
<td>Current smokers</td>
<td>Current smokers</td>
</tr>
<tr>
<td></td>
<td>Former / ex-smokers</td>
<td>Former / ex-smokers</td>
</tr>
<tr>
<td></td>
<td>Non-smokers</td>
<td>Non-smokers</td>
</tr>
<tr>
<td>Alcohol</td>
<td>Derived from frequency and quality items for alcohol according to NHMRC guidelines(^{215})</td>
<td>Derived from frequency and quality items for alcohol according to NHMRC guidelines(^{215})</td>
</tr>
<tr>
<td></td>
<td>Non drinker</td>
<td>Non drinker</td>
</tr>
<tr>
<td></td>
<td>Low risk drinker (up to 14 drinks/ week)</td>
<td>Low risk drinker (up to 14 drinks/ week)</td>
</tr>
<tr>
<td></td>
<td>Risky / high risk drinker (&gt;15 drinks / week)</td>
<td>Risky / high risk drinker (&gt;15 drinks / week)</td>
</tr>
</tbody>
</table>

\(^{213}\) WHO Classification of Overweightness and Obesity. \(^{214}\) Australian Institute of Health and Welfare. \(^{215}\) NHMRC Guidelines for Alcohol Drinking.
Baseline characteristics of the 1946 – 51 cohort (using Survey 1 as baseline) and the 1973 – 78 cohort (using Survey 2 as baseline) are presented below:

Table 3.8: Baseline characteristics of the 1946 – 51 cohort and the 1973–78 cohort.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>1946 – 51 cohort (N= 11,551) %</th>
<th>1973 – 78 cohort (N=10,715) %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic diseases *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes (yes)</td>
<td>3.0</td>
<td>1.3 (Type1+2)</td>
</tr>
<tr>
<td>Asthma (yes)</td>
<td>15.9</td>
<td>27.3</td>
</tr>
<tr>
<td>Depression at S2* (yes)</td>
<td>9.5</td>
<td>12.0</td>
</tr>
<tr>
<td>Arthritis at S3* (yes)</td>
<td>22.3</td>
<td>-</td>
</tr>
<tr>
<td>Current work Status *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full time</td>
<td>37.6</td>
<td>54.2</td>
</tr>
<tr>
<td>Part time</td>
<td>32.8</td>
<td>11.6</td>
</tr>
<tr>
<td>Not in paid work</td>
<td>29.6</td>
<td>34.2</td>
</tr>
<tr>
<td>Educational qualification</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No qualification</td>
<td>16.9</td>
<td>1.2</td>
</tr>
<tr>
<td>School and higher school</td>
<td>47.1</td>
<td>30.8</td>
</tr>
<tr>
<td>Trade /apprenticeship</td>
<td>3.5</td>
<td>2.6</td>
</tr>
<tr>
<td>Certificate/ diploma</td>
<td>16.1</td>
<td>20.6</td>
</tr>
<tr>
<td>University or higher degree</td>
<td>16.5</td>
<td>44.8</td>
</tr>
<tr>
<td>Area of residence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major cities (Urban)</td>
<td>72.5</td>
<td>45.7</td>
</tr>
<tr>
<td>Rural</td>
<td>24.8</td>
<td></td>
</tr>
<tr>
<td>Remote</td>
<td>2.7</td>
<td>36.6</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>3.9</td>
<td>54.8</td>
</tr>
<tr>
<td>Married</td>
<td>75.1</td>
<td>22.9</td>
</tr>
<tr>
<td>De facto</td>
<td>5.6</td>
<td>20.2</td>
</tr>
<tr>
<td>Widowed</td>
<td>2.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Divorced &amp; separated</td>
<td>13.2</td>
<td>2.0</td>
</tr>
<tr>
<td>Smoking status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current smoker</td>
<td>18.3</td>
<td>22.9</td>
</tr>
<tr>
<td>Ex-smoker</td>
<td>28.0</td>
<td>11.6</td>
</tr>
<tr>
<td>Never smoked</td>
<td>53.7</td>
<td>65.5</td>
</tr>
<tr>
<td>Alcohol consumption</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 drinks/ week</td>
<td>15.2</td>
<td>25.0</td>
</tr>
<tr>
<td>1 – 8 drinks/ week</td>
<td>84.4</td>
<td>56.3</td>
</tr>
<tr>
<td>9 or more drinks/ week</td>
<td>0.5</td>
<td>18.7</td>
</tr>
</tbody>
</table>

* Question about depression and arthritis were asked from Survey 2 and 3 respectively
3.3 Analysis Strategies

3.3.1 Logistic Regression – Study 1

Logistic regression is a technique used to explore the association between a binary, dependent outcome variable with an independent, explanatory variable(s) which might be continuous or categorical. The analysis involves modelling the probability \( p \) of having the outcome by using a logistic function, with the assumption that the relationship between \( \ln \left( \frac{p}{1-p} \right) \) and \( X \) (explanatory variable) is linear in the following logistic regression equation:

\[
\ln \left( \frac{p}{1-p} \right) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_x X_x
\]

In the above logistic regression equation \( \ln \left( \frac{p}{1-p} \right) \) denotes the log of the odds for the outcome of interest, \( \alpha \) and \( \beta \) are the estimates of the coefficients and \( \alpha + \beta X \) is the logistic function.

3.3.1.1 Regression modelling with backward stepwise elimination

Univariate models were conducted initially to establish which variables were individually associated with the outcome. A backwards stepwise elimination strategy was used for multivariate modelling, whereby all variables were included in the first model regardless of their p-value in the univariate model. Parameter estimates for each variable were calculated and the estimates that did not meet the level of significance (\( \alpha=0.05 \)) were sequentially removed, starting with the variables with largest probability. Once a variable was removed from the model, it remained excluded. The process was repeated sequentially, until only statistically significant variables remained in the model.

3.3.2 Multinomial Logistic Regression – Study 2, 3 and 4

Multinomial logistic regression is a generalized form of logistic regression analysis for a multi-category or polytomous response variable. This technique is used to predict the probability of polytomous response variable as a function of a set of predictor variables. In other words,
This analysis technique predicts the probability of category membership of a dependant, response variable based on independent predictor variables.\textsuperscript{219}

### 3.3.3 Proc Surveylogistic – Study 5

This is a specialized regression technique within SAS Software which fits logistic regression models for discrete response survey data by method of maximum likelihood. This procedure was used in Chapter 5 B (Health predictors of work force participation over time – longitudinal evidence for young women) as it has the capability to incorporate large survey samples with stratification.

This procedure is similar to logistic regression, except that it accounts for repeated surveys on participants (clustering on ID numbers) and also allows for stratum specific models which allows multinomial regression. Subsequent regression models assessed the outcome of work status (full time work, part time work and not in paid work) with adjustments for various health and other factors.

### 3.3.4 Latent Class Analysis (LCA) – Study 2, 3, 4 and 5

When the data regarding the workforce participation over multiple time points was evaluated, many complex patterns with much variability were found. Some of these patterns were more dominant than others, while some patterns had similarities. One of the main aims for Studies 2, 3 and 4 was to see whether there were any patterns of workforce participation that occurred more frequently than others, despite the variability.

LCA provided the means to evaluate the complex array of workforce participation patterns in a more parsimonious format. Therefore, the main objective of performing LCA for these studies was to discern a meaningful and well distinguished array of latent classes which represented workforce participation patterns over a significant period of time.
### 3.3.4.1 Latent Class Theory and Main Concepts

Latent class theory postulates that an unobserved underlying and error free latent variable can be derived from a set of categorical observed variables. Figure 3.5 shows a hypothetical latent variable, where $X_1$, $X_2$ and $X_3$ indicate observed variables and $e_1$, $e_2$, and $e_3$ represent error associated with observed indicator variable.

![Figure 3.5: A simple depiction of latent and observed variables in LCA model.](image)

Latent Class Analysis was performed by means of PROC LCA, which is a programming code developed by Lanza and Collins to be used within SAS environment.

### 3.3.4.2 LCA model notation

In a simple LCA model:

- $c$ = number of latent classes
- $Y$ = vector of response patterns
- $y$ = particular response pattern
- $\gamma_c$ = probability of membership in latent class ‘$c$’
- $\rho_{i|c}$ = probability of response ‘$i$’ to item 1, conditional on membership in latent class ‘$c$’

The notation of a basic LCA model is

$$P(Y = y) = \sum_{c=1}^{c} \gamma_c \prod_{i} \rho_{i|c}$$
3.3.4.3 Estimates and Parameters of LCA model

The main parameters and concepts of interest in LCA which helped to assign distinct and meaningful labels to latent classes included:

**Latent class membership probabilities (γ_c)**

This refers to the proportion of participants expected to belong to each latent class. These class membership probabilities (sums to 1) are used to assign distinguishable and meaningful labels to each class.\(^7\)

**Item response probability (ρ_{ic})**

This is the probability of different or particular responses (for example a simple dichotomous ‘Yes’ or ‘No’) to a particular item, conditional on membership in a particular class. Along with latent class membership, this provides relevant information for the interpretation and labelling of latent classes.\(^7\)

**Latent class prevalence**

This is the number of participants in each latent class.\(^7\)

**Homogeneity and latent class separation**

A high level of homogeneity refers to a single and distinct response pattern that is more likely to be a characteristic of a particular latent class, i.e. the probability that members of the same latent class will provide the same response to an item. Item response probabilities near 0 and 1 correspond to high homogeneity.\(^7\)

Latent class separation refers to the clear distinction of an overall pattern of item response probability across the latent classes. A high level of latent class separation means that no two latent classes have the same response pattern, and implies a high degree of homogeneity.\(^7\)
3.3.4.4 Assessment of Model Fit and Selection

LCA models from two to seven latent classes were conducted by specifying the number of classes in each model in the SAS programme. Selecting the LCA model with the best possible model fit was a critical decision and a number of guidelines were used. The model fit refers to a specific model providing an adequate representation of data, assessed by comparing the cross-classification frequencies to the expected frequencies predicted by the model and information criterion. The main concepts behind the selection of a baseline LCA model are explained below.

3.3.4.5 Estimates of model fit and information criterion

Parsimony

According to the principal of parsimony, simpler models with fewer estimates should be preferred to complex ones if other factors are equal.

Model interpretability

A model with better fit should be readily interpretable with the ability to provide meaningful labels to its latent classes, so as to provide better knowledge about the research question.

Likelihood Ratio Statistic – $G^2$

$G^2$ was used to assess the difference between models using the same data, and reflects the degree to which a LCA model fits the observed data when compared with another model. This test compares expected response pattern proportions with the observed response pattern proportions.

Entropy

Entropy is a measure of latent class separation in a model which takes into account the weighted average of individuals’ posterior probabilities. Its value ranges between 0 and 1, with values closer to one indicating better class separation. However, its value decreases as the number of latent classes increases.
Information criterion – AIC, BIC, Adjusted BIC

Information criterion are used to compare the relative balance of model fit and parsimony i.e. the model simplicity, when two or more models are being compared.\textsuperscript{7} Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), Adjusted BIC are some of the main indices for checking competing models for their parsimony and fit. They take into account the log likelihood of the model, number of parameters and sample size.\textsuperscript{7, 223} Lower values for AIC, BIC and Adjusted BIC indicate a better model with optimal fit,\textsuperscript{7} and therefore selection of the final model was influenced by the AIC, BIC and Adjusted BIC.

Thus the informational criterion (AIC, BIC), Entropy, G\textsuperscript{2}, principles of parsimony and model interpretability were used for the final selection of a model which provided the best fit of data. The selected model was referred to as the baseline LCA model which provides distinct and meaningfully labelled latent classes.

3.3.4.6 Visualizing the class memberships using stacked bar graphs

For better representation of latent class membership for the selected baseline model, stacked bar graphs were used to succinctly display the item response probabilities. This approach provided better visual representation and distinct understanding of differences between latent classes. After selecting the baseline model and visualizing the class membership, further analysis was carried out and is detailed in the next sections.

3.3.5 Latent Class analysis with Covariates

For Studies 2, 3, 4 and 5 (See Table 3.1), this advanced LCA technique was conducted by introducing covariates into the baseline model. The main objective of this step in analysis was to identify statistically significant associations between covariates and latent classes, to identify how covariates predict the class membership in latent classes. The use of word ‘predict’ here and in later sections does not imply causality, but rather, it indicates the statistical effect of a variable (whether observed or latent) on latent class membership. Statistically significant p-
values (at <0.05) suggest strong associations between latent class variables and covariates (see ‘Glossary of Terms’ for definitions of these terms).

The LCA accomplishes this by means of regressing the latent class variable on the covariates. The main differences between this method and logistic regression is that the outcome in this instance is latent\(^7\), and in this case more than two latent classes can also be investigated (compared with a dichotomous outcome variable in logistic regression).

One category of the latent variable which had highest prevalence was designated as the reference category.

### 3.3.5.1 Estimates of LCA with Covariates

**Intercepts \((\beta_0)\) and Regression coefficients \((\beta's)\)**

In LCA with covariates, the latent class prevalence was not estimated. In addition to item response probabilities \((\rho's)\), regression coefficients \((\beta's)\) were calculated.\(^7\) See ‘Glossary of Terms’ for definition of terms.

For the ease of interpretation, coefficients were exponentiated to odds ratios. Intercepts \(\beta_0\) were transformed to odds \((e^{\beta_0} = \text{odds})\) and other regression coefficients were transformed to odds ratios \((e^{\beta_1} = \text{odds ratio})\).\(^7\) Negative intercept signs indicated that each corresponding latent class had smaller prevalence than the latent reference class when covariates were not taken into account.

**Odds ratios**

Odds ratios reflected the change (either increase or decrease) in the odds of membership in a particular latent class ‘c’ relative to the reference latent class ‘C’, associated with one unit change in covariate ‘X’.\(^7\)

### 3.3.5.2 LCA with Covariates – Two Step Approach

The covariates were subsequently incorporated in the latent class model to identify characteristics that influenced the latent class membership of various workforce participation
classes. Rather than establishing causality, this analysis technique explored the statistical effect of the presence of various covariates, when determining the patterns of workforce participation over time.

The log likelihood for the baseline model ($l_1$) is compared with the log likelihood of the model with covariates ($l_2$), such that $[-2 (l_1 - l_2)]$. A P-value of less than 0.05 indicates that the covariate was significantly associated with the latent class variable and influences latent class membership.

This association of the latent class variable with covariates was investigated in the following two steps:

**3.3.5.3 LCA model with a single covariate (Univariate approach)**

In the first step, covariates were included individually in the baseline latent class model. This approach allowed identification of individual covariates which had a statistically significant association (p-value of <0.05) with the latent class variable (and predicting latent class membership), without controlling for other variables.

**3.3.5.4 LCA model with entire set of covariates (Multivariate approach)**

All covariates were introduced simultaneously to determine the unique contribution of each covariate in predicting the class membership in latent variable, while controlling for other covariates.

The model with single covariates and the entire set of covariates were statistically compared with the baseline model (without covariates) by means of the likelihood ratio $\chi^2$ test and the level of significance was set as $p<0.05$. Item response probabilities, regression coefficients ($\beta$’s) and odds ratios (OR) were then estimated and results were interpreted.
3.3.6 Non-inclusive Latent Class analysis: Classify – Analyse Approach

3.3.6.1 Overview

In the previous section, LCA with covariates was described.

For analysis of Study 4 – Chapter 7 (see Table 3.1), the objective was to identify the dominant workforce participation patterns among middle aged women.

Next, any associations between chronic conditions and the latent class variable (treated as known variable) were examined. An advanced LCA technique known as ‘Latent Class Analysis with Distal Outcome’ was adopted for this analysis step. Chronic conditions were not distal outcomes in this study, therefore this technique was modified and the analysis of associations between latent class variable and chronic conditions was achieved by means of a ‘classify – analyse approach’.

The main steps in the ‘classify – analyse approach’ are described below:

3.3.6.2 Steps of the ‘classify – analyse’ approach

This is a model based approach for treating the latent class variable as an independent and known explanatory variable. As the outcome of interest (chronic diseases for this study) is not included in the classification model, this technique is referred to as the ‘Non-inclusive, classify – analyse approach’.

*Classification model:*

LCA was carried out as described earlier, and a baseline model which fits the data best was chosen. This model was referred to as the ‘classification model’. As the outcome of interest (chronic diseases for this study) is not included in the classification model, this technique is referred to as ‘Non-inclusive, classify analyse approach’.
Maximum probability assignment rule:

After the classification model was run, individuals were assigned to latent classes based on their maximum posterior probability as follows:

Uncertainty in each individual’s true class membership was ignored and their class membership based on maximum posterior probability (represented by a new variable called ‘classify’) was retained from the chosen latent class model.\textsuperscript{225}

The individuals were then assigned to a latent class based on their maximum posterior probability (most likely to be their true class membership) using the maximum probability assignment rule.\textsuperscript{8}

Analysis Model:

Multivariate regression models were the final step in analysis, with workforce patterns as the outcome variable. Separate models for each chronic disease were run.

3.4 SOFTWARE:

The analysis for this thesis and all the papers included as part of this thesis has been generated using SAS software. Copyright, SAS Institute Inc. SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc., Cary, NC, USA.

3.5 Next Chapter – Chronic Diseases and Employment Among 60 – 64 Year Old Men and Women

The next chapter is the first results chapter and constitutes a peer-reviewed published paper, examining the association between current employment status and chronic diseases among 60 – 64 year old men and women.
CHAPTER 4:

CHRONIC DISEASES AND
EMPLOYMENT AMONG 60 – 64
YEAR OLD MEN AND WOMEN

Peer Reviewed Published Paper

This chapter outlines the analysis undertaken to identify the chronic conditions that were common among 60 – 64 year old participants of the NSW 45 and Up study. Their current employment status and its associations with health conditions were studied. A paper from this study has been published and included in this chapter.

4.1 INTRODUCTION

The main objective of this study was to identify chronic conditions that were common among this cohort and to assess their association with the current employment status.

Within the context of this thesis, the aims were to:

i) Determine the prevalence and age of onset for diabetes, asthma and arthritis reported by 60 – 64 year old participants of the ‘45 & Up Study’.

ii) Assess the prevalence and age of onset of the three index chronic conditions (diabetes, asthma and arthritis) by gender, socio-economic conditions, marital status and disease risk factors.

iii) Evaluate the association between current employment status and index chronic conditions (asthma, arthritis and diabetes) after adjustment for other covariates.

4.2 ANALYSIS AND RESULTS

This study used data from the ‘45 and Up study’ for 41,754 participants who were aged 60 – 64 years old. The sample was restricted to participants in pre-retirement age, as we wanted to explore how current employment status was associated with chronic diseases, maximising exposure time for disease development. Further details about the study, participants and variables used have been provided in Chapter 3 ‘Methods and Analysis Strategy’.

In this analysis, there were 53.3% (N=22,255) women and 46.7% (N=19,499) men.

4.2.1.1 Employment Categories

Current employment status was prioritised into five mutually exclusive categories: i) Full time employment ii) Part time employment iii) Self-employed iv) Disabled / Sick v) Not in Paid work. More details have been discussed in Chapter 3 ‘Methods and Analysis Strategy’.
Figure 4.1 below presents the distribution of participants in the five employment categories.

![Employment Categories](image)

<table>
<thead>
<tr>
<th>Employment Categories</th>
<th>0 hrs n (%)</th>
<th>1-7 hrs n (%)</th>
<th>8-14 hrs n (%)</th>
<th>15-21 hrs n (%)</th>
<th>22-28 hrs n (%)</th>
<th>29-35 hrs n (%)</th>
<th>&gt;36 hrs n (%)</th>
<th>Missing n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full-time</td>
<td>25 (0.3)</td>
<td>10 (0.1)</td>
<td>33 (0.4)</td>
<td>30 (0.4)</td>
<td>49 (0.6)</td>
<td>999 (12.5)</td>
<td>6748 (84.1)</td>
<td>133 (1.7)</td>
</tr>
<tr>
<td>Part-time</td>
<td>26 (0.4)</td>
<td>590 (9.5)</td>
<td>1018 (16.4)</td>
<td>2001 (32.2)</td>
<td>1163 (18.7)</td>
<td>1004 (16.1)</td>
<td>301 (4.8)</td>
<td>118 (1.9)</td>
</tr>
<tr>
<td>Self-employed</td>
<td>412 (8.4)</td>
<td>245 (5.0)</td>
<td>374 (7.6)</td>
<td>599 (12.2)</td>
<td>203 (4.1)</td>
<td>580 (11.8)</td>
<td>1892 (38.5)</td>
<td>608 (12.4)</td>
</tr>
<tr>
<td>Disabled/ Sick</td>
<td>2195 (74.6)</td>
<td>36 (1.2)</td>
<td>17 (0.6)</td>
<td>2 (0.1)</td>
<td>1 (0.03)</td>
<td>8 (0.3)</td>
<td>21 (0.7)</td>
<td>661 (22.5)</td>
</tr>
<tr>
<td>Not in paid work</td>
<td>2603 (64.8)</td>
<td>692 (4.0)</td>
<td>458 (2.4)</td>
<td>314 (1.6)</td>
<td>71 (0.4)</td>
<td>65 (0.3)</td>
<td>97 (0.5)</td>
<td>5162 (26.5)</td>
</tr>
</tbody>
</table>

As seen in Table 4.1, 84.1% of the participants categorised as ‘full time’ employed were working for more than 36 hours each week, while 93% of the ‘part time’ working participants were working up to 35 hours. Majority of the participants (75.8%) classified as ‘disabled / sick’ were working 7 hours or fewer each week. However, 16.2% of the total participants...
(predominantly in the category of ‘disabled/ sick’ and ‘not in paid work’) did not provide the number of hours they spent in paid work, and were treated as missing values.

Table 4.2: Hours spent in unpaid work per week according to employment categories in participants aged 60-64 years (N=41,754).

<table>
<thead>
<tr>
<th>Employment categories</th>
<th>0 hrs</th>
<th>1-7 hrs</th>
<th>8-14 hrs</th>
<th>15-21 hrs</th>
<th>22-28 hrs</th>
<th>29-35 hrs</th>
<th>&gt;36 hrs</th>
<th>Missing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full-time</td>
<td>1541 (19.2%)</td>
<td>1107 (13.7%)</td>
<td>316 (3.9%)</td>
<td>112 (1.4%)</td>
<td>23 (0.3%)</td>
<td>19 (0.2%)</td>
<td>18 (0.2%)</td>
<td>37 (0.5%)</td>
</tr>
<tr>
<td>Part-time</td>
<td>1056 (17.0%)</td>
<td>1162 (18.7%)</td>
<td>450 (7.2%)</td>
<td>250 (4.0%)</td>
<td>43 (0.7%)</td>
<td>63 (1.0%)</td>
<td>35 (0.6%)</td>
<td>48 (0.8%)</td>
</tr>
<tr>
<td>Self-employed</td>
<td>913 (18.6%)</td>
<td>963 (19.6%)</td>
<td>350 (7.1%)</td>
<td>185 (3.8%)</td>
<td>28 (0.6%)</td>
<td>50 (1.0%)</td>
<td>116 (2.4%)</td>
<td>127 (2.6%)</td>
</tr>
<tr>
<td>Disabled/ Sick</td>
<td>1890 (64.3%)</td>
<td>364 (12.4%)</td>
<td>165 (5.6%)</td>
<td>69 (2.4%)</td>
<td>16 (0.5%)</td>
<td>12 (0.4%)</td>
<td>16 (0.5%)</td>
<td>31 (1.1%)</td>
</tr>
<tr>
<td>Not in paid work</td>
<td>3023 (46.4%)</td>
<td>4587 (23.6%)</td>
<td>1711 (8.9%)</td>
<td>1218 (6.3%)</td>
<td>193 (1.0%)</td>
<td>247 (1.3%)</td>
<td>270 (1.4%)</td>
<td>344 (1.8%)</td>
</tr>
</tbody>
</table>

Conversely, 33.0% of the ‘full time’ and 35.7% of the ‘part time’ employed participants spent less than 8 hours per week doing unpaid work. However, 1.4% of the total participants did not provide the number of hours spent in unpaid work, and were treated as missing values.

4.2.1.2 Chronic Diseases

Prevalence of the chronic diseases across the employment categories

As part of the preliminary analysis, the prevalence of chronic conditions was obtained for the five employment categories (Table 4.3). These were carried out to validate the selection of diabetes, asthma and arthritis as focus conditions of this thesis (justification discussed previously in Chapter 2, Section 2.2.5 - Chronic diseases). To provide context, the prevalence of other chronic diseases are also provided in Table 4.3. Among the participants classified as in ‘full time’ paid work, 8.2% reported having diabetes, 9.2% had asthma and 4.2% were treated for arthritis. ‘Part-time’ employed participants reported lower prevalence of diabetes (6.7%), but slightly higher prevalence of asthma (10.1%) and arthritis (6.3%). Among the ‘self-employed’ participants, 6.7% had diabetes, 10.1% had asthma, while 6.3% were treated for arthritis.

Participants who were classified as ‘disabled / sick’ reported substantially higher prevalence in all the chronic conditions – 22.5% had diabetes, 14.8% had asthma and 20.7% were treated for
arthritis. Participants who were classified as ‘not in paid work’ had chronic disease prevalence similar to the prevalence for participants classified as in ‘full time’ work, although the prevalence of arthritis was higher (8.1%) among those ‘not in paid work’.

Table 4.3: Frequency and prevalence of chronic health conditions across 5 employment categories (N=41,754)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Full-time work (n=8027)</th>
<th>Part-time work (n=6221)</th>
<th>Self-employed (n=4913)</th>
<th>Disabled/Sick (n=2941)</th>
<th>Not in paid work (n=19462)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Percentage</td>
<td>Percentage</td>
<td>Percentage</td>
<td>Percentage</td>
<td>Percentage</td>
</tr>
<tr>
<td>Diabetes</td>
<td>655 (8.2%)</td>
<td>415 (6.7%)</td>
<td>344 (7.0%)</td>
<td>662 (22.5%)</td>
<td>1820 (9.4%)</td>
</tr>
<tr>
<td>Asthma</td>
<td>738 (9.2%)</td>
<td>631 (10.1%)</td>
<td>417 (8.5%)</td>
<td>434 (14.8%)</td>
<td>1960 (10.1%)</td>
</tr>
<tr>
<td>Arthritis</td>
<td>338 (4.2%)</td>
<td>389 (6.3%)</td>
<td>221 (4.5%)</td>
<td>609 (20.7%)</td>
<td>1581 (8.1%)</td>
</tr>
<tr>
<td>Stroke</td>
<td>86 (1.1%)</td>
<td>87 (1.4%)</td>
<td>67 (8.2%)</td>
<td>241 (8.2%)</td>
<td>394 (2.0%)</td>
</tr>
<tr>
<td>Heart Disease</td>
<td>754 (9.4%)</td>
<td>493 (7.9%)</td>
<td>454 (9.2%)</td>
<td>672 (22.9%)</td>
<td>1906 (9.8%)</td>
</tr>
<tr>
<td>High Blood Pressure</td>
<td>2922 (36.4%)</td>
<td>2118 (34.1%)</td>
<td>1625 (33.1%)</td>
<td>1435 (48.8%)</td>
<td>7560 (38.8%)</td>
</tr>
<tr>
<td>Depression</td>
<td>752 (9.4%)</td>
<td>855 (13.7%)</td>
<td>473 (9.6%)</td>
<td>965 (32.8%)</td>
<td>2802 (14.4%)</td>
</tr>
<tr>
<td>Anxiety</td>
<td>520 (6.5%)</td>
<td>513 (8.3%)</td>
<td>290 (5.9%)</td>
<td>619 (21.1%)</td>
<td>1906 (9.9%)</td>
</tr>
<tr>
<td>Skin Cancer</td>
<td>1922 (23.9%)</td>
<td>1576 (25.3%)</td>
<td>1230 (25.0%)</td>
<td>705 (24.0)</td>
<td>5181 (26.6)</td>
</tr>
<tr>
<td>Melanoma</td>
<td>390 (4.9%)</td>
<td>329 (5.3%)</td>
<td>252 (5.1%)</td>
<td>196 (6.7%)</td>
<td>1031 (5.3%)</td>
</tr>
<tr>
<td>Breast Cancer</td>
<td>127 (1.6%)</td>
<td>234 (3.8%)</td>
<td>78 (1.6%)</td>
<td>107 (3.6%)</td>
<td>779 (4.0%)</td>
</tr>
<tr>
<td>Prostate Cancer</td>
<td>217 (2.7%)</td>
<td>94 (1.5%)</td>
<td>132 (2.7%)</td>
<td>106 (3.6%)</td>
<td>328 (1.7%)</td>
</tr>
<tr>
<td>Enlarged Prostate</td>
<td>655 (8.2%)</td>
<td>313 (5.0%)</td>
<td>401 (8.2%)</td>
<td>269 (9.2%)</td>
<td>1133 (5.8%)</td>
</tr>
<tr>
<td>Other Cancer</td>
<td>362 (4.5%)</td>
<td>319 (5.1%)</td>
<td>208 (4.2%)</td>
<td>347 (11.8%)</td>
<td>1131 (5.8%)</td>
</tr>
<tr>
<td>Osteoporosis</td>
<td>242 (3.0%)</td>
<td>324 (5.2%)</td>
<td>134 (2.7%)</td>
<td>286 (9.7%)</td>
<td>1099 (5.7%)</td>
</tr>
<tr>
<td>Thrombosis</td>
<td>244 (3.0%)</td>
<td>232 (3.7%)</td>
<td>157 (3.2%)</td>
<td>268 (9.1%)</td>
<td>921 (4.7%)</td>
</tr>
<tr>
<td>Hay Fever</td>
<td>965 (12.0%)</td>
<td>864 (13.9%)</td>
<td>558 (11.4%)</td>
<td>361 (12.3%)</td>
<td>2543 (13.1%)</td>
</tr>
<tr>
<td>Parkinson's Disease</td>
<td>18 (0.2%)</td>
<td>18 (0.3%)</td>
<td>16 (0.3%)</td>
<td>53 (1.8%)</td>
<td>88 (0.5%)</td>
</tr>
<tr>
<td>Thyroid problems</td>
<td>271 (3.4%)</td>
<td>335 (5.4%)</td>
<td>137 (2.8%)</td>
<td>251 (8.5%)</td>
<td>1185 (6.1%)</td>
</tr>
</tbody>
</table>

Also, diabetes was more prevalent in men across all employment categories, while asthma and arthritis were more prevalent among women.

**Age of diagnosis of the chronic diseases**

The mean age of diagnosis for each condition was calculated corresponding to the employment categories (see Table 4.4). However, there were some missing values for the age of diagnosis. The mean age of diagnosis for ‘diabetes’ was approximately 53 years for men and women in all
employment categories, except for those classified as ‘disabled/sick’ who were diagnosed slightly earlier at around 51 years of age.

Mean age of diagnosis of ‘asthma’ was similar for the participants classified as in ‘full time’ work and ‘self-employed’ (28.6 years and 28.5 years respectively). While those classified as ‘disabled/ sick’ and ‘not in paid work’ had mean age of diagnosis around 33 – 34 years.

The participants classified as ‘disabled / sick’ had an earlier mean age of diagnosis for ‘arthritis’ (50.8 years), while the participants in ‘full time’, ‘part time’ or ‘self-employment’ category were all diagnosed after 53 years of age.

Apart from the index conditions (diabetes, asthma and arthritis), only seven other health conditions such as high blood pressure, Parkinson’s disease, osteoporosis were indicated to have earlier onset of disease for participants who were classified as ‘disabled / sick’.
Table 4.4: The mean age of diagnosis for health conditions, by employment categories.

<table>
<thead>
<tr>
<th>Health Condition</th>
<th>Full-time Work (N=8027)*</th>
<th>Part-time Work (N=6221)*</th>
<th>Self-employed (N=4913)*</th>
<th>Disabled/ Sick (N=2941)*</th>
<th>Not in paid work (N=19462)*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n**  Mean age (yrs)</td>
<td>n**  Mean age (yrs)</td>
<td>n**  Mean age (yrs)</td>
<td>n**  Mean age (yrs)</td>
<td>n**  Mean age (yrs)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>604  52.9</td>
<td>382  53.3</td>
<td>310  53.0</td>
<td>587  51.0</td>
<td>1655  53.1</td>
</tr>
<tr>
<td>Asthma</td>
<td>646  28.6</td>
<td>554  31.6</td>
<td>377  28.5</td>
<td>366  33.8</td>
<td>1721  33.1</td>
</tr>
<tr>
<td>Arthritis</td>
<td>295  53.5</td>
<td>339  53.6</td>
<td>200  53.4</td>
<td>517  50.8</td>
<td>1358  52.0</td>
</tr>
<tr>
<td>Stroke</td>
<td>72   54.2</td>
<td>73   50.0</td>
<td>56   53.8</td>
<td>204  53.5</td>
<td>337   53.6</td>
</tr>
<tr>
<td>Heart Disease</td>
<td>628  51.7</td>
<td>417  51.0</td>
<td>405  50.6</td>
<td>561  50.1</td>
<td>1628  51.0</td>
</tr>
<tr>
<td>High Blood Pressure (Males)</td>
<td>1788  50.0</td>
<td>766  50.5</td>
<td>1037 50.8</td>
<td>744  48.7</td>
<td>2860  50.3</td>
</tr>
<tr>
<td>High Blood Pressure (Females)</td>
<td>933   50.2</td>
<td>1189  50.9</td>
<td>472  50.8</td>
<td>537  47.9</td>
<td>4078  50.0</td>
</tr>
<tr>
<td>Depression</td>
<td>680   46.4</td>
<td>783   45.4</td>
<td>435   45.6</td>
<td>828   46.2</td>
<td>2526  46.4</td>
</tr>
<tr>
<td>Anxiety</td>
<td>464   45.5</td>
<td>466   43.1</td>
<td>257   44.4</td>
<td>538   43.7</td>
<td>1694  46.4</td>
</tr>
<tr>
<td>Skin Cancer</td>
<td>1803  47.8</td>
<td>1467  47.9</td>
<td>1158  47.8</td>
<td>620   48.6</td>
<td>4779  48.5</td>
</tr>
<tr>
<td>Melanoma</td>
<td>353   49.6</td>
<td>302   50.5</td>
<td>229   49.5</td>
<td>171   50.8</td>
<td>936   49.5</td>
</tr>
<tr>
<td>Breast Cancer</td>
<td>117   51.9</td>
<td>218   51.2</td>
<td>77    52.1</td>
<td>97    52.8</td>
<td>721   53.0</td>
</tr>
<tr>
<td>Prostate Cancer</td>
<td>197   58.6</td>
<td>80    58.6</td>
<td>121   58.6</td>
<td>96    58.5</td>
<td>295   58.4</td>
</tr>
<tr>
<td>Enlarged Prostate</td>
<td>606   56.1</td>
<td>293   54.9</td>
<td>379   55.4</td>
<td>235   56.1</td>
<td>1049  56.3</td>
</tr>
<tr>
<td>Other Cancer</td>
<td>315   49.8</td>
<td>273   48.6</td>
<td>178   52.3</td>
<td>310   52.2</td>
<td>991   50.6</td>
</tr>
<tr>
<td>Osteoporosis</td>
<td>210   56.2</td>
<td>289   56.0</td>
<td>120   57.2</td>
<td>243   55.9</td>
<td>968   56.4</td>
</tr>
<tr>
<td>Thrombosis</td>
<td>227   46.4</td>
<td>214   44.6</td>
<td>143   48.0</td>
<td>224   47.1</td>
<td>831   45.2</td>
</tr>
<tr>
<td>Hay Fever</td>
<td>841   25.6</td>
<td>750   26.0</td>
<td>497   24.7</td>
<td>297   27.4</td>
<td>2192  26.1</td>
</tr>
<tr>
<td>Parkinson's Disease</td>
<td>12    54.3</td>
<td>13    50.2</td>
<td>13    56.6</td>
<td>37    50.2</td>
<td>59    55.9</td>
</tr>
<tr>
<td>Thyroid problems</td>
<td>237   49.2</td>
<td>285   48.5</td>
<td>119   51.0</td>
<td>208   50.0</td>
<td>1040  49.0</td>
</tr>
</tbody>
</table>

Where N*= Total number of participants in each employment category and n**= no. of participants in a particular employment category having chronic health condition and providing age of diagnosis.

