The Value of Continuity of Care in Australian General Practice

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Certificate of Authorship/Originality

I, Michael Clifford Wright, declare that this thesis is submitted in fulfilment of the requirements for the award of Doctor of Philosophy in the Faculty of Business at the University of Technology Sydney.

This thesis is wholly my own work unless otherwise reference or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

This document has not been submitted for qualifications at any other academic institution. This thesis is supported by an Australian Government Research Training Program Scholarship.

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A PhD is a journey that is not completed alone.

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Abbreviations List

Glossary	Abbreviations
2SLS	two-stage least squares
ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
AHHA	Australian Healthcare and Hospitals Association
AIC	Akaike information criterion
AIHW	Australian Institute of Health and Welfare
ALSWH	Australian Longitudinal Study on Women's Health
AMA	Australian Medical Association
ARIA	Accessibility/remoteness index of Australia
AUD	Australian dollar
BIC	Bayesian information criterion
BMI	Body mass index (calculated as weight in kilograms squared/height in metres)
CHERE	Centre for Health Economics Research and Evaluation
CI	Confidence interval
COCI	Bice Boxerman Continuity of Care index
COPD	Chronic obstructive pulmonary disease
eg	For example
FE	Fixed effects estimator
FFS	Fee for service (payment model)
GDP	Gross Domestic Product
GP	General Practitioner
HCC	Health care (concessional) card
HCH	Health Care Home model of care
HIC	Health Insurance Commission
HREC	Human Research Ethics Committee
iid	Independent and identically distributed
IRR	Incidence rate ratio
IV	Instrumental variable
LR	Likelihood ratio
MBS	Medicare Benefits Schedule
NA	Not applicable
NHMRC	National Health and Medical Research Council
NSW	New South Wales
NT	Northern Territory
OECD	Organisation for Economics Co-operation and Development
OLS	Ordinary least squares estimator

OR	Odds ratio
PBS	Pharmaceutical Benefits Scheme
PCMH	Patient centred medical home
PhD	Doctor of Philosophy
Qld	Queensland
RACGP	Royal Australian College of General Practitioners
RCGP	Royal College of General Practitioners (UK)
RE	Random effects estimator
SA	South Australia
SF-36	Short form 36
UK	United Kingdom of Great Britain and Northern Island
Unk	Unknown
UPC	Usual Provider Continuity
USA	United States of America
Vic	Victoria
WA	Western Australia
WHO	World Health Organization

Abstract

Introduction

Health systems internationally are facing demographic and financing pressures, together with changes to the health provider workforce. Multiple changes in the Australian population are increasing the demand for health care services. These demographic changes include population growth, an ageing population, and the increased burden of chronic disease in the population (AIHW 2016a). Additionally, the Australian health reform agenda is focusing on better integration and coordination of primary care, the utilisation of information technology, and increasing delivery of care by multidisciplinary teams (Australian Health Ministers' Advisory Council 2017; Primary Health Care Advisory Group 2015). These changes are potentially shifting the emphasis of general practice care away from a relationship between an individual doctor and a patient, towards care focused at a practice level. These changes are occurring in a primary health care system which permits patients to access care from multiple GPs in multiple locations.

Changes to primary care may affect the availability of continuity of care, a concept referring to the benefits obtained from consulting the same health care provider over time (Freeman & Hughes 2010). It has been suggested that continuity of care is a core component of high performing primary health care systems (American Academy of Family Physicians 2010; Bodenheimer 2014; Macinko, Starfield & Shi 2003) and international research has reported an association between increased continuity of care

and positive health outcomes (Cabana & Jee 2004; Saultz & Lochner 2005; van Walraven et al. 2010), and reduced health costs (Chen & Cheng 2011; Hussey et al. 2014; Raddish, Horn & Sharkey 1999; Shin et al. 2014). However, most of the existing empirical literature emerges from clinical medicine, is cross-sectional in design, and unable able to provide evidence of a causal relationship.

This thesis investigates continuity of care in the delivery of general practice care in Australia. It examines continuity of care with an individual general practitioner (personal continuity of care) and continuity of care with a general practice (site continuity of care), in order to understand whether unrestricted access to general practice services is consistent with high levels of continuity of care at both a provider and practice level, and whether an association between increased continuity of care and improved health screening (as a proxy for the quality of general practice care) exists.

Methods

Data

To provide a robust analysis of continuity of care, the empirical research presented in this thesis uses multiple data sources, including cross-sectional data from a survey of 2,477 Australians (the GP Survey), panel data from the Australian Longitudinal Study on Women's Health (ALSWH) survey and linked Medicare claims data. The absence of practice-level Medicare data limits its usefulness in investigating site continuity of care.