One of the reasons diabetes, asthma and arthritis were selected as outcome diseases of interest was the suspected differences in the age of diagnosis and prevalence of these conditions among men and women. This assumption was examined by comparing the mean age of diagnosis of the chronic diseases by gender.
Table 4.5: The mean age of diagnosis for each employment category by gender.

<table>
<thead>
<tr>
<th></th>
<th>Full-time work</th>
<th>Part-time work</th>
<th>Self-employed</th>
<th>Sick/Disabled</th>
<th>Not in paid work</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean age (yrs)</td>
<td>Mean age (yrs)</td>
<td>Mean age (yrs)</td>
<td>Mean age (yrs)</td>
<td>Mean age (yrs)</td>
</tr>
<tr>
<td><strong>Men</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>53.2</td>
<td>53.5</td>
<td>53.1</td>
<td>51.4</td>
<td>53.0</td>
</tr>
<tr>
<td>Asthma</td>
<td>26.0</td>
<td>26.4</td>
<td>27.1</td>
<td>32.9</td>
<td>28.9</td>
</tr>
<tr>
<td>Arthritis</td>
<td>54.7</td>
<td>54.8</td>
<td>53.9</td>
<td>51.9</td>
<td>53.0</td>
</tr>
<tr>
<td><strong>Women</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>52.2</td>
<td>53.0</td>
<td>52.9</td>
<td>50.4</td>
<td>53.2</td>
</tr>
<tr>
<td>Asthma</td>
<td>31.6</td>
<td>33.6</td>
<td>30.6</td>
<td>34.3</td>
<td>34.8</td>
</tr>
<tr>
<td>Arthritis</td>
<td>52.6</td>
<td>53.3</td>
<td>52.7</td>
<td>49.9</td>
<td>51.7</td>
</tr>
</tbody>
</table>

Women reported an early age of diagnosis for diabetes and arthritis when compared with men, for all employment categories. Asthma was reported at an earlier age by men, regardless of their employment category. However, it is interesting to note that while diabetes and arthritis were reported at an early age by both men and women classified as disabled / sick, asthma was reported at a comparatively younger age by men engaged in paid work (full time, part time or self-employed). From the above results, it appears that diabetes, asthma and arthritis have different mean age of diagnosis across the different employment categories. This point was further investigated by examining the age of onset in age groups with comparisons made across the employment categories.

*Categorizing the age of diagnosis of diabetes, asthma and arthritis in age groups*

The distribution for age of diagnosis was collapsed into decade (of age) groups for each of the employment group. The age groups were 0 – 30 years, 31 – 40 years, 41 – 50 years, 51 – 60 years and 61 – 64 years groups. This grouping was applied to the age of diagnosis for all the reported chronic diseases. However, in the context of this thesis, diabetes, asthma and arthritis were assessed in Study 1.
**Diabetes**

The mean age of diagnosis for diabetes was 52.7 years, with this condition mostly diagnosed between 51 – 64 years of age in the participants classified as ‘full time’ employed. This pattern was similar for ‘part time’ working participants, although the participants classified as ‘self-employed’, ‘disabled / sick’ and ‘not in paid work’ were diagnosed at an early age (See Figure 4.2).

![Diabetes by decades of age of diagnosis & employment categories](image)

Figure 4.2: Diabetes by the age of diagnosis and the employment categories.

**Asthma**

Asthma was diagnosed after 30 years of age in approximately 2.3% of the ‘full time’ employed, 3.6% of the ‘part time’ employed, 3.9% of the ‘self-employed’, 5.4% of the ‘sick/ disabled’ and 5.5% of the participants ‘not in paid work’ category. However it was also of interest to note that the proportion of participants with delayed diagnosis (after 30 years) was higher in participants categorized as ‘disabled / sick’ and ‘not in paid work’. Almost 2.5% of participants ‘not in paid work’ and 1.8% of those categorized as ‘disabled / sick’ were diagnosed with asthma at 61 – 64 years of age.
The categorization of age of diagnosis for arthritis into age groups indicated that, for the participants who were either classified as ‘full time’ employed, ‘part time’ employed or ‘self-employed’, the most common age of diagnosis was after 40 years of age. No participants in any of the above employment categories were diagnosed between 31-40 years, however almost 58.4 % of the participants classified as ‘disabled/ sick’ and 49.3 % of the participants ‘not in paid work’ were diagnosed before 50 years of age, with the majority of them diagnosed either in childhood or early adult hood (See Figure 4.4).
Figure 4.4: Arthritis by age of diagnosis and employment categories.

The prevalence of diabetes, asthma and arthritis differs between men and women and there also appears to be an association between different employment categories and age of diagnosis for conditions, with sick/ disabled people tending to report early onset of conditions.

4.3 Peer Reviewed Published Paper

Further analysis from this study has been published as a peer reviewed paper “Employment status and chronic diseases among 60 – 64 year old men and women” in the ‘International Journal of Aging and Society’, and is presented here as the final submitted version of paper. The actual published paper can be found at [http://ijj.cgpublisher.com/product/pub.212/prod.100](http://ijj.cgpublisher.com/product/pub.212/prod.100)
Employment Status and Chronic Diseases: A Cross-sectional Study among 60–64 Year-old Men and Women

Tazeen Majed, University of Newcastle, Australia
Peta Forder, University of Newcastle, Australia
Julie Byles, University of Newcastle, Australia

Abstract: This study aims to investigate the association between chronic conditions [diabetes, asthma, and arthritis] and current employment status for men and women aged 60 – 64 years old. The study used the baseline data from the NSW 45 and Up Study, restricted to 41,734 participants aged 60 - 64 years old. The participants were prioritized into mutually exclusive employment categories – full time employed, part time employed, self-employed, disabled/sick, and not in paid work. The association between current employment status and chronic conditions was evaluated separately for men and women, before and after adjustment for relevant groups of covariates [socio-demographic factors, health risk factors, and health capacity factors]. Current employment was associated with having a chronic disease, specifically diabetes, asthma, or arthritis. Participants who were not in paid work or disabled/sick were more likely to report chronic conditions while having some form of paid employment was associated with decreased risk of having a chronic condition [diabetes or arthritis]. However, this effect diminished once socio-demographic conditions, health risk factors [smoking, BMI, alcohol] and health capacity factors [SP-36 physical function and need help for daily tasks] were taken into account. There were significant associations between different employment patterns and chronic diseases [diabetes and arthritis]. Better understanding of these associations and related risk factors could inform policies and guidelines for preventing the decline in employment in males and females of pre-retirement age.

Keywords: Workforce Participation, Employment Patterns, Diabetes, Asthma, Arthritis, Chronic Diseases, Gender

Introduction

Health conditions, particularly chronic diseases, limit the capacity of an individual to work, forcing them to adapt their employment. Such adaptations include reduced hours, working from home or losing their job (Australian Institute of Health and Welfare 2000, Pit and Byles 2012, Peter and Michal 2009, Au, Crossley, and Schellhorn 2005, Currie and Madrian 1999, Cai and Cong 2009, Shultz, Morton, and Weekele 1998). The association between chronic conditions and employment is also influenced by other factors such as gender, financial conditions, functional capacities, caring status, health risk factors like smoking or alcohol consumption (Australian Institute of Health and Welfare 2000, Zhang, Zhao, and Harris 2009, Harris 2008, Pit and Byles 2012). A holistic approach which accounts for interactions between employment and health is needed to maintain workforce participation among mature age men and women. Understanding these relationships is particularly important as populations age, and chronic diseases become more common.

Many chronic conditions result in functional limitation and disability in older population. In the 2010 Global Burden of Disease Study, leading causes of years of life lost to disability among older people included diabetes, arthritis and respiratory disease, as well as cardiovascular and neurological disorders (Vos et al. 2012). Diabetes can be either juvenile onset, or commence in later life. Type II diabetes usually commences in middle to older age, and is increasingly affecting people above 55 years (Australian Institute of Health and Welfare 2012). Asthma is commonly diagnosed among children, many of whom will outgrow this condition in adult life. However, adult onset asthma remains an underdiagnosed and undertreated condition, particularly among older people (Australian Institute of Health and Welfare 2012, Australian Bureau of Statistics). Pain and physical limitations associated with arthritis are common after age 60, and
are among the leading causes of work restrictions and forced adaptations (Australian Institute of Health and Welfare 2007) as well as other social and economic problems, morbidity and mortality (Australian Bureau of Statistics). These three common conditions were chosen as the focus in this study to examine the effects of common conditions with different natural history, gender prevalence, and age of onset.

The gender differences in prevalence of these conditions are well documented in the literature (World Health Organization, Gueciardi et al. 2008, Australian Centre for Asthma Monitoring 2011). For instance, diabetes is more common in men (McCullum et al. 2005); arthritis affects people 45 years or older, but women with arthritis are affected more often and severely (World Health Organization). Asthma affects women more after 15 years of age, with higher rates of morbidity and mortality (Australian Centre for Asthma Monitoring 2011).

Many researchers have examined the relationship between workforce participation and single chronic conditions and other health problems; such as diabetes (Elémore et al. 2011, Bastida and Pagan 2002, Shelton Brown, Pagan, and Bastida 2005, Kahn 1998), asthma (Balder et al. 1998, Blanc et al. 2001) and arthritis (Lacaille 2005, Barrett et al. 2000). Some studies focused on the association of comorbid conditions and employment (Turner, Cherry, and Robinson 2005, Harris 2008, Zhang, Zhao, and Harris 2009). Others who analyzed the impact of health on employment choices had focused on either self-reported health status or overall long-term health conditions, with employment as the outcome of interest (Pit and Byles 2012, Last and Association 2001, Au, Crossley, and Schellhorn 2005, Peter and Michal 2009, Schofield, et al. 2008). Across most of these studies, better health was associated with increased work and productivity, and older workers were found to have complex employment patterns (Gong and McNamara 2011). However there is a lack of evidence on the association of diabetes, asthma and arthritis with employment in mature age men and women.

In this study we aim to analyze the relationship between employment status and chronic diseases [diabetes, asthma and arthritis], and how these associations differ between men and women. Our focus is on men and women aged 60-64 years who are at a life stage when they are at increasing risk of chronic disease and also at the age when many might consider whether to retire or to keep working. This study is particularly important in the light of efforts to enable mature workers to remain in the workforce for longer periods, and can add an impetus for chronic disease prevention and better treatment.

Methods and Analysis

Data Source and Manipulation

This study used baseline data collected for the NSW 45 and Up Study, which is the largest long-term prospective, longitudinal study of ageing in Australia (Banks E et al. 2008). Analysis was restricted to 41,754 men and women aged 60 to 64 years. The baseline questionnaire covered many themes including: demography; lifestyle; family; health; diet; and work. This study focuses on three chronic conditions [diabetes, asthma and arthritis] and the employment related questions.

In the baseline questionnaire, participants answered questions concerning doctor diagnosed health conditions. The question “Has a doctor ever told you, you have ..?” was used to identify the occurrence of diabetes and asthma. The occurrence of arthritis was identified by using the question “In the last month have you been treated for: arthritis?”.

The participants were asked: “what is your current work status?”. Multiple response options included: full time paid work; part time paid work; completely retired; partially retired; disabled /sick; self-employed; doing unpaid work; studying; looking after home; unemployed and other. Responses were prioritized into five mutually exclusive categories using conditional statements. Those who responded ‘Yes’ to working full time were categorized as “full time employed”;

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while those who responded ‘Yes’ to part time but did not indicate as working ‘full time’ were marked as “part time employed”. Participants who said ‘Yes’ to self-employed work but did not indicate either working full time or part time were categorized as “self-employed”; and those who only indicated as being ‘disabled/sick’ were categorized as “disabled/sick”. All those who only gave affirmative response to unpaid work, study, looking after home, unemployed were marked as “not in paid work” and this was the reference category for analysis. Partially and fully retired participants were included as ‘not in paid work’ unless they indicated that they were in paid work, self-employed or disabled/sick.

Participants were asked about their marital status. For the purpose of this study, responses were categorized as “partnered” if participants indicated being married or had a partner; otherwise, they were categorized as “not partnered”. Participants were asked about their highest educational qualification and whether they provided care for any sick/disabled person. Country of birth of participants was also included and categorized as ‘born in Australia’ and ‘not born in Australia’. These were included as socio-demographic factors.

Health risk factors included BMI [Body Mass Index], smoking and alcohol consumption. BMI was provided in the baseline data set and was categorized as ‘underweight [BMI ≤ 18.5]’; ‘healthy [18.5 < BMI ≤25.0]’; ‘overweight [25.0 < BMI ≤ 30.0]’ and ‘obese [BMI >30]’.

Participants were asked a number of questions about smoking habits which were used to create three categories for smoking status: “current smoker”; “former smoker”; and “never smoked”. The questions concerning drinking behavior were used to describe alcohol consumption as “0 drinks/week”, “1-7 drinks/week”, “8-14 drinks/week”, “15-20 drinks/week” and “>20 drinks/week”.

Participants were also asked “Do you regularly need help with daily tasks because of long-term illness or disability?”. The SF-36 physical function score was calculated from eight questions regarding physical activities (Brazier et al. 1992). These two variables were included as health capacity factors.

**Statistical Analysis**

Prevalences were calculated for each of the focus health conditions [diabetes, asthma and arthritis] across the five employment categories, for both men and women.

Multivariate regression models evaluated the association between each chronic condition and current employment status after adjustment for other covariates, separately for men and women. The multivariate approach built upon the results from the univariate analysis, gradually controlling for the influence of the socio-demographic factors, health risk factors, and the health capacity factors. For each chronic condition, the following models were examined:

- **Model 1** – The effect of employment status only.
- **Model 2** – Model 1 variable + socio-demographic factors [marital status, education, country of birth and caring for sick/disabled].
- **Model 3** – Model 2 variables + health risk factors [i.e. BMI, alcohol consumption groups and smoking status].
- **Model 4** – Model 3 variables + health capacity factors [needing help in daily tasks and SF-36 Physical function scores].

SAS 9.3 software was used to conduct the analysis (Doyal 2001).

**Results**

Table 1 shows the prevalence of diabetes, asthma and arthritis in men and women, according to the employment categories. The majority [46.8%] of the participants were categorized as not in paid work, 19.3% as in full time employment, 15.0% in part time employment, 11.8% in self-employment and 7.1% participants were categorized as disabled/sick.
Participants classified as disabled/sick reported the highest prevalence for all the chronic conditions [diabetes 22.9%, asthma 14.8%, and arthritis 20.7%]. Those working full time reported prevalence similar to those not in paid work [diabetes: full time 8.2%, not in paid work 9.4%; asthma: full time 9.2%, not in paid work 10.1%], except for arthritis that had higher prevalence for not in paid work [full time 4.2%, not in paid work 8.1%]. Diabetes was more prevalent in men; while asthma and arthritis were more prevalent in women.

Table 1: Prevalence of diabetes, asthma and arthritis across the employment categories [N=41,754]

<table>
<thead>
<tr>
<th></th>
<th>Full time work</th>
<th>Part time work</th>
<th>Self-employed</th>
<th>Disabled/sick</th>
<th>Not in paid work</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OVERALL</strong></td>
<td>n=8,027 (19.3%)</td>
<td>n=6,221 (15.0%)</td>
<td>n=4,913 (11.8%)</td>
<td>n=2,941 (7.1%)</td>
<td>n=19,462 (46.8%)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>655 (8.2%)</td>
<td>415 (6.7%)</td>
<td>344 (7.0%)</td>
<td>662 (22.5%)</td>
<td>1820 (9.4%)</td>
</tr>
<tr>
<td>Asthma</td>
<td>738 (9.2%)</td>
<td>631 (10.1%)</td>
<td>417 (8.5%)</td>
<td>434 (14.8%)</td>
<td>1960 (10.1%)</td>
</tr>
<tr>
<td>Arthritis</td>
<td>338 (4.2%)</td>
<td>389 (6.3%)</td>
<td>221 (4.5%)</td>
<td>609 (20.7%)</td>
<td>1581 (8.1%)</td>
</tr>
<tr>
<td><strong>MALES</strong></td>
<td>(n=5,058)</td>
<td>(n=2,168)</td>
<td>(n=3,246)</td>
<td>(n=1,680)</td>
<td>(n=7,280)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>491 (9.7%)</td>
<td>215 (9.9%)</td>
<td>245 (7.6%)</td>
<td>400 (23.8%)</td>
<td>888 (12.2%)</td>
</tr>
<tr>
<td>Asthma</td>
<td>391 (7.7%)</td>
<td>178 (8.2%)</td>
<td>253 (7.8%)</td>
<td>164 (9.8%)</td>
<td>583 (8.0%)</td>
</tr>
<tr>
<td>Arthritis</td>
<td>147 (2.9%)</td>
<td>57 (2.6%)</td>
<td>105 (3.2%)</td>
<td>241 (14.4%)</td>
<td>329 (4.5%)</td>
</tr>
<tr>
<td><strong>FEMALES</strong></td>
<td>(n=2,969)</td>
<td>(n=4,058)</td>
<td>(n=1,667)</td>
<td>(n=1,261)</td>
<td>(n=12,182)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>164 (5.5%)</td>
<td>200 (4.9%)</td>
<td>99 (5.9%)</td>
<td>262 (20.8%)</td>
<td>932 (7.7%)</td>
</tr>
<tr>
<td>Asthma</td>
<td>347 (11.7%)</td>
<td>453 (11.2%)</td>
<td>164 (9.8%)</td>
<td>270 (21.4%)</td>
<td>1377 (11.3%)</td>
</tr>
<tr>
<td>Arthritis</td>
<td>191 (6.4%)</td>
<td>332 (8.2%)</td>
<td>116 (7.0%)</td>
<td>368 (29.2%)</td>
<td>1252 (10.3%)</td>
</tr>
</tbody>
</table>

**Diabetes and Employment**

**Men**

As seen in Table 2, participants in the disabled/sick category were twice as likely to significantly report diabetes [OR=2.25, p<0.0001]. In contrast, being in paid work or self-employed was associated with lower odds of reporting diabetes [full-time employed OR=0.77, p<0.0001; part-time employed OR=0.79, p=0.0042; self-employed OR=0.59, p<0.0001]. The addition of sociodemographic and health risk factors in subsequent models reduced the association between part-time employment and diabetes in men [OR=0.85, p-value= 0.05; Model 4 Table 2].

**Women**

As seen in Table 2, participants in paid employment were less likely to report diabetes [full-time employed OR=0.71, p<0.0001; part-time employed OR=0.63, p<0.0001; self-employed OR=0.76, p<0.0001]. Women classified as disabled/sick had over three times the odds of having diabetes. In subsequent models it was found that women in part-time employment continued to have significantly lower odds of having diabetes [OR=0.75, p=0.0012; Model 4 Table 2]; whereas women in the disabled/sick category were more likely to report diabetes.
Asthma and Employment

Men

As seen in Table 2, there was no evidence of an association between asthma and employment - full time employment, part time employment and self-employment [p=0.36, 0.96 and 0.67 respectively]. However participants classified as disabled/sick were more likely to report asthma [OR=1.26, p=0.014]. Once health risk and health capacity factors were accounted for, there was no evidence to support an association between current employment and asthma.

Women

Women who were identified as disabled/sick were more than two times as likely to have asthma [OR=2.15, p<0.0001; Model 1 Table 2] compared to those not in paid work; although this effect was not significant once health capacity factors were included in model [OR=1.01, p=0.73, Model 4 Table 2].

Arthritis and Employment

Men

Risk of reporting arthritis was around 3.5 times higher for males categorized as disabled/sick [OR=3.54, p=0.002]; whereas being in paid employment [full time, part time or self-employed] reduced the odds of arthritis [full time OR=0.63, p<0.0001; part time OR=0.57, p=0.0001; self-employed OR=0.71, p<0.0001; Model 1 Table 2]. Once other factors were taken into consideration, there was no evidence of association between arthritis and being employed [Model 4].

Women

Women classified as disabled/sick were more than three times as likely to have arthritis, while women in paid employment were less likely to report arthritis [full time OR=0.60, p=<0.0001; part time OR=0.78, p=0.0001; self-employed OR=0.65, p<0.0001]. After considering other risk factors, the likelihood of reporting arthritis was not associated with self-employment and disabled/sick category [p=0.08 and p=0.50 respectively]. Women in full time and part time employment had lower odds of reporting arthritis once health capacity and health risk factors were included [full time OR=0.67, p<0.0001 and part time OR=1.83, p=0.0104].
<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
</tr>
<tr>
<td><strong>DIABETES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males (N=2,247)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not in paid work</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full time</td>
<td>0.77 (0.67, 0.87)</td>
<td>0.79 (0.76, 0.89)</td>
<td>0.80 (0.70, 0.90)</td>
<td>0.82 (0.72, 0.94)</td>
</tr>
<tr>
<td>Part time</td>
<td>0.79 (0.68, 0.93)</td>
<td>0.82 (0.76, 0.96)</td>
<td>0.85 (0.72, 1.00)</td>
<td>0.86 (0.73, 1.03)</td>
</tr>
<tr>
<td>Self-employed</td>
<td>0.59 (0.51, 0.68)</td>
<td>0.60 (0.51, 0.70)</td>
<td>0.63 (0.54, 0.74)</td>
<td>0.66 (0.56, 0.77)</td>
</tr>
<tr>
<td>Disabled/Sick</td>
<td>2.25 (1.97, 2.57)</td>
<td>1.99 (1.73, 2.29)</td>
<td>1.62 (1.40, 1.88)</td>
<td>1.16 (0.97, 1.39)</td>
</tr>
<tr>
<td>Females (N=1,668)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not in paid work</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full time</td>
<td>0.71 (0.60, 0.84)</td>
<td>0.79 (0.66, 0.94)</td>
<td>0.78 (0.65, 0.94)</td>
<td>0.88 (0.73, 1.07)</td>
</tr>
<tr>
<td>Part time</td>
<td>0.63 (0.54, 0.73)</td>
<td>0.67 (0.57, 0.79)</td>
<td>0.70 (0.59, 0.82)</td>
<td>0.75 (0.63, 0.89)</td>
</tr>
<tr>
<td>Self-employed</td>
<td>0.76 (0.62, 0.94)</td>
<td>0.82 (0.66, 1.02)</td>
<td>0.89 (0.71, 1.12)</td>
<td>0.93 (0.72, 1.19)</td>
</tr>
<tr>
<td>Disabled/Sick</td>
<td>3.17 (2.72, 3.68)</td>
<td>2.83 (2.41, 3.33)</td>
<td>2.14 (1.80, 2.55)</td>
<td>1.41 (1.14, 1.74)</td>
</tr>
<tr>
<td><strong>ASTHMA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males (N=1,573)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not in paid work</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full time</td>
<td>0.94 (0.82, 1.07)</td>
<td>0.97 (0.85, 1.12)</td>
<td>1.00 (0.87, 1.15)</td>
<td>1.02 (0.88, 1.19)</td>
</tr>
<tr>
<td>Part time</td>
<td>0.99 (0.84, 1.19)</td>
<td>1.01 (0.84, 1.20)</td>
<td>1.04 (0.87, 1.25)</td>
<td>1.09 (0.90, 1.31)</td>
</tr>
<tr>
<td>Self-employed</td>
<td>0.97 (0.83, 1.16)</td>
<td>0.95 (0.81, 1.12)</td>
<td>0.95 (0.81, 1.12)</td>
<td>0.98 (0.82, 1.16)</td>
</tr>
<tr>
<td>Disabled/Sick</td>
<td>1.26 (1.05, 1.51)</td>
<td>1.32 (1.05, 1.61)</td>
<td>1.36 (1.11, 1.66)</td>
<td>1.01 (0.79, 1.28)</td>
</tr>
<tr>
<td>Females (N=2,621)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not in paid work</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full time</td>
<td>1.01 (0.88, 1.14)</td>
<td>0.96 (0.84, 1.11)</td>
<td>0.94 (0.82, 1.08)</td>
<td>1.01 (0.87, 1.16)</td>
</tr>
<tr>
<td>Part time</td>
<td>0.96 (0.85, 1.07)</td>
<td>0.95 (0.85, 1.07)</td>
<td>0.95 (0.85, 1.07)</td>
<td>0.98 (0.87, 1.12)</td>
</tr>
<tr>
<td>Self-employed</td>
<td>0.86 (0.73, 1.02)</td>
<td>0.84 (0.70, 1.00)</td>
<td>0.87 (0.72, 1.04)</td>
<td>0.93 (0.77, 1.12)</td>
</tr>
<tr>
<td>Disabled/Sick</td>
<td>2.15 (1.85, 2.49)</td>
<td>2.09 (1.78, 2.45)</td>
<td>1.86 (1.57, 2.20)</td>
<td>1.04 (0.85, 1.27)</td>
</tr>
<tr>
<td><strong>ARTHRIITIS</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Males (N=886)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not in paid work</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full time</td>
<td>0.63 (0.52, 0.77)</td>
<td>0.67 (0.55, 0.82)</td>
<td>0.71 (0.58, 0.87)</td>
<td>0.89 (0.71, 1.11)</td>
</tr>
<tr>
<td>Part time</td>
<td>0.57 (0.43, 0.76)</td>
<td>0.61 (0.46, 0.81)</td>
<td>0.66 (0.49, 0.88)</td>
<td>0.76 (0.60, 1.03)</td>
</tr>
<tr>
<td>Self-employed</td>
<td>0.71 (0.57, 0.88)</td>
<td>0.72 (0.57, 0.90)</td>
<td>0.76 (0.60, 0.96)</td>
<td>0.85 (0.66, 1.10)</td>
</tr>
<tr>
<td>Disabled/Sick</td>
<td>3.54 (2.97, 4.22)</td>
<td>3.17 (2.63, 3.83)</td>
<td>3.09 (2.54, 3.76)</td>
<td>1.34 (1.07, 1.68)</td>
</tr>
<tr>
<td>Females (N=2,268)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not in paid work</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full time</td>
<td>0.60 (0.51, 0.70)</td>
<td>0.59 (0.50, 0.69)</td>
<td>0.58 (0.49, 0.68)</td>
<td>0.67 (0.56, 0.81)</td>
</tr>
<tr>
<td>Part time</td>
<td>0.78 (0.69, 0.88)</td>
<td>0.76 (0.66, 0.86)</td>
<td>0.75 (0.66, 0.86)</td>
<td>0.83 (0.71, 0.96)</td>
</tr>
<tr>
<td>Self-employed</td>
<td>0.65 (0.54, 0.80)</td>
<td>0.66 (0.54, 0.81)</td>
<td>0.69 (0.56, 0.85)</td>
<td>0.82 (0.66, 1.03)</td>
</tr>
<tr>
<td>Disabled/Sick</td>
<td>3.60 (3.14, 4.12)</td>
<td>3.48 (3.01, 4.03)</td>
<td>3.20 (2.75, 3.72)</td>
<td>1.07 (0.89, 1.29)</td>
</tr>
</tbody>
</table>

Model 1 – Employment category only
Model 2 – Model 1 + Socio-demographic factors [marital status, education, country of birth and caring for sick/disabled]
Model 3 – Model 2 + Health risk factors [BMI, smoking, alcohol consumption]
Model 4 – Model 3 + Health capacity factors [SF-36 physical function scores, needing help in daily tasks]
Discussion

We explored the association between current employment status and three chronic diseases [diabetes, asthma and arthritis]. Diabetes and arthritis were associated with employment in older men and women. Compared to those not in paid work, those in any form of employment had lower odds of having these conditions. People in the sick and disabled category had higher odds of having these conditions, and of having asthma. Some of these associations were attenuated when socio-demographic, health risk and health capacity factors were taken into consideration. A major strength of this study was the use of data from the largest long-term prospective study of ageing in Australia – “NSW 45 and Up Study” (Banks, E et al. 2008). This allowed us to examine a large sample of the population that was nearing retirement age i.e. participants aged 60 – 64 years old.

Diabetes was more prevalent in men across all employment categories, consistent with findings from other studies that reported differences in diabetes prevalence between men and women (Harris, 2008, McCollum et al. 2005). However, the association between employment and diabetes was similar for both men and women. This would indicate that the effect of diabetes on people’s capacity to stay within the workforce is similar for both genders. The major gender difference is that women working part time had the lowest prevalence of diabetes across the employment categories, whereas self-employed men had the lowest prevalence. These gender differences may reflect underlying patterns of workforce participation; where women are more likely than men to work part time. It may also be that self-employed men had lower risk factors for diabetes, and the differences did attenuate as risk factors were added to the model. Participants who were categorized as disabled/sick were at increased risk of reporting diabetes, consistent with findings from other studies (Zhang, Zhao, and Harris. 2009, Cai and Cong 2009, Eléonore et al. 2011, Shelton Brown, Pagán, and Bastida 2005, Von Korff et al. 2005). Around 22% of people in the sick and disabled category reported diabetes. These people may have suffered from complications and disability related to their diabetes that affected their capacity to work. Evidence for this possibility is that the association between the sick/disabled category and diabetes attenuated greatly when health capacity was added to the model. However, another plausible argument for this finding may be workplace discrimination. It has been reported that individuals with diabetes may suffer from discriminatory hiring practices from employers (Songer et al. 1989, Von Korff et al. 2005). Among women, the association between the disabled/sick category and diabetes was stronger than among men, and did not fully attenuate when other factors were added to the model.

Asthma was more prevalent among women than men in all employment categories. This finding is consistent with empirical research indicating that asthma is a major health problem with significant gender differences, being more common in women after puberty (Lim and Kobzik 2010, Postma 2007). However, there is evidence in the literature that women are more likely to be labeled as ‘asthmatics’ and men as having COPD; misdiagnosis and underdiagnoses of asthma is a major issue in the elderly population (Byles 2005, Tinkelman et al. 2006, Enright et al. 1999). Research findings regarding the relationship between asthma and employment are not consistent, with most research focusing on the impact of asthma on employment. For instance, some studies report that asthma results in changes in employment (Blanc et al. 1993, Yelin et al. 2006, Byles 2005, Balder et al. 1998), while a study reported that asthma has no major association with employment (Yelin et al. 1999). We found that asthma was not significantly associated with current employment status among male participants. Among women, those classified as disabled/sick were more likely to report asthma. This effect became weaker in model 4, suggesting that most of the relationship was accounted for by health capacity.

Arthritis was more common in women than men across all employment groups, and this gender difference in arthritis prevalence has been well documented (World Health Organization, Yelin 1992, Theis, Helmick, and Hootman 2007). We found that health capacity factors
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attenuated the relationship between current employment and reporting treatment for arthritis, again suggesting that it is not the disease or its treatment that is associated with workforce participation but the disability associated with this condition. This finding is in agreement with other studies, which reported that people with arthritis have changes in employment due to pain and disability (Lacaille 2005, Barrett et al. 2000, Australian Institute of Health and Welfare 2007). For women, unlike men however, the association between work and arthritis remained significant even after all other factors were taken into consideration. This finding suggests that for women the effects of arthritis on employment go beyond the effects of arthritis on physical capacity.

Limitations

Despite the strengths of this study, there are also some limitations. As this study was cross-sectional in nature, we could not identify causal relationships within the associations between chronic diseases [diabetes, asthma and arthritis] and current employment of participants. Another limitation is that we used self-reported doctor diagnosed health conditions, so reporting bias cannot be excluded. However self-reported health conditions are considered a valid measure with many studies using self-report as the method for ascertainment of chronic conditions (Wannamethee and Shaper 1991). Our prevalence of arthritis is lower than that reported by others and may reflect the nature of questionnaire which only asked about treatment of arthritis. Many people may have arthritis without regular treatment. We have not considered the severity of chronic conditions, nor the duration, and these factors can also have an impact on employment.

Conclusion

Diabetes and arthritis were significantly associated with employment status of pre-retirement age men and women, with some gender differences. There was no evidence of association between asthma and current employment. Better understanding of these associations could inform policies for creating health friendly work environments. To increase and maintain workforce participation among mature age workers; we need to apply a holistic approach that accounts for interactions between different employment choices, chronic conditions, socio-demographic and other health factors among men and women.

Acknowledgments

This research was completed using data collected through the 45 and Up Study (www.saxinstitute.org.au). The 45 and Up Study is managed by the Sax Institute in collaboration with major partner Cancer Council NSW; and partners: the National Heart Foundation of Australia (NSW Division); NSW Ministry of Health; beyond blue; Ageing, Disability and Home Care, Department of Family and Community Services; the Australian Red Cross Blood Service; and Uniting Care Ageing. We thank the many thousands of people participating in the 45 and Up Study.
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MAJEED, ET AL.: EMPLOYMENT STATUS AND CHRONIC DISEASES


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4.4 Next Chapter – A Gendered Approach to Workforce Participation Patterns Across the Life Course

This first study encouraged us to further explore various workforce participation patterns over the life course with a gendered approach, and to examine relationships between these patterns and various early and adult life factors. The next study “A gendered approach to workforce participation patterns over the life course” was the next part of this research journey.
CHAPTER 5:

A GENDERED APPROACH TO WORKFORCE PARTICIPATION PATTERNS ACROSS THE LIFE COURSE

Peer Reviewed Published Paper

Within the context of this thesis, this study provided an opportunity to examine the workforce participation patterns of women and men over the life course. This study was undertaken using the data from the Australian Life History and Health (LHH) Survey (a sub-study of NSW 45 and Up Study), which provided a rich source of retrospectively collected data from men and women aged 60 – 64 years.

5.1 INTRODUCTION

For this study, the aim was to identify, define and explore the workforce participation patterns and their various associations for women and men over their adult life course. This was accomplished by using the analysis technique of Latent Class Analysis (LCA), which allowed us to establish previously unidentified, dominant patterns of workforce participation over time. The workforce participation patterns for women and men were then further investigated to explore the influence of various early and adult life socio-demographic factors across the life course.