Analysis

All analyses were completed using Stata Version 14 (Statacorp 2017). Analysis of summary statistics and regression analysis of the GP Survey was conducted. Summary statistics and regression analysis of the ALSWH survey data and linked Medicare data was also completed. The panel nature of the ALSWH data permitted use of panel data modelling techniques. Panel data techniques provide stronger evidence of a relationship between continuity of care and improved quality of care than cross-sectional analysis. In order to control for some of the biases in existing continuity of care literature, additional econometric techniques are utilised. These techniques include the use of instrumental variables (IV) to control for the endogeneity of health care within models, and the use of individual fixed effects to control for unobserved patient-level factors which might confound the relationship between continuity of care and health screening.

Results

Results from the GP survey analysis showed that over 80% of patients identified having a usual GP and over 90% have a usual general practice. However, over 25% of respondents also reported attending more than one general practice in the previous year.

Analysis of the ALSWH survey data provided multiple statistically significant findings. Site continuity of care has increased in prevalence over time and is more common with increasing age. Personal continuity of care is decreasing in prevalence for women aged under forty, but increasing for women over sixty years of age. There are multiple differences in patient and practice characteristics associated with personal and site continuity of care, which will not be detected without investigation of continuity of care at both levels. Both personal and site continuity of care are associated with increased cancer screening rates. Failing to control for the endogeneity of continuity of care downwardly biases estimates of the association between continuity of care and cancer screening. Significant differences in screening rates according to continuity of care persist after controlling for individual fixed effects.

Conclusion

This is the first Australian research to investigate both personal and site continuity of care. Most Australians report having continuity of care with either a single GP or with a general practice. Continuity of care is associated with increased quality of care, at least pertaining to cancer screening. This thesis concludes that policy attempts to encourage continuity of care have the potential to improve the quality of primary care. Policy interventions to encourage continuity of care include increasing awareness of the benefits of continuity of care and potentially providing incentives to patients and doctors. The availability of practice-level Medicare data would permit further investigation of the association between site continuity of care and general practice care. More robust research methods are needed in continuity of care research in order to better evaluate potential associations between personal and site continuity of care, and positive health outcomes.

1 Chapter 1 – The Australian Health System and Continuity of Primary Care

1.1 Introduction

In this chapter, the context of this research is described, Australian general practice. This includes an outline of multiple changes to the Australian population and the Australian health system which may be altering the delivery of continuity of care in Australian general practice. Demographic and workforce changes are described, together with changes to the role of primary care, the largest component of which is general practice. This overview suggests that the ability for patients to obtain care with one doctor may be decreasing, and that care is increasingly provided at a practice level.

In this thesis, a distinction is made between continuity of care with a single general practitioner (GP), and continuity of care with a location or health service, such as a general practice. Personal continuity refers to continuity of care with a single GP and site continuity refers to continuity of care at a practice level. This distinction between personal continuity and site continuity is potentially important, and is integral to the analyses in the later empirical chapters of this thesis.

1.2 Australia's health system – performance and expenditure

In structuring a health system so as to maximise its performance, an important consideration is to balance the multiple objectives of effective, efficient and equitable care (WHO 2000). By international standards, the Australian health system performs well in providing high quality care and good health outcomes, however it ranks less highly on equity measures (Schneider et al. 2017).

Australia spends 10.3% of its gross domestic product (GDP) on health (2015/16 figures) (AIHW 2017c). This has grown from 6.8% of GDP in 1986-87, with health care expenditure increasing from $4,276 per person in 2001/02 to $6,230 per person in 2011/12 (AIHW 2014). Australia's health spending is close to the Organisation for Economic Co-operation and Development (OECD) average, but significantly less than the United States of America (USA), which spent over 16% of its GDP on health care in 2015 (OECD 2017).

1.2.1 Primary care

Primary health care is considered the front line of Australian health care delivery, with GPs and general practices being recognised as central to the delivery of primary health care (Standing Council on Health 2013; Swerissen, Duckett & Wright 2016). Patients in Australia have unrestricted access to general practice services, thus being able to consult multiple GPs and multiple general practices for primary care (Hall 2015).

1.2.1.1 Primary care activity

Nearly 85% of Australian residents have at least one consultation with a general practitioner each year (Australian Government Department of Health 2015). The average number of annual GP visits has increased from 4.5 visits annually in 1987/88 up to 5.6 visits annually in 2012/13 (National Health Performance Authority 2015).

After excluding non-attenders, patients average 6.8 visits annually (Britt H et al. 2015). Visits by patients to multiple GPs are common, particularly by those who have greater total numbers of GP visits. A patient who makes less than three GP visits per year will consult on average 1.5 GPs, while those patients who make between 12 and 19 visits per year will consult on average 3.9 GPs (National Health Performance Authority 2015).

1.2.1.2 Primary care funding

General practice services are subsidised by fee-for-service (FFS) payments which are provided to patients through the Australian Government's national insurance scheme Medicare. GPs are free to charge any fee, or to accept the Medicare subsidy as full payment (known as 'bulk-billing)[1]. In addition to FFS payments, the Australian Government provides additional funding to support high quality primary care, improve access and health outcomes through the Practice Incentives Program (Productivity Commission 2017; Scott et al. 2009). FFS payments comprise over 93% of Federal Government expenditure on general practice (Productivity Commission 2017), with payments under the Practice Incentives Program payments being made quarterly to accredited general practices and comprising between 4% and 7% of practice income (Cashin & Chi 2011).