The main aims of this study are summarized as follows:

i) To explore the workforce participation patterns for women and men over their life course, and identify gender differences.

ii) To determine the evidence supporting the influence of early and later life factors on the workforce participation over the life course for both women and men.

Based on these aims, the first hypothesis for the study was that ‘there are distinct differences between the workforce participation patterns for women and men over the life course’. The second hypothesis was that ‘for women and men, the patterns of workforce participation over the life course are associated with, and influenced by various early and late life factors’.

Social and economic determinants of employment patterns are very important predictors of how men and women engage in work and employment over the life course, thus strongly affecting quality of life and employment.1, 178

The importance of childhood socio-economic conditions in determining individuals’ future employment is well documented in literature.163-165, 174-178 A large number of studies around the world have reported that early life experiences, especially childhood circumstances are
important predictors of later life outcomes such as their health, socio-economic status and employment. These studies found that childhood socio-economic status (SES) may affect the social position in later years and impact on workforce participation patterns. However, past studies have not established longitudinal associations between the patterns of workforce participation over the life course and various early and adult life factors (detailed gaps in literature discussed in Chapter 2, Section 2.4 –Literature Review).

Among the childhood socio-economic factors which might influence an individual’s workforce participation in later life, the numbers of books available during childhood and the father’s occupation were included in this study. Highest educational qualification, marital status and informal caring status were taken into consideration as the adult life socio-economic factors associated with workforce participation of women and men over the life course.

These variables have been discussed in detail in Chapter 2 (Background and Literature Review) and Chapter 3 (Methods and Analysis Strategies).

5.2 Peer Reviewed Paper

This study has already been published in a peer reviewed journal – the ‘Journal of Vocational Behaviour’. This paper is presented here as the final published version.

A gendered approach to workforce participation patterns over the life course for an Australian baby boom cohort

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ABSTRACT

Population ageing and its future implications for governments and individuals have been central to much policy debate and research targeted to retain older people in the workforce. This study identified workforce participation patterns across the adult life course for women and men entering later life, and explored the influences of various early and adult life socio-demographic circumstances. Data were collected from 1261 men and women aged 60 to 64 years in the Life History and Health (LHH) Survey (a sub-study of the Sax Institute’s 45 and Up Study, Australia) in 2010–11. LHH provides detailed information on personal histories of paid work, socio-economic resources from childhood (number of books and father’s occupation) and adult life factors such as educational attainment, marital histories, childcare and informal caring. Latent class analysis (LCA) was undertaken to identify patterns of workforce participation for participants across their adult life. Significant gender differences were confirmed. Further analysis (LCA with covariates) showed that women who reported having books during childhood, and those who had post-school qualification, were more likely to have mostly been in paid work and less likely to have not been in paid work; while ever partnered women had significantly higher odds of increasing part time work over time. Men who had reported ever having had informal caring activities were likely to have had decreasing participation in paid work over time, and were highly likely to be not in paid work after 55 years. Ever partnered status was protective for being in paid work for men. These findings indicate the need for gender-specific policies and strategies to enable continued workforce participation throughout adult life and into later working years, particularly for people who had fewer social or economic opportunities earlier in life.

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1. Introduction

1.1. Mature age workforce and its challenges

Population ageing is a global phenomenon indicating rapid growth in the proportion of people aged 60 years and older. In the next few decades, younger people (aged 0–15 years) will be outnumbered by people aged 60 years and above (World Health Organization, 2014) and there will be declining numbers of younger adults in the workforce. This demographic and social change presents a number of challenges, with long term productivity and activity of mature age workers becoming increasingly important (Christensen, Dobblhammer, Rau, & Vaupel, 2009; European Commission, 2000; Loh & Kendig, 2013). Mature age workers are a critical

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part of the workforce, and contribute years of knowledge and skill (Fasbender, Delier, Wang, & Wiernik, 2014). The exit of these workers from the paid workforce, combined with fewer younger workers to replace them, will have considerable impacts on the productivity and sustainability of industry, and on national economies (Loretto & White, 2006). Moreover, as populations age, successive generations are likely to be required to remain longer in paid work in order to maintain the tax base, to support their own aging, and to minimize demands on public pensions and welfare.

Among the many challenges of population ageing, workforce participation of mature age workers and its associated economic and financial implications are of major concern to governments and have been widely discussed (Australian Treasury, 2010; European Commission, 2000; Duncan & Miranti, 2013). To alleviate these potential burdens, governments and institutions around the globe are proclaiming the necessity of retaining mature age workers (Australian Treasury, 2010; Loretto & White, 2006; Phillipson, 2013). Policies have been initiated to promote increased workforce participation and remove barriers to longer work life, and financial incentives have been introduced for people to remain in work (Speehr, Barnett, & Parras, 2009; Temple, Adair, & Hossetini-Chavishi, 2011; World Health Organization, 2002). In some countries like Australia and other OECD countries, age-based anti-discrimination reforms have been implemented (Chomik & Piggott, 2012; Loretto & White, 2006; OECD, 2013). Many governments such as the United Kingdom, France, Netherlands and Australia are seeking to raise retirement ages and pension eligibility age to retain mature age workers for longer into the future (Chomik & Piggott, 2012; ILC, 2011; OECD, 2013). However, despite raising pension eligibility ages, installing financial incentives, and increasing flexibility of working hours, many people do not remain in the workforce in their older ages (Abhayaratna & Lattimore, 2006; Speehr et al., 2009). Among those who do continue to work, many people aged 60 years and above will work part-time work, with different trends for men and women (Speehr et al., 2009).

To date, most research interest in older workers has focussed on retirement with many studies investigating factors associated with early exit from the workforce (Alavina & Burdorf, 2008; Dahl, Nilsen, & Vaage, 2003; Rice, Lang, Henley, & Melzer, 2011), or on the effects of retirement on health (Coe & Zamarro, 2011; van der Heide, van Rijn, Robroek, Burdorf, & Proper, 2013), or financial implications (Luxardi & Mitchell, 2007; Van Rooij, Luxardi, & Alessie, 2012). For many people, retirement comes as a consequence of their own life decisions, ‘at the right time’, and is associated with a positive change in their lives and wellbeing (Byles et al., 2013; Hardy, 2002; Kim & Moen, 2001). For other people, retirement arises from external pressures including redundancy, the onset of ill health, or needing to care for a sick or disabled family member (Alavina & Burdorf, 2008).

It has also been hypothesized that older age workforce participation is likely to depend on patterns of employment at earlier life stages, and the social and economic circumstances that prevail across the life course (Case, Fertig, & Paxson, 2005; Flores & Kubli, 2014; Mazzone & Havari, 2011). With greater focus on the heterogeneity in life course trajectories, the traditional expectation that people will exhibit a “normal work biography” whereby they commence work as young adults, continue to work until a normative retirement age, and then cease work and retire to a life of leisure is increasingly being brought into question. Two major criticisms of this traditional life course model are a) that it is highly gendered pertaining mostly to a male breadwinner role (Everingham, Warner-Smith, & Byles, 2007), and b) that it has been changed in the current economic and social order (Kendig, Wells, O’Loughlin, & Heese, 2013; Kohli, 2007).

Many older people report having left work at a relatively early age due to health problems, redundancy, to care for family, for lifestyle choices or due to other circumstances (Abhayaratna & Lattimore, 2006; Brooke & Taylor, 2005; Larsen & Pedersen, 2013; Rall, 2013; Shultz, Morton, & Weckerle, 1998); and they may or may not return to work on a full or part-time basis when their circumstances change. Compared to men, women’s working lives are likely to be more fragmented, combining family and caring roles with full or part-time work at different life stages.

The purpose of this study is to ascertain different patterns of workforce participation among men and women over their working lives and to explore various factors associated with different workforce participation patterns. We also aim to investigate the relationship between early and adult life factors and patterns of workforce participation, and to examine differences by gender.

2. Conceptual framework and hypotheses

There is substantial literature on gender differences in workforce participation at various points over the life course. However, here has been little work conceptualizing how the differences in employment probabilities of mature age men and women reflect the continuation of their earlier life employment patterns, and other earlier life circumstances (Ruhm, 1996). Social factors in later life, such as needing to care for a disabled parent or spouse, will be overlayed on these established patterns, potentially creating a disruption or interruption to work. In this paper, we hypothesize on how employment patterns and their predictors over the life course are different for men and women, as a result of gender related roles, expectations, opportunities and constraints since this baby boom cohort reached adulthood in 1960’s.

2.1. Workforce participation by gender

Women have complex workforce participation patterns because of their varying family and work roles (Gerber, Wittekind, Groe, & Staffeldbach, 2006; Huang, El-Khouri, Johansson, Lindroth, & Sverke, 2007). They exhibit different workforce participation trajectories over the life course depending on their age, social and economic situations and family life (Gerber et al., 2009). Many women choose to remain out of work or to work part time during child bearing ages, and in their middle ages while they still have

2 The OECD (Organisation for Economic Co-operation and Development) is an organisation dedicated to global development and is made up of 34 member countries (see http://www.oecd.org/about/membersandpartners/ for a full list of these countries).
children living at home (Arnold, 2003; Australian Bureau of Statistics, 2010; Gerber et al., 2000; Spoehr et al., 2003). Some of these women will return to full-time work in later life, but many remain mostly out of paid work through the remainder of their life (Australian Bureau of Statistics, 2006; Yeates, 2010). However, the gender patterns are changing, and increasing proportions of women work full time throughout their lives (Australian Bureau of Statistics, 2006; Evans & Kelley, 2002; Yeates, 2010).

Men traditionally exhibit workforce participation patterns that vary depending on their individual and family circumstances. In Australia, for example, men mostly remain in full-time work up until 60 years of age (Australian Bureau of Statistics, 2010; Spoehr et al., 2009), and they have a lower rate of participation in part time employment than women (Australian Bureau of Statistics, 2010). However, significant numbers of men will cease work after the age of 45 years due to poor health, or because they are unable to find suitable work (Rice et al., 2011). Based on these different working traditions and their gendered roles, we propose:

**Hypothesis 1.** That women and men in this birth cohort will have different patterns of workforce participation over the life course, with women being more likely to be in and out of work and have more part-time work and men having more consistent participation in full-time work.

2.2. Childhood socio-economic factors associated with workforce participation patterns

Many social factors such as parent’s social status and childhood socio-economic conditions play an important role in the dynamics of workforce participation patterns for women and men, and have been well documented (Case et al., 2005; Currie, 2008; Currie, Stabile, Manwong, & Roos, 2010; Dal Bianco, Garrouste, & Pascagnella, 2013; Flores & Kalwij, 2014; Luo & Waite, 2005; Mazzonna & Havari, 2011; Otero-Rodriguez et al., 2011). For this study we chose two indicators of childhood socio-economic conditions that have been shown to be important predictors of later life circumstances: books and father’s occupation. These are discussed below.

2.2.1. Books

The number of books available in the childhood home has been frequently used as an important indicator of the intellectual and educational background of family, with their availability usually measured in terms of number of shelves, bookcases filled with books (Cavagnero, Garrouste, & Pascagnella, 2011; Dal Bianco et al., 2013; Flores & Kalwij, 2014; Mazzonna & Havari, 2011). Studies have reported that the better the educational background of family, the better the chances for children to attain better employment later in life (Case et al., 2005; Currie, 2008; Currie et al., 2010). Based on these previous findings, we propose:

**Hypothesis 2.** Among women and men, having at least one shelf of books during childhood will be associated with greater participation in paid work across the life course, including older ages.

2.2.2. Father’s occupation

Parental occupation, especially father’s occupation, is regarded as an important indicator of childhood socio-economic factors and associated future life and employment outcomes (Currie, 2008; Luo & Waite, 2005; Mazzonna & Havari, 2011). Previous literature found that children whose fathers had higher level of occupation and thus more income were more likely to be better employed themselves (Case et al., 2005; Currie, 2008; Luo & Waite, 2005; Mazzonna & Havari, 2011). On the basis of this argument, a third hypothesis for this study was:

**Hypothesis 3.** Among women and men, higher level of father’s occupation is associated with greater participation in paid work across the life course, including older ages.

2.3. Adult life factors associated with workforce participation patterns

Many social factors that operate throughout adult life are also associated with employment prospects and work patterns. These include education, marital status and informal caring responsibilities (Larsen & Pederson, 2013; Ruhm, 1996; van der Wel, 2011).

2.3.1. Education

National and international studies found level of education to be strongly associated with increased workforce participation by mature age people (Australian Institute of Family Studies, Australian Government, 2008; Flores & Kalwij, 2014; Rudi, 2013; van der Wel, 2011). Results from these studies suggested the presence of a relationship between education level and labour force participation, with women and men having some higher education being more likely to be in some kind of paid job at older ages. On the basis of these findings, our fourth hypothesis is:

**Hypothesis 4.** Among women and men, having higher level of education is associated with greater participation in paid work across the life course, including older ages.

2.3.2. Marital status

Varying and contrasting findings have been reported by studies regarding the association of marital status and workforce participation. Dahl et al. (2003), Larsen and Pedersen (2013) and Ruhm (1996) found that partnered women were less likely to
remain in work at later ages; while partnered men were more likely to participate in the workforce. In contrast, Li et al. (2013) and Haider and Loughran (2001) reported marriage or partnered relationship to have a protective effect from underemployment, regardless of gender. Based on these arguments our fifth hypothesis is two-fold:

**Hypothesis 5a.** Among women, being partnered is associated with lesser participation in workforce across the life course, particularly at older ages.

**Hypothesis 5b.** Among men, being partnered is associated with greater participation in workforce across the life course, particularly at older ages.

### 2.3.3. Caring responsibilities

Of the various social roles affecting employment in later life, care giving responsibilities have been identified as an important barrier to retain employment for mature age workers (Berecki-Gisolf, Lucke, Hockley, & Dobson, 2008; Ruhm, 1996; Speeher et al., 2009; Temple et al., 2011). Bittman, Hoffman, and Thompson (2004), Gray, Edwards, and Zmijewski (2008) and Speeher et al. (2009) reported caring as a particular issue for women who are the primary care givers for sick or disabled family members. Considering these findings, we hypothesized that:

**Hypothesis 6.** Among women and men, having caring responsibilities is associated with reduced workforce participation across the life course, particularly at older ages.

### 2.4. Gaps in literature

The existing literature reports associations between labour force participation in older age and early and adult life socio-economic factors. However, previous studies do not examine patterns of employment over complete adult life, nor do they examine how socio-economic factors are associated with life course patterns of workforce participation from a gendered perspective. Many past reports and studies targeted the retirement issues (Burless, 2012; Dahl et al., 2003; Møller, Dinesen, & Husted, 2005; Palmore, 1965; Radl, 2013; Rice et al., 2011; Ripplin, 1997; Shultz et al., 1998), and only a few explored the gender differences in employment (Abhayaratna & Lattimore, 2006; Australian Bureau of Statistics, 2010; Ruhm, 1996).

This study examines gender differences in workforce participation patterns over the life course, taking into consideration various childhood and adult life factors. The findings of this study will help to identify different patterns of workforce participation for men and women, with emphasis on various social and economic factors over the life course. The findings will contribute towards developing effective strategies to address barriers to working longer and increasing workforce participation for both men and women in later life.

### 3. Methods

#### 3.1. Data source

The Australian Life History and Health (LHH) Survey was conducted as a sub-study of the Sax Institute’s 45 and Up Study, which recruited residents of New South Wales (NSW, Australia) aged 45 years and older by sampling from Medicare, Australia’s National Public Health Insurance database (45 and Up Study Collaborators, 2007; Kendig et al., 2014; The 45 and Up Study, 2012). The details of the 45 and Up Study are given elsewhere (45 and Up Study Collaborators, 2007; Kendig et al., 2014).

#### 3.2. Participants

Participants of Sax Institute’s 45 and Up Study were invited to participate in LHH Survey if they were born between 1947 and 1951, aged 60–64 at the time of pilot study in 2011 (Kendig et al., 2014). These participants born during post-war baby boom in the 1940’s and 50’s are usually referred to as early baby boomers (Buckley et al., 2013). Of the 2800 invited participants, 1261 participants provided consent, completed the survey questionnaire and participated in follow-up telephone interviews with the use of self-administered life history calendars (Kendig et al., 2014). Those who agreed to participate were more educated, many had trade qualifications and were more likely to be in full time or part time work, as compared to those who did not participated in LHH survey (Kendig et al., 2014). This data provided detailed retrospective information where individuals reported on their health status and living conditions in childhood, as well as their experiences in health and education and specific information about their employment across their adult life (Kendig et al., 2014).

#### 3.3. Measure of workforce participation patterns

#### 3.3.1. Work status

The LHH survey used telephone interviews to obtain details on participants’ work and employment history. For each job, the commencement and finish year was provided, as well as relevant attributes of the position (e.g. whether it was shift work, physically demanding work, dangerous or had an injury risk, full-time or part-time). Each job was also matched to a three digit code from
Australian and New Zealand Standard Classification of Occupations (ANZSCO). Based on the retrospective data, it was possible to construct longitudinal data with observations of workforce participation at five-year intervals over the life course (e.g. at age 20, age 25, up to age 65). At each time point, work status (‘full time’, ‘part time’ or ‘not in paid work’) was determined. If participants had more than one job, it was assumed that they were working equivalent to full time workers. These indicator variables for work status from age 20 to 65 at five yearly intervals were used to determine the patterns of workforce participation (latent variable).

3.4. Covariates

3.4.1. Number of books when aged 10 years

Participants were asked about the number of books in their home when they were 10 years old. The response categories were none/few, enough to fill one bookshelf, enough to fill one bookcase, enough to fill two bookcases, and enough to fill three or more bookcases. The original response options were collapsed into a binary variable for analysis purposes (‘having books’ and ‘not having any books’).

3.4.2. Father’s occupation

Participants provided their father’s occupation which made the most significant financial contribution, which were categorised according to ANZSCO codes. The eight occupation categories identified (managers, professionals, technicians, personal services, clerical/admin, machinery and labourers) were then dummy coded to three main variables representing the father’s occupation: (i) managerial/admin jobs — ‘office jobs’; (ii) ‘technical and personal services job’; and (iii) ‘physical labour jobs’.

3.4.3. Education (post-school qualification)

The question about participants’ post-school qualifications was included in the analysis. They responded to the question as ‘yes’ if they had any post-school education.

3.4.4. Marital status

Participants indicated their marital status according to the response categories: single, married, de facto/partner, divorced/separated, and widowed. Participants responding yes to being single, divorced/separated or widowed were recoded as ‘not partnered’ and participants who were married or lived in a de facto/partnered relationship were labelled as ‘partnered’.

3.4.5. Caring responsibilities (informal care)

Participants responded ‘yes’ if they provided long term care to a disabled/sick friend or family. This dichotomous variable was included as informal care.

4. Analysis — latent class analysis (LCA)

LCA is finite mixture model and is used for the identification of subgroups of population, based on dichotomous responses to multiple observed variable (Lanza & Collins, 2010; Nylund, Asparouhov, & Muthén, 2007). This analytic technique was used to identify and explore workforce participation patterns and to examine differences between men and women. The latent class theory posits that underlying latent variable is not observed, but derived from a set of categorical, observed indicator variables (Lanza & Collins, 2010). In this study, the latent variable (workforce participation) was measured by observed variables ‘work status’ over the life course at five year intervals i.e. work status at age 20 up to work status at age 65. This approach was the basis of our ‘person oriented’ approach for conducting LCA (Lanza & Collins, 2010) by grouping participants into latent classes who had common individual work status (full time work, part time work and not in paid work) throughout their life course. More details of LCA and its extensions are detailed elsewhere (Lanza & Collins, 2010; Lanza, Collins, Lemmon, & S查ffer, 2007; Lanza et al., 2010; Nylund et al., 2007).

4.1. Baseline LCA model and assessment of model fit

For both women and men, separate LCA models were run, specifying two to six classes with three categories of work status over life course (full time paid work, part time paid work and not in paid work). Covariates were not included in baseline model. These models were compared in order to select a model with the best possible fit and parsimony. Using the principle of parsimony and provided information criteria (Akaike’s Information Criterion (AIC), Bayesian Information Criterion (BIC) and Entropy) an optimal baseline model with low AIC, BIC and higher Entropy was selected (Lanza & Collins, 2010). The main parameter estimates in LCA are latent class membership and item response probabilities which provided the basis for the interpretation and distinct labelling of each latent class (Lanza & Collins, 2010; Nylund et al., 2007).

4.2. LCA with covariates — two step approach

In the next stage of analysis, covariates were incorporated in the latent class model to identify characteristics that predicted the latent class membership in the various workforce participation classes. The association of covariates with workforce participation in predicting membership in various classes was done in the following two steps following the methods of Lanza and Collins (2010) and Dayton and Macready (2002):
4.2.1. LCA model with single covariate

All of the covariates (books, father’s occupation, education, marital status and caring responsibilities) were initially included separately in the latent class model. This allowed identifying the extent to which each covariate predicted the membership in workforce participation classes.

4.2.2. LCA model with entire set of covariates

Lastly, the entire set of covariates (books, father’s occupation, education, marital status and caring responsibilities) were introduced in the latent class model to estimate the unique contribution of each covariate in predicting the class membership in workforce participation (latent variable) in the overall model. The model with individual covariates and entire set of covariates were statistically compared to baseline model (without any covariates) by means of likelihood ratio \( \chi^2 \) test and the level of significance was set at \( p < .05 \) (Lanza & Collins, 2010). Item response probabilities, regression coefficients (\( b_i \)'s) and odds ratios (OR) were estimated and compared. Analyses were carried out separately for men and women.

5. Results

Of the 1261 participants, there were 577 women and 684 men. The results for baseline latent class model for both women and men are presented concurrently for ease of interpretation of differences in patterns of workforce participation (Hypothesis 1). However further analysis results (Hypotheses 2a and b-6a and b) are presented separately for women and men.

5.1. Latent class analysis — model selection

For both women and men, a four class latent model with optimal balance of fit and parsimony was finally selected after consideration of results of model fit statistics from five possible models (see Table 1). Models with more than four classes lacked sufficient reliable estimation based on AIC and BIC; while the four class model had the higher Entropy in each case.

5.1.1. Item response probabilities for selected model — women

Fig. 1 presents the item response probabilities of responding ‘Yes’ to either full time paid work or part time paid work or being not in paid work for women. These four classes for workforce participation over the life course of women were labelled as ‘mostly full time work’, ‘decreasing full time work after 55 years’, ‘increasing part time work’ and ‘mostly not in paid work’. These classes as seen in Fig. 1 were distinct, non-trivial and well distinguishable from each other.

5.1.2. Item response probabilities for selected model — men

Among men, four latent classes were identified on the basis of item response probabilities for endorsing either ‘full time’, ‘part time’ or ‘not in paid work’ for their work status at five yearly age intervals (age 20 to age 65). Fig. 2 shows item response probabilities and the four latent classes for men which were labelled as ‘mostly full time work’, ‘decreasing full time work after 40 years’, ‘early and late full time work’ and ‘not in paid work after 55 years’.

As seen in Figs. 1 and 2, there were distinct differences between workforce participation patterns of women and men; with majority (62%) of men being ‘mostly in full time work’ compared to only 35% of women in classed in same category. Moreover, majority of men were classed as ‘decreasing full time work’ or ‘mostly not in paid work’ after 40–50 years, while women showed increased participation in part time work and 17% were also classed as ‘mostly not in paid work’. These results support our Hypothesis 1—workforce participation patterns are different for men and women.

To further describe how class membership might vary according to participant’s own occupation, each of the latent class was also cross tabulated against participant’s own most recent occupation (Table 2). Women who were ‘mostly in full time work’ were more likely to be managers and professionals, whereas women in ‘increasing part time work’ were more likely to be in clerical/admin jobs or personal services. Men who were ‘mostly in full time work’ were more likely to be managers or professionals, as were those classed as ‘early and late full time work’. Men with ‘decreasing full time work after 40 years’ had more people in trade/technicians as compared to other groups, while ‘not in paid work after 55 years’ included the highest proportion of men whose job was clerical and trade/technicians.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Comparison of information criterion values for LCA models.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model fit statistics</td>
<td>nclasses = 2</td>
</tr>
<tr>
<td><strong>Women (N = 577)</strong></td>
<td></td>
</tr>
<tr>
<td>AIC</td>
<td>3278.9</td>
</tr>
<tr>
<td>BIC</td>
<td>3540.6</td>
</tr>
<tr>
<td>Entropy</td>
<td>0.87</td>
</tr>
<tr>
<td><strong>Men (N = 684)</strong></td>
<td></td>
</tr>
<tr>
<td>AIC</td>
<td>1305.1</td>
</tr>
<tr>
<td>BIC</td>
<td>1480.7</td>
</tr>
<tr>
<td>Entropy</td>
<td>0.97</td>
</tr>
</tbody>
</table>
Fig. 1. Patterns of workforce participation over the life course for 577 middle-aged women, using four latent classes.

5.1.3. LCA with covariates in women—models with single covariates

To test Hypotheses 2-6, individual characteristics (i.e., books, father’s occupation, post-school qualification, marital status and caring responsibilities) were included as independent predictors of patterns of workforce participation for men and women separately. All covariates were significantly associated with patterns of workforce participation for women (p ≤ .05, Table 3), with the exception of father’s occupation and informal caring. Relative to women who were categorised as ‘mostly full time work’, women who had books at home during childhood had 50% decreased odds of being classed as ‘mostly not in paid work’ (OR = 0.50) and more than four times increased odds of classed as ‘increasing part time work’ (OR = 4.16, overall p = .0003). Compared to women classed as ‘mostly full time work’, women with post-school qualifications had significantly decreased odds of being ‘mostly not in paid work’ (OR = 0.44). However, no significant associations were observed between post-school qualification and being in
Fig. 2. Patterns of workforce participation over the life course for 684 middle-aged men, using four latent classes.

'increasing part time work' and 'decreasing full time work after 55 years'. Being in a partnered relationship significantly increased the odds of being classed as 'decreasing full time work after 55 years' (OR = 1.76) and being classed as 'increasing part time work' (OR = 1.10).

Among women, there is evidence to support Hypotheses 2, 4 and 5a (i.e. greater workforce participation is associated with having books during childhood, having post-school qualification and being partnered) for selected latent classes.

5.1.4. LCA with covariates in women—overall model

Results from the overall model where all covariates were included simultaneously in the LCA model are shown in Table 4. Books, post-school qualification and marital status were found to be significant predictors of patterns of workforce participation, when each
Table 2  
Participant’s occupation for baseline latent class model (nlatent = 4) for women and men.

<table>
<thead>
<tr>
<th>Women N = 577</th>
<th>Workforce participation patterns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mostly FT* work (N (%)</td>
<td>Decreasing FT* work after 55 years (N (%))</td>
</tr>
<tr>
<td>Managers</td>
<td>60 (28.4)</td>
</tr>
<tr>
<td>Professionals</td>
<td>65 (30.8)</td>
</tr>
<tr>
<td>Clerical/admin</td>
<td>64 (30.3)</td>
</tr>
<tr>
<td>Trade/technicians</td>
<td>1 (0.5)</td>
</tr>
<tr>
<td>Community/personal services</td>
<td>12 (5.7)</td>
</tr>
<tr>
<td>Sales</td>
<td>5 (2.4)</td>
</tr>
<tr>
<td>Machinery driver/operator</td>
<td>1 (0.5)</td>
</tr>
<tr>
<td>Labourers</td>
<td>3 (1.4)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Men N = 684</th>
<th>Workforce participation patterns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mostly FT* work (N (%))</td>
<td>Decreasing FT* work after 40 year</td>
</tr>
<tr>
<td>Managers</td>
<td>184 (43.0)</td>
</tr>
<tr>
<td>Professionals</td>
<td>97 (22.7)</td>
</tr>
<tr>
<td>Clerical/admin</td>
<td>24 (5.6)</td>
</tr>
<tr>
<td>Trade/technicians</td>
<td>60 (14.0)</td>
</tr>
<tr>
<td>Community/personal services</td>
<td>13 (3.0)</td>
</tr>
<tr>
<td>Sales</td>
<td>17 (4.0)</td>
</tr>
<tr>
<td>Machinery driver/operator</td>
<td>24 (5.6)</td>
</tr>
<tr>
<td>Labourers</td>
<td>9 (2.1)</td>
</tr>
</tbody>
</table>

Where % = row percentages; *FT = full time; **FT = part time; ***NPW = not in paid work.

covariate was controlling for others (p = .0006, .0555 and .0245 respectively). The association between patterns of workforce participation and women having books when aged ten years remained unchanged, even after taking into account other factors, which supports Hypothesis 2. Compared to women categorised as ‘mostly in full time work’, those who had some post-school qualification were 61% less likely to be classified as ‘mostly not in paid work’; whereas other patterns were not found to be significantly associated with post-school qualification. This indicates that association between post-school higher education and patterns of workforce participation was impacted by other factors and supports Hypothesis 4. Partnered women were significantly less likely to be categorised as ‘decreasing full time work after 55 years’ (OR = .56), although other associations were not statistically significant. This result rejects Hypothesis 5a as stated, and is partly in favour of the alternate hypothesis that partnered women have greater workforce participation particularly at older ages.

Hypothesis 3 and Hypothesis 6 were not supported by our data. Father’s occupation and informal caring had no statistically significant association with workforce participation patterns of middle aged women, even when other factors were considered.

Table 3  
Odds ratios for individual effects of predictors on workforce participation patterns, among 577 middle aged women.

<table>
<thead>
<tr>
<th>Covariates</th>
<th>Workforce participation patterns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Books at age 10 (yes)</td>
<td>Mostly FT* work</td>
</tr>
<tr>
<td>1</td>
<td>1.12 (0.60, 2.08)</td>
</tr>
<tr>
<td>Father’s occupation</td>
<td>Early and late FT* work</td>
</tr>
<tr>
<td>Office/admin (reference)</td>
<td>1</td>
</tr>
<tr>
<td>Technical/personnel</td>
<td>1</td>
</tr>
<tr>
<td>Physical labour</td>
<td>1</td>
</tr>
<tr>
<td>Post-school qualification (yes)</td>
<td>1</td>
</tr>
<tr>
<td>Marital status (partnered)</td>
<td>1</td>
</tr>
<tr>
<td>Informal caring (yes)</td>
<td>1</td>
</tr>
</tbody>
</table>

Where *FT = full time; **FT = part time; ***NPW = not in paid work.

Statistically significant p < .05.
Table 4
Parameter estimates from the full prediction model for patterns of workforce participation for 577 middle aged women.

<table>
<thead>
<tr>
<th>Covariates</th>
<th>Workforce participation patterns</th>
<th>Mostly FT* work (ref)</th>
<th>Decreasing FT* work after 55 years</th>
<th>Increasing FT* work</th>
<th>Mostly NPW***</th>
<th>Likelihood test p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Books at age 10 (yes)</td>
<td></td>
<td>0.86 (0.89, 1.26)</td>
<td>1.33 (1.26, 8.79)</td>
<td>0.49 (0.26, 0.95)</td>
<td>.0006</td>
<td></td>
</tr>
<tr>
<td>Father’s occupation</td>
<td></td>
<td>0.78 (0.41, 1.45)</td>
<td>0.77 (0.46, 1.27)</td>
<td>0.91 (0.49, 1.67)</td>
<td>.78</td>
<td></td>
</tr>
<tr>
<td>Physical labour</td>
<td></td>
<td>0.73 (0.42, 1.26)</td>
<td>1.06 (0.55, 2.03)</td>
<td>0.68 (0.34, 1.36)</td>
<td>.48</td>
<td></td>
</tr>
<tr>
<td>Pre-school qualification (yes)</td>
<td></td>
<td>0.80 (0.41, 1.53)</td>
<td>0.57 (0.27, 1.20)</td>
<td>0.39 (0.20, 0.79)</td>
<td>.0555</td>
<td></td>
</tr>
<tr>
<td>Marital status (married)</td>
<td></td>
<td>0.56 (0.40, 0.99)</td>
<td>1.26 (0.65, 2.44)</td>
<td>0.79 (0.45, 1.46)</td>
<td>.0245</td>
<td></td>
</tr>
<tr>
<td>Informal caring (yes)</td>
<td></td>
<td>0.66 (0.39, 1.09)</td>
<td>0.72 (0.38, 1.38)</td>
<td>0.88 (0.47, 1.60)</td>
<td>.47</td>
<td></td>
</tr>
</tbody>
</table>

Where *FT = full time; **FT = part time; ***NPW = not in paid work.

1Statistically significant p < .05.

5.1.5. LCA with covariates in men—models with single covariates

The results of the single covariate models for men are shown in Table 5. None of the covariates were found to be significantly associated with patterns of workforce participation, with the exception of marital status (being in partnered relationship p = .0032) and informal caring (p = .0025). For men in partnered relationship, there were 66% less odds of being classified as 'decreasing full time work' (OR = 0.34) compared to 'mostly full-time work'. Hypothesis 5b was therefore partly supported by our data. Men who responded as having informal caring responsibilities were five times more likely to be in 'early and late full time work' class and also had increased likelihood of being classified as 'mostly not in paid work after 55 years' (OR = 4.97 and 2.27 respectively); p = .0025. This finding supports Hypothesis 6 for men.

Even though Hypotheses 2, 3 and 4 were rejected due to statistically non-significant results (p > .05), all the covariates were examined in the overall model.

5.1.6. LCA with covariates in men—overall model

The association of patterns of workforce participation with marital status and informal caring remained statistically significant after adjustment for other covariates (p = .0002 and .0008 respectively, Table 6). This result supports Hypotheses 5b and 6. Other covariates had no significant association with workforce participation patterns in the overall model, thus rejecting Hypotheses 2, 3 and 4.

Another important finding was the impact of covariates on the class membership of workforce participation (results not shown). As compared to women, the addition of covariates in overall model for men significantly impacted the membership in workforce participation patterns.

6. Discussion and conclusion

This study aimed to identify workforce participation patterns for men and women in the Australian baby boom cohort across the adult life course, and to explore associations between these patterns and various childhood and adult life factors. The results provide evidence to support our hypotheses regarding the presence of different underlying workforce participation patterns throughout life course for women and men. Compared to men, women were less likely to be classified as mostly working full time over their adult life, and with a higher proportion participating in part time work. Women also had more even distribution across different workforce participation patterns. For men, the dominant workforce participation pattern was ‘mostly in full time work’. These results corroborate

Table 5
Odds ratios for individual effects of predictors on workforce participation patterns, among 684 middle aged men.

<table>
<thead>
<tr>
<th>Covariates</th>
<th>Workforce participation patterns</th>
<th>Mostly FT* work (ref)</th>
<th>Decreasing FT* work</th>
<th>Early and late FT* work</th>
<th>Mostly NPW***</th>
<th>Likelihood test p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Books at age 10 (yes)</td>
<td></td>
<td>0.70 (0.38, 1.27)</td>
<td>0.42 (0.15, 1.21)</td>
<td>0.97 (0.61, 1.55)</td>
<td>.37</td>
<td></td>
</tr>
<tr>
<td>Father’s occupation</td>
<td></td>
<td>0.86 (0.45, 1.65)</td>
<td>0.82 (0.32, 3.17)</td>
<td>1.02 (1.02, 2.27)</td>
<td>.18</td>
<td></td>
</tr>
<tr>
<td>Physical labour</td>
<td></td>
<td>1.62 (1.24, 2.81)</td>
<td>1.17 (0.73, 1.16)</td>
<td>1.03 (0.47, 1.16)</td>
<td>.13</td>
<td></td>
</tr>
<tr>
<td>Pre-school qualification (yes)</td>
<td></td>
<td>0.44 (0.14, 1.36)</td>
<td>0.13 (0.57, 2.23)</td>
<td>1.29 (0.70, 2.37)</td>
<td>.18</td>
<td></td>
</tr>
<tr>
<td>Marital status (married)</td>
<td></td>
<td>0.34 (0.19, 0.60)</td>
<td>2.31 (0.30, 5.98)</td>
<td>1.38 (0.77, 2.71)</td>
<td>.0003</td>
<td></td>
</tr>
<tr>
<td>Informal caring (yes)</td>
<td></td>
<td>1.12 (0.41, 3.07)</td>
<td>4.97 (1.70, 8.98)</td>
<td>2.27 (1.24, 4.15)</td>
<td>.0025</td>
<td></td>
</tr>
</tbody>
</table>

Where *FT = full time; **NPW = not in paid work.

1Statistically significant p < .05.
Table 6
Parameter estimates from the full prediction model for patterns of workforce participation for 684 middle aged men.

<table>
<thead>
<tr>
<th>Covariates</th>
<th>Workforce participation patterns</th>
<th>Mostly FT work (ref)</th>
<th>Decreasing FT* work</th>
<th>Early and late FT* work</th>
<th>Mostly NW after 55 years</th>
<th>Likelihood test p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age at 10 (yes)</td>
<td></td>
<td>0.70 (0.38, 1.27)</td>
<td>0.42 (0.15, 1.21)</td>
<td>0.97 (0.61, 1.55)</td>
<td></td>
<td>0.27</td>
</tr>
<tr>
<td>Father's occupation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office/admin (reference)</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technicians/personnel</td>
<td></td>
<td>0.86 (0.45, 1.65)</td>
<td>0.82 (0.21, 3.17)</td>
<td>1.52 (0.62, 3.27)</td>
<td></td>
<td>0.18</td>
</tr>
<tr>
<td>Physical labour</td>
<td></td>
<td>1.62 (0.94, 2.81)</td>
<td>1.17 (0.37, 3.66)</td>
<td>0.73 (0.47, 1.16)</td>
<td></td>
<td>0.13</td>
</tr>
<tr>
<td>Post-school qualification (yes)</td>
<td></td>
<td>0.44 (0.14, 1.36)</td>
<td>1.13 (0.57, 2.33)</td>
<td>1.29 (0.70, 2.37)</td>
<td></td>
<td>0.18</td>
</tr>
<tr>
<td>Marital status (partnered)</td>
<td></td>
<td>0.34 (0.19, 0.60)</td>
<td>2.31 (0.30, 6.98)</td>
<td>1.38 (0.77, 2.71)</td>
<td></td>
<td>0.0032</td>
</tr>
<tr>
<td>Informal caring (yes)</td>
<td></td>
<td>1.12 (0.41, 3.07)</td>
<td>4.57 (1.70, 9.98)</td>
<td>2.27 (1.24, 4.15)</td>
<td></td>
<td>0.0025</td>
</tr>
</tbody>
</table>

Where *FT = full time; "FT = part time; "NW = not in paid work.

1 Statistically significant p < .05.

Findings from previous research (Dahl et al., 2003; Gerber et al., 2009; Huang et al., 2007; Rubin, 1996) who discuss gender differences in retirement behaviour, but add further insight into different patterns of workforce participation for women and men throughout their life course. The fact that many women and men will have low or declining rates of workforce participation from relatively early ages is also of great importance to prevalent debates about working longer. Pertinent discussions should concern not only how to encourage people to work past "retirement age" but to enable greater workforce participation up to retirement age.

The patterns of workforce participation revealed by this study highlight 'gender roles' in relation to work and their evolution over the life course, and also reflect the changing dynamics and development of work across the life course of this cohort. When this cohort entered the workforce, almost 50 years ago, the Australian work environment was very different and largely characterized by expected roles of men and women in society. Men were the main breadwinners and women were mostly expected to be homemakers and look after families. This trend began to change in the 1960s when the "women's movement" asserted the rights of women to equal work and equal pay. Over the last 50 years, women's workforce participation has considerably increased (from 34% in 1961 to 59% in 2011) (Australian Bureau of Statistics, 2011), along with increasing participation of women in higher education and in other aspects of public life. Also, the substantial growth of part time work has enabled women to combine paid work with their family and social commitments (Australian Bureau of Statistics, 2011; Birch, 2005; Evans & Kelley, 2002). Moreover, women's wages have increased relative to men, indicating that the value of women's work is increasing (Birch, 2005). The patterns of women's workforce participation in this study illustrates a mix between women who appear to have adopted a more traditional model involving low levels of work across their lives (not in paid work), and those who defied this model and had consistently high levels of workforce participation often mixing their work with marriage and family responsibilities, and mirroring the dominant workforce patterns observed among men (mostly full time work, decreasing full time work after 55). An alternative pattern also indicates a group of women with increasing participation in part-time work later in life. This fourth model potentially embodies the "new, creative forms of living" identified by Onyx (1998) whereby women wished not equality with male models of the work/non-work dichotomy, but a better balance between work and other life activities.

Increased flexible work practices, should mean that men's workforce participation patterns also become more diverse. However, this diversity was not seen among men in this cohort with most working full-time across the entirety of their working lives, or not in paid work. We found that few men were adopting part-time work, with men being more likely to have a pattern of leaving paid work after age 55. This finding is consistent with the Australian Bureau of Statistics who reports a decline in men's employment by middle age (2011), with the average male retirement age being 58.5 years (Australian Bureau of Statistics, 2013). Research into men's early retirement indicates that for many men this exit from the workforce is not due to their own choice, but necessitated by health concerns or due to redundancy (Alvoinia & Burdorf, 2008).

Our study findings also suggest the influence of early and late factors such as childhood socio-economic factors, education, marital status and informal caring in defining the patterns of workforce participation, but with different effects for women and men. Childhood books were used as a predictor of early life socio-economic opportunities, and were found to be associated with workforce participation patterns for women but not for men. Similar findings have been reported by some other studies that showed positive associations between books as a marker of childhood socio-economic status and workforce participation at older ages (Case et al., 2005; Currie, 2008; Currie et al., 2010; Horese & Kalwij, 2014; Mazzonna & Havari, 2011), and studies showing education to be a strong predictor of workforce participation status in later life (Horese & Kalwij, 2014; Radl, 2013). Contrary to findings by Currie (2008), Luo and Waite (2005) and Mazzonna and Havari (2011), we did not find any significant association between father's occupation and workforce participation patterns among women.

Having post-school higher education was associated with patterns of workforce participation among women. Education has a positive role for retaining employees in paid employment for longer time, with educated women less likely to be out of paid work (Australian Bureau of Statistics, 2010, 2012; Australian Institute of Family Studies, Australian Government, 2008; Horese & Kalwij, 2014; Radl, 2013). Higher education levels may strengthen the attachment of women to the labour market, enable their participation in higher status occupations, and increase their wage earning capacity. All of these factors may increase women's participation in work at later ages, particularly after their children have left home. The lack of a similar association among men, suggests men engage in paid...
work regardless of their level of education. However, education does play an important role in type of occupation (such as managerial or physical labour), and men in physically demanding jobs tend to retire early due to health issues (Modrek & Callen, 2012). We found that partnered women and men were less likely to have decreasing full-time work, as compared to mostly full-time work. The findings of international and Australian studies by Gerber et al. (2009), Huang et al. (2007), Haider and Loughran (2001) and Li et al. (2013) are in agreement with ours; that partnered women were more likely to be in some paid work. However, some Danish, Norwegian and US researchers reported that women with partners were less likely to continue working in later years (Dahl et al., 2003; Larsen & Pedersen, 2013; Ruoh, 1996). Our sample was more highly educated (Kendig et al., 2014), compared to other studies (Larsen & Pedersen, 2013) which might explain the contrasting results to other studies.

Our results did not show any significant association between informal caring responsibilities and workforce participation among women over the life course. This finding is in conflict with some previous studies, for example Berecki-Gizol et al. (2008), Bittman et al. (2004), Dentinger and Clarkberg (2002), Gray et al. (2008) and Spoehr et al. (2009) as in these studies most carers were women and this affected their workforce participation. However other studies suggest that women who undertake caregiving roles are those who are more likely either not to be in paid work, or likely to leave work for other reasons (Lee & Grammner, 2007). In contrast, our study did identify workforce participation patterns of men to be highly associated with informal caring. This finding is in accordance with the results of Nolan (1994) who found that men are more likely than women to be not in paid work due to their caring roles. This finding could be explained by combined impact of socio-economic conditions and caring responsibilities which may directly influence the decision of men to leave workforce early (Dentinger & Clarkberg, 2002) and higher proportion of taking caring roles as they age (Dahlgberg, Jenack & Bamia, 2007). The results may also reflect less availability of options for flexible work options for men who need to take on these responsibilities.

6.1. Theoretical and practical implications

The results add new dimensions to the existing body of literature about gender differences in workforce participation patterns. We identified clear and distinguishable workforce participation patterns over the life course, which differed for women and men. We provide evidence that childhood and adult life circumstances (especially books during childhood, education, marital status and informal caring) are associated with distinct patterns of workforce participation across the life course and these associations differ among women and men. This study emphasized the importance of understanding gender inequalities in workforce participation, along with identifying some key concern areas over the life course which are strongly associated with later life work experiences. Consistent with human capital theory (Ilo & Kendig, 2013) our findings suggest that early investment in women’s intellectual development may make a crucial difference in their life-long motivation and capacity for employment over middle age. Yet these same resources of books in the childhood home did not influence adult workforce participation patterns among men. It may be that, given cultural expectations for men serving as primary earners, their workforce participation patterns over the life course were consistently high irrespective of childhood human capital; the effects of this capital on boys was more likely to be observed in their level of occupational attainment rather than their workforce participation.

Policies shape the longer term experiences and attitudes of people, and currently little attention is being paid to the longer term importance of early life intellectual opportunities on later life workforce participation. Similarly, the effects of intense disadvantage earlier in mid-life – such as long term unemployment, marital dissolution, and mental and physical health problems – need to be further explored in terms of their consequences for health, employment, and housing security later in life (Quine, Kendig, Russell, & Touchard, 2004). A range of practical approaches are needed to address issues at different points in the life course; while also looking at factors which might affect men and women differently. Socially and economically disadvantaged people, who have problems in workforce engagement, need to be given better opportunities and training options so they are encouraged to work in paid employment. If governments aim to engage mature and older workers in workforce for longer, more research and some practical actions are needed to be taken to ensure that they are socially and physically prepared to do so.

6.2. Strengths and potential limitations

A strong feature of this study was the use of Australian Life History and Health Survey, which provided rich data about workforce participation, childhood and adult influences affecting individuals over the life course. These retrospective data permitted the identification of distinct patterns of workforce participation over the life course between men and women. The participants were residents of New South Wales and may not be representative of all the Australians. Life history interviews may be subject to recall bias and other potential problems relating to the ability of respondents in remembering correctly details about events that took place several years in the past. However, the use of the life history calendar which worked as a memory aid minimised the problem of recall bias to a great extent (Kendig et al., 2014).

With regard to generalizability, these data show patterns of workforce participation for early baby boomers in Australia that could be more different for earlier or later cohorts as well as baby boomers in other countries (Kendig et al., 2013). Employment and other outcomes also will be affected by prevailing policies and opportunities relating to work and other social factors.

6.3. Conclusion

Our results show different patterns of workforce participation for men and women, with men exhibiting more of a work/non-work dichotomy and women exhibiting a more diverse range of workforce participation patterns including greater engagement in part time
work. Higher education was associated with greater workforce participation among women, and caring was associated with less workforce participation (after age 55) among men. Engagement in work at older ages is affected not only by late life circumstances, but also by early socio-economic factors and by events that prevail across the life course. Attempts to enable people to work for longer must consider gender roles, the influence of early life factors, and the impact of caring and other mid-life events which may limit men (and women’s) options to remain in paid work. This knowledge about workforce participation patterns over the life course needs to be translated and further researched.

Ethics approvals

The conduct of the 45 and Up Study and Australian Life History (LHLH) study was approved by the University of New South Wales and University of Newcastle Human Research Ethics Committee (HREC), Protocol ID: H-2010-1208.

Disclosure statement

No competing financial, personal and other interests exist.

Submission declaration

This paper has arisen from an original and empirical research project, has not been published elsewhere and is not currently under consideration for publication elsewhere.

Acknowledgments

This research was completed using data collected through the 45 and Up Study (www.saxinstitute.org.au). The 45 and Up Study is managed by the Sax Institute in collaboration with major partner Cancer Council NSW; and partners: the National Heart Foundation of Australia (NSW Division); NSW Ministry of Health; beyondblue; Ageing, Disability and Home Care, Department of Family and Community Services; and the Australian Red Cross Blood Service. We thank the many thousands of people participating in the 45 and Up Study.

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5.3 CONCLUSION
This study provides important information about the workforce participation patterns which were distinctly different for mature age men and women over their life course. Women showed much more diverse workforce patterns than men, while men had work / no work dichotomy. Early and adult life socio-economic factors were also given priority in this study to investigate their impact on the employment patterns in later life. Understanding these socio-economic influences and the impact of the life course can guide policy perspectives, which will enable to translate this research. This study lends supporting evidence which implies that gender roles play a very important role in defining employment trajectories, and this should be taken into account when restructuring social and policy issues to produce more equitable approaches.

5.4 NEXT CHAPTER - EXPLORING WORKFORCE PARTICIPATION PATTERNS AND CHRONIC DISEASES AMONG MID-AGE AUSTRALIAN MEN AND WOMEN OVER THE LIFE COURSE
The next study is a continuation of this research, with an objective to further investigate these patterns of workforce participation over the life course of men and women, by exploring their associations with chronic diseases (diabetes, asthma, depression and arthritis) and early and adult life socioeconomic factors.
CHAPTER 6:
WORKFORCE PARTICIPATION
PATTERNS AND CHRONIC
DISEASES AMONG MID-AGE
AUSTRALIANS OVER THE LIFE
COURSE

Peers Reviewed Published Paper

Majeed, Tazeen., Forder, Peta., Mishra, Gita., Kendig, Hal., & Byles, Julie (2016). “Exploring Workforce Participation Patterns And Chronic Diseases Among Mid-Age Australian Men and Women Over the Life Course”. Accepted: Journal of Aging and Health
This study is a continuation of the Study 2 (Chapter 5) and provides an opportunity to further investigate the workforce participation patterns of men and women identified in Study 2. Within the context of this thesis, various associations of workforce participation patterns of women and men with chronic diseases (diabetes, asthma, depression and arthritis) and early and adult life socio-economic factors over the life course were examined. This study was undertaken using the data from the Australian Life History and Health (LHH) Survey (a sub-study of NSW 45 ad Up Study), which is a rich source of longitudinally collected data from 60 – 64 year old men and women.

6.1 INTRODUCTION

In this study, the objective was to extend the knowledge about workforce participation patterns identified in previous chapter (Study 2 – Chapter 5). Using the data from the ‘LHH study’, Latent Class Analysis (LCA) identified different patterns of workforce participation for men and women. Among men, the workforce participation patterns were identified as: ‘mostly full time work (61.9%)’, ‘decreasing full time work after 40 years (10.9%)’, ‘early and late full time work (3.2%)’ and ‘not in paid work after 55 years (24.0%)’. Among women, the workforce participation patterns were: ‘mostly full time work (35.6%)’, ‘decreasing full time work after 55 years (28.7%)’, ‘increasing part time work (18.4%) and ‘mostly not in paid work (17.3%).

In the context of this thesis, the aims of this study were:

i) To examine the associations between chronic diseases (diabetes, asthma, depression and arthritis) and the workforce participation patterns over the life course, while accounting for presence of various early and adult life factors.

ii) To ascertain if these associations were significantly different for men and women.

6.2 PEER REVIEWED PAPER

This study has been re-submitted (after some minor revisions, as suggested by reviewers) to the ‘Journal of Aging and Health’, which is a peer reviewed journal. This paper is currently awaiting final acceptance. Below is the final submitted version of this paper, while some figures which were not included in the paper are presented in Appendix 4.
Exploring Workforce Participation Patterns and Chronic Diseases among Mid-age Australian Men and Women over the Life-course

Majeed, Tazeen, Forder, Peta., Mishra, Gita., Kendig, Hal., and Byles, Julie

Abstract

Objectives: This study identified associations between chronic diseases (diabetes, asthma, depression and arthritis) and workforce participation patterns with a gendered perspective.

Methods: We used data from 1,261 mid-age participants of the Australian Life History and Health Survey (LHH), aged 60 – 64 year in 2011. Latent class analysis identified dominant workforce patterns and associations between chronic diseases and these patterns were explored by multinomial regression models.

Results: Diabetes, asthma, depression and arthritis were less prevalent in men and women in class ‘mostly full time work’, compared to other workforce patterns. The odds of ‘mostly full time work’ were lower for men reporting depression or arthritis, while among women, depression was associated with ‘increasing part time work’ after adjusting early and adult life factors.

Discussion: The results strengthen the importance of gender focussed policies aimed to promote and preserve health of young and mid-age workers, and creating supportive environment for those with chronic health issues over the life course.

Key words: Workforce participation; Mid-age Australians; Latent class analysis; Chronic diseases
Introduction

Population ageing and its demographic, social and financial impacts and implications are a major global challenge, with increasing numbers and proportions of people aged 60 years and above in most countries. In response, governments around the world have identified the need to avert potential economic and financial problems by introducing strategies enabling continued workforce participation into older ages (Australian Treasury, 2010; Loretto & White, 2006; Phillipson, 2013). Strategies such as increasing the pension eligibility age (Chomik & Piggott, 2012), more favourable treatment of superannuation taken after the age of 60 years, increased part time work and the availability of various retirement transition strategies are some of the policies encouraging men and women over 60 years of age to continue workforce participation in Australia and other OECD countries (Loretto & White, 2006; McDonald, 2012; Phillipson, 2013; Spoehr, Barnett, & Parnis, 2009). However, a significant proportion of people remain out of paid work or exit from the workforce before the standard retirement age of 60 years (Majeed, Forder, Mishra, Kendig, & Byles, 2015; Spoehr et al., 2009; Stattin, 2005; Temple, Adair, & Hosseini-Chavishi, 2011), with this trend of declining participation expected to continue in future as well (Australian Treasury, 2015). Workforce participation among mature age workers (aged 45+ years) also differs for men and women. For example, in Australia, among those employed, 40% of 60-64 year old men were in full time employment, as compared to 16% of 60-64 year old women. (Australian Bureau of Statistics, 2008)

Various factors related to workforce participation of mature age workers have been discussed in many studies. Specially, much attention has been paid to retirement, unemployment, loss of paid work and re-entry into jobs at older ages. For example, Larsen and Pedersen (Larsen & Pedersen, 2013) examined factors associated with delayed retirement in Denmark, while Jonas (Radl, 2013) concluded that unemployment was the main obstacle in workforce participation in Western Europe (Radl, 2013).

The importance of early and adult life factors (such as number of books during childhood, father’s occupation, post school qualifications, marital status and informal caring responsibilities) on workforce participation has also been researched (Case, Fertig, & Paxson, 2005; Flores & Kalwij, 2014; Luo & Waite, 2005; Majeed, Forder, Mishra, Kendig, et al., 2015; Otero-Rodriguez et al., 2011; World Health Organization, 2002). Studies found that, childhood health and circumstances may
act as a potential mechanism of intergenerational transmission of economic status; whereby an individual born into economically disadvantaged family, experiences poorer childhood health, has poor health in early adulthood, all of which are associated with lower earnings in later adult life (Case et al., 2005; Flores & Kalwij, 2014; Luo & Waite, 2005; Majeed, Forder, Mishra, Kendig, et al., 2015; Menec, Shooehari, Nowicki, & Fournier, 2010; Otero-Rodriguez et al., 2011). Our earlier analysis also strengthened these findings, with early and adult life factors found to be significantly associated with workforce participation patterns over the life course for mid-age Australian men and women (author’s citation removed for blinding purpose).

The relationship between health and workforce participation has also been extensively examined both in Australia (Anthony, 2008; Majeed, Forder, & Byles, 2014; Majeed, Forder, Mishra, & Byles, 2015; McPhedran, 2012; Pit & Byles, 2012; Spoehr et al., 2009; Temple et al., 2011) and in many other countries (Flores & Kalwij, 2014; Larsen & Pedersen, 2013; Salinas & Peek, 2008). The literature on human capital recognizes the health of an individual is an important factor in an individual’s ability to work productively over time (Currie & Madrian, 1999; Grossman, 1972; Loh & Kendig, 2013; Zhang, Zhao, & Harris, 2009). Healthy people are more likely to be in paid work (Buckley, Tucker, et al., 2013; Zhang et al., 2009). As people age, they are more likely to develop chronic health issues which not only increase health expenditures, but also limit their capacity to engage in paid work (Anthony, 2008; Australian Institute of Health and Welfare, 2009; Australian Treasury, 2010; Schofield et al., 2013; Williams, Menyen, & Adair, 2014; Zhang et al., 2009). Various studies have reported chronic diseases as significant factors in workforce participation at older ages. For instance, Temple and colleagues (2011), Harris (2008), Buckley et al. (2013) identified chronic diseases as a major barrier to continued employment for older Australians. Internationally, Salinas and Peek (2008), Larsen and Pedersen (2013) and Munir et al. (2005) also reported that health issues and particularly chronic diseases impact employment after 60 years. Among many chronic diseases, some have been identified as conditions significantly impacting workforce participation at older ages (Australian Institute of Health and Welfare, 2007; Backman, 2004; Barrett, Scott, Wiles, & Symmons, 2000; Buckley, O'Dwyer, et al., 2013; Doshi, Cen, & Polsky, 2008; Eléonore, Herquelot, Alice, Guéguen, Sébastien. Bonenfant, & Rosemary. Dray-Spira, 2011; Lerner &
Henke, 2008; Majeed et al., 2014; Majeed, Forder, Mishra, & Byles, 2015; Munir et al., 2005; Salinas & Peek, 2008; Schofield et al., 2013; Yelin et al., 2006). Pit and Byles (2012), identified diabetes, high blood pressure, depression and arthritis as significantly impacting employment of mature age Australian women. Harris (2008) reported diabetes and cardiovascular disease to have a strong impact on workforce particularly for males, while other studies found depression (Buckley, O'Dwyer, et al., 2013; Doshi et al., 2008; Drentea, 2002; Lerner & Henke, 2008; Wang et al., 2014) and arthritis (Backman, 2004; Barrett et al., 2000; Buckley, O'Dwyer, et al., 2013; James, Miller, Brown, & Weaver, 2005; Schofield et al., 2013) significantly influencing workforce participation.

In this study, we extend our earlier analysis of workforce participation patterns of men and women (Author’s citation removed) to examine the effects of chronic diseases on workforce patterns, considering that the chronic diseases may not only affect work at older ages, but may also influence workforce patterns at earlier ages (Broom et al., 2006). We also expect that these effects may be different for men and women, due to different roles, relationships, attitudes and behaviours. (Health Canada’s gender-based analysis policy, 2000). How men and women respond to their family commitments also affects their workforce participation. (Larsen & Pedersen, 2013; Spoehr et al., 2009) It is therefore important to examine the associations between chronic diseases and workforce separately for men and women.

We chose to investigate four chronic diseases (diabetes, asthma, depression and arthritis), which are common diseases in older people (Australian Institute of Health and Welfare, 2009). These conditions have different age of onset among men and women and also their prevalence varies by gender at different ages (Australian Institute of Health and Welfare, 2009). Asthma is more prevalent in boys than in girls before puberty but has a higher prevalence in women than in men in adulthood (Postma, 2007). Though not found to be directly associated with loss of work, asthma results in work limitations, shortened work life and particularly affecting various occupations at all ages (Eisner, Yelin, Trupin, & Blanc, 2002; Munir et al., 2005; Yelin, Henke, Katz, Eisner, & Blanc, 1999). Prevalence of diabetes increases with age, and is more prevalent among men (World Health Organization, 2006). Diabetes is reported to greatly affect workforce participation, and has significant economic impacts at especially middle-age when its prevalence is at peak (Ervasti et al., 2015). Herquelot
et al. (2011) and Ervasti et al. (2015) reported that diabetes was associated with significantly increased risks of transition from employment to disability, retirement, and mortality compared with participants without diabetes. Depression affects people of all ages and is more common among women, beginning after puberty and persisting through adult life (Piccinelli & Wilkinson, 2000). Higher risk of unemployment, absences, and at-work performance deficits has been reported for those with depression, regardless of their age (Doshi et al., 2008; Drentea, 2002; Lerner & Henke, 2008; Munir et al., 2005; Pit & Byles, 2012; Wang et al., 2014). Arthritis (osteoarthritis) is a debilitating disorder, with increasing prevalence with age (and predominantly among women). Also, there is heterogeneity in severity of arthritis among men and women according to site of disease (e.g. women having severe knee arthritis) (Srikanth et al., 2005). Arthritis greatly impacts the ability to perform work in middle aged men and women due to pain and disability (Australian Institute of Health and Welfare, 2007; Backman, 2004; Barrett et al., 2000; James et al., 2005; Schofield et al., 2013). The clinical and epidemiological evidence on the variability of these diseases by age and gender, indicates the possibility of potential differential impacts on functional capacities and eventual workforce participation by men and women.

This study aims to focus on i) identifying associations between workforce participation patterns and chronic diseases (diabetes, asthma, depression and arthritis), while accounting for the presence of some early and adult life course factors and ii) to establish that these associations are significantly different among men and women.

Data Source and Methods

The Australian Life History and Health (LHH) Survey was conducted as a sub-study of the Sax Institute’s 45 and Up Study, with the aim to assess the impact of early life social and behavioral factors on health in later life. The 45 and Up study recruited residents of New South Wales (NSW, Australia) aged 45 years and older, by sampling from Medicare, Australia's National Public Health Insurance database (45 and Up Study Collaborators, 2007; Kendig et al., 2014). A random sample of 2800 participants of Sax Institute’s 45 and Up Study were invited to participate in LHH Survey if they were aged 60-64 in 2011 (born 1947-1951) (Kendig et al., 2014). A total of 1261 participants provided consent (of the 2800 invited), completed a postal survey questionnaire, and
participated in follow-up telephone interviews (Kendig et al., 2014).

**Measures**

The questionnaires and interviews collected detailed life history data about health status and living conditions in childhood, health, education and specific information about employment across their adult life (Kendig et al., 2014). A life history calendar obtained participants' work history. For each job, the year of commencing and finishing, and all the relevant attributes such as full time or paid work, shift work, physically demanding work, and injury risks were also provided. Each job was also classified using Australian and New Zealand Standard Classification of Occupations (ANZSCO) code (Kendig et al., 2014). The original ANZSCO job categories (managers, professionals, technicians, personal services, clerical/admin, machinery and labourers) were collapsed to create a three category variable representing each individual's job type as ‘non-physical’, ‘technical’ and ‘physical’.

Participants were asked about childhood diseases (e.g. type 1 diabetes, childhood asthma, juvenile arthritis etc.), and adult onset conditions including type 2 diabetes, asthma, depression and arthritis. If they had any disease, they reported age at first onset. As diabetes, asthma, depression and arthritis were conditions of interest in this study, age of onset at five yearly age intervals from age 15 to 65 was identified. Conditions were treated as enduring.

Number of books during childhood and father’s occupation have been reported as important indicators of childhood socioeconomic status and educational background of family (Flores & Kalwij, 2014; Luo & Waite, 2005), and were used in this study to assess early life socioeconomic factors. Studies show that children who had books and whose fathers had higher level of occupation had better education, with chances to attain better jobs themselves (Case et al., 2005; Luo & Waite, 2005; Mazzonna & Havari, 2011). A binary variable for number of books was created. Those responding as enough to fill one book shelf, enough to fill one book case, enough to fill two book cases, and enough to fill three or more book cases were classified as ‘having books’ and those with none/few books were classified as ‘not having any books’.

Father’s most significant occupation (in terms of financial contribution) was provided and categorized as ‘office jobs’, ‘technical and personal services job’ and ‘physical labour jobs’.
Education (highest post-school qualification), marital status and caring responsibilities were included as adult life factors. Participants responded ‘yes’ if they had any post-school education, otherwise they were classified as ‘no’. Marital status was indicated as single, married, defacto/partner, divorced/separated, widowed. Participants who were married or lived in a defacto/partnered relationship were classified as ‘partnered’, otherwise they were classified as ‘not partnered’. Informal caring (for disabled/sick family/friends) was included as a dichotomous variable (yes/no).

**Analysis**

Longitudinal data on work status over the life course was constructed by classifying each participant’s work status at five year intervals (e.g. 20 years, 25 years, up to age at survey (65 years)). Work status was classified as ‘full time’, ‘part time’ or ‘not in paid work’ as reported for each time point. It was assumed that they were working full time if they had more than one job. The patterns of workforce participation (latent variable) was derived from this indicator variable (work status from age 20 to 65).

Latent class analysis (LCA) was the method of choice to identify and explore workforce participation patterns. LCA is a finite mixture model, used in identification of discrete subgroups, based on dichotomous responses to multiple observations (‘work status’ in this study) (S. T. Lanza & Collins, 2010; S. T. Lanza, Collins, L. M., Lemmon, D. R., & Schafer, J. L., 2007; Nylund, Asparouhov, & Muthén, 2007). Using the ‘person oriented’ approach (S. T. Lanza & Collins, 2010), the latent variable (workforce participation) was measured by grouping participants with common individual work status (full time work, part time work and not in paid work) across five yearly data points. For men and women separate LCA models (from two to six latent classes) were run. Using the principle of parsimony and Information Criteria (models with lower Akaike’s and Bayesian Information Criteria and higher Entropy were selected) (S. T. Lanza & Collins, 2010). Latent class membership and item response probabilities are main parameter estimates in LCA which were used for interpretation and distinct labelling of latent classes (S. T. Lanza & Collins, 2010). Latent class membership based on their posterior probability was retained, using first maximum probability rule (Bray, Lanza, & Tan, 2012) and a categorical variable ‘Workforce participation patterns’ was created (separately for men and women) for subsequent analysis. These latent classes were then treated as known variables, and entered into multinomial
logistic regression models. Unadjusted associations between workforce participation pattern and each chronic disease (diabetes, asthma, depression and arthritis) were initially assessed, and then other factors were added to the models in a stepwise three model approach.

1. **Univariable Model:** Workforce participation patterns + chronic condition

2. **Multivariable Model - Early life factors:** Workforce participation patterns + chronic condition + Early life socio-economic factors (number of books during childhood, father's occupation)

3. **Multivariable Model – Overall model:** Early life factor model + Adult life factors (post-school qualification, marital status and informal caring).

These models were tested separately for men and women, and for each chronic disease, with workforce participation patterns as the outcome variable.

**Results**

Of the 1,261 participants, there were 684 men and 577 women. Diabetes was more prevalent among men and its prevalence doubled at each decade regardless of gender. There were no gender differences in prevalence of asthma at any age decade. Prevalence of depression significantly increased over the life course, particularly after 50 years of age and was higher among women. Arthritis was most prevalent in later adult life (increasing in prevalence after 40 years of age) and more common among women (See Table 1).

Figure 1 presents proportion of men and women (with diabetes, asthma, depression and arthritis), in full time, part time or not in paid work status, as indicated by them and their most significant type of job (non-physical, technical and physical). As seen in Figure 1, most men remain in full time paid work regardless of chronic condition, with some out of full time work after 50 years of age. As compared to those with diabetes, asthma and arthritis, more of men who reported depression were not in paid work.

Women, in comparison, transitioned in and out of full time paid work regardless of their condition, with a steady rise in proportion of those in part time work throughout their life course. A sharp increase in proportion of women not in paid work was seen for those who reported asthma. Women’s main type of job was different to men’s. For instance, majority of women with diabetes had non-physical jobs, while the majority of men with diabetes had physical jobs.
Table 1: Prevalence of diabetes, asthma, depression and arthritis among 1,261 mid-age men and women

<table>
<thead>
<tr>
<th>Age</th>
<th>Total Participants with each chronic disease</th>
<th>Men (Total N=684)</th>
<th>Women (Total N=577)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
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<tr>
<td></td>
<td>Diabetes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>5 (0.4)</td>
<td>5 (0.7)</td>
<td>-</td>
</tr>
<tr>
<td>30</td>
<td>9 (0.7)</td>
<td>7 (1.0)</td>
<td>2 (0.4)</td>
</tr>
<tr>
<td>40</td>
<td>19 (1.5)</td>
<td>15 (2.2)</td>
<td>4 (0.7)</td>
</tr>
<tr>
<td>50</td>
<td>41 (3.3)</td>
<td>28 (4.1)</td>
<td>13 (2.3)</td>
</tr>
<tr>
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<td>59 (8.6)</td>
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<tr>
<td>At LHH</td>
<td>98 (7.8)</td>
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<td>32 (5.6)</td>
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<tr>
<td></td>
<td>Asthma</td>
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<td>20</td>
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<td>56 (9.2)</td>
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<tr>
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<td>50</td>
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<td>263 (20.9)</td>
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<td>Arthritis</td>
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<td>20</td>
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<td>83 (12.1)</td>
<td>99 (17.5)</td>
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<tr>
<td>60</td>
<td>363 (28.8)</td>
<td>156 (22.8)</td>
<td>207 (35.9)</td>
</tr>
<tr>
<td>At LHH</td>
<td>870 (31.0)</td>
<td>172 (25.2)</td>
<td>219 (38.0)</td>
</tr>
</tbody>
</table>
Figure 1: Type of occupation (non-physical, technical and physical) and work status (full time, part time, not in paid work) of men and women with chronic disease, over the life course.
These preliminary results indicated the likelihood of presence of other factors, in addition to chronic diseases influencing work status of men and women over the life course.

In order to examine associations between workforce patterns and chronic diseases, this study used latent patterns of workforce participation identified in earlier analysis (Author citation removed), which were different for men and women. The four classes in the selected LCA model for men were labelled as: ‘mostly full time work (61.9%)’; ‘decreasing full time work after 40 years (10.9%)’; ‘not in paid work after 55 years (24%)’ and ‘early and late full time work (3.2%)’. Among women, the four classes in the selected model were: ‘mostly full time work (35.6%)’; ‘decreasing full time work after 55 years (28.7%)’; ‘increasing part time work (18.4%)’ and ‘mostly not in paid work (17.3%)’. Although these classes were distinct and well distinguishable from each other, only 16 men (3.2%) were in the fourth class for men characterized as ‘early and late full time work’. This class excluded from further analysis on the basis of insufficient number. Details of these patterns have been reported elsewhere (Author’s citation removed).