The majority of general practice services in Australia are delivered without cost to patients. Since 2010, over 80% of annual GP attendances have been bulk-billed. Over 85% of general practice attendances were bulk-billed in 2016-17 (ABS 2017a). Out of

[1] Bulk-billing originally referred to guaranteed (but reduced) reimbursement for services paid directly by Medicare which were sent by batches (or 'bulked' together). Bulk-billing now is taken to mean provision of service without out of pocket costs to patients.

pocket health costs are a feature of the Australian health system, with around 17% of health expenditure being borne by individuals. More than two thirds of these costs are in primary care, with medication costs being the largest component (AIHW 2017c). For those patients who incurred costs associated with a GP attendance, the average out-of-pocket costs were $36.09 in 2017-18 (Department of Health 2018). Figures from 2016-17 indicate that around 4% of patients delayed or omitted seeing a GP at least once during the previous year due to cost (ABS 2017b).

1.3 Pressures facing the Australian health system

The Australian health system is currently facing multiple pressures. These include demographic changes in the Australian population, changes within the GP workforce, and structural and regulatory changes designed to clarify the role and improve the quality of general practice care (AIHW 2016a). These pressures have the potential to change the delivery of health care, in particular general practice services, and affect the performance of the health system. The following section discusses these issues in more detail.

1.3.1 Changing population demographics

Multiple changes in the Australian population are increasing the demand for health care services. These demographic changes include population growth, an ageing population, and the increased burden of chronic disease in the population.

1.3.1.1 Growing population

The Australian population is growing, with the resident population approaching 25 million (ABS 2018). The population grew by an estimated 404,000 in 2013, with 40% due to births and 60% due to net overseas migration (AIHW 2014). In the five years between 2011 and 2016, the Australian population grew by 1.8 million, with net population growth averaging 1.58% per annum (ABS 2018).

1.3.1.2 Ageing population

The Australian population is on average living longer. Over the 50 year period between 1960/62 to 2011/13, the average life expectancy of males increased from 67.9 years to 80.1 years. For females, over the same period life expectancy increased from 74.2 years to 84.3 years (AIHW 2016c).

Life expectancy for Australians at different ages and for different time periods is shown in Table 1 below.

Table 1 – Average life expectancy for Australian men and women of different ages classified according to year of birth (Source: AIHW, 2016)

Age (years)	Males 1881–1890	Males 1960–1962	Males 2011–2013	Females 1881–1890	Females 1960–1962	Females 2011–2013
0 (birth)	47.2	67.9	80.1	50.8	74.2	84.3
1	54.3	69.5	80.4	57.4	75.5	84.6
15	59.5	70.1	80.5	62.5	76.0	84.7
25	62.1	70.8	80.8	64.7	76.3	84.9
45	68.0	72.4	81.8	70.6	77.4	85.4
65	76.1	77.5	84.2	77.3	80.7	87.1
85	88.9	89.1	91.1	88.9	89.8	92.1
95	97.2	97.3	97.9	97.3	97.6	98.3

As a result of this increasing longevity, between 1995 and 2015 the median age of the Australian population increased by three years, from 34 years of age to 37 years of age (ABS 2015). The proportion of the population over 65 years of age has increased from 9% of the population in 1973 to over 15% in the most recent figures (2016) (AIHW 2014, 2017d).

1.3.1.3 The growing burden of chronic disease

In addition to living longer, Australians are increasingly living with chronic diseases. Chronic diseases, also known as chronic conditions, or noncommunicable diseases (NCDs), are typically long lasting, are slowly progressive, have persistent effects and generally require long term management (Australian Health Ministers' Advisory Council 2017; WHO 2014). Chronic diseases include conditions such as diabetes mellitus, chronic obstructive lung disease, and heart disease. In 2014/15, nearly half of all Australians were living with at least one of eight chronic diseases (arthritis, asthma, back problems, cancer, chronic obstructive pulmonary disease, cardiovascular disease, diabetes and mental health conditions) and nearly 40% of people aged over 45 years have two more of these conditions (AIHW 2015). In Australia, chronic diseases are the leading cause of disability and illness and account for over 90% of deaths (AIHW 2014).

1.3.2 Changing role for general practice

Australian general practice has multiple health system roles, including providing the first point of access for most Australians with acute health conditions, along with provision of preventative health care and health promotion, and management of chronic conditions (AIHW 2016a). The general practice role in managing chronic diseases has grown with the prevalence of these conditions (Harris & Zwar 2007), and most care for these conditions can be provided within the community (Grumbach & Bodenheimer 2002). GPs also have a role in filtering referrals to other health professionals before Medicare payments can be obtained, although patients can directly access public hospital emergency department care without referral or cost.