The prevalence of chronic disease for each workforce participation pattern for men and women is presented in Table 2. Chronic diseases tended to be less prevalent in men and women classed as ‘mostly full time work’ compared to other classes, except asthma was more prevalent among women in ‘mostly full time work’ (see Table 2).

The strength of association between workforce participation patterns and each chronic disease were then compared in univariate models, early life factors model and overall model for men and women respectively. No significant associations were reported for diabetes or asthma and workforce patterns in either men or women (results not presented here). In univariate analysis, the odds of being in category other than ‘mostly full time work’ were higher for
men reporting depression or arthritis (see Figure 2). These associations did not attenuate greatly after early life factors were added, but reduced after addition of adult life factors.

Among women, depression was found to be associated with ‘increasing part time work’ only after the addition of early and adult life factors.

Table 2: Prevalence of chronic diseases according to the workforce participation patterns among 664 men and 577 women.

| Men | Workforce participation patterns¹ | | | |
| --- | --- | --- | --- |
| Covariates (Predictor variables) | Mostly FT work (61.9%) | Decreasing FT work after 40 years (10.9%) | NPW after 55 years (24%) |
| Diabetes | Yes | 35 (8.2%) | 4 (5.6%) | 23 (13.6%) |
| | No | 393 (91.8%) | 67 (94.4%) | 146 (86.4%) |
| Asthma | Yes | 44 (10.3%) | 9 (12.7%) | 23 (13.6%) |
| | No | 384 (89.7%) | 62 (87.3%) | 146 (86.4%) |
| Depression | Yes | 62 (14.5%) | 17 (23.9%) | 48 (28.4%) |
| | No | 366 (85.5%) | 54 (76.1%) | 121 (71.6%) |
| Arthritis | Yes | 93 (21.7%) | 25 (35.2%) | 49 (29.0%) |
| | No | 335 (78.3%) | 46 (64.8%) | 120 (71.0%) |

| Women | Workforce participation patterns² | | | |
| --- | --- | --- | --- |
| Covariates (Predictor variables) | Mostly FT work (35.6%) | Increasing FT work (18.4%) | Decreasing FT after 55 years (28.7%) | Mostly NPW (17.3%) |
| Diabetes | Yes | 10 (4.7%) | 5 (4.8%) | 11 (6.8%) | 6 (6.1%) |
| | No | 201 (95.3%) | 100 (95.2%) | 151 (93.2%) | 93 (93.9%) |
| Asthma | Yes | 27 (12.8%) | 11 (10.5%) | 17 (10.5%) | 11 (11.1%) |
| | No | 184 (87.2%) | 94 (89.5%) | 145 (89.5%) | 88 (88.9%) |
| Depression | Yes | 40 (19.0%) | 30 (28.6%) | 39 (24.1%) | 24 (24.2%) |
| | No | 171 (81.0%) | 75 (71.4%) | 123 (75.9%) | 75 (75.8%) |
| Arthritis | Yes | 73 (34.6%) | 43 (41.0%) | 60 (37.0%) | 43 (43.4%) |
| | No | 138 (65.4%) | 62 (59.0%) | 102 (63.0%) | 56 (56.6%) |

Note: FT=Full time work, PT= Part time work, NPW= Not in paid work

¹ Workforce patterns of men identified by latent class analysis and discussed in Authors’ earlier publication (Majeed, Forder, Mishra, Kendig, et al., 2015)
² Workforce patterns of women identified by latent class analysis and discussed in Authors’ earlier publication (Majeed, Forder, Mishra, Kendig, et al., 2015)
Figure 2: Association between chronic diseases and workforce participation patterns of 664 middle aged men and 577 women over the life course
Discussion

While the role of health status in employment of older men and women has been discussed by many past studies, we have showcased a different approach by exploring associations between chronic diseases (diabetes, asthma, depression and arthritis) and workforce participation patterns over the life-course.

The significant associations between depression and arthritis and men’s work could be explained by two hypotheses. According to ‘Health selection hypothesis’ (Wang et al., 2014), those who have depression or arthritis may find it harder to get paid work, are less likely to retain it, with resultant higher risk of job turnover (Barrett et al., 2000; Buckley, O'Dwyer, et al., 2013; Doshi et al., 2008; Larsen & Pedersen, 2013; Wang et al., 2014). Alternatively, as per ‘Social causation hypothesis’ (Wang et al., 2014), being out of paid work, not getting enough work, or forced early exit from workforce can have deleterious effect on health, and especially on mental health (Dooley, Prause, & Ham-Robottom, 2000; Doshi et al., 2008). Also, it is important to note that work environment and related stresses can themselves result in depression (Doshi et al., 2008).

In contrast, none of the chronic diseases had significant impact on workforce participation of women when analysed without other variables. However, depression had a significant association with workforce patterns in the adjusted models for women. One of the likely explanations might be that women who have depression have difficulty in getting full time paid jobs (Doshi et al., 2008; Druss, Rosenheck, & Sledge, 2000; Lerner & Henke, 2008), and alternatively may also find it harder to retain a full time job (Druss et al., 2000). Non-significant findings for other chronic diseases might suggest that as compared to chronic diseases, other life factors may have more effect on workforce participation of women than that of men.
Arthritis though more prevalent among women, had no significant associations with work patterns for women, but was associated with decreasing full time work among men. This illustrates alternative work patterns of men and women with a debilitating illness such as arthritis. Men might showcase the work/no work dichotomy in event of a chronic health issue and forced to exit early from work (Alavinia & Burdorf, 2008), women on other hand balance their health issues, work and other life factors (Onyx, 1998).

The findings of this study are of substantial importance for policy makers in the current policy and labour market environment. According to our results, men with depression or arthritis are less likely to be in full time work, while women with depression are more likely to work part time. This point is important when considering the important role of gender in disease progression, prognosis and on quality of life. While economic impact of loss of productivity due to arthritis and depression have been well documented, the role of gender and life factors is often underrepresented. Policy makers could invest in potential interventions addressing the needs of workers with chronic diseases, with emphasis on gender. As men and women conform to different roles in societies which significantly impacts their employment decisions, there is a need for policies to address gender as a separate entity. There may also be some programs or strategies to encouraging employers to hire people with chronic health issues and to support men and women with these issues (Munir, Randall, Yarker, & Nielsen, 2009). In addition, public and private sector could introduce interventions for primary prevention of chronic diseases, managing and minimizing the risk and severity of complications. The imperative to these policies is therefore not only to reduce the burden of disease, but also the related costs and enabling longer working lives which influences greater economic stability for nations. Moreover, greater workplace
flexibility; supportive work environments; programs for continuous skill development for mature workers; stronger anti-age discrimination policies will also help workers to continue work despite their health issues (Kaptein, Gignac, & Badley, 2009; Kessler, Greenberg, Mickelson, Meneades, & Wang, 2001). These multiple approaches are not only needed for older workers but for young people as well, so as to enable people to work for longer by providing them with better opportunities over the life course.

This study has some potential limitations. Firstly, the participants of the study were residents of New South Wales, and therefore may not be representative of Australian population on the whole. Secondly, due to the retrospective nature of data, there is a risk of recall bias. However, the life history calendar worked as a memory aid and minimised this problem to a great extent (Kendig et al., 2014). Also, the workforce participation patterns of this sample would differ for different birth cohorts and in other countries. Lastly chronic diseases and work status were self-reported and might have introduced error. However, the number of hours in paid work was found to be consistent with self-reported work status.

Conclusion

In conclusion, this study provides evidence to suggest that depression (among both men and women) and arthritis (among men) may act as barriers to continued workforce participation among mature age workers. With recent shift in policy towards the extension of working life along with increasing longevity, there is a need to promote and preserve the health of workers, to improve their workforce participation. It is also imperative to take into account gender differences and the different effects of health and social circumstances on the mature age workers.
Funding

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Declaration of Conflicting Interests

There is no potential conflict of interest with respect to research, authorship, and/or publication of this article.

Ethics Approval

This research is approved by Research Integrity (Human Ethics committee) of University of Sydney and University of Newcastle, Australia.
References


Health Canada’s gender-based analysis policy. (2000). Retrieved from Ottawa:


10.1016/j.ajane.2008.04.005


6.3 Conclusion
This study was aimed to further explore the patterns of workforce participation of mid-age Australian men and women over their life course (discussed in detail in Study 2 – Chapter 5). Findings of this study significantly contribute to the existing empirical evidence about associations between chronic diseases (particularly depression and arthritis) and the workforce participation, with significant gender differences. While among men, depression (after 55 years of age) and arthritis (after 40 years of age) both may act as barriers to be in ‘full time paid work’, only depression had significant association with work patterns among women. These findings suggest that distinct differences exist between men and women, in regards to association of workforce participation patterns, chronic diseases and socio-economic factors. Thus, this study re-emphasizes the importance of gender differences and gender roles (also established in Study 1 and Study 2). This study also highlights the important role of early and adult life factors, which have been underrepresented in previous studies examining chronic diseases and workforce of mature men and women.

6.4 Next Chapter - Women, Work and Illness: Latent Class Analysis of Longitudinal Data for 11,551 Middle Age Women
The previous chapters have established that men and women have different patterns of workforce participation over the life course, and these patterns have varied associations with chronic diseases (diabetes, asthma, depression and arthritis) and early and adult life factors among men and women. As the next step in this research, workforce participation patterns of women from two different birth cohorts were examined, using prospective, longitudinal data from Australian Longitudinal Study on Women’s Health, collected since 1996. The next chapter presents the findings of the study using 1946 – 51 birth cohort of women (in the form of a peer reviewed published paper).
CHAPTER 7:

WOMEN, WORK AND ILLNESS:
LATENT CLASS ANALYSIS OF
LONGITUDINAL DATA FOR
11,551 MIDDLE AGE WOMEN

Peer Reviewed Published Paper

This chapter outlines the analysis undertaken period for the 1946–51 cohort for women participating in Australian Longitudinal Study on Women’s Health (ALSWH), to identify the workforce participation patterns over a 14 year period. The main purpose was to identify different workforce participation patterns and assess the association of chronic conditions (diabetes, asthma, arthritis and depression) and workforce participation.

7.1 INTRODUCTION

In the previous three chapters (Chapter 4, Section 4.3; Chapter 5, Section 5.2 and Chapter 6, Section 6.2), peer reviewed published papers from three of the studies (Study 1, Study 2 and Study 3 respectively) were presented. Study 1 was based on a cross-sectional study and Studies 2 and 3 analysed longitudinal data sets, and examined and compared workforce participation among middle-aged Australians with a gendered approach. Various associations between chronic diseases (diabetes, asthma, depression and arthritis) and workforce participation patterns were established.

It has been discussed in detail in Chapter 2 – ‘Background and Literature Review’ that workforce patterns of women have evolved a lot over time. The previous studies (Study 2 and 3) presented in this thesis also indicated that men and women differ in their workforce participation patterns over the life course. The association between chronic diseases (diabetes, asthma, depression and arthritis) and workforce patterns were also different for men and women, with lower prevalence of these diseases reported by men (see Chapter 6, Section 6.2 – Peer Reviewed Paper). While men in Study 2, showed distinct patterns of ‘mostly full time work’ over their life course and then ‘declining full time work’ as they entered their 40’s, women had much more diverse work patterns over the life course.

These results warranted further study of women’s work patterns and how they diversify when over time. Moreover, we wanted to explore how women’s work patterns are influenced by presence of chronic diseases (diabetes, asthma, depression and arthritis) and various life course factors when followed prospectively over their adult life course.
Therefore, data from the 1946 – 51 birth cohort of the ‘Australian longitudinal Study on Women’s Health (ALSWH) was used in this study (See details about data source in Section 3.2.3). In the context of this thesis the aims of this study can be summarized as:

i) To identify underlying patterns of workforce participation of middle-aged women over their adult life course.

ii) To explore the associations between these patterns of workforce participation and chronic diseases (diabetes, asthma, depression and arthritis), while accounting for various socio-demographic factors, health risk factors and competing activities.

The next sections present the peer-reviewed published paper of this study.

7.2 Peer Reviewed Paper

This study has already been published in a peer reviewed journal – the ‘Journal of Women’s Health’. This paper is presented here as the final published version.

Online version at: http://online.liebertpub.com/doi/10.1089/jwh.2014.5009
Women, Work, and Illness: A Longitudinal Analysis of Workforce Participation Patterns for Women Beyond Middle Age

Tazeen Majeed, MPH,1 Peta Forder, MS,1 Gila Mishra, PhD,2 and Julie Byles, PhD1

Background: Labor policies and economic incentives encourage women to work beyond middle age. However, women exhibit complex patterns of workforce participation over this life stage. This study examined transitions in and out of paid work across the life course of middle-aged women over a 14-year period and investigated associations between work and chronic diseases.

Methods: Latent class analysis identified dominant workforce participation patterns among 11,551 middle-aged women from the 1946–1951 birth cohort of Australian Longitudinal Study on Women’s Health. Multinomial logistic regression examined associations between work patterns and chronic diseases (diabetes, asthma, depression, and arthritis), while adjusting for health risk factors, sociodemographic factors, and competing activities.

Results: Five latent classes were identified: “mostly in paid work” (48%), “early paid work” (9.4%), “increasingly paid work” (8.9%), “gradually not in paid work” (11.4%), and “mostly not in paid work” (22.3%). Results showed that women with chronic diseases (diabetes, asthma, depression, and arthritis) were less likely to be in paid work. These associations remained mostly unchanged after adjustments for other factors.

Conclusions: The findings of this study provide better understanding of workforce participation patterns in women’s late working life. This has important implications for policy design, aimed to engage middle-aged women in paid employment for longer in spite of chronic diseases and their complications. We suggest that there is a need for work place programs that support people with chronic diseases. Policies are also needed to facilitate better prevention and management of chronic health issues over the life course for women, in order to encourage workforce participation over later years.

Introduction

Women and their participation in the workforce is an important subject for research, policy, and planning. Many studies have explored women's workforce participation behavior over the last few decades and how their workforce involvement has changed substantially over time.1–4 In most economically developed countries, women’s participation in paid work has increased dramatically over the last 25 years, with middle-aged women (aged 45–64 years) in particular engaging more in paid employment options.5,6 This issue of workforce participation among middle-aged women has gained more importance because of the demographic trend of population ageing, with a rapid growth in the proportion of people aged 60 years and older.7 A large proportion of these women will leave the workforce in the next few decades without younger workers to replace them, potentially creating skill shortages.7,8 This situation presents many challenges for policy makers to address issues associated with an ageing workforce.5,6

Despite continued economic incentives and changed labor policies to encourage middle-aged women to continue working until later years, there is increasing heterogeneity of workforce participation at and beyond middle age. This heterogeneity may depend on current health and social circumstances as well as past life circumstances.5,10 For example, women exhibit multiple working patterns over their life course depending on varying family and work roles.11–12 A large proportion of women work full-time,13 while many are employed part time during childbearing and middle ages,4,14,15 and some remain out of paid work.7,13

Long-standing health issues have been identified as major constraints on women's workforce participation.8,17 Chronic diseases such as diabetes, asthma, depression, and

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arthritic have been reported to be associated with limited work capacity, influencing women to make adaptations in employment such as reduced working hours or premature retirement. These chronic diseases are particularly important as they are common among women, and have different ages of onset with different natural histories. Diabetes (metabolic disorder) increasingly affects middle-aged women and has many complications. Asthma (chronic, progressive lung disease) affects women with increasing prevalence as they age. Depression is twice as common in women and can affect many aspects of women’s lives, while arthritis increases in prevalence with age and is a major cause of disability and physical limitation among women.

Studies have reported that health risk factors such as smoking and unhealthy body mass index (BMI) may also directly or indirectly affect workforce participation by affecting health status and increased susceptibility to health problems. The dynamics of workforce participation patterns are complex and influenced by other factors such as competing activities and sociodemographic factors such as marital status, education, and caring responsibilities. For example, some studies found that educated and partnered women were more likely to continue working in later years, as they were better skilled and, despite increased responsibilities, preferred to work. In contrast, Pitt and Byles and Beresford-Guif et al. reported that informal caring negatively affects workforce participation.

Past studies have examined the associations between chronic diseases and employment, however, many studies were cross-sectional. Some studies focused on diabetes and employment, or on the impact of arthritis on employment, and various studies investigated the impact of overall health status on labor force. For our knowledge no previous research has investigated the patterns of workforce participation over time among middle-aged women using longitudinal data.

We hypothesized that women who reported having diabetes, asthma, depression, or arthritis conditions had less engagement in paid work over their middle-aged life stage. Thus we had two main aims for this study: (1) identifying patterns of workforce participation through the middle-aged life stage and (2) explaining the association between workforce participation patterns of middle-aged women and chronic diseases (diabetes, asthma, depression, and arthritis). Examining these patterns and associations is important for the current policy climate, where governments are redesigning policies to encourage mature age workers to continue working longer.

Materials and Methods

Sample and eligibility

This paper presents the results of a qualitative study using self-reported data collected prospectively over a period of 14 years from the Australian Longitudinal Study on Women’s Health. This is an ongoing population-based longitudinal study since 1996, designed to track the health of Australian women over their lifetime and funded by the Australian Government Department of Health. Women were randomly selected from Medicare (national health insurance coverage for the whole population), with oversampling of women from rural and remote areas. For this study, self-reported questionnaire data from up to 6 survey points (over a period of 14 years) for women born in 1946-1951 were used. These women were aged 45–50 years in 1996 at the baseline survey and since then they have been surveyed every 3 years (1998, 2001, 2004, 2007, and 2010). They were aged 59–64 years at survey 6. This sample of women is broadly representative of the national population of women in the target age groups. To be eligible for this analysis, women had to provide valid responses to questions concerning work status for at least three out of the six surveys.

Measures of workforce participation: indicator variable

At each survey women were asked if they were in paid employment, unpaid employment, or were unemployed and were categorized as “paid work” and “not in paid work.” This work status was used to identify robust workforce participation patterns (the latent variable) over a substantial period of time.

Measures of chronic diseases

Women were asked if they had been diagnosed or treated for chronic conditions (“ever” in the first two surveys and “in the last 3 years” from the third survey onward). Diabetes, asthma, depression, and arthritis were considered as lasting conditions, so if participants reported diagnosis/treatment of diabetes, asthma, depression, or arthritis at any time point, they were categorized as having that condition.

Health risk factors

BMI. Body mass index was calculated from self-reported height and weight and categorized based on World Health Organization BMI classifications of “healthy weight BMI,” “underweight BMI,” “overweight BMI,” and “obese BMI.”

Smoking. Smoking was coded as “current smokers,” “ex-smokers,” and “non-smokers” according to classification methods of the Australian Institute of Health and Welfare.

For both BMI and smoking, the last available observation was identified and used in analysis.

Measures of sociodemographic factors

Marital status. Participants who responded as being married or in a de facto relationship were categorized as “partnered”; otherwise, they were coded as “not partnered.” A transition variable was created to represent marital status at survey 1 and survey 6 as “not partnered at S1, S6”; “partnered at S1, S6”; “partnered at S1, not partnered at S6”; and “partnered at S6, not partnered at S1.”

Education. Participants reported their highest educational qualification at survey 1 and then at survey 6 (school certificate, diploma, or higher degree). They were categorized as having education if they indicated “yes” to any qualification at either survey 1 or survey 6, and as “no education” if they responded “no qualification” at both time points.

Income. Income was found to be highly correlated with workforce participation and was not included in analysis as a sociodemographic factor.
Women, Work, and Illness

Measures of competing activities

Women were categorized as ‘yes’ to grandchild care if they reported that they provided care for their grandchildren on any survey from baseline to survey 6. Women were categorized as ‘yes’ to informal care if they reported that they provided unpaid care to a sick/disabled person on any survey from baseline to survey 6.

Statistical analysis

Latent class analysis (LCA) was the method of choice to identify the underlying subgroups of workforce participation patterns in a format that was parsimonious and easy to comprehend. LCA is a finite mixture model, used to identify latent subgroups within a population based on individuals’ responses to multiple observed variables. Results from the LCA model also provided the prevalence of each latent class and error associated with observed variables in measuring the latent classes. This method enabled us to fit a model that represented the workforce participation in our data, including the most common and least common workforce participation patterns. The latent classes were then treated as an independent variable and its associations with specific chronic diseases (diabetes, asthma, depression, and arthritis) were explored. SAS 9.4 (SAS Institute, 2014) was used to carry out the LCA procedure, which was developed by the Methodology Center, Penn State University.

Six latent class models were conducted (fitting two to seven latent classes) and results compared. An optimal classification model with the best fit was identified based on the principle of best model fit, parsimony, and information criteria (Akaike’s information criterion, Bayesian information criterion, and entropy). Labels were assigned to each latent class using the item response probability and latent class membership probability.

The characteristics of each latent class were graphically summarized using a type of Langue plot to provide a simple and comprehensible way to visualize the class membership and validate the labels.

Participants were then assigned to maximum probability based workforce participation classes using the first maximum probability rule. Class membership based on maximum posterior probability was retained, creating a five-category variable “workforce participation” for subsequent multivariate regression analysis and model interpretation. Unadjusted associations between workforce participation patterns and chronic diseases were initially assessed.

Multinomial logistic regression

Regression analysis was performed to assess the effect of each chronic disease (diabetes, asthma, depression, and arthritis) on workforce participation patterns while adjusting for health risk factors, sociodemographic factors and competing activities. A model building approach was taken, where groups of variables were added in to the initial unadjusted models. The analyses for multinomial logistic models defined below were carried out in separate models for diabetes, asthma, depression, and arthritis.

Model 1: Workforce participation patterns + each chronic disease in separate unadjusted models.

Model 2: Workforce participation patterns + each chronic disease separately adjusted for health risk factors.

Model 3: Workforce participation patterns + each chronic disease separately adjusted for health risk factors and sociodemographic factors.

Model 4: Workforce participation patterns + each chronic disease separately adjusted for health risk factors, sociodemographic factors, and competing activities.

Results

To reliably identify workforce participation patterns across time, the analysis was restricted to participants who had at least three valid survey observations for paid work status. Using this eligibility criteria, 1670 (12.2%) women with four or more missing survey observations were excluded from analysis. To maintain the same sample across various regression models, a further 484 (4.1%) women were excluded from analysis due to missing covariate observations, resulting in a total of 11,551 women included for analysis. Participants’ engagement in paid work was graphed over the six survey points to demonstrate changes in workforce participation at each survey point. The majority of women were partnered at surveys 1 and 6 and had some educational qualification. Most were providing informal care and caring for grandchildren on at least one survey (1-6) and had a healthy BMI and were nonsmokers. Figure 1 presents the transitions from “paid work” to “not in paid work” and vice versa over all the survey points. The majority of participants (70%) were in paid work at survey 1, but transitioned in and out of paid work, with 49% of participants in paid work by survey 6. The frequency of transitions greatly increased toward surveys 4, 5, and 6, with more and more women transitioning in and out of paid work.

The model with five latent classes was selected on the basis of Akaike’s information criterion, Bayesian information criteria, and entropy, as shown in Table 1. This model provided adequate representation of data, distinct labels and easy interpretation of classes.

Figure 2 and Table 2 present item response probabilities (for responding “yes” to paid work) for each latent class at each survey time point. Many women (48%) were classified as “mostly in paid work,” with the majority responding “yes” to being in paid employment at most time points. In contrast, women categorized as “mostly not in paid work” had item

FIG. 1. Transition patterns of 11,551 middle-aged women in and out of paid work over six survey points.
Table 1. Model fit statistics for baseline latent models for evaluation of workforce participation patterns in 11,551 middle-aged women (2–7 classes)

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<td>268.9</td>
</tr>
<tr>
<td>BIC</td>
<td>355.5</td>
<td>1458.5</td>
<td>488.7</td>
<td>316.5</td>
<td>335.3</td>
<td>355.1</td>
</tr>
<tr>
<td>Entropy</td>
<td>0.79</td>
<td>0.83</td>
<td>0.80</td>
<td>0.79</td>
<td>0.78</td>
<td>0.77</td>
</tr>
</tbody>
</table>

AIC, Akaike's information criterion; BIC, Bayesian information criterion.

Fig. 2. Workforce participation patterns among 11,551 middle-aged women, using five latent classes.
response probabilities closer to 0. Item response probabilities of women classed as “increasingly in paid work” were closer to 0 in surveys one and two, and closer to 1 in later surveys. Participants classed as “gradually not in paid work” were clearly distinguishable from “early paid work” by higher item response probabilities at survey 3 and 4.

Chronic diseases (diabetes, asthma, depression and arthritis) were less prevalent in women classed “mostly in paid work” compared with other classes (see Table 3).

Figure 3 presents the strength of association between each chronic condition and workforce participation patterns in the final adjusted models. For all the conditions, the odds of being in a category other than “mostly in paid work” were higher for those reporting diabetes, asthma, depression, or arthritis (see Fig. 3). There were no substantive differences between unadjusted and final adjusted models (results not shown here).

Table 4 presents the fully adjusted model for diabetes. Workforce participation patterns were also found to be associated with

1. **BMI.** Women with underweight or obese BMI were more likely to be “mostly not in paid work” and “early paid work.”

2. **Marital status.** Married women were more likely to be in a workforce pattern other than “mostly in paid work.”

3. **Education.** Less-educated women were more likely not in “mostly paid work.”

4. **Grandchild care and informal caring.** Women with either of caring responsibility were more likely to be “mostly not in paid work” and “gradually not in paid work.”

**Discussion**

The main emphasis of this study was on establishing patterns of workforce participation of middle-aged women as they age from their 40s through to the age of 60 years and on assessing the associations between these patterns and chronic diseases (diabetes, asthma, depression, and arthritis). The findings indicated that middle-aged women exhibit distinct patterns of workforce participation when analyzed over a long period of time. The frequency of transitions in and out of paid work increased as the women entered into their 50s, and these transitions and employment patterns were identified by a five-class latent structure. Workforce participation patterns were significantly associated with diabetes, asthma, depression, and arthritis on their own, and also after adjusting for health risk factors, socioeconomic factors, and competing activities.

In this cohort, many women were classed as “mostly in paid work,” meaning that they had a high probability of being in paid work at all time periods. These women tend to

---

**Table 2. Probability of Being in Paid Work Over a 15-Year Period, According to Five Latent Classes for 11,551 Middle-Aged Women**

<table>
<thead>
<tr>
<th>Latent classes</th>
<th>Mostly in paid work (48.0%)</th>
<th>Early paid work (19.4%)</th>
<th>Increasingly paid work (8.9%)</th>
<th>Gradually not in paid work (11.4%)</th>
<th>Mostly not in paid work (22.2%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey 1</td>
<td>0.93</td>
<td>0.81</td>
<td>0.25</td>
<td>0.87</td>
<td>0.13</td>
</tr>
<tr>
<td>Survey 2</td>
<td>0.98</td>
<td>0.99</td>
<td>0.22</td>
<td>0.91</td>
<td>0.09</td>
</tr>
<tr>
<td>Survey 3</td>
<td>0.95</td>
<td>0.36</td>
<td>0.53</td>
<td>0.94</td>
<td>0.08</td>
</tr>
<tr>
<td>Survey 4</td>
<td>0.94</td>
<td>0.12</td>
<td>0.73</td>
<td>0.64</td>
<td>0.05</td>
</tr>
<tr>
<td>Survey 5</td>
<td>0.97</td>
<td>0.10</td>
<td>0.87</td>
<td>0.05</td>
<td>0.04</td>
</tr>
<tr>
<td>Survey 6</td>
<td>0.81</td>
<td>0.08</td>
<td>0.73</td>
<td>0.05</td>
<td>0.04</td>
</tr>
</tbody>
</table>

---

**Table 3. Prevalence of Chronic Diseases According to the Workforce Participation Patterns for 11,551 Women Born in 1946-1951**

<table>
<thead>
<tr>
<th>Chronic diseases</th>
<th>Mostly in paid work</th>
<th>Early paid work</th>
<th>Increasingly paid work</th>
<th>Gradually not in paid work</th>
<th>Mostly not in paid work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes Yes</td>
<td>472 (8.0%)</td>
<td>105 (12.1%)</td>
<td>111 (14.0%)</td>
<td>149 (10.9%)</td>
<td>407 (15.4%)</td>
</tr>
<tr>
<td>No</td>
<td>5406 (92.0%)</td>
<td>763 (87.9%)</td>
<td>680 (86.0%)</td>
<td>1220 (89.1%)</td>
<td>2238 (84.6%)</td>
</tr>
<tr>
<td>Asthma Yes</td>
<td>1336 (22.7%)</td>
<td>233 (26.8%)</td>
<td>255 (25.9%)</td>
<td>356 (24.5%)</td>
<td>706 (26.7%)</td>
</tr>
<tr>
<td>No</td>
<td>4542 (77.3%)</td>
<td>635 (73.2%)</td>
<td>560 (74.1%)</td>
<td>1033 (75.5%)</td>
<td>1939 (73.3%)</td>
</tr>
<tr>
<td>Depression Yes</td>
<td>1596 (27.2%)</td>
<td>310 (25.7%)</td>
<td>257 (25.2%)</td>
<td>427 (31.2%)</td>
<td>952 (36.0%)</td>
</tr>
<tr>
<td>No</td>
<td>4282 (72.8%)</td>
<td>558 (64.3%)</td>
<td>534 (67.5%)</td>
<td>942 (68.8%)</td>
<td>1692 (64.0%)</td>
</tr>
<tr>
<td>Arthritis Yes</td>
<td>2073 (35.3%)</td>
<td>399 (44.8%)</td>
<td>302 (38.2%)</td>
<td>595 (43.5%)</td>
<td>1191 (45.0%)</td>
</tr>
<tr>
<td>No</td>
<td>3805 (64.7%)</td>
<td>479 (55.2%)</td>
<td>489 (61.8%)</td>
<td>774 (56.5%)</td>
<td>1454 (55.0%)</td>
</tr>
</tbody>
</table>
be more educated than women in the other classes and perhaps represent the new generation of women in the baby boomer cohort with high education and career-oriented attitudes. The post-war (World War II) period was marked by increased attainment of education by women and this was a key factor contributing to career-oriented attitudes in this cohort of women. We also found an association between marital status and workplace participation patterns, with unpartnered women having higher odds of being mostly in paid work. This association between work and not partnered marital status may work two ways; women who are in longer-term paid work may be more empowered to either remain single or (more commonly) seek divorce if the marriage is unsatisfactory, or alternatively, single women may be more dependent on their own paid work for economic security. Previous research suggests that both of these economic influences may operate. A cultural explanation has also been proposed whereby career orientation and single status are influenced by emancipatory norms. However, it should be noted that as for the other workplace patterns, the majority of women in the "mostly in paid work" class were partnered.

Women classified as "mostly not in paid work" and "early paid work" may represent women who undertook more traditional female gender roles such as caring for grandchildren after their own children left home, informal caring, or as stay at home wives. Even though there has been greater social acceptance of working women, many women may prefer to (or have to) opt out of paid work after being married and due to family responsibilities. Women who are informal caregivers are also more likely to give up work or reduce their workforce participation to allow them to take on this role. However, it should be noted that in this study many women who were mostly in paid work also took on a caregiver role, underscoring the need for many women to juggle these different roles of paid work and informal care. Likewise, while there was an association between workplace participation patterns and grandchild care, the many women mostly in paid work also cared for grandchildren.

Women in the "Increasingly paid work" class represented the proportion of the cohort who joined (or reentered) the workforce in their late 40s and 50s and continued working into their later years. The experience of freedom due to children leaving home, divorce or separation, change in partner's work (e.g., retirement), or financial conditions may be factors driving these women toward increased employment.

The "gradually not in paid work" class is comprised of women who were previously in paid work but who increasingly moved out of paid work, potentially due to caring responsibilities, financial security, partner's retirement, and other life course, ageing and health related factors. As women age, they are more likely to decrease their working hours or stop working.

The second part of this study was focused on understanding the association between workplace participation patterns and chronic health conditions (diabetes, asthma, depression, and arthritis). This issue has important policy implications in terms of population ageing, health, and government incentives to promote working in older women, by means of creating a better understanding of the interplay between chronic health issues and workforce participation.
### Table 4. Association Between Diabetes and Workforce Participation Patterns of 11,551 Middle-Aged Women in the Final Adjusted Model

**Workforce participation patterns (reference: mostly paid work)**

<table>
<thead>
<tr>
<th>Model 4. Diabetes + health risk factors + socio-demographic factors + competing activities</th>
<th>Early paid work</th>
<th>Increasingly paid work</th>
<th>Gradually not in paid work</th>
<th>Mostly not in paid work</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Diabetes</strong></td>
<td>Odds ratio (95% CI)</td>
<td>p</td>
<td>Odds ratio (95% CI)</td>
<td>p</td>
</tr>
<tr>
<td>No (reference)</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1.44 (1.14–1.81)</td>
<td>0.0020</td>
<td>1.80 (1.43–2.26)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td><strong>BMI</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Healthy weight (reference)</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Underweight</td>
<td>1.64 (0.92–2.92)</td>
<td>0.09</td>
<td>1.13 (0.57–2.22)</td>
<td>0.72</td>
</tr>
<tr>
<td>Overweight</td>
<td>0.95 (0.79–1.13)</td>
<td>0.53</td>
<td>0.98 (0.82–1.17)</td>
<td>0.83</td>
</tr>
<tr>
<td>Obese</td>
<td>1.23 (1.03–1.46)</td>
<td>0.0234</td>
<td>1.05 (0.86–1.28)</td>
<td>0.59</td>
</tr>
<tr>
<td><strong>Smoking</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nonsmoker (reference)</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Current smoker</td>
<td>1.34 (1.06–1.68)</td>
<td>0.0134</td>
<td>1.24 (0.97–1.57)</td>
<td>0.08</td>
</tr>
<tr>
<td>Ex-smoker</td>
<td>1.08 (0.92–1.27)</td>
<td>0.35</td>
<td>1.00 (0.93–1.30)</td>
<td>0.27</td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not partnered</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Partnered S1–S6 (reference)</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Partnered S1</td>
<td>1.92 (1.49–2.48)</td>
<td>&lt;0.0001</td>
<td>1.36 (1.06–1.72)</td>
<td>0.0130</td>
</tr>
<tr>
<td>Partnered S6</td>
<td>2.29 (1.74–3.02)</td>
<td>&lt;0.0001</td>
<td>1.79 (1.39–2.32)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Partnered S6</td>
<td>1.74 (1.14–2.64)</td>
<td>0.0100</td>
<td>0.88 (0.55–1.43)</td>
<td>0.61</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No (reference)</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>0.42 (0.34–0.53)</td>
<td>&lt;0.0001</td>
<td>0.57 (0.45–0.73)</td>
<td>0.0007</td>
</tr>
<tr>
<td><strong>Grandchild care</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No (reference)</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1.14 (0.93–1.40)</td>
<td>0.29</td>
<td>1.15 (0.94–1.40)</td>
<td>0.07</td>
</tr>
<tr>
<td><strong>Informal caring</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No (reference)</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1.25 (1.08–1.45)</td>
<td>0.0030</td>
<td>1.11 (0.97–1.29)</td>
<td>0.19</td>
</tr>
</tbody>
</table>
Health status plays an important role in women's workforce participation, as demonstrated by our findings and by other studies. However, in contrast to previous studies, this study presents a different analytic approach by exploring the association between women's underlying workforce patterns and particular chronic conditions and over a period of 14 years. The identification of five distinct latent classes shows the variations in middle-aged women's workforce participation patterns over this period.