Improved general practice management of chronic diseases has been identified as a potential driver to slow increasing health care costs. Better quality primary care is theorised to slow chronic disease progression, reduce rates of disease complications and hospitalisation, and potentially decrease overall health costs (Dennis et al. 2008; Macinko, Starfield & Shi 2003). It is has been theorised that higher quality care in the community will also be associated with lower costs and improved patient experience, referred to as the 'triple aim' of health care (Berwick, Nolan & Whittington 2008). By shifting health care to primary care (first contact undifferentiated care, such as Australian general practice), the provision of health services is potentially more efficient and unnecessary secondary and tertiary care may be reduced (National Health and Hospitals Reform Commission 2009 ; Standing Council on Health 2013). However there is limited empirical evidence supporting this link between improved quality of primary care and decreased costs (Dusheiko et al. 2011; Martin 2011).

1.3.3 The changing general practice workforce

The medical workforce has greatly expanded over the last thirty years, and concerns about maldistribution of the medical workforce are long-standing (Australian Medical Workforce Advisory Committee and Australian Institute of Health and Welfare 1998). Regarding primary care, there have been changes to the size, composition and distribution of the general practice workforce that are potentially influencing the delivery of care, and continuity of care. Since 2000 there has been an increasing number of GPs in Australia, and a decreasing number of general practices. The GP workforce is aging and is its gender balance is changing to be more representative of the general population. Solo practices are becoming less common, while practices with multiple providers are increasing in number. Taken together, these changes are potentially influencing how primary care and continuity of care is delivered in general practice in Australia.

1.3.3.1 Increasing general practitioner (GP) numbers.

Since 2000, GP numbers have increased markedly. Based on General Practice Workforce statistics, the number of full service equivalent (FSE—equal to working 37.5 hours a week) GPs in Australia rose by over 80% in the fifteen years from 2001/02 (14,086) to 2016/17 (25,825) (Department of Health 2017a). The growth in the GP workforce is still large when population increases are taken into account, with GP numbers increasing from 72.3 FSE GPs per 100,000 population in 2001/02 to 104.2 FSE per 100,000 population in 2016/17, a 44% increase over the fifteen-year period. Growth in per capita GP numbers has occurred in both urban and rural locations, but has been most rapid in the most remote regions of Australia between 2006/07 and 2016/17 (Department of Health 2017a), shown in Table 2 below.

Table 2: Full service equivalent (FSE) GPs per 100,000 population according to urban/rural location between 2006/07 and 2016/17

	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
Major cities	82.6	85.9	86.7	87.9	89	90.8	92.7	97	102.1	106.6	108.8
Inner regional	71.4	76.3	78.4	81.6	84.6	86.9	90.3	96.4	103.2	107.4	109.3
Outer regional	64.1	68	69.4	72.6	74.8	77.7	80.9	85.3	92.4	95.8	96.3
Remote	54.5	56.9	57.6	59.5	60.7	61.2	61.4	66.3	72.8	75.1	77.2
Very remote	40.4	43.7	42.4	45.5	47.6	47.9	51.5	54.2	57.2	59.5	65.5

1.3.3.2 Changing composition of the GP workforce

Gender balance within the GP workforce has been changing to be more representative of the general population, with the percentage of females increasing from 35.5% in 2000/01 to 45.4% in 2016/17 (Department of Health 2017a). The GP population is also ageing, with a greater proportion of GPs aged over 55 years, and a decreasing proportion aged between 35 and 44 years of age (Britt H et al. 2015; Britt H 2013).

1.3.3.3 Decreasing hours worked

The limited workforce data suggests that the average hours of work for GPs may be gradually decreasing. Between 2005 and 2015, the average number of hours worked by all employed doctors (not just general practitioners) decreased slightly from 43.7 hours per week in 2005 to 42.4 hours in 2015 (AIHW 2011, 2016d). Results from repeated cross sectional surveys of Australian GPs indicate that the proportion of GPs who reported working 41-60 hours per work decreased significantly from 39.0% in 2005/06 to 28.4% in 2014/15, while the proportion of GPs who reported working 21-40 hours per week increased from 47.1% in 2005/06 to 58% in 2014/15 (Britt H et al. 2015).

1.3.4 Changing general practices

There have been multiple changes to the typical structure of general practices since the introduction of Medicare in 1983. In addition to changes in the size of practices, practices increasingly provide co-located services, and the ownership models of practices have also become more diverse. Multiple regulatory changes have been implemented with the aim of encouraging improved quality with general practice, most notable being general practice accreditation (Coote 2009; Harris & Zwar 2014).

1.3.4.1 Changing practice size

While the number of GPs has increased markedly, limited data available suggests that there has been a decrease in the number of registered general practices, with the number falling from over 8,000 in 2002 to just over 7,000 in 2012 (Carne 2013). Much of this decrease has been attributed to practice mergers (Britt et al. 2016). In addition, the average size of practices has been increasing, with the proportion of GPs reported to be working in practices with more than 10 GPs increasing from 11% in 2001/02 to 27% in 2013/14 (Britt et al. 2016).

1.3.4.2 Co-located practices

As well as having more GPs, general practices increasingly have co-located providers and services, including visiting allied health professionals (such as podiatrists, dieticians, exercise physiologists, physiotherapists) pharmacists and diagnostic services (such as radiological imaging and pathology services).

1.3.4.3 Changing ownership models

Anecdotal reports suggest that there has been a shift in the ownership structure of general practices from the traditional GP-owned practice (typically operating under a shared partnership model with multiple GPs/owners) towards non-GP practice ownership, either by non-GP health professionals (such as pharmacists) or corporate entities. Concerns about the motivation of non-GP owners and the potential impact on the quality of care have been voiced by some authors (Sturmberg & Martin 2003), although the limited evidence to date has found no differences between corporate and non-corporate practice in terms of quality of care or billing practices (Erny-Albrecht & Bywood 2016; Fitzgerald 2002).

1.3.5 Other pressures

1.3.5.1 Changing expectations of care

In addition to the pressures outlined already, further challenges for primary care include increasing expectations of the quality of care, and an expectation of increased patient and carer involvement in medical decision-making (AIHW 2014). These increasing expectations may increase the workload of primary care health professionals, including GPs.

1.3.5.2 *Increasing costs of care*

There are other factors increasing the costs of care, in addition to population changes and increasing medical workforce. As incomes rise, people are likely to spend more of their income on health. As new technologies are introduced, they add cost to the health system and such costs have been suggested to lead to greater increases in health costs than demographic changes (Commonwealth of Australia 2015).

1.4 Summary

In summary, the Australian population, the health of the nation and the delivery of primary services have been changing over the last twenty years. This time period has seen an increasing population with an increased chronic disease burden, and a growing GP population with a trend to working in larger practices for reduced working hours.

With primary care increasingly delivered by GPs working together in larger general practices, there has been a potential shift in focus from receiving all care from a single GP, to that being delivered at a particular practice. This moves the emphasis of care from being about the relationship with one provider to better coordination around a practice team. Previous authors have questioned whether the shift from a personal connection to a reliance on information technology will undermine the essence of the healing relationship been patient and doctor and lead to lower quality care (Saultz 2003).

The concept of obtaining care from one provider is known as continuity of care, and is considered a core characteristic of primary health care (American Academy of Family

Physicians 2010; Macinko, Starfield & Shi 2003). It is unclear whether the changes outlined above are affecting continuity of care in Australia, although international authors suggest that global demographic and structural changes are threatening the ability to provide continuity of primary care (Baker & Jeffers 2016).

As continuity of care is considered a core component of high quality primary care, it appears important to investigate whether changes to the Australian health system are changing the ability of patients to obtain continuity of care, and furthermore, whether changing continuity of care is impacting on health outcomes. This is the focus of this thesis.

The remaining chapters of the thesis are structured as follows:

1.4.1 Chapter 2

In Chapter 2 of this thesis, the conceptual and empirical literature about continuity of care is reviewed. Existing theories of continuity of care are analysed in order to define an economic framework for understanding continuity of care in the Australian primary care setting. Continuity of care is considered within a framework of the principal-agent problem. Commonly used measures of continuity of care are described in order to inform choice of measures for the subsequent empirical chapters of this thesis. There is a large body of existing literature reporting an association between continuity of care and improved health outcomes. Most of this literature is cross-sectional in design. There is a smaller body of methodologically superior literature providing evidence of potential causality which is the focus of this thesis. The literature review within

Chapter 2 identifies both an absence of Australian research and multiple unanswered research questions.

The four questions explored within the subsequent empirical chapters of this thesis are as follows:

- Is multiple practice attendance a common behaviour in Australia, indicating that investigation of both personal and site continuity of care are warranted (Chapter 3)?
- Are demographic and workforce pressures changing personal continuity of care and increasing care focused around a practice (Chapter 4)?
- What patient and practice factors are associated with personal and site continuity of care (Chapter 5)?
- Is there an association between continuity of care and improved health outcomes in the Australian setting (Chapters 6 and 7)?

1.4.2 Chapter 3

Given the importance of understanding context in the modelling of continuity of care, the research reported in Chapter 3 of this thesis analyses GP attendance patterns in order to estimate the prevalence of multiple practice attendance in Australia. This analysis informs whether investigation of both personal and site continuity of care appear justified in subsequent empirical chapters of this thesis. Results of this analysis indicate strong patient preferences for having both a usual GP and usual general practice. However over 25% of adults in the sample reported attending multiple general practices in the previous year. These results indicate that a significant proportion of care is provided away from a patient's usual practice and that investigation of both personal and site continuity of care of care are warranted. A journal article based on the analysis detailed in Chapter 3 has been submitted for peer review and published in the Australian Journal of General Practice (Wright et al. 2018).

1.4.3 Chapter 4

The data used in the subsequent empirical chapters is described, and summary statistics are provided within Chapter 4.