Women with diabetes were found twice as likely to be classified "mostly not in paid work" compared with those classified "mostly in paid work." They were also more likely to be classified "early paid work" and "increasingly in part-time work," although there was no significant relationship between diabetes and gradually not in paid work once all factors were added to the models. One potential explanation for this relationship between diabetes and work is that the health effects of diabetes may significantly affect women's ability to participate in the workforce. It has also been reported that individuals with diabetes may suffer from discriminatory hiring practices by employers, and this may have played a role in defining these associations. Another potential explanation for the association between diabetes and lesser workforce participation at this life stage is that diabetes is associated with lower socioeconomic position and employment in lower employment grades, which may be harder for mature workers to sustain.

Asthma was most strongly associated with being mostly not in paid work, and being in early paid work. These results support previous findings that women with asthma are less likely to be in some kind of paid work. Other studies suggest that people with asthma may have difficulty maintaining employment due to frequent acute episodes requiring time off work. Other health factors (particularly BMI) may also explain some of the association between asthma and workforce patterns, although the association between asthma and work patterns remains even once these had been included in our models.

Women who reported depression had much lower odds of being mostly in paid work, both in unadjusted and adjusted models. Again, this association could work in more than one direction. One likely explanation might be that women with depression are less likely to seek employment, find it harder to get paid employment, and are less likely to be able to remain employed. Alternatively, being out of the workforce may predispose to depression. Studies have also found that movement from unemployment to employment is associated with improved mental health.

Arthritis was the most commonly reported condition and was associated with being mostly not in paid work, in early paid work, and gradually not in paid work. The latter two patterns are consistent with the progressive nature of this degenerative condition and its increasing prevalence in later life. Other studies have reported that people with arthritis reduce their workforce participation due to pain and disability. Given the high prevalence of this condition, the impact of arthritis on an ageing workforce is substantial. In a large cross-sectional study undertaken in Canada, more than 50% of working-age people with arthritis were not in the labor force. This effect was stronger for women than for men, and those who were working reported that they needed more flexibility in the workplace to allow them to cope with this condition. In our study, arthritis was also common among the majority of women who remained mostly in paid work across the study period indicating that many women continue working with arthritis. However, the extent to which they struggle to continue working despite pain and disability and the extent to which their workplaces support them to continue working is not available from our data. The strong association between work patterns and arthritis even after other factors were added to the models suggests that the association between continuing to work and having arthritis is not wholly explained by disability.

Implications for policy

The ability of an ageing population to contribute to work will be limited by chronic disease, and many women will decrease their workforce participation as they age. Policies are needed to accommodate the needs of older women and to recognize that many women will continue to work with chronic diseases and juggling other competing productive activities. These policy approaches require action on multiple fronts, including greater workplace flexibility to respond to fluctuations in symptoms and other needs such as caring, supportive work environments that reduce stress on older workers, addressing age discrimination, and encouraging intergenerational approaches to workforce development.

Strengths and limitations

A major strength of this study was the use of a large cohort of women surveyed over many time points from the Australian Longitudinal Study on Women's Health, which is the largest long-term and nationally representative study targeting women's health and life issues in Australia. However, this study was limited by the fact that chronic conditions were self-reported, and even though they are valid measures, the possibility of reporting bias cannot be excluded. We also have limited information about the duration, severity, and complications of diseases and were not able to establish any causality. Also, not all social and contextual factors could be measured. It should also be noted that latent classes and resultant patterns of workforce participation are hypothetical, and information regarding women seeking employment was not included. Other factors associated with life course ageing and social demands may explain some of the differences in workforce participation patterns over time. Some women were excluded from analysis because of missing observations; however, this was considered to have a negligible impact on the interpretation of the observed results.

Conclusions

Our results indicate that workforce participation patterns are associated with chronic conditions that may affect women's ability to work beyond middle age. Australia's working age population is projected to decrease in coming years, and many sectors with an older workforce profile will be greatly affected. Similarly, other governments around the world are responding to population ageing with policies to extend working life, and governments worldwide are
increasing the retirement age. The success of these policies is dependent on a better understanding of the interplay between chronic conditions and employment patterns. This study has important implications for the design of policies aiming to engage middle-aged women in paid employment for longer in spite of chronic diseases and their complications. We suggest that there is a need for work-place programs that support people with chronic diseases. Policies are also needed to facilitate better prevention and management of chronic health issues over the life course for women, in order to encourage workforce participation into later years.

Acknowledgements

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Author Disclosure Statement

No competing financial interest exists.

References


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7.3 CONCLUSION

The main aim of this study was to identify the patterns of workforce participation among middle-aged women and to examine the associations between the workforce patterns, chronic diseases (diabetes, asthma, depression and arthritis) and other health risk factors, socio-demographic factors and competing activities. Results indicated that as women age from their 40’s to 60’s, they transition in and out of paid work. These transitions were represented by five latent patterns of workforce participation, which were found to be significantly associated with chronic diseases. Many of these women were ‘mostly in paid work’, with some showing patterns of ‘increasing paid work after 40’s’ and some women only working till early 50’s. However, some women remained ‘mostly out of paid work’ as they aged into their 60’s. Women who reported having any of the chronic conditions (diabetes, asthma, depression and arthritis) were less likely to be in paid work.

These patterns of workforce participation are comparable to work patterns of middle aged women identified in Study 2 – Chapter 5 (see Section 5.2 – Peer Reviewed Paper), with same direction for the association between the work patterns and the chronic diseases. But, as Study 2 had a smaller sample size (N= 577 women), it is likely that it did not have the statistical power to detect the differences. In contrast, Study 4 had more than 11,000 women, and thus more power to detect statistically significant associations. Therefore, the findings of Study 2 and Study 4 establish that the workforce participation patterns of middle aged women are more diverse over the life course, with many women engaging in part time work or increasing paid work as they age into their 60’s. These findings have important implications for policies, and most importantly for those aiming to engage women in paid work for longer. Not only we need programmes that better support women with chronic diseases, initiatives for prevention and early management of chronic diseases are also important.
This chapter has provided significant empirical information about workforce participation patterns of middle-aged women over their adult life course. However, one of the main hypotheses for this thesis was that work patterns in later and mature ages are also a reflection of one’s workforce patterns at young age, and are associated with many early and adult life factors over the life course.

Therefore, the next chapter presents the findings of the last study which used prospective, longitudinal data of young women born from 1973 – 78 cohort of the ‘Australian Longitudinal Study on Women’s Health (ALSWH)’. This data was stratified and analysed for workforce patterns and their associations according to women’s motherhood status: young women with children and young women without children. The findings of this study are presented as manuscript submitted to a peer review journal and undergoing peer review.
CHAPTER 8:

HEALTH PREDICTORS OF WORKFORCE PARTICIPATION OVER TIME – LONGITUDINAL EVIDENCE FOR YOUNG WOMEN

Submitted As Peer Reviewed Paper

Chapter 8 outlines the analysis undertaken to identify the workforce participation patterns over five survey points for the 1973-78 cohort of women participating in Australian Longitudinal Study on Women’s Health (ALSWH). This study used stratified data set based on young women’s motherhood status – women with children and women without children. The main purpose was to identify different workforce participation patterns among these two strata of women, and to assess the association of workforce participation with chronic conditions (diabetes, asthma, arthritis and depression), while accounting for various life course factors.

8.1 Introduction

Study 5 used data from the 1973–78 cohort of young women. These women were aged 18–23 years at the time of first survey of the ‘Australian Longitudinal Study on Women’s Health (ALSWH)’ in 1996, with many of them (34%) commencing their higher education. At Survey 1, 47.9% of the women reported that they were not in paid work, with remainder doing some paid work (full time or part time). However, over time these workforce participation patterns were likely to diversify and evolve. For this study we hypothesized that, as these young women age and experience various life events such as achieving higher education, marriage and childbirth, caring responsibilities or reporting chronic diseases; their patterns of workforce participation will change and various transitions will be seen. For example, some women may remain out of paid work when in partnered marital status, while some will transition from full time paid work to part time paid work when they have children.41, 42 In particular, having children is a major life event for many women, which may influence their work choices.42 Some women may remain out of paid work after they have children, while some may transition from full time paid work to part time paid work to accommodate their life circumstances and home duties. In contrast, women who do not have children may remain in paid work over their life course.
For this study, the main research questions were:

i) Are there different workforce participation patterns among women (born from 1973 – 78) who have children, compared to those who do not have children? In other words is there a latent class structure that adequately represents and explains the heterogeneity in employment among these two groups of women of the same age cohort?

ii) For women with and without children, is there any association between the chronic conditions (diabetes, asthma, depression and arthritis) and the workforce participation patterns over time, while accounting for the presence of various health factors and socio-demographic factors?

iii) How do these associations differ for these two groups of women – women with children and women without children?

8.2 Analysis and Preliminary Results

In this section, some preliminary results are presented, while detailed results and discussion are presented in the next section as the manuscript submitted to a peer reviewed journal.

This study used five waves of data from 1973 – 78 cohort of the ‘ALSWH’, i.e., Survey 2 conducted in 1999 to Survey 6 in 2012 (details about surveys explained in Chapter 3, Section 3.2.3).

The first survey has been excluded from the analysis, as majority of the women in this cohort (aged 18 – 23 years in 1996 at Survey 1), were not in paid work and were commencing education. Table 8.1 presents the characteristics of women at each survey, according to the work status reported by them at each survey (as full time work, part time work and not in paid work).

At Survey 2, women were aged 22 – 27 years, with 8,893 of them having no children, compared with 1,723 women having one or more children. With each consecutive survey, the proportion
of women with children increased. By Survey 6, when women were 34 – 39 years old, 5,845
women reported having one or more children. At Survey 3, majority of the women who were
not in paid work had one or more children, while majority of those in full time work had no
children. However, those in part time work had an equal proportion of women with and without
children (49.8% and 50.1% respectively). In consecutive surveys, the proportion of women who
were working part time and had one or more children increased. The proportion of women
reporting asthma and depression also increased from Survey 2 to 6, however, there were no
major differences in their proportion according to their work status.
Table 8.1: Characteristics of young women from 1973 – 78 cohort of ALSWH from Survey 2 (as baseline) to Survey 6

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NPW n(%)</td>
<td>PT n(%)</td>
<td>FT n(%)</td>
<td>NPW n(%)</td>
<td>PT n(%)</td>
</tr>
</tbody>
</table>

**Children**
- no children: 1118 (67.5), 2182 (75.7), 5683 (91.9)
- >1 children: 538 (32.5), 699 (24.3), 486 (8.0)

**Self-reported Health**
- Excellent/Good: 1495 (90.7), 2546 (89.2), 5597 (90.8)
- Fair/Poor: 153 (9.3), 310 (10.8), 570 (9.2)

**Diabetes**
- No: 1634 (98.7), 2844 (98.7), 6127 (99.2)
- Yes: 22 (1.3), 37 (1.3), 51 (0.8)

**Asthma**
- No: 1199 (72.3), 2021 (70.5), 4568 (73.8)
- Yes: 498 (27.7), 803 (29.5), 1629 (26.2)

**Depression**
- No: 1532 (92.5), 2567 (86.1), 5061 (80.7)
- Yes: 124 (7.5), 314 (10.9), 577 (19.3)

**BMI**
- Underweight: 125 (7.6), 202 (7.0), 395 (6.4)
- Healthy: 836 (50.5), 1835 (63.7), 4016 (65.0)
- Overweight: 308 (22.1), 560 (19.3), 1192 (19.3)
- Obese: 326 (19.8), 285 (10.0), 574 (9.3)

**Alcohol consumption**
- Non drinker: 1028 (62.1), 333 (22.0), 1021 (16.3)
- Low risk: 650 (36.6), 2154 (74.7), 4286 (79.9)
- High risk: 19 (1.2), 94 (3.3), 221 (3.6)

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<tbody>
<tr>
<td></td>
<td>NPW  (%)</td>
<td>PT  (%)</td>
<td>FT  (%)</td>
<td>NPW  (%)</td>
<td>PT  (%)</td>
</tr>
<tr>
<td><strong>Smoking status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non smoker</td>
<td>1271 (76.7)</td>
<td>1752 (50.8)</td>
<td>3690 (54.6)</td>
<td>1059 (60.0)</td>
<td>1620 (62.1)</td>
</tr>
<tr>
<td>Former smoker</td>
<td>139 (8.4)</td>
<td>399 (13.9)</td>
<td>709 (11.5)</td>
<td>318 (18.4)</td>
<td>452 (17.4)</td>
</tr>
<tr>
<td>Current smoker</td>
<td>246 (14.9)</td>
<td>730 (25.3)</td>
<td>1479 (23.9)</td>
<td>375 (21.6)</td>
<td>535 (20.5)</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No education</td>
<td>948 (57.2)</td>
<td>511 (17.7)</td>
<td>833 (13.5)</td>
<td>411 (23.7)</td>
<td>523 (20.1)</td>
</tr>
<tr>
<td>School</td>
<td>378 (22.8)</td>
<td>568 (33.3)</td>
<td>1486 (24.0)</td>
<td>604 (34.8)</td>
<td>719 (27.5)</td>
</tr>
<tr>
<td>Trade/apprentice</td>
<td>132 (8.0)</td>
<td>569 (19.7)</td>
<td>1341 (21.7)</td>
<td>356 (20.5)</td>
<td>570 (21.9)</td>
</tr>
<tr>
<td>Higher educ</td>
<td>158 (12.0)</td>
<td>843 (29.3)</td>
<td>2518 (40.6)</td>
<td>362 (21.0)</td>
<td>795 (30.4)</td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not partnered</td>
<td>1283 (77.5)</td>
<td>1722 (50.8)</td>
<td>3765 (61.0)</td>
<td>690 (39.8)</td>
<td>1148 (44.0)</td>
</tr>
<tr>
<td>Partnered</td>
<td>373 (22.5)</td>
<td>1159 (40.2)</td>
<td>2413 (36.0)</td>
<td>1042 (60.2)</td>
<td>1459 (56.0)</td>
</tr>
<tr>
<td><strong>Area residence</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>306 (47.1)</td>
<td>1332 (53.3)</td>
<td>3204 (57.8)</td>
<td>692 (48.5)</td>
<td>1105 (51.2)</td>
</tr>
<tr>
<td>Rural/remote</td>
<td>411 (52.9)</td>
<td>1171 (46.8)</td>
<td>2341 (42.2)</td>
<td>728 (51.5)</td>
<td>1053 (48.8)</td>
</tr>
<tr>
<td><strong>Informal caring</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1597 (96.4)</td>
<td>2720 (94.4)</td>
<td>5962 (96.5)</td>
<td>1616 (93.3)</td>
<td>2484 (94.5)</td>
</tr>
<tr>
<td>Yes</td>
<td>59 (3.6)</td>
<td>161 (5.6)</td>
<td>216 (3.5)</td>
<td>118 (6.7)</td>
<td>143 (5.5)</td>
</tr>
</tbody>
</table>

* Work Status = As reported by participants at each survey

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For further analysis, data was stratified into two groups: i) Women with children; and ii) Women without children.

As seen in Table 8.2, among the young mothers who had depression, many reported their work status as ‘not in paid work’ from Survey 2 to 6. However, those women with children who had diabetes and asthma reported their work status as ‘full time’ or ‘part time’ work.

In comparison, women without children who reported having any chronic diseases (diabetes, asthma and depression) were working ‘part time’ at Survey 2, but from Survey 3 onwards they reported their work status as ‘not in paid work’.
Table 8.2: Proportion of chronic diseases (diabetes, asthma and depression) across the work status at each survey for women with and without children

<table>
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</thead>
<tbody>
<tr>
<td></td>
<td>NPW n(%)</td>
<td>PT n(%)</td>
<td>FT n(%)</td>
<td>NPW n(%)</td>
<td>PT n(%)</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Women with 1 or more children</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>523 (57.2)</td>
<td>688 (68.4)</td>
<td>406 (48.2)</td>
<td>1153 (69.0)</td>
<td>1272 (67.9)</td>
</tr>
<tr>
<td>Yes</td>
<td>15 (2.8)</td>
<td>11 (1.8)</td>
<td>9 (1.8)</td>
<td>23 (2.0)</td>
<td>27 (2.1)</td>
</tr>
<tr>
<td>Asthma</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>368 (68.4)</td>
<td>506 (72.4)</td>
<td>345 (69.7)</td>
<td>812 (69.0)</td>
<td>914 (70.3)</td>
</tr>
<tr>
<td>Yes</td>
<td>170 (31.6)</td>
<td>193 (27.6)</td>
<td>150 (30.3)</td>
<td>364 (31.0)</td>
<td>386 (29.7)</td>
</tr>
<tr>
<td>Depression</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>486 (90.3)</td>
<td>637 (91.1)</td>
<td>458 (92.5)</td>
<td>966 (83.8)</td>
<td>1126 (86.5)</td>
</tr>
<tr>
<td>Yes</td>
<td>52 (9.7)</td>
<td>62 (8.9)</td>
<td>37 (7.5)</td>
<td>199 (16.2)</td>
<td>175 (13.5)</td>
</tr>
<tr>
<td><strong>Women without children</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1111 (99.4)</td>
<td>2156 (98.8)</td>
<td>6541 (99.3)</td>
<td>547 (98.4)</td>
<td>1288 (98.6)</td>
</tr>
<tr>
<td>Yes</td>
<td>7 (0.6)</td>
<td>26 (1.2)</td>
<td>42 (0.7)</td>
<td>9 (1.6)</td>
<td>18 (1.4)</td>
</tr>
<tr>
<td>Asthma</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>830 (74.2)</td>
<td>1525 (69.9)</td>
<td>4213 (74.1)</td>
<td>409 (71.9)</td>
<td>901 (68.9)</td>
</tr>
<tr>
<td>Yes</td>
<td>268 (25.8)</td>
<td>657 (30.1)</td>
<td>1470 (25.9)</td>
<td>158 (28.1)</td>
<td>406 (31.1)</td>
</tr>
<tr>
<td>Depression</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1046 (93.6)</td>
<td>1930 (88.4)</td>
<td>5143 (90.5)</td>
<td>433 (77.9)</td>
<td>1065 (81.5)</td>
</tr>
<tr>
<td>Yes</td>
<td>72 (6.4)</td>
<td>252 (11.6)</td>
<td>540 (9.5)</td>
<td>123 (22.1)</td>
<td>242 (18.5)</td>
</tr>
</tbody>
</table>

* Work Status = As reported by women at each survey
Latent class analysis was used as the next step in analysis to identify dominant workforce participation patterns of women with and without children. For each strata of women (women with and without children), five latent class models were conducted (fitting two to six latent classes) and results were compared. As shown in Table 8.0.3 below, an optimal baseline model with three classes each, was identified based on the principle of best model fit, parsimony and information criteria\(^7\) (AIC, BIC and Entropy – see Glossary for definitions). The three class latent models provided adequate representation of data and enabled easy labelling and interpretation of classes for both the ‘women with children’ and the ‘women without children’.

Table 8.3: Model fit statistics for baseline latent models for evaluation of workforce participation

<table>
<thead>
<tr>
<th>Model fit Statistics</th>
<th>2 class model</th>
<th>3 class model</th>
<th>4 class model</th>
<th>5 class model</th>
<th>6 class model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Women with children</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AIC(^1)</td>
<td>1978.9</td>
<td>960.9</td>
<td>899.3</td>
<td>850.3</td>
<td>765.9</td>
</tr>
<tr>
<td>BIC(^2)</td>
<td>2123.1</td>
<td>1180.6</td>
<td>1042.6</td>
<td>986.2</td>
<td>930.2</td>
</tr>
<tr>
<td>Entropy</td>
<td>0.69</td>
<td>0.71</td>
<td>0.70</td>
<td>0.70</td>
<td>0.70</td>
</tr>
<tr>
<td><strong>Women without children</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AIC(^1)</td>
<td>1737.78</td>
<td>1084.7</td>
<td>1012.9</td>
<td>986.3</td>
<td>896.2</td>
</tr>
<tr>
<td>BIC(^2)</td>
<td>1886.9</td>
<td>1311.9</td>
<td>1123.6</td>
<td>1003.8</td>
<td>965.3</td>
</tr>
<tr>
<td>Entropy</td>
<td>0.67</td>
<td>0.73</td>
<td>0.68</td>
<td>0.66</td>
<td>0.66</td>
</tr>
</tbody>
</table>

\(^1\) AIC = Akaike’s Information Criterion  
\(^2\) BIC = Bayesian Information Criterion

The graphical presentation and further discussion of the three classes for both the groups of women is presented in next Section 8.3 – Peer Reviewed Paper. Further analysis involved stratum specific, survey adjusted multinomial regression models to assess longitudinal associations between chronic diseases (diabetes, asthma, depression and arthritis), workforce patterns and other health and socio-demographic factors. These are discussed in the next section as the peer reviewed paper.
8.3 **Peer Reviewed Paper**

This study has been submitted to a peer reviewed journal – ‘American Journal of Public Health’, and is currently under review. This paper is presented here as the final submitted version.
Health Predictors of Workforce Participation Over Time – Longitudinal Evidence for Young Women

Majeed, Tazeen., Forder, Peta., and Byles, Julie

Abstract

Objectives: This study aimed to describe workforce participation patterns of women with and without children over time and to explore the impact of health and socio-economic factors on work status.

Methods: Stratified analysis was done on 1973-78 birth cohort of Australian Longitudinal Study on Women’s Health over five surveys. Latent class analysis identified workforce patterns, while stratum specific, survey adjusted multinomial models explored associations between work status (full-time, part-time and not in paid work) and chronic diseases (diabetes, asthma, depression), health and socio-demographic factors.

Results: According to latent patterns, majority of women without children worked full time (75%), while 44.3% young mothers were in part time work and 34.5% transitioned in and out of paid work. Multinomial models demonstrated that mothers’ work status was associated with socio-demographic and other health factors, while that of women without children was significantly related to chronic diseases and other health factors.

Conclusion and Policy Implications: Findings provided insight into work patterns and associations existing among women, diversified by motherhood status. Different strategies and polices are needed to cater the needs of these women experiencing varied life roles. While, mothers need accessible and flexible work options, women without children, with chronic diseases need supportive work environments.

Key Words: Chronic diseases, Children, Health, Women, Workforce participation
Introduction

Women's workforce participation has changed remarkably over the last 50 years. Considerably more women have entered the labour market in most developed countries, with average number of hours worked by women rising since late 1960's. For instance, in 15 European Union member states, women's participation rates have increased by approximately 15% over last 15 years. Likewise, in Australia overall female workforce participation has increased by at least 30% since late 1970's. In many developed countries such as United States, United Kingdom and Australia, these changes could be explained in part by increased education among women, better employment opportunities and changes in social norms and stereotypical beliefs and responsibilities.

Many social and family factors have also played a key role in shaping women's workforce participation over many decades. For instance, family responsibilities and particularly motherhood is a major deciding factor, often influencing young women's paid work more profoundly than economic benefits or social standing. Researchers have also reported that many mothers remain out of paid work, shouldering a disproportionate load of child and homecare, while many move to part time work options to accommodate family needs.

Conversely, we can anticipate that women who do not have children and childcare responsibilities would be fully engaged in paid work. However, despite the apparent educational success of women without children and economic incentives of paid work, women's work may still be susceptible to changes in health status. Regardless of their age, marital and motherhood status, health issues and presence of chronic diseases impact women's ability to participate in workforce. A large body of literature has examined relationship between employment, health and chronic diseases. For example a Swedish study by Reine and colleagues and a Brazilian study found strong relationship between unemployment and suboptimal self-rated health and presence of other health issues. Various studies found chronic diseases such as diabetes, asthma and depression to be associated with work patterns. Many of these studies either focused on just health status, or individual chronic diseases. Tunceli et. al and Bastida and Pagan and other researchers for example, reported diabetes to negatively impact
employment, while Eisner and colleagues\(^\text{18}\) and Blanc et al.\(^\text{19,20}\) found negative impact of asthma on an individual’s workability. Depression, which is particularly more common among women,\(^\text{21}\) was also reported by many researchers to affect workforce participation by impacting performance, absence from work and higher unemployment risk.\(^\text{16,22}\)

These analyses have focused on either men or women or in some cases both, but they have not focused on comparisons within a single gender, exploring different work status and their varied associations with health and chronic diseases within a group of women. Therefore, the aim of this research is to examine how young mothers differ from women without children in terms of their workforce status, and the longitudinal relationships between chronic diseases and workforce participation. We hypothesize that health and chronic diseases are major determinants of work status, but their associations will be different according to young women’s motherhood status. For young mothers, the probability of being in paid work and particularly full-time work will drop, regardless of their health status. But for women without children, health and chronic diseases along with other sociodemographic factors will be the significant factors predicting their work status. Using longitudinal survey data followed up over a 15 year period, we explore dominant workforce patterns of young women with and without children and identify chronic diseases and other factors which might influence or predict paid work status of these two strata of young women over time.

**Methods**

**Study Design and Participants:**

This paper uses data from the Australian Longitudinal Study on Women’s Health, which is an ongoing longitudinal study, prospectively collecting data from Australian women since 1996.\(^\text{23,24}\) Women were randomly selected from Medicare database and administered by the Health Insurance Commission, with oversampling from rural and remote areas, and are broadly representative of the national population of women in this age group.\(^\text{23,24}\) For this study, questionnaire based from five survey points (2000, 2003, 2006, 2009 and 2012) were used for women born between 1973 – 1978. These women were aged 22 – 27 years and 34 – 39 years at the second and sixth survey respectively.\(^\text{25}\) The first survey (1996) was excluded from this study as participants were 18 – 23 years old and were mostly studying and not working.
Women were eligible for this study if they had provided valid responses to their work status for at least three surveys (from survey 2 to 6).

Measures:

Paid work status: At each survey, women provided the number of hours spent in paid work and these hours were used to categorize their work status as ‘full time paid work (35 or more hrs/week)’, ‘part time paid work (1-34 hrs/week)’ and ‘not in paid work (0 hrs/week)’. This work status was the outcome for our study.

Number of children: Participants were requested to provide date of each live birth up to the date of the survey, and the dates were then used to calculate the number of children at each survey. Number of children was categorized as ‘no children’ and ‘1 or more children’.

Health factors:

General health: Women were asked to self-report their general health as ‘excellent’, ‘very good’, ‘good’, ‘fair’ and ‘poor’ at each survey. This was categorized as a binary variable with ‘fair/poor’ and ‘excellent/good/very good’.

Chronic diseases: At each survey, women were asked if they had ever been diagnosed with diabetes and asthma. Depression was included from survey two onwards. These were treated as enduring conditions in our analysis, such that if women reported having one of these conditions at a particular survey, they were categorized as having that condition from that survey onwards.


Smoking status: We used the classification of the Australian Institute of Health and Welfare to categorize smoking as ‘current smoker’, ‘former smoker’ and ‘non-smoker’.

Alcohol consumption: Alcohol consumption status of women was derived from the frequency and quantity items for alcohol and was categorized as ‘non-drinker’, ‘low risk drinker (up to 14 drinks/week)’ and ‘risky/ high risk drinker (> 15 drinks/week)’ in accordance with the National Health and Medical Research Council (NHMRC) guidelines.
**Socio-demographic factors:**

**Area of residence:** RRMA (Rural, Remote and Metropolitan Areas) Index developed by Department of Primary Industries and Energy and Department of Human Services and Health was the locality measure used for the sampling. We re-categorized it as 'urban' and 'rural/remote' reflecting distance from service centres and other people.

**Education:** Highest educational qualification of women at each survey point was used to categorize education as 'no qualification', 'school certificate', 'trade/apprenticeship' and 'university/higher' degree.

**Marital status:** Women reported their current status at each survey and their responses were used to categorize them as 'partnered' if they reported married or de facto relationship, otherwise they were coded as 'not partnered.'

**Informal caring:** A binary variable was created for each survey to categorize participants who reported providing unpaid care to sick/disabled person (yes/no).

**Statistical Analysis**

The main data set was set into two strata according to whether they had children or no children, to examine different workforce patterns within strata. For this purpose, latent class analysis (LCA) was used to identify latent subgroups of work patterns for each of strata, based on participant’s responses to multiple observations of work status over time. For each strata, latent class models with two to six classes were evaluated, and results were compared. Based on the principle of parsimony, best model fit and information criterion (Akaike’s Information Criteria, Bayesian Information Criteria and Entropy). The optimal model for each strata was selected and labels were assigned for each class. These classes were then graphically presented which provides a comprehensible visualization for each work pattern.

Survey adjusted, stratum specific multinomial models were subsequently performed to assess the outcome of work status (full time work, part time work and not in paid work) with adjustments for health factors, chronic diseases and socio-demographic factors. For each strata, the models were as follows:

**Model 1:** Survey only

**Model 2:** Survey + Self-reported health + Chronic diseases (diabetes, asthma, depression)

**Model 3:** Survey + Other health factors (BMI, alcohol consumption and Smoking status)
Model 4: Survey + Socio-demographic factors (area of Residence, education, marital status and informal caring)

Model 5: Full adjusted model with all covariates

Statistical significance was defined at a level of 0.05 and all analyses were performed using SAS software, version 9.4 for Windows.33

Results

At survey two, there were 1,732 women (22 – 27 years old) with one or more children. At each consecutive survey more women reported having at least one child, with 5,854 women with one or more child by survey 6 (women were aged 34 – 39 years). Within this group of women, approximately 2% reported having diabetes, while asthma and depression was reported by 25.7 and 19% of women with one or more children respectively.

In comparison, 8,893 women had no children at survey 2, with this proportion decreasing at each subsequent survey. By survey 6, only 2,061 women reported having no children. In this group of women, 2% reported having diabetes, 28.3% had asthma and 18% reported having depression (Results not shown here).

Patterns of workforce participation

For each strata (women with and without children), separate latent class models with three classes each were selected. These patterns were examined and distinct labels were assigned to each of these classes to allow easy interpretation of workforce patterns from survey two to six. The workforce patterns were markedly different for women with and without children (Figure 1).

i) Women with children – workforce patterns and chronic diseases:

While many women with children (44.3%) worked part time, some had increasing pattern of full time paid work (21.5%) as they entered 30’s and some (34.5%) transitioned in and out of paid work. Among those classed as in ‘increasing full time work’, 1.4% reported having diabetes, while 22.6% reported having asthma and 16.6% had depression. Similar prevalences of chronic disease were reported by women (with children) classed as either ‘in and out of paid work’ or ‘mostly part time work’ (results not shown here).

ii) Women without children – Workforce patterns and chronic diseases:

In comparison, women without children were mostly working full time (74.9%) with few transitioning between full time...
and part time work (17.4%), with the remaining 7.8% of women shifting in and out of paid work over time. In this group of women, 31% classed as ‘in and out of paid work’ and 33% of classed as ‘full time and part time work’ reported having asthma, in comparison to 27% classed as ‘mostly full time work’ reporting asthma. Similarly, higher proportion of women who were classed as either ‘in and out of paid work’ and full time and part time work’ reported having depression, while 16% of full time working women without children had depression (results not shown here).

Figure 1: Pattern of workforce participation for women with and without children

**Strata specific multinomial models**

i) *Women with children:*

In the final, multinomial model (see Table 1), at Survey 3, 4 and 5 (compared to Survey 2), women with children were significantly more likely to be in part time work and not in paid work (compared to full time). For example, at survey 3 these women were three times
more likely (OR=3.26; p<0.05) and twice as likely (OR=2.13; p<0.05) at survey 4 to be not in paid work. Chronic diseases had no significant association with survey adjusted work status among young mothers. As compared to non-drinkers, low risk and risky alcohol consumption was associated with increased likelihood of being in full time paid work, while those living in rural areas were 18% (OR=0.82, p<0.05) less likely to be not in paid work. Women with obese BMI had significantly decreased odds of part time work and not in paid work (OR=0.71 and 0.83 respectively), while those who were partnered had decreased likelihood of full time work.

Women who had diploma or higher education were less likely to be not in paid work. There were no substantive differences between model 1 – 4 and the final adjusted models (results not shown here).

**ii) Young women without children:**
As seen in Table 1, compared to Survey 2, the odds of being in part time work were significantly lower in all surveys after accounting for all the factors, compared to those in full time work. However, odds of being in not in paid work were significantly higher at survey 3 (OR=1.26; p<0.05) and lower at survey 4 (OR=0.77; p<0.05), compared to survey 2. Women who reported asthma were 31% and 27% more likely to be not in paid work and part time work respectively (OR=1.31 and 1.27, p<0.05 respectively), when compared to full time work. Likewise, those with depression were twice as likely to be not in paid work (OR=2.12; p<0.05), with increased odds of being in part time work, and those with diabetes had 88% increased odds of being not in paid work (OR=1.88; p<0.05).

Residence in rural/remote areas, caring responsibilities and having underweight or overweight BMI was found to be negatively associated with full time work. However, having some educational qualification and partnered status were associated with full time work (for example: higher education and part time work OR=0.58; p<0.05 and partnered status and not in paid work OR=0.65; p<0.05). Associations of model 1, 2, 3 and 4 (results not shown here) were not significantly different from the final, survey adjusted model presented in Table 1.
### Table 1: Final and survey adjusted multinomial models for women with and without children

<table>
<thead>
<tr>
<th>Work Status (Reference = Full time work)</th>
<th>Women With Children (n=7,819)</th>
<th>Women Without Children (n=6,428)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part time work OR (95% CI)</td>
<td>Not in paid work OR (95% CI)</td>
<td>Part time work OR (95% CI)</td>
</tr>
<tr>
<td>Survey 2</td>
<td>1.69 (1.41, 2.02)</td>
<td>3.06 (2.68, 3.47)</td>
</tr>
<tr>
<td>Survey 4</td>
<td>1.42 (1.19, 1.69)</td>
<td>2.13 (1.76, 2.58)</td>
</tr>
<tr>
<td>Survey 5</td>
<td>1.42 (1.20, 1.68)</td>
<td>1.70 (1.40, 2.05)</td>
</tr>
<tr>
<td>Survey 6</td>
<td>1.05 (0.92, 1.30)</td>
<td>0.99 (0.81, 1.21)</td>
</tr>
</tbody>
</table>

### Health and chronic diseases

**Self-rated Health**

- Excellent/ good: 1
- Fair/poor: 0.90 (0.77, 1.05)  (OR 1.36 (1.20, 1.55), 2.82 (2.17, 3.17))

**Diabetes**

- No: 1
- Yes: 1.01 (0.72, 1.41)  (OR 1.22 (0.85, 1.77), 1.88 (1.11, 3.19))

**Asthma**

- No: 1
- Yes: 0.85 (0.71, 1.05)  (OR 1.27 (1.05, 1.53), 1.31 (1.01, 1.69))

**Depression**

- No: 1
- Yes: 0.88 (0.73, 1.06)  (OR 1.39 (1.17, 1.66), 2.12 (1.65, 2.72))

### Other health factors

**Body Mass Index (BMI)**

- Underweight: 1.15 (0.88, 1.49)  (OR 1.12 (0.94, 1.33), 1.34 (1.01, 1.78))
- Healthy: 1
- Overweight: 0.93 (0.83, 1.04)  (OR 0.95 (0.85, 1.06), 1.21 (1.02, 1.44))
- Obese: 0.71 (0.62, 0.83)  (OR 0.85 (0.74, 0.97), 1.23 (0.99, 1.53))

**Alcohol consumption (drinking)**

- Non-drinkers: 1
- Low risk drinkers: 0.83 (0.71, 0.96)  (OR 0.66 (0.56, 0.76), 0.34 (0.27, 0.41))
- Risky drinkers: 0.66 (0.50, 0.88)  (OR 0.69 (0.54, 0.86), 0.24 (0.16, 0.35))

**Smoking**

- Non-smoking: 1
- Former (ex) smokers: 1.00 (0.89, 1.12)  (OR 1.06 (0.94, 1.19), 1.11 (0.92, 1.34))
- Current smokers: 0.83 (0.72, 0.96)  (OR 1.01 (0.91, 1.12), 0.87 (0.72, 1.05))

### Sociodemographic factors

**Marital status**

- Not partnered: 1
- Partnered: 1.69 (1.47, 1.95)  (OR 1.52 (1.29, 1.78), 0.85 (0.78, 0.92), 0.65 (0.57, 0.76))

**Education**

- No education: 1
- School certificate: 1.29 (0.98, 1.70)  (OR 0.84 (0.65, 1.09), 0.44 (0.31, 0.63))
- Diploma/apprenticeship: 1.12 (0.85, 1.48)  (OR 0.66 (0.50, 0.85), 0.27 (0.19, 0.40))
- Higher education: 1.05 (0.81, 1.35)  (OR 0.56 (0.45, 0.74), 0.22 (0.15, 0.32))

**Area of Residence**

- Urban: 1
- Rural: 0.97 (0.86, 1.08)  (OR 1.20 (1.10, 1.31), 1.19 (1.02, 1.39))

**Informal Caregiving**

- No: 1
- Yes: 1.06 (0.89, 1.26)  (OR 1.46 (1.23, 1.73), 1.49 (1.14, 1.93))

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Discussion

The current study identified distinctly different workforce participation patterns for women without children and those who had one or more children. Secondly, it examined whether chronic diseases, other health factors and socio-demographic factors were significant predictors of work status (full time work, part time work and not in paid work) over time. Latent class patterns revealed by this study highlight the divergence in young women’s work status, with children being the crucial distinction. Majority of women without children were engaged in full time work, with some transitioning between full time and part time work and few were continuously in and out of paid work over time. This scenario was different for young mothers. Almost half of women in this group worked part time and many had increased participation in full time work as they entered their 30’s, reaching a peak at 31–36 years of age. However, a large number of women in this group transitioned in and out of paid work at all time points. It is interesting to note that some mothers might combine childcare and flexible working plans by working part time, others may remain out of paid work either voluntarily or involuntarily. While mothers may decide not to work by own choice or orientation to work as emphasized by many Neo-classical theories, there are other factors which might act as barriers to get paid work.

Further longitudinal analysis identified factors which might impact the odds of being in paid work for both groups of women with and without children. Findings suggested that different factors were associated with work status for these two strata of women. Work status of women without children was found to be associated with chronic diseases (diabetes, asthma and depression), health factors and socio-demographic factors. This correlation of health, chronic disease and work patterns of young women could be expounded by ‘social causation theory’ and by ‘health selection hypothesis’. According to ‘selection hypothesis’ women who reported poor general health, or had asthma, depression and diabetes may have difficulty finding and retaining their work. Alternatively, as per ‘social causation theory’ being not in paid work or involuntarily exit from work can have detrimental effect on health.

Also, attainment of education became easier and accessible for women, with well educated women finding the opportunities and right skills to engage in full time work. These findings also corroborate other studies, that having some sort of qualification was likely to encourage and
facilitate full time work in women. Women without children living in rural areas may also face a number of barriers to get paid work. For example, unavailability of suitable full time work, or the only option of doing some casual part time work or long travel distance to jobs may impact work status of women.

With time many traditional female gender norms such as, married women or mothers staying at home, or women quitting work after marriage have been challenged. Especially young mothers embraced these egalitarian gender beliefs and were drawn into paid work. Also, policy reforms addressed the need for affordable childcare to allow young mothers greater work opportunities to return to work.

Part-time work schedules are also a popular option for women struggling to reconcile the competing demands of employment and motherhood, thus adapting their work patterns to suit the needs of the family. While many women leave work when they have children, a substantial share of women remain in paid work and also engage in full time work, for financial reasons and to maintain living standards as also reported by Birch, International Labour Organization and others. Mothers who had partners were less likely to be in full time work, possibly supporting the theory of ‘income effects’ whereby partner’s income reduces women’s paid work participation. This is in contrast to women without children who were more likely to engage in full time work when partnered.

The association between risky alcohol consumption and smoking among women might be explained by ‘multiple burden hypotheses’. Considering this theory, women might consume alcohol as a coping strategy for their complex social roles. In particular, women who feel forced to accept work which gives little or no satisfaction might use alcohol or smoking to alleviate tensions that this situation may engender. Also, possible conflicting demands of these roles (e.g. childcare, paid work, living in rural areas) may also put mothers under stress and thus use alcohol or smoking to cope. Women with or without children are more likely to spend more time on household, childcare or informal caring duties as compared to their partners or as un-partnered women.

**Implications**

There are two implications of our findings. Firstly, our analysis demonstrated diversity in workforce participation of young women, with children making the vital distinction. This is very important in current workforce related policy environment. Despite willingness to work,
many mothers face significant barriers to join or re-enter paid work. Apart from easily accessible and affordable childcare options for families and mothers, women could also be supported in both flexible working arrangements and when transitioning back to full-time work by focused recruiting and pay scale strategies such as German Familienpflegezeit plan.

Secondly, the results demonstrated the capacity of health and socio-demographic factors to particularly impact work status of women without children. In addition to economic and financial implications of women not engaged in paid work due to poor health, there are some important public health perspectives of this issue. Chronic diseases and particularly depression are on the rise in young women, and enabling these young women to actively participate in work could also positively affect their health. Thus, more health and employee-friendly policies are needed to encourage employers to hire women with chronic diseases in a supportive work environment. Also, multiple preventive risk minimizing strategies for prevention and management of chronic diseases at young age are needed, which are imperative for long term workforce participation and greater economic stability of nations. On the other hand, work is also associated with increases in health risk behaviours, therefore health promotion is also very important for working women of childbearing age.

This study had some limitations. For instance, chronic conditions were self-reported and though self-reported data is considered valid, there exists a possibility of reporting bias. We could not establish causality as we had limited information about duration, severity and trajectory of diseases. Also, the latent workforce patterns were hypothetical, and our data did not provide information of women were seeking work and reasons they were out of paid work.

However, our main strength was the use of longitudinal data collected over five survey points for over 15 years. Australian Longitudinal Study on Women’s Health is the nationally representative and largest long-term study on women life and health issues in Australia.

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8.4 Conclusion

The aim of this study was to explore the workforce participation patterns and their associations with the chronic diseases and various life course factor, among a cohort of young women (born 1973 – 78) over five survey points (from 1999 to 2012). It was hypothesized that among this group of women, life events such as having children are vital in shaping employment choices and work patterns. Therefore, the data and analysis was stratified according to the motherhood status. The findings of this study are very important in understanding the work behaviours of the young women, depending on their motherhood status. While chronic diseases seem to influence the work patterns of women without children, those with children exhibit strong associations between the socio-demographic factors and the work patterns. These findings depict the strong influence of children on the work patterns of women, along with how life factors such as education, marital status impact mothers. On the other hand, women without children exhibit work patterns similar to men (see Study 2 – Chapter 5), with many of them in full time work, and those with chronic diseases more likely to be out of paid work. Considering these variations among the women of same age cohort, it is fundamental for work related policies to be tailored to enable these young women to engage in paid work. If governments want to increase the workforce participation of mature age people, it is equally important to identify barriers to paid work at young ages as well. Better education and support systems for young mothers such as flexible work options and enabling women with chronic diseases to work (if they want to) are crucial for a sustained, healthier and productive workforce.

8.5 Next Chapter – Thesis Discussion, Conclusion and Policy Briefs

The next chapter presents the thesis discussion and the final conclusion.
CHAPTER 9:

THESIS DISCUSSION AND
CONCLUSION
This chapter provides the final discussion and conclusion of the findings from preceding chapters (Chapters Four to Eight) and summarizes the patterns of workforce participation across the life course and their associations with chronic diseases (diabetes, asthma, depression and arthritis) and various life course factors.

9.1 DISCUSSION

Men and women often face voluntary or involuntary changes and transitions in their work over the life course, with many people not participating fully in paid work over their adult lives. This might become an increasingly important human resource and skills issue as the population’s age composition shifts towards men and women aged 60 years and over. Health, particularly chronic diseases play a major role in shaping work trajectories not only at mature and older ages, but at younger age as well. In addition, many early and adult life circumstances act in conjunction and continuously over the life course to impact work related decisions throughout life. Moreover, patterns of work also differ greatly by gender. However, as outlined in Chapter 2 – ‘Background and Literature Review’, little attention has been given to the importance of a gendered approach in examining patterns of workforce participation and its associations with chronic diseases and various early and adult life factors over the life course. This thesis endeavours to address these gaps, with a focus on exploring workforce participation patterns of men and women across adult life, up to the age of 60 – 64 years old.

The overarching aim of this thesis was to ascertain the patterns of workforce participation over the life course, and their associations with chronic diseases and various early and adult life factors for men and women. Herein, background of the relevant topics and review of existing literature was discussed and five chapters comprising the results of cross-sectional and longitudinal (both retrospective and prospective) research have been presented.

The findings of this thesis add significant knowledge to the understanding of the diversity of patterns of workforce participation over the life course among men and women, highlighting the complex interplay between gender roles and norms, chronic diseases and other life factors. This
final chapter provides contextualized synthesis and discussion of the study findings, along with suggested implications for policies and reforms. The five studies presented in this thesis are:

i) Employment status and chronic diseases: A cross-sectional study among 60 – 64 year old men and women.

ii) A gendered approach to workforce participation patterns across the life course for an Australian ‘baby boom’ cohort.

iii) Exploring workforce participation pattern and chronic diseases among mid-age Australian men and women over the life course.

iv) Women, work and illness: Latent class analysis of longitudinal data for 11,551 middle age women.

v) Health predictors of workforce participation over time – Longitudinal evidence for young women.

While the findings of Study 1 (Chapter 4) are based on cross-sectional analysis showing associations between employment and chronic diseases at mid-age, subsequent studies present the patterns of work over time. The findings from each of these studies have been combined and presented concurrently to address the research aims posed in Chapter 1 ‘Introduction’, Section 1.2, and are discussed below.

**9.1.1 Employment categories and patterns of workforce participation among men and women over the life course**

The first of the studies presented in this thesis (Study1 – Chapter 4), showed that on the basis of current employment, men and women aged 60 – 64 years were classified as ‘full time work’, ‘part time work’, ‘self-employed’, ‘disabled/ sick’ and ‘not in paid work’, with the majority of men and women being not in paid work. As compared with men, more women were engaged in part time work. This finding of a higher proportion of women in part time work was also corroborated by findings of the second study (Chapter 5), which identified four dominant workforce patterns among 60 – 64 year old men and women, over their adult life course. Findings of this study also indicated that when compared with men, more women exhibit the
pattern of increasing part time work, particularly after the age of 40 years. Study 4 (Chapter 7) confirms these work patterns within a prospective cohort of women as they age from their 40’s into their 60’s. Study 5 (Chapter 8) analysed the work patterns of a younger cohort of women (born 1973 – 78), finding different patterns for women with and without children. Young women without children had patterns similar to the men’s workforce patterns, especially when they were in their 20’s and 30’s, whereas young women with children had patterns similar to the middle aged women of 1946-51 cohort. These women, regardless of their cohort, represent women who adapt their work life in order to reconcile the competing demands of their work and family life. Past decades have seen an exponential rise in the trend of increased part time (and casual) work options.

For middle aged women, part time work may be a popular choice for those who left work when they were young due to the responsibilities of family or children, and then decided to return to work when their children left home or after divorce or separation. Furthermore, for many young mothers and for women in middle age, financial conditions and changes in partners’ work e.g. redundancy or retirement, may also be a driving force to engage in part time work as a step towards ‘increasing full time work’ as suggested by one of the dominant class for the mid-aged women. While working part time may be a choice made by many middle aged and young women, exhibiting their own orientation to work; for many it may depict barriers in obtaining full time employment. For instance, unavailability of affordable child care, not finding suitable full time work according to qualifications, long distance travel to work or family responsibilities may act as an impediment in finding work of their own choice.

Interestingly, men’s working patterns do not show this adaption to part time work. Increased part time options might allow more men to work part time. Compared with women, few men aged 60 – 64 years reported their current work status as ‘part time’ in Study 1 (Chapter 4). Correspondingly, some 60 – 64 year old men (in Study 2 – Chapter 5) engaged in part time work over the life course. Among this cohort of men, those classified as ‘decreasing full time work after 40 years’, showed some part time work as they left full time work. According to the
workforce patterns of men over the life course in Study 2 (Chapter 5), many men were classed as ‘not in paid work after 55 years’, and the majority of men in Study 1 (Chapter 4) reported their current work status as ‘not in paid work’ when aged 60 – 64 years in 2011. The workforce patterns defined in these studies are consistent with previous work models for men, whereby they predominantly exhibit the work/ no work dichotomy. The pattern of decline in work after age 55 is also consistent with the Australian Bureau of Statistics’ reports of a decline in Australian men’s employment as they reach middle age, with the median age of retirement being 58.5 years for men. Contrary to women’s much more flexible, diverse workforce patterns exhibited over their life course, men showcase more stereotypical patterns of mostly working full time across the entirety of their working life and then leaving the workforce in their late 50’s.

Though the proportion of women in full time work was lower than men, many women do engage in full time employment over the course of their lives. For example, among those cross-sectionally examined in Study 1 (Chapter 4), some women (13.4%) reported their work as ‘full time’. Also, among 60 – 64 year old women in Study 2 (Chapter 5), ‘mostly full time work’ was the dominant work pattern, followed by ‘decreasing full time work after 55 years’ (similar to men), but with an ‘increase in part time work’ as another workforce pattern. Among middle aged women followed prospectively over their life as they aged from 40’s to 60’s (Study 4 – Chapter 7), most were in paid work for most of their adult working life. Similarly, young women with children were more engaged in part time work, but some had a pattern of ‘increasing full time work’ as they entered their 30’s. Young women without children were predominantly ‘mostly in full time work’. These women exemplify two generations of career oriented and educated women engaged in paid work and full time paid work throughout their adult working lives. When the middle aged women entered the workforce, Australia’s work environment was changing, women were given more opportunities to study and enter careers which were previously dominated by male workers. With time and changing societal perspectives and behaviours about working women, decreased fertility rates and increased costs
of living, many women defied the stereotypical female homemaker roles prevalent in 1950s and 1960s, and embraced more competitive roles in employment as full time workers.37, 39 In many instances, women such as young mothers or young women without children may need to work full time in order to support their partners, and to maintain their living standard in the face of increasing costs of living and economic depression.41, 229

In direct contrast, a significant proportion of young and mid-age women remain out of paid work over the life course (Study 4 – Chapter 7 and Study 5 – Chapter 8 respectively), while adopting the traditional gender norms of women as carers and with family responsibilities.179, 186, 231, 234, 235 However for some, this might not be their choice, rather they may face barrier to obtain and/ or retain work, possibly due to their health issues, lack of skills and education or other life circumstances.21, 77, 129, 141, 142

These results support the hypothesis of this thesis, that workforce participation patterns are vastly different for men and women, and provide substantial evidence to highlight the importance of ‘gender roles’ in relation to work and various patterns of work over the life course. The workforce patterns identified in the studies also reflect the changing dynamics of work as men and women age. One very important aspect of these findings is the emerging pattern of decreasing engagement in paid work by men and women at relatively young ages, which is of great importance in view of current debate about working for a longer period of time.

9.1.2 Workforce participation patterns and early and adult life circumstances – Associations over the life course

After identifying dominant patterns of workforce participation, the next aim addressed in this thesis was to explore associations of workforce patterns with various early and adult life factors over the life course, while highlighting gender differences in these associations.

Findings of the Study 2 (Chapter 5) of this thesis suggest the influence of early and adult life factors such as childhood socio-economic conditions, education, marital status and caring
responsibilities, in defining the pattern of workforce participation, highlighting different effects for men and women. The number of books available during childhood was used as an indicator of early life socio-economic conditions, and were found to be associated with work patterns of women, but had no association with work patterns of men.

This finding supports previous research which showed that childhood books have a positive association with workforce participation at mature ages, with those having books during childhood being more likely to be employed at older ages. Moreover, having books in the home during childhood also indicates a higher level of educational and intellectual background of families. Educational qualifications, including some post school qualifications such as trade/apprenticeship or diploma or graduate studies, were also found to be protective against the ‘not in paid work’ status among 60 – 64 year old women over the life course (Study 2 – Chapter 5). A similar association between education and paid work was reported for middle aged women in Study 4 (Chapter 7). This reinforces previous research which has indicated that a better educational background of the family is positively associated with increased chances of children obtaining educational qualifications, acquiring better jobs and continuing in paid work for longer. The women of the ‘baby boomer’ cohort epitomize the educated and career oriented women of late 20th century. This association of their later life employment with childhood books and educational qualifications highlights the importance of education and workforce participation, which is more pronounced for women. Higher education also enables women to attain better jobs, increase their earning capacity and also increase their chances of re-entering paid work in later adult life. Lack of a similar association among men indicates that they engage in paid work regardless of their education, and confirms that for men, the male breadwinner model of work still exists and impacts their work decisions.

In addition to childhood socio-economic status and educational qualifications, marital status and informal caring responsibilities were also found to be associated with workforce participation patterns of men and women. Results from Study 2 (Chapter 5), indicate that partnered men and
women were more likely to be working full time over the life course. Similarly, partnered young women without children were also more likely to be in full time work over their life course, as reported in Study 5 (Chapter 8). Alternatively, young women with children and middle aged women (Study 4 and 5 respectively), were less likely to be mostly in paid work if their marital status was partnered. These contrasting findings corroborate result of other studies, which also present conflicting results. For instance, Gerber et al.,237 Huang et al,230 Haider and Loughran184 and Li et al.26 reported that partnered women were more likely to be employed, while other international researchers (such as Dahl et al.,182 Larsen and Pedersen,125 and Ruhm183) found that women with partners were less likely to work, especially at older ages. These differences in association of marital status with work patterns for women in the current studies might be attributed to at least three factors. Firstly, young mothers with partners who were less likely to be working may depict the class of women who leave the workforce when they have children in order to embrace a traditional homemaker role.231 Secondly, their partners may also provide financial support which assists in women’s decisions to remain out of paid work, supporting the theory of ‘income effects’, whereby women’s workforce participation reduces if her partner has a good income.39 Moreover, women who have been in paid work for longer may be more empowered to remain single, or conversely they may need to work full time for financial reasons as they do not have additional financial support from partner. Many middle aged women preferred to (or they have had to) remain out of paid work when they married and then never re-entered the workforce due to family and caring responsibilities.39, 182, 186, 230, 235 However, it should be noted that the majority of women in these studies who were in paid work were partnered as well. This underscores the need for women (who want to work) to juggle their various social roles and work choices.
9.1.3 Associations between chronic diseases (diabetes, asthma, depression and arthritis), workforce participation, and early and adult life factors over the life course

Findings from the cross-section analyses in Chapter 4 (Study 1), coupled with those from the longitudinal analyses in Chapter 6, Chapter 7 and Chapter 8 (Studies 3, 4 and 5 respectively) suggest that chronic diseases (diabetes, asthma, depression and arthritis) are associated with workforce patterns of men and over the life course. While the role of health on the whole has been shown to impact workforce participation by many past studies, this thesis has presented a unique approach by first identifying dominant patterns of workforce participation over the life course, and then exploring their association with chronic diseases (diabetes, asthma, depression and arthritis) and early and adult life factors.

Diabetes

Diabetes was found to be more prevalent among 60 – 64 year old men of both the ‘45 and Up Study’ and the ‘LHH survey’, as compared with the women. Men in full time work and self-employment were less likely to report diabetes, and those classed as ‘disabled/ sick’ had increased likelihood of reporting diabetes among both men and women. Although, there was no significant association between diabetes and workforce patterns among 60 – 64 year old men and women from Study 3 (Chapter 5), and young mothers from Study 5 (Chapter 8); the middle aged women (Study 4 – Chapter 7) were less likely to be ‘mostly in paid work’ if they had diabetes. Likewise, young women without children were more likely to exhibit patterns of ‘not in paid work’ and ‘increasing part time work’ if they had diabetes (Study 5 – Chapter 8).

In summary, diabetes was more prevalent among men but had a significant association with work among middle aged women and young women without children. There was no association between diabetes and work patterns of men. There are a few potential explanations for these results which substantiate and further establish the impact of diabetes on workforce participation described by previous research. Firstly, the health effects of diabetes (described in detail in
Chapter 2, section 2.2.5.5), may impact women’s ability to participate in the workforce, as they cannot sustain the pressures and demands of their work. Secondly, they may face hiring discrimination on the basis of their health issues. Women from Study 3 (the ‘LHH survey’) were probably the more educated of our cohorts and due to this reason were more likely to be in better jobs. Other life factors such as marital status and education may have a more significant effect on their work, than compared to the effect of diabetes. Men may have other pressures to work that over-ride the effects of diabetes (discussed in Chapter 5).

**Asthma**

According to Study 1, asthma was more prevalent among women and was significantly associated with women classified as ‘disabled/ sick’. Conversely, there were no gender differences in asthma prevalence for participants of the ‘LHH survey’ (Study 3 – Chapter 6). Also, asthma was not found to have any significant association with workforce participation in this study, which might be due to the smaller sample size (N=1,266). In contrast, when data from the middle aged women and young women without children were analysed longitudinally over time (Study 5 and 4 respectively), asthma was found to negatively influence workforce participation, though asthma had no association with work patterns of young mothers.

In summary, asthma was not associated with workforce participation of men, but was likely to influence middle aged women’s and young women’s work patterns over time. As explained in Chapter 2, section 2.2.5.6, asthma can be associated with severe bouts of breathlessness and difficulty in breathing. These health impacts can act as a major barrier for women in retaining some particular occupations, while also requiring frequent time off from their work schedules.  

90, 92-94, 155, 156

**Depression**

In accordance with Australian and international figures, women were found to have a much higher prevalence of depression as compared with men, with depression found to have different consequences for men than for women. Though men were more likely to be ‘not in paid
workforce’ if they had depression, women with depression showed a contrasting pattern of being more often classified as in ‘part time work’ (Study 3). However, young women without children and middle aged women were not in paid work if they had depression (Study 5 and 4 respectively).

One likely explanation for these differences might be the way women and men respond to and balance their life situations and chronic health issues. For women, one choice (or it might be the only option they have) is to transition to part time work if they find it harder to work full time due to depression. However, men may find it harder to retain jobs once they develop depression and this might result in high job turnovers.99, 100, 102, 137, 140 Alternatively, being out of paid work or an early exit from the workforce due to other health conditions (such as diabetes) may also have a negative effect on their mental health.68, 104

**Arthritis**

As compared with men, arthritis was more prevalent among 60 – 64 year old women participants of Study 1 and 3 (Chapter 4 and 6 respectively). Middle aged women from Study 1 in full time or part time work were less likely to report having arthritis. However, arthritis was not significantly associated with workforce participation patterns among middle aged women of the ‘LHH’ cohort (Study 4 – Chapter 7), most likely due to small sample size (N=577 women). Among men, arthritis was associated with ‘decreasing full time work after 40 years’. Also in Study 4, middle aged women with arthritis were less likely to be in paid work.

One likely explanation of arthritis impacting men’s full time working status more significantly, is that women with arthritis might have opted out of paid work much earlier, as women are affected much earlier and with more severity in the life course (as evident from Study 2, Chapter 5).115 This theory is further corroborated by findings from Study 4 (Chapter 7), which indicated that middle aged women with arthritis were more likely to exhibit work patterns of ‘early paid work’, ‘mostly not in paid work’ and ‘gradually not in paid work’. Moreover, other early and adult life factors such as education and marital status (and the possibility of financial
security as a result), may also be important when defining the impact of arthritis on women’s work patterns.\textsuperscript{160, 238, 239} Highly educated women are more likely to be in well paid office jobs and less likely to be in physical labour and therefore, more likely to retain their jobs despite having arthritis. In contrast, many men who are in physical labour may find it harder to retain their jobs due to the disability associated with arthritis.\textsuperscript{159-161}

**Summary**

Chronic diseases (diabetes, asthma, depression and arthritis), act along with various early and adult life factors over the life course to affect the workforce participation of men and women.\textsuperscript{17, 77, 130, 131, 139, 188} These associations will be different for men and women, depending not only on the natural history of disease, but also on how men and women respond to their health issues and various life circumstances. Men are more likely to show a work/no work dichotomy in the event of chronic disease.\textsuperscript{31} Women on other hand might choose more flexible working options, while balancing their caring and family responsibilities, children and health issues.\textsuperscript{31, 39, 229, 234, 237, 240-242} Furthermore, being out of paid work (whether by choice or not) can negatively affect health as per the ‘Social causation model’, and then health issues may act as a limitation and impediment to obtain and retain paid work as explained by ‘Health selection hypothesis’.\textsuperscript{243}

Therefore, it is of utmost importance to consider all the aspects of these complex associations of chronic disease and workforce participation patterns over the life course, and with a gendered perspective when discussing the implications and translation of these research findings.

### 9.2 Implications Of Findings

Results of the five studies presented in this thesis add new evidence to the existing body of literature about gender differences in workforce participation patterns. This research identified distinct workforce participation patterns over the life course, which differed for women and men. In addition, evidence is provided about associations of childhood and adult life circumstances, (especially the availability of books during childhood, education, marital status and informal caring) with distinct patterns of workforce participation across the life course.
which differ among women and men. Moreover, the findings establish the importance of understanding gender inequalities in workforce participation, along with ascertaining some key concern areas over the life course which are strongly associated with work experiences, not only at mature age but impacting young people as well. For instance, better educational attainment at younger ages is essential in shaping people’s intellect, while motivating them to achieve better employment opportunities in later life.

Policies are fundamental in forming the longer term experiences and attitudes of people. Currently, policies have been introduced to increase workforce participation of older people. However, little attention is being paid to the importance of early life factors on later life workforce participation. Likewise, the impact of disadvantages in early middle life – such as unemployment, marital dissolution and chronic diseases – needs to be considered for some gender specific policies and strategies. This gender specific approach is crucial in addressing particular needs and issues of men and women, which will enable them to participate in the work force through adult life and into later working years. In particular, this will be a vital step for men and women who had fewer social or economic opportunities earlier in life.

In addition to policies, some practical approaches which are targeted to act at different points in the life course are also needed. For example, socially disadvantaged people having difficulty in finding and retaining jobs, need to be given better opportunities and skill training. Furthermore, as governments aim to encourage mature workers to keep working for longer periods, mature age men and women should be given additional support such as computer training etc. to ensure they are socially and mentally prepared to work longer.

The ability of people to contribute to work can be limited by chronic disease. Many men and women decrease their workforce participation as they age and as their disease progresses. Therefore, policy makers could invest in future interventions and practical programmes aimed at people who have chronic diseases, with emphasis on gender. A gendered approach is very important when considering the important role of gender in disease progression, prognosis and on quality of life. As men and women conform to different roles in society, and chronic
diseases such as diabetes, depression or arthritis significantly impact their employment decisions in different ways, policies and programs should address gender as a separate entity. There may also be some programmes or strategies to encourage employers to hire people with chronic health issues and to support men and women with these issues. As previously discussed in Study 3 (Chapter 5), engagement in paid work can also positively affect the health of men and women suffering from chronic diseases such as depression. Therefore, hiring men and women with health issues might benefit their health in the long run, which will have a positive affect on long term workforce participation and greater economic stability for nations.

Another possible implication of the research findings, is realizing the potential of encouraging flexible and part time work options. As reported in these studies, part time work has been a viable option for women with chronic diseases. Comparatively, men should also be encouraged to embrace part time working options, by means of better health promotion activities and supportive work environments.

Stronger anti-age discrimination policies, with employer incentives to employ people with chronic diseases, will also help men and women to work, regardless of their age and health status. Also, encouraging intergenerational approaches to workforce development may help to accommodate the needs of people with social and health disadvantages not only at older ages, but at younger ages as well. For instance, many young women, particularly mothers, may face barriers in continuing employment after they have children. Such barriers are being addressed in Australia by parental paid leave schemes and the childcare services which are available. However, childcare should be more affordable, and more easily and widely accessible to all. Furthermore, mothers should be offered easy and flexible work plans to enable them to transition back to work after their children.

Public health campaigns are required to educate people about chronic diseases and the importance of their prevention from young ages. It is equally important to inform individuals about the long term effects of early and adult life factors and how these factors link together with health issues and workforce participation in later life.
Workforce patterns are a reflection of an individual’s circumstances and health over their life course. Current government policies and programmes will only succeed in encouraging young and older people to remain in the workforce for a longer period of time, if their health and life circumstances allow them to do so.
9.3 STRENGTHS AND LIMITATIONS

A major strength of this thesis is its research design and the use of data from three different sources. Data from the largest long-term retrospective study of ageing in Australia197 – the “45 and Up Study”197 was used to cross-sectionally examine a sample of over 41,000 men and women nearing retirement age, i.e. participants aged 60 – 64 years old (see Study 1 – Chapter 4). Study 2 and Study 3 (see Chapter 5 and 6 respectively) used data from the Australian ‘Life History and Health Survey (LHH)’. The ‘LHH’ was specifically designed to collect comprehensive work histories as well as health conditions across the life course and provided rich information about workforce participation, childhood and adult influences affecting individuals over the life course. This data permitted the identification of distinct patterns of workforce participation over the life course between men and women. Studies 4 and 5 (see Chapter 7 and 8 respectively) used data from two large cohorts of women surveyed over six time points (since 1996) from the ‘Australian Longitudinal Study on Women’s Health’ (ALSWH). ALSWH is the largest, long-term and nationally representative study targeting women’s health and life issues in Australia,206,208 with over 11,000 mid-age women in Study 4 and over 14,000 young women in Study 5. Using cohorts of this magnitude in five studies allowed for cohort contrasts and examination of various factors over the life course.

A further strength of this thesis is the use of a number of novel statistical techniques. To date, latent class analysis has not been used to identify patterns of workforce participation over the life course. This thesis used latent class analysis to identify patterns of workforce participation in Studies 2, 3, 4 and 5, while further advanced forms of LCA were used to explore various associations of workforce patterns and early and adult life factors. There have been some methodological developments of using other statistical techniques to summarize specific groups of trajectories, with emphasis on the temporal sequence of events. One such technique is ‘Sequence Analysis’ which is a non-parametric approach to analyse ordered sequence of particular life events.247,248 In this thesis latent class analysis was found to be an appropriate
analysis technique, as it identified dominant workforce patterns and accounted for presence of completely random variations across the participants.\textsuperscript{247, 248} However, sequence analysis or other advanced techniques will be used to extend this research in some future projects.

Despite the strengths of this thesis, there are also some limitations. Study 1 was cross-sectional in nature, therefore, workforce participation of men and women over time could not be ascertained. As reporting bias cannot be excluded, we also used self-reported doctor diagnosed health conditions. However self-reported health conditions are considered a valid measure,\textsuperscript{134} with many studies using self-report as the method for ascertainment of chronic conditions in population health research. Also, common diseases such as diabetes, asthma, depression and arthritis which are readily identifiable were used. However, information regarding the severity and complexity of chronic conditions or their duration was not available, and these factors can also have an impact on workforce patterns over the life course. Some of the participants were categorized as ‘disabled/ sick’ according to their responses. It should be noted that ‘disability’ might be a labelling issue for a small number of people who want to leave the workforce and may be used to claim benefits and government assistance.\textsuperscript{249} This may bias the results due to the possibility of reciprocal causation between their ‘disability’ status and work status.\textsuperscript{249}

The participants of the ‘45 and Up Study’ and the ‘LHH’ were residents of New South Wales and may not be representative of all the Australians.\textsuperscript{202} However, employment status and self-rated health of the data sets used was comparable to the general Australian population (See Figure 3.3).

The life history interviews may be subject to recall bias and other potential problems relating to the ability of respondents to correctly recall details about their past life events. However, life history calendars were introduced as a memory aid to minimise recall bias.\textsuperscript{202}

It should also be noted that information regarding men and women seeking employment and the reasons they were out of paid work were not included. Moreover, some middle aged and young
women were excluded from analysis because of missing observations, however this was considered to have a negligible impact on the interpretation of the observed results.

Further research should involve semi-structured interviews with men and women to explore particular workforce participation patterns in detail, and focus on the aspects of chronic disease severity and complexity which were beyond the scope of this thesis.
9.4 CONCLUSION

Findings from this thesis establish different patterns of workforce participation for men and women, with men exhibiting more of a work/non-work dichotomy, and women exhibiting a more diverse and heterogeneous patterns of workforce participation, and greater engagement in part time work. Engagement in paid work is affected not only by early and adult life circumstances, but also by variations in the vulnerabilities and resources across socio-economic groups that prevail across the life course. These factors may act in conjunction with health effects of chronic diseases and limit men (and women's) choices to remain in paid work. Moreover, attempts to enable people to work for a longer time must consider the gender roles. This becomes more important with the recent shift in policy towards the extension of working life, thus highlighting the need to promote and preserve the health of workers, in order to improve their workforce participation.

The success of governments’ policies is dependent on the public’s better understanding of the interplay between chronic conditions and employment patterns. This knowledge about workforce participation patterns over the life course needs to be translated and further researched.
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164. Mazzonna F, Havari E. Can We Trust Older People’s Statements On Their Childhood Circumstances? Evidence From SHARELIFE. 2011.


Support for the 45 and Up Study

"For years, older women and men have identified the need for exactly this sort of research to help understand our health needs. I will definitely take part in the Study myself and it has the blessing of the NSW Older Women’s Network."

Betty Johnson, AG, Long term consumer advocate on health and ageing

"I am very excited that The Cancer Council will be able to play a key role in the 45 and Up Study. I believe the Study will provide a powerful resource for answering key questions about the causes of cancer and the factors that increase our risk, as well as effective treatments."

Dr Andrew Ferrier, CEO, The Cancer Council NSW

"The Heart Foundation is proud to support the 45 and Up Study. This Study will assist us to improve the health outcomes for people living with, at risk of, or affected by heart disease in NSW now and in the future. I am going to do my part to support the Study by signing up."