The main data source used in this thesis is from the Australian Longitudinal Study on Women's Health (ALSWH). ALSWH is a longitudinal survey of over 50,000 Australian women which began in 1996. The ALSWH data permits estimation of both personal and site continuity of care, and longitudinal data analysis is particularly appropriate given the panel nature of the data.   ALSWH data is linked to Medicare claims data for over 90% of ALSWH participants and this linked data provides additional variables. Medicare data does not contain practice-level information and measures of site continuity of care cannot be calculated.

In order to answer the second research question, an analysis of how self-reported personal and site continuity of care has changed through ALSWH survey waves is provided within Chapter 4.

Finally, a comparison of self-reported measures of continuity of care derived from ALSWH survey data and estimates of personal continuity derived from Medicare data is provided. This comparison indicates low concordance between these different estimates of personal continuity of care in this sample. The absence of practice-level Medicare data, and the aim to investigate personal and site continuity of care motivates the use of ALSWH data in the remaining empirical chapters.

1.4.4 Chapter 5

Research question

> What patient and practice factors are associated with personal and site continuity of care?

In order to answer the third question regarding the predictors of personal and site continuity of care for Australians, the research presented in Chapter 5 investigates patient stated preferences for continuity of care at both a GP and practice-level. This research utilises ALSWH longitudinal data to investigate the association between continuity of care and patient demographic, health status, and heath service characteristics

The analyses provided in Chapter 5 discriminate between the characteristics of women with personal continuity of care, from those with site continuity of care. Within Chapter 5, an extended list of covariates is incorporated to reduce omitted variable bias.

1.4.5 Chapter 6

Research question.

> Is there an association between continuity of care and improved health outcomes in the Australian setting?

In analysing the final question, the relationship between patient adherence to preventative cancer screening and continuity of care will be investigated. As preventative screening has no immediate benefit for patients, the uptake of screening potentially reflects the strength of the relationship between patient and their doctor or practice. The analysis within Chapter 6 utilises ALSWH panel data to investigate the relationship between continuity of care (site continuity and personal continuity) and receipt of guideline appropriate preventative cancer screening (mammography and Pap smear) for Australian women.

There is only a small body of existing literature examining the association between continuity of care and health outcomes that considers temporality, and also the endogeneity between health status and continuity of care. This analysis considers both of these issues, by utilising longitudinal data and instrumental variables (IV).

1.4.6 Chapter 7

Research question.

> What is the relationship between continuity of care and cancer screening rates? Does this association hold at a GP and practice-level using administrative data estimations of Pap testing?

To overcome some of the limitations found in Chapter 6 regarding the use of survey data, Chapter 7 presents a second analysis of the relationship between continuity of care and cancer screening rates, using Medicare administrative data to estimate Pap test participation. Models estimating rates of Pap testing and months until next Pap test for women who are overdue for a screening test are provided. Fixed effects modelling is incorporated to control for individual level heterogeneity, a technique not possible using only the ALSWH survey data.

1.4.7 Chapter 8

Chapter 8 concludes this thesis with an examination of the policy implications of the findings from the empirical chapters. The chapter also provides an outline of potential policy options that may be worthy of consideration by health economists or health system funders who seek to encourage continuity of care within Australian primary care.

2 Chapter 2 – Evidence about continuity of care

2.1 Introduction

In Chapter 2 the existing literature about continuity of care is reviewed.

First, existing theories of continuity of care are described, and an economic framework for continuity of care is outlined. This framework is based on agency theory, as it is hypothesised that continuity of care is a mechanism used by patients to improve utility in the patient-doctor (principal-agent) relationship. Various methods previously used to measure continuity of care are summarised and those measures considered most appropriate for the investigation of personal and site continuity of care in Australia are identified.

Second, a review of the existing empirical evidence base regarding continuity of care is provided. There is a large body of research undertaken in clinical medicine suggesting an association between continuity of care and positive health outcomes. Most of this research is limited by being cross-sectional in nature and thus only able to report simple associations. A smaller body of higher quality research exists, using longitudinal data and econometric techniques to take into account temporality, endogeneity and other biases. This higher quality research is the focus of the literature review undertaken here.

This literature review identified a number of gaps in knowledge, particularly in terms of understanding continuity of care in the Australian context.

2.2 What is continuity of care?

Continuity of care is the term used to describe care provided beyond a single episode of illness, provided on multiple occasions, and how that care is connected in a coherent way (Haggerty et al. 2003). Continuity of care is regarded as a core component of a high performing primary health care system (Bodenheimer et al. 2014; RACGP 2015). Despite this, its definition has been debated by authors for decades (Freeman et al. 2001; Hennen 1975; McWhinney 1975; Rogers & Curtis 1980; Starfield 1980).

Currently, continuity of care is defined as a multi-dimensional concept which includes both the relationship that may exist between a doctor and patient (known as relational, personal or interpersonal continuity of care), and additional dimensions reflecting the benefits of shared information which are thought to improve decision-making in health care (most commonly termed informational or management continuity of care) (Haggerty et al. 2003; Reid, Haggerty & McKendry 2002).