Tony Thwaites, CEO, National Heart Foundation of Australia (NSW Division)

"Health has always been important to me, but every year it seems to become more so. I’m very supportive of the 45 and Up Study as the best way we have of making sure our people and governments can ensure better health in the coming years. I’m looking forward to joining it."

Dr Denise Hobson, Chief Health Officer, NSW Health

"I am going to take part in the Study because it’s the first of its kind and we vitally need information for long term planning for a very important sector of our community. By taking part, I feel I will be making an input based on my own experience. I was naturally concerned about privacy, anonymity and how the information will be used. However, I am very much reassured by the commitment to protect the use of these data."

Vine Attoe, AG, Former Commissioner, Independent Commission Against Corruption (ICAC) and NSW Ombudsman, Chair the Sax Institute Board.

"Rural residents are facing significant health challenges; understanding these health issues is vital both for this generation and generations to come. For this reason, I would encourage you to get involved and support the 45 and Up Study. We need to do what we can to help ensure the health and longevity of rural Australia."

Jack Laurie, President, NSW Farmers' Association

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**Consent Form**

The 45 and Up Study relies on the willingness of people over 45 years of age to help improve our health services by donating information about their lives and experiences and to have their health followed over time by signing this form you are agreeing to take part in the 45 and Up Study and for the Study team to follow your health over time. It is important to understand that you can withdraw from the Study at any time, by calling the Study Helpline on 1300 45 11 45.

I agree to have my health followed over time through:

- The 45 and Up Study team following health and other records relating to me, including NSW hospital records, cancer records, health records and other health-related records, as currently in the Study database. The 45 and Up Study team may also use the information for research purposes provided to us under Medicare, the Department of Veterans’ Affairs, the Pharmaceutical Benefits Scheme and the Registration Pharmaceutical Benefits Scheme, including past health information, until the end of the Study or for the duration of my involvement in the Study.

- Being contacted by the Study in the future to provide information on changes to my health and lifestyle. I may be asked to provide further information including a questionnaire in telephone samples. My participation in any of these would be completely voluntary.

I give my consent on the understanding that:

- My information will only be used for the purposes outlined in the Study consent form or for purposes approved by the Study investigators, of which I have a copy.

- My information will be kept strictly confidential and will be used for health research only.

- Reports and publications from the Study will be based on de-identified information and will not identify any individual taking part.

- My participation in the study is solely voluntary and my consent will continue to be valid following death or displacement unless withdrawn by my next of kin or other person responsible. I am free to withdraw from the Study at any time by calling the Study Helpline on 1300 45 11 45.

- My decision on Withdrawal may be taken to be final evidence of withdrawal by the Study or any additional research, which may be conducted for the Study or any of these purposes.

I have been provided with information about the 45 and Up Study including how it will gather, store, use and disclose information about me in the Study as part of the Study consent form. I have been given an opportunity to ask questions and have been fully informed about the Study.

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**Information for participants**

**What is the 45 and Up Study?**

The 45 and Up Study is the largest follow-up study ever conducted in Australia and in the Southern Hemisphere. More than 250,000 NSW men and women aged 45 and over are needed to participate in this large scale study and to provide information about their health and use of health services. Close to 100,000 people have already joined the Study.

This study is unique in that this large group of people will be followed over time to provide new information that will help answer many important health questions. It will also assist in the future planning for Australia’s ageing population, including understanding the impact of major diseases like cancer and heart disease, the quality of life of older people and their use of health services.

**Who is conducting the Study?**

The 45 and Up Study involves the work of over 120 leading NSW health and medical researchers – the largest collaborative effort ever seen in an Australian health study. The Study is being conducted by the Sax Institute, in collaboration with The Cancer Council NSW, the National Heart Foundation of Australia (NSW Division), NSW Health and beyondblue: the national depression initiative, with support from the Macfarlane Buenos Foundation, Fred Hollows legal services, the Saxer.ads Foundation and the NHMRC Trust (both managed by Perpetual Limited) and the MSF Foundation.

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**Appendix 1 - '45 AND UP STUDY' INFORMATION LEAFLET AND CONSENT FORM**
Why have I been sent a questionnaire?
Because we need you – you are one of the 250,000 NSW men and women who have been randomly selected to take part in the Study. This represents around 10% of the population in this age group and for reliable research we need as wide a range of people as possible to join it – men and women from 46 to 105, from all walks of life, all social and ethnic backgrounds and all lifestyles and interests.

What do I need to do?
To take part you need to do is complete the enclosed questionnaire that should take around 30-45 minutes. Please make sure you also sign the consent form on the back of the questionnaire to indicate that it is the same patient and return it in the reply-paid envelope, so we can follow your health over time. A follow-up questionnaire will be sent to you within 5 years after joining the Study to update information about your health and lifestyle.

At some stage you may also be invited to take part in additional research or to provide saliva or blood samples. It is entirely your choice whether you take part in this study and in any future studies. If you do choose to take part, you are free to withdraw from the Study at any time, by calling the help line on 1300 45 11 45.

What sort of information do you need from me?
The questionnaires have been developed by leading NSW Health professionals and research organisations and include general questions about you and your family (such as your age, education and employment) and more specific questions about your health and wellbeing, lifestyle, diet, existing medical conditions, disability, use of medication, health insurance and social connections. The questionnaire is for you to fill out yourself and should not involve a health professional to get information to complete it. Please be as accurate as you can, but remember that an approximate answer is still very valuable for the Study. If you don’t have to answer a question for any reason, you don’t have to.

How do I know my information will be treated confidentially?
This study is bound by Commonwealth and State privacy legislation, including the Health Records and Information Privacy Act and the NSW Health Privacy Manual. All information collected will be treated completely confidentially and used for health research only. To further ensure security, confidentiality and anonymity, all information will be stored, analysed and reported on with your identifying details removed. No information will be released in a way that would allow an individual or household to be identified, except as is required by law. In addition, the Study has an Independent Community and Ethical Oversight Committee and is accountable to the University of NSW Human Research Ethics Committee.

How will information from the Study be used to help me and others?
Information from the 46 and Up Study will give us a better understanding of what determines healthy ageing and how individuals and health services can assist in prevention of health and improve the quality of life in current and future generations. Collaborating researchers will be able to use information from the Study to improve health services and programs for many health problems we face in later life, including cardiovascular diseases, diabetes, mental health problems and arthritis.

To realise the full potential of the Study, particularly to develop new treatments and diagnostic tools, researchers from commercial companies may also be involved with the Study. All research projects will be in the public interest and have the potential to provide important information to improve health. They will also satisfy strict quality and ethical standards and as such, no identifying information about participants will be released to collaborating researchers.

How will my health be followed over time if I agree to take part?
An important aspect of this study is observing your health over time and linking information you have given us in questionnaires with a number of other sources of information about your past, current and future health, medication, treatment and use of health services such as:

- hospital, pathology and death records; NSW Health and Department of Veterans’ Affairs data; hospital waiting times; surgical procedures and emergency department information; ambulance services data and Roads and Traffic Authority information on accidents;
- Medicare and general practice information; Pharmaceutical Benefits Scheme and Prescriptions Pharmaceutical Benefits Scheme; aged care, mental health and hearing services information;
- special disease or treatment record systems, including diabetes and cancer registers; infectious diseases notifications; disability information; radiology, injury, midwifery and birth defects data; and dialysis and transplant waiting;
- breast, cervical, prostate and bowel cancer screening.

Again, any information used from these data sources will be treated completely confidentially and used for health research only.

How can I find out more about the Study?
You can visit www.46andup.org.au or call the Study helplines on 1300 45 11 45 to find out more and get regular updates on the Study’s progress. People taking part in the Study will also receive a yearly newsletter.

Any questions or comments?
If you have any questions, comments or complaints about the Study, you can call the toll-free Study helpline on 1300 45 11 45 or write to:
Associate Professor Emily Banks
Scientific Director
The 46 and Up Study
PO Box 123
Broadway NSW 2007

For any complaints you may also contact:
Ethics Secretariat
The University of NSW
Sydney NSW 2052
Phone (02) 9385 4034 or
Email: ethicssec@unsw.edu.au
# Appendix 2 – ‘45 and Up Study’ Questionnaire for Women

## The 45 and Up Study Questionnaire for Women

The 45 and Up Study relies on the willingness of people in New South Wales to share information about their lives and experiences, to provide knowledge that will help people live healthy and fulfilling lives for as long as possible. Participation is completely voluntary, and you are free to withdraw from the Study at any time. To take part, please read the participant information leaflet, then complete the questionnaire and consent form and return them in the envelope provided. We very much hope you will be able to take part.

*Any questions or comments? Please call the Study helpline: 1300 45 11 45 or go to www.45andUp.org.au*

### General questions about you

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is your date of birth?</td>
<td>Day</td>
</tr>
<tr>
<td>What is today's date?</td>
<td>Day</td>
</tr>
<tr>
<td>How tall are you without shoes?</td>
<td>cm</td>
</tr>
<tr>
<td>About how much do you weigh?</td>
<td>kg</td>
</tr>
<tr>
<td>What is the highest qualification you have completed?</td>
<td>Yes</td>
</tr>
<tr>
<td>Are you of Aboriginal or Torres Strait Islander origin?</td>
<td>Yes</td>
</tr>
<tr>
<td>In which country were you born?</td>
<td>No</td>
</tr>
</tbody>
</table>

### Additional questions

#### 1. What are your top five hobbies?
- [ ] 1. Reading
- [ ] 2. Jogging
- [ ] 3. Painting
- [ ] 4. Gardening
- [ ] 5. Cooking

#### 2. Do you smoke?
- [ ] Yes
- [ ] No

#### 3. How many alcoholic drinks do you have each week?
- [ ] None
- [ ] 1-2
- [ ] 3-5
- [ ] 6 or more

#### 4. Do you usually drink alcohol?
- [ ] Yes
- [ ] No

#### 5. What is your ancestry? (please cross up to 2 boxes)
- [ ] Australian
- [ ] English
- [ ] Irish
- [ ] Italian
- [ ] Scottish
- [ ] German
- [ ] Dutch
- [ ] French
- [ ] Indian
- [ ] Chinese
- [ ] Other

#### 6. Do you speak a language other than English at home?
- [ ] Yes
- [ ] No

#### 7. How many hours do you sleep each night?
- [ ] Less than 6
- [ ] 6-7
- [ ] 8-9
- [ ] 9 or more

#### 8. How many hours do you work each week?
- [ ] Less than 20
- [ ] 21-30
- [ ] 31-40
- [ ] 41 or more

#### 9. How many hours do you spend exercising each week?
- [ ] Less than 30
- [ ] 31-60
- [ ] 61 or more

#### 10. How many times do you exercise each week?
- [ ] Less than 1
- [ ] 1-2
- [ ] 3 or more

#### 11. How often do you eat fruit and vegetables?
- [ ] Less than 3 times a week
- [ ] 3-5 times a week
- [ ] 6 or more times a week

#### 12. How many times do you go to the movies each year?
- [ ] Less than 3
- [ ] 3-5
- [ ] 6 or more

#### 13. How often do you travel?
- [ ] Never
- [ ] Once a year
- [ ] Twice a year
- [ ] More than twice a year

#### 14. How often do you eat out?
- [ ] Never
- [ ] Once a week
- [ ] Twice a week
- [ ] More than twice a week

#### 15. How often do you go to the gym?
- [ ] Never
- [ ] Once a week
- [ ] Twice a week
- [ ] More than twice a week

#### 16. How many times do you go to the doctor each year?
- [ ] Less than 2
- [ ] 2-5
- [ ] 6 or more

#### 17. How many times do you take medication each year?
- [ ] Less than 2
- [ ] 2-5
- [ ] 6 or more

#### 18. How many times do you visit the hospital each year?
- [ ] Less than 2
- [ ] 2-5
- [ ] 6 or more

#### 19. How many times do you go on holiday each year?
- [ ] Less than 1
- [ ] 1-2
- [ ] 3 or more

#### 20. How many times do you go on vacation each year?
- [ ] Less than 1
- [ ] 1-2
- [ ] 3 or more

#### 21. How many times do you go on day trips each year?
- [ ] Less than 1
- [ ] 1-2
- [ ] 3 or more

#### 22. How many times do you go on hiking trips each year?
- [ ] Less than 1
- [ ] 1-2
- [ ] 3 or more

#### 23. How many times do you go on camping trips each year?
- [ ] Less than 1
- [ ] 1-2
- [ ] 3 or more

#### 24. How many times do you go on cycling trips each year?
- [ ] Less than 1
- [ ] 1-2
- [ ] 3 or more

#### 25. How many times do you go on walking trips each year?
- [ ] Less than 1
- [ ] 1-2
- [ ] 3 or more

#### 26. How many times do you go on swimming trips each year?
- [ ] Less than 1
- [ ] 1-2
- [ ] 3 or more

#### 27. How many times do you go on snorkeling trips each year?
- [ ] Less than 1
- [ ] 1-2
- [ ] 3 or more

#### 28. How many times do you go on scuba diving trips each year?
- [ ] Less than 1
- [ ] 1-2
- [ ] 3 or more

#### 29. How many times do you go on kayaking trips each year?
- [ ] Less than 1
- [ ] 1-2
- [ ] 3 or more

#### 30. How many times do you go on boating trips each year?
- [ ] Less than 1
- [ ] 1-2
- [ ] 3 or more

#### 31. How many times do you go on fishing trips each year?
- [ ] Less than 1
- [ ] 1-2
- [ ] 3 or more

#### 32. How many times do you go on hunting trips each year?
- [ ] Less than 1
- [ ] 1-2
- [ ] 3 or more

#### 33. How many times do you go on bird watching trips each year?
- [ ] Less than 1
- [ ] 1-2
- [ ] 3 or more

#### 34. How many times do you go on photography trips each year?
- [ ] Less than 1
- [ ] 1-2
- [ ] 3 or more

#### 35. How many times do you go on painting trips each year?
- [ ] Less than 1
- [ ] 1-2
- [ ] 3 or more

#### 36. How many times do you go on drawing trips each year?
- [ ] Less than 1
- [ ] 1-2
- [ ] 3 or more

#### 37. How many times do you go on cooking trips each year?
- [ ] Less than 1
- [ ] 1-2
- [ ] 3 or more

#### 38. How many times do you go on baking trips each year?
- [ ] Less than 1
- [ ] 1-2
- [ ] 3 or more

#### 39. How many times do you go on gardening trips each year?
- [ ] Less than 1
- [ ] 1-2
- [ ] 3 or more

#### 40. How many times do you go on flower arranging trips each year?
- [ ] Less than 1
- [ ] 1-2
- [ ] 3 or more

#### 41. How many times do you go on flower arranging trips each year?
- [ ] Less than 1
- [ ] 1-2
- [ ] 3 or more

#### 42. How many times do you go on sewing trips each year?
- [ ] Less than 1
- [ ] 1-2
- [ ] 3 or more

#### 43. How many times do you go on knitting trips each year?
- [ ] Less than 1
- [ ] 1-2
- [ ] 3 or more

#### 44. How many times do you go on crocheting trips each year?
- [ ] Less than 1
- [ ] 1-2
- [ ] 3 or more

#### 45. How many times do you go on quilting trips each year?
- [ ] Less than 1
- [ ] 1-2
- [ ] 3 or more

**Note:** This is a sample only.
Questions about your family

18. Have your mother, father, brothers, or sisters ever had:

- Heart disease
- High blood pressure
- Stroke
- Diabetes/Alzheimer's
- Parkinson's disease
- Severe depression
- Severe arthritis
- Do not know

Questions about your health

20. About how many hours a week are you exposed to someone else’s tobacco smoke?

- Never
- 1-9 hours
- 10-19 hours
- 20-29 hours
- 30 or more hours

21. Have you ever used the pill or other hormonal contraceptives?

- Yes
- No

22. Have you ever used hormone replacement therapy (HRT)?

- Yes
- No

23. Have you taken any medications, vitamins, or supplements for most of the last 4 weeks, including HRT and the pill?

- Yes
- No

Please list any other regular medications or supplements here.

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<table>
<thead>
<tr>
<th>Questions about your family</th>
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<tbody>
<tr>
<td>Have your mother, father, brothers, or sisters ever had:</td>
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<tr>
<td>Heart disease</td>
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<tr>
<td>High blood pressure</td>
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<td>Stroke</td>
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<td>Diabetes/Alzheimer's</td>
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<td>Severe depression</td>
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<td>Severe arthritis</td>
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<td>Do not know</td>
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</table>

<table>
<thead>
<tr>
<th>Questions about your health</th>
<th></th>
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<tbody>
<tr>
<td>About how many hours a week are you exposed to someone else’s tobacco smoke?</td>
<td></td>
</tr>
<tr>
<td>- Never</td>
<td></td>
</tr>
<tr>
<td>- 1-9 hours</td>
<td></td>
</tr>
<tr>
<td>- 10-19 hours</td>
<td></td>
</tr>
<tr>
<td>- 20-29 hours</td>
<td></td>
</tr>
<tr>
<td>- 30 or more hours</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Have you ever used the pill or other hormonal contraceptives?</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Yes</td>
<td></td>
</tr>
<tr>
<td>- No</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Have you ever used hormone replacement therapy (HRT)?</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Yes</td>
<td></td>
</tr>
<tr>
<td>- No</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Have you taken any medications, vitamins, or supplements for most of the last 4 weeks, including HRT and the pill?</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Yes</td>
<td></td>
</tr>
<tr>
<td>- No</td>
<td></td>
</tr>
</tbody>
</table>

Please list any other regular medications or supplements here.
24. Has a doctor EVER told you that you have:  

<table>
<thead>
<tr>
<th>Condition</th>
<th>Yes</th>
<th>Age when condition was first found</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin cancer (not melanoma)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Melanoma</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breast cancer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other cancer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of cancer (please specify)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heart disease</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of heart disease (please specify)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High blood pressure – when pregnant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High blood pressure – when not pregnant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stroke</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blood clot (thrombosis)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asthma</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hayfever</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parkinson's disease</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None of these</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

25. In the last month have you been treated for:  

<table>
<thead>
<tr>
<th>Condition</th>
<th>Yes</th>
<th>Age when treatment started</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cancer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heart attack or angina</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other heart disease</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High blood pressure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High blood cholesterol</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blood clotting problems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asthma</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Osteoarthritis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thyroid problems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Osteoporosis or low bone density</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None of these</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

26. Are you NOW suffering from any other important illness?  

- Yes  
- No  

*Please describe this illness and its treatment.*

27. Do you regularly need help with daily tasks because of long-term illness or disability?  

- Yes  
- No  

(As a patient only getting in and out, cooking meals, etc.)

28. Does your health now LIMIT YOU in any of the following activities?  

- Yes, limited a lot  
- Yes, limited a little  
- No, not limited at all  

**VIGOROUS activities:**  
- Jogging, swimming, dancing, soccer, etc.  
- Running, jumping, tennis, etc.  

**MODERATE activities:**  
- Doing a house job, moving heavy objects, etc.  
- Cleaning, ironing, shopping, cooking, etc.  

**Light activities:**  
- Walking one kilometre  
- Working at a keyboard  
- Walking 100 metres  
- Bathing, dressing, showering  

29. Have you ever had any of the following operations?  

- Yes  
- No  

<table>
<thead>
<tr>
<th>Operation</th>
<th>Yes</th>
<th>Age when had operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removal of skin cancer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hysterectomy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Both ovaries removed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sterilisation (tubes tied)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repair of prolapsed womb, bladder or bowel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knee replacement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hip replacement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gallbladder removed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heart or coronary bypass surgery (excluding heart and bypass)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Other operations, any other operations you have had in the last 10 years, with your age when you had them.*
47. What is your current work status?
- in paid work
- in full-time paid work
- in part-time paid work
- self-employed or own business
- doing unpaid work
- looking after home, family or friend
- looking after someone else
- student
- disabled or chronically ill
- other

48. If you are partially or completely retired, how old were you when you retired?
- years old

49. About how many hours each week do you usually spend doing the following? (Please put '0' if you do not do any of these)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paid work</td>
<td></td>
</tr>
<tr>
<td>Voluntary/Unpaid</td>
<td></td>
</tr>
</tbody>
</table>

50. Which of the following do you have? (Including Medicare)
- Private health insurance - with extras
- Private health insurance - without extras
- Department of Veterans Affairs white or gold card
- Health care concession card
- None of these

51. What best describes the colour of the skin on the inside of your upper arm, that is your skin colour without any tanning?
- very fair
- light olive
- brown
- dark olive
- black

52. What would happen if your skin was repeatedly exposed to bright sunlight during summer without any protection? Would it:
- Get very burned?
- Get slightly or occasionally burned?
- Get moderately tanned?
- Never tan or get tanned?

53. About how many hours a day do you usually spend outdoors on a weekday and at the weekend?

<table>
<thead>
<tr>
<th>Time of Day</th>
<th>Hours per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>weekday</td>
<td></td>
</tr>
<tr>
<td>weekend</td>
<td></td>
</tr>
</tbody>
</table>

54. About how many hours in each 24-hour day do you usually spend doing the following? Please put '0' if you do not spend any time doing it

<table>
<thead>
<tr>
<th>Activity</th>
<th>Hours per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleeping (including at night &amp; naps)</td>
<td></td>
</tr>
<tr>
<td>Sitting</td>
<td></td>
</tr>
<tr>
<td>Watching television</td>
<td></td>
</tr>
<tr>
<td>Using a computer</td>
<td></td>
</tr>
<tr>
<td>Standing</td>
<td></td>
</tr>
</tbody>
</table>

55. How many times in the last week did you:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Times in the last week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Talk to someone (friends, relatives or others) on the telephone</td>
<td></td>
</tr>
<tr>
<td>Go to meetings of social clubs, religious groups or other groups you belong to</td>
<td></td>
</tr>
</tbody>
</table>

56. How many people outside your home, but within one hour of travel, do you feel you can depend on or feel very close to?

<table>
<thead>
<tr>
<th>Number of People</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

57. During the past 4 weeks, about how often did you:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Days of the week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feel cut off from people you know</td>
<td></td>
</tr>
<tr>
<td>Feel upset or angry</td>
<td></td>
</tr>
<tr>
<td>Feel depressed</td>
<td></td>
</tr>
<tr>
<td>Feel helpless or hopeless</td>
<td></td>
</tr>
<tr>
<td>Not at all happy you could be</td>
<td></td>
</tr>
<tr>
<td>Feel depressed or hopeless</td>
<td></td>
</tr>
<tr>
<td>Feel that everything was an effort</td>
<td></td>
</tr>
</tbody>
</table>

58. During the past 4 weeks, have you had any of the following problems with your work or daily activities because of any emotional problems (such as being depressed or anxious)

<table>
<thead>
<tr>
<th>Problem</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unable to concentrate or perform tasks correctly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unable to care for family, home or work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxious or nervous when doing tasks or activities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxious or scared when doing tasks or activities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxious or frightened when doing tasks or activities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxious or nervous when looking at yourself or your environment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxious or scared when looking at yourself or your environment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxious or frightened when looking at yourself or your environment</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Thank you very much for filling in the questionnaire. DON'T FORGET TO SIGN THE CONSENT FORM OVERLEAF

Are your name and address correct on the front of this questionnaire?  Yes  No
Appendix 3 – ‘45 AND UP STUDY’ QUESTIONNAIRE FOR MEN

The 45 and Up Study relies on the willingness of people in New South Wales to share information about their lives and experiences, to provide knowledge that will help people live healthier and longer lives for as long as possible. Participation is completely voluntary, and you are free to withdraw from the Study at any time. To take part, please read the participant information leaflet, then complete the questionnaire and consent form and return them in the envelope provided. We very much hope you will be able to take part.

Any questions or comments? Please call the Study helpline: 1300 45 11 45 or go to www.45andUp.org.au

Your answers and experiences are important to us. To help us read your answers, please write as clearly as possible using a BLACK or BLUE pen, and be sure to complete the questionnaire as shown:

General questions about you
1. What is your date of birth? [day] [month] [year]
2. What is today’s date? [day] [month] [year]
3. How tall are you without shoes? [cm] OR [inches]
4. About how much do you weigh? [kg] OR [stone]
5. What is the highest qualification you have completed? [check the appropriate box]
   - None or school certificate or other qualifications
   - School or intermediate certificate (or equivalent)
   - Higher school or university certificate (or equivalent)
   - Trade/apprenticeship (e.g. hairdresser, chef)
   - Certificate/Diploma (e.g. child care, technician)
   - University degree or higher
6. Are you of Aboriginal or Torres Strait Islander origin? [check the appropriate box]
7. In which country were you born? [select the appropriate country]
8. What year did you first come to live in Australia for one year or more? [check the appropriate box]
9. What is your ancestry? [click the appropriate box]
   - Australian
   - English
   - Irish
   - Scottish
   - German
   - Italian
   - Greek
   - Lebanese
   - Dutch
   - Maltese
   - Polish
   - Spanish
   - Other please specify:
10. Do you speak a language other than English at home? [check the appropriate box]
11. Have you ever been a regular smoker? [check the appropriate box]
   - Yes
   - No
12. About how many alcoholic drinks do you have each week? [check the appropriate box]
   - None
   - 1 or 2 drinks
   - 3 or more drinks
   - More than 10 drinks
13. On how many days each week do you usually drink alcohol? [check the appropriate box]
   - None
   - 1 or 2 days
   - 3 or more days
24. Has a doctor EVER told you that you have:
   - skin cancer (not melanoma)
   - melanoma
   - prostate cancer
   - other cancer
   - type of cancer (please describe)
   - heart disease
   - type of heart disease (please describe)
   - high blood pressure
   - stroke
   - diabetes
   - blood clot (thrombosis)
   - enlarged prostate
   - asthma
   - hay fever
   - depression
   - arthritis
   - Parkinson’s disease
   - none of these

25. In the last month have you been treated for:
   - cancer
   - heart attack or angiography
   - other heart disease
   - high blood pressure
   - high blood cholesterol
   - blood clotting problems
   - asthma
   - colitis/diverticulitis
   - thyroid problems
   - osteoporosis or any bone density
   - depression
   - anxiety
   - none of these

26. Are you NOW suffering from any other important illness?
   - Yes
   - No
   - Please describe this illness and its treatment

27. Do you regularly need help with daily tasks because of long-term illness or disability?
   - Yes
   - No

28. Does your health now LIMIT your ability to do any of the following activities?
   - Vigorous activities
   - Moderate activities
   - Light activities
   - Any

29. Have you ever had any of the following operations?
   - Removal of skin cancer
   - Vasectomy
   - Part of prostate removed
   - Whole prostate removed
   - Knee replacement
   - Hip replacement
   - Gallbladder removed
   - Heart or coronary bypass surgery
   - Please describe any operation you have had in the last 10 years, with your age when you had them
47. What is your current work status? (You can choose more than one box)
- Full-time paid work
- Part-time paid work
- Full-time unpaid work (voluntary/unpaid work)
- Part-time unpaid work
- Self-employed
- Doing unpaid work
- Unemployed
- Long-term sick
- Retired (not a carer)
- Partially retired
- Disabled/disabled
- Other

48. If you are partially or completely retired, how old were you when you retired?
- 50 years old
- 60 years old
- 65 years old
- Other

49. About how many HOURS each week do you usually spend doing the following? Please put “0” if you do not spend any time doing it.

- Housework: hours per week
- Volunteer unpaid work: hours per week

50. Which of the following do you have? (Including Medicare)
- Private health insurance with extras
- Private health insurance without extras
- Department of Veterans Affairs white or gold card
- Health care concession card

51. What best describes the colour of the skin on the inside of your upper arm that is your skin colour without any tanning?
- Very fair
- Fair
- Light olive
- Dark olive
- Black

52. What would happen if your skin was repeatedly exposed to bright sunlight during summer without any protection?
- Get very burned
- Get mildly burned
- Get moderate burned
- Never burn or very get tanned

53. About how many hours a DAY do you usually spend outdoors on a weekday and on the weekend?

- Hours per day
- Weekday
- Weekend

54. About how many HOURS in each 24 hour DAY do you usually spend doing the following? Please put “0” if you do not spend any time doing it.

- Sleeping: hours per day
- Eating: hours per day
- Watching TV or computer: hours per day

55. How many TIMES in the LAST WEEK did you:

- Spend time with friends or family who do not live with you?
- Talk to someone: friends, relatives, or other?
- Use the telephone?
- Go to meetings of social clubs, religious groups, other groups you belong to?

56. How many other people outside your home, but within one hour of travel, do you feel you can rely on or feel very close to?
- 0 people
- 1-4 people
- 5-10 people
- 11-15 people
- 16 or more people

57. During the past 4 weeks, on an average day, how often did you feel:

- Very tired
- Annoyed
- Sad
- Insomnia
- Worried
- Tired
- Helpless
- Counted the days

58. During the past 4 weeks, how serious have you found the following problems with your work or daily activities because of any emotional problems (such as being depressed or anxious)?

- Did not work as usual
- Worked less than you would have liked to do
- Did not work as usual
- Did not work as usual
- Did not work as usual
- Did not work as usual

---

Thank you very much for filling in this questionnaire.

DON'T FORGET TO SIGN THE CONSENT FORM OVERLEAF

If INCORRECT, give details below.

Surname:

Given name(s):

Postal address:

City or Suburb:

State or territory:

Postcode:

---

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APPENDIX 4 – FIGURES FROM CHAPTER 6 – STUDY 3

Figure 1: Association between diabetes and workforce participation patterns of 577 middle aged women over the life course.

Effect of diabetes on workforce participation patterns among women – Univariate model

1: 'decreasing FT work after 55 years', compared to those who were 'mostly FT work' [OR=1.96, 95% CI=0.81, 3.84]
2: 'increasing FT work', compared to those who were 'mostly FT work' [OR=1.01; 95% CI=0.84, 1.06]
3: 'mostly NPW', compared to those who were 'mostly FT work' [OR=1.50; 95% CI=0.46, 5.65]

Effect of diabetes on workforce participation patterns among women – Early life model

1: 'decreasing FT work after 55 years', compared to those who were 'mostly FT work' when early life factors were taken into account [OR=1.96; 95% CI=0.87, 3.05]
2: 'increasing FT work', compared to those who were 'mostly FT work' when early life factors were taken into account [OR=1.01; 95% CI=0.83, 1.20]
3: 'mostly NPW', compared to those who were 'mostly FT work' when early life factors were taken into account [OR=1.35; 95% CI=0.46, 3.98]

Effect of diabetes on workforce participation patterns among women – Overall model

1: 'decreasing FT work after 55 years', compared to those who were 'mostly FT work' when all the factors were accounted for [OR=1.14; 95% CI=0.47, 3.28]
2: 'increasing FT work', compared to those who were 'mostly FT work' when all the factors were accounted for [OR=1.20; 95% CI=0.39, 3.89]
3: 'mostly NPW', compared to those who were 'mostly FT work' when all the factors were accounted for [OR=1.30; 95% CI=0.50, 3.39]
Figure 2: Association between asthma and workforce participation patterns of 577 middle aged women over the life course.

Effect of asthma on workforce participation patterns among women - Univariate model

1= 'decreasing FT work after 55 years', compared to those who were 'mostly FT work' [OR=0.80, 95% CI=0.42, 1.59]

2= 'increasing FT work', compared to those who were 'mostly FT work'
[OR=0.05, 95% CI=0.01, 1.69]

3= 'mostly NPW', compared to those who were 'mostly FT work'
[OR=0.93, 95% CI=0.40, 1.90]

Effect of asthma on workforce participation patterns among women - Early life model

1= 'decreasing FT work after 55 years', compared to those who were 'mostly FT work' when early life factors were taken into account [OR=0.42, 95% CI=1.87]

2= 'increasing FT work', compared to those who were 'mostly FT work' when early life factors were taken into account
[OR=0.92, 95% CI=0.59, 1.42]

3= 'mostly NPW', compared to those who were 'mostly FT work' when early life factors were taken into account
[OR=0.54, 95% CI=0.40, 1.17]

Effect of asthma on workforce participation patterns among women - Overall model

1= 'decreasing FT work after 55 years', compared to those who were 'mostly FT work' when all the factors were accounted for
[OR=0.92, 95% CI=0.42, 1.57]

2= 'increasing FT work', compared to those who were 'mostly FT work' when all the factors were accounted for
[OR=0.93, 95% CI=0.49, 1.79]

3= 'mostly NPW', compared to those who were 'mostly FT work' when all the factors were accounted for
[OR=0.50, 95% CI=0.39, 1.33]
Figure 3: Association between diabetes and workforce participation patterns of 684 middle aged men over the life course

Effect of diabetes on workforce participation patterns among men - Univariate model

1: 'decreasing FT work after 40 years', compared to those who were 'mostly FT work'
   \[ OR = 0.67, 95\% CI = 0.28, 1.61 \]

2: 'not in paid work after 55 years', compared to those who were 'mostly FT work'
   \[ OR = 1.77, 95\% CI = 1.01, 3.10 \]

Effect of diabetes on workforce participation patterns among men - the early life factor model

1: 'decreasing FT work after 40 years' compared to those who were 'mostly FT work' when early life factors were taken into account
   \[ OR = 0.66, 95\% CI = 0.22, 1.91 \]

2: 'not in paid work after 55 years', compared to those who were 'mostly FT work' when early life factors were taken into account
   \[ OR = 1.56, 95\% CI = 0.89, 2.88 \]

Effect of diabetes on workforce participation pattern among men - the overall model

1: 'decreasing FT work after 40 years' compared to those who were 'mostly FT work' when all the factors were accounted for
   \[ OR = 0.68, 95\% CI = 0.21, 2.08 \]

2: 'not in paid work after 55 years', compared to those who were 'mostly FT work' when all the factors were accounted for
   \[ OR = 1.48, 95\% CI = 0.90, 2.40 \]
Figure 4: Association between asthma and workforce participation patterns of 684 middle-aged men over the life course

Effect of asthma on workforce participation among men - Univariate model

1 = 'decreasing FT work after 40 years', compared to those who were 'mostly FT work'
[OR = 1.27, 95% CI = 0.59, 2.72]

2 = 'not in paid work after 55 years', compared to those who were 'mostly FT work'
[OR = 1.38, 95% CI = 0.90, 2.26]

Effect of asthma on workforce participation among men - Early life model

1 = 'decreasing FT work after 40 years', compared to those who were 'mostly FT work' when early life factors were taken into account
[OR = 1.32, 95% CI = 0.61, 2.85]

2 = 'not in paid work after 55 years', compared to those who were 'mostly FT work' when early life factors were taken into account
[OR = 1.56, 95% CI = 0.77, 3.17]

Effect of asthma on workforce participation among men - Overall model

1 = 'decreasing FT work after 40 years', compared to those who were 'mostly FT work' when all the factors were accounted for
[OR = 1.88, 95% CI = 0.68, 3.08]

2 = 'not in paid work after 55 years', compared to those who were 'mostly FT work' when all the factors were accounted for
[OR = 1.87, 95% CI = 0.77, 4.69]