The relationship between patient and doctor has long been central to the understanding of continuity of care (Freeman & Hjortdahl 1997; McWhinney 1975). When this relationship improves the quality of care, it has been called a therapeutic doctor-patient relationship (Greenhalgh & Heath 2010). Early authors suggested that in a therapeutic doctor-patient relationship, a patient gains trust in their doctor and the doctor gains additional information about the patient's clinical and personal characteristics. When this occurs, decision-making is improved (Banahan & Banahan 1981; McWhinney 1975).

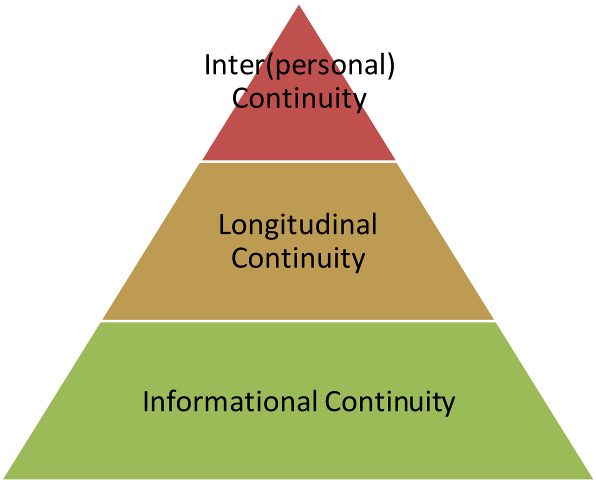
Differentiating the potential benefits of the therapeutic doctor-patient relationship from the potential improvements related to the gathering of information was an important contribution of early authors (Hennen 1975; Starfield 1980). Starfield argued that the personal relationship between patient and provider which developed over time (which Starfield termed 'longitudinality' but now is usually termed 'relational' or 'interpersonal' continuity of care), should be considered separately from the provision of sufficient information and consistency to allow safe ongoing care (now commonly known as 'informational' continuity of care) (Starfield 1980).

Additional dimensions of continuity of care have been proposed by multiple authors; most commonly proposed are the length of time of the doctor-patient relationship (typically called longitudinality) the strength of the relationship (relational or interpersonal continuity), the sharing of information between doctor and patient (informational continuity of care) and the use of consistent treatment pathways (management continuity of care) (Freeman et al. 2001; Hennen 1975; McWhinney 1975; Rogers & Curtis 1980; Starfield 1980). While some authors believe that the strength of the doctor-patient relationship has independent benefits over and above the length of time of the relationship and should be encouraged (Guthrie et al. 2008; Saultz 2003), others argue that the benefits of the relationship are less clear and that the relationship may be a proxy for the length of time of the relationship (Freeman, Olesen & Hjortdahl 2003).

Greater agreement about the component dimensions of continuity of care has occurred since the publication of two influential frameworks in the early 2000s by Saultz (2003) and Reid et al. (2002).

In the USA, John Saultz (2003) proposed a three-tier hierarchical framework to understand continuity of care, comprising informational continuity at its base, longitudinality (length of time under care) as an intermediate dimension, with interpersonal (or relational) continuity of care at its summit (described in Table 3 and Figure 1 below). At the lowest level in this framework, information is recorded which could assist care (such as the recording of allergies or current medications). At Level 2, termed longitudinality, the information obtained in Level 1 is used over multiple encounters to guide future care. This use of information over multiple occasions potentially facilitates safe and higher quality care. Level 3, interpersonal continuity, is the highest level, and reflects the additional benefit gained from the therapeutic doctor-patient relationship. Although longitudinality and informational continuity may encourage safe care, they can occur in the absence of a therapeutic doctor-patient relationship. Saultz argued that interpersonal continuity includes the doctor taking responsibility for the patient's individual care, and while longitudinality reflects the length of time with a provider, it is inadequate to describe the quality of the doctor-patient relationship (Saultz 2003).

Figure 1 - Saultz Conceptual Hierarchy of Continuity



Hierarchy of continuity (adapted from Saultz, 2003)

Table 3: Saultz 3-level framework for understanding continuity of care

Interpersonal continuity – Level 3	Indicating the presence of a therapeutic doctor-patient (or other health care provider) relationship. Effects of Interpersonal continuity are those related to the therapeutic relationship.
Longitudinal continuity – Level 2	Implies multiple interactions between patient and health provider and the use of the information gained in Level 1. Longitudinality may entail the use of a shared record or shared information within a health service. Longitudinality might exist without any therapeutic relationship between patient and providers of health care.
Informational continuity – Level 1	Information transfer occurs between patient and health care providers. This might include sharing of demographic information and is potentially important for patient safety (such as avoiding drug allergies). Level 1 information is gathered, may be shared between health care providers or retained by one doctor.

A second framework of continuity of care was developed by Canadian researchers led by Richard Reid and Jeannie Haggerty (Reid, Haggerty & McKendry 2002). These authors suggested three dimensions of continuity each needing consideration in different contexts: relational continuity of care, informational continuity of care and management continuity of care.

Within the Reid and Haggerty framework, relational continuity recognises the importance of an ongoing relationship between patients and providers in connecting knowledge and care over time and in linking discontinuous events. Relational continuity is analogous to the interpersonal continuity described by Saultz and is considered the aspect of continuity most valued in a primary care setting. Informational continuity of care and management of continuity of care differentiate between the non-relational dimensions of continuity of care. Informational continuity means that information on prior events is used to provide appropriate care for current and future circumstances (similar to Level 2 in the Saultz framework). Management continuity refers to the consistency of care and suggests that care received from different providers is coordinated and cohorent way, through shared protocols or pathways. Management continuity focuses on specific disease states or care pathways, and has more relevance in a hospital rather than a community setting (Haggerty et al. 2003; Reid, Haggerty & McKendry 2002).

The Reid and Haggerty framework does not consider longitudinality to be a separate dimension (suggesting it is intrinsic to understanding continuity), nor does it rank the three different dimensions; merely proposing that all require consideration. In contrast, Saultz suggests that additional value to that obtained through continuity of information or from seeing a patient for a long time is attained via a high-quality doctor-patient relationship.

Despite difference in their frameworks, the authors of the these typologies gradually collaborated (Freeman et al. 2007; Haggerty et al. 2003) and released a consensus statement (Guthrie et al. 2008) which agreed on three overarching dimensions of continuity of care based on the Reid Haggerty framework: relational continuity, informational continuity, and management continuity—with other components subsumed within these dimensions.

Continuity of care has been viewed as particularly important in primary care, such as general practice care. In primary care, patients present on multiple occasions for a variety of conditions, and care for both acute illness and preventative health is provided (Hennen 1975; Wall 1981). Continuity of care is widely considered a core characteristic of primary health care (American Academy of Family Physicians 2010; Macinko, Starfield & Shi 2003) and has been called "the key element of what makes general practice effective" (Baker & Jeffers 2016).

Continuity of care has been advocated as particularly important for patients with chronic and complex conditions (DuGoff, Bandeen-Roche & Anderson 2016; Muth et al. 2014; Napolitano et al. 2016) as these patients are at greater risk of fragmented care and more likely to suffer negative effects from poor coordination of care.

As health care is increasingly being provided by a multidisciplinary team, continuity of care is viewed as extending beyond the care between a patient and single clinician, to encompass continuity of care with a particular health service or around a single location, such as a general practice (Freeman & Hjortdahl 1997; Haggerty et al. 2003). Continuity of care around a location (or site continuity of care) has been the subject of less research than continuity of care with an individual doctor (personal continuity of care).

2.3 Why might continuity of care influence health care?

Multiple interactions between patients and their doctors provide greater opportunities for sharing of information. Other potential effects of continuity of care may be the development of a long-term relationship between patient and doctor which may increase trust and lead to a mutual sense of responsibility.

Through the accumulation of information from multiple visits, diagnostic decisions may be improved, so that a correct diagnosis is more likely to be made. This information sharing may occur in the absence of any bond between the doctor and patient. An improved understanding of the social, emotional and financial needs of patients might influence the acceptability or practicality of treatment options, while an understanding of patients' preferences may result in increased levels of compliance (Freeman & Hughes 2010; Gulliford, Naithani & Morgan 2006; Hjortdahl 1990, 1992; Mainous et al. 2001; Saultz 2003).

In addition to this information sharing process, there is the potential for patients and doctors to develop a bond or therapeutic relationship. The doctor-patient relationship has been suggested as a form of 'attitudinal contract' between patient and provider (Banahan & Banahan 1981). This informal two-way contract is thought to encourage doctors to feel more responsible for their long-term patients, permit patients to gain trust and confidence with the doctor, and improve patient compliance with a doctor's recommendations (Banahan & Banahan 1981; McWhinney 1975). Doctors may feel more obliged to provide care in the best interest of someone they know rather than a stranger, and patients may potentially adhere more rigorously to care recommendations from a familiar provider rather than an unknown doctor.

Continuity of care may facilitate better alignment of treatment goals and potentially increase trust between patients and doctors (Freeman, Olesen & Hjortdahl 2003; Hall et al. 2001), and a link between continuity of care and greater trust and satisfaction for patients has been proposed by some authors (Baker et al. 2003; Mainous et al. 2001). The exchange of information between patient and doctor potentially operates in both directions, with patients becoming more familiar with the behaviour of their doctor. These doctor behaviours may include the likelihood of prescribing medication or ordering investigations. Understanding a doctor's behaviour may help patients gain care which is better aligned with their preferences and treatment goals.

There are potential downsides to having all care with one provider. Complete continuity of care may be a negative if a patient has a low-quality provider. Longstanding familiarity with a patient could potentially lead to worse health outcomes. A long-term provider may think they know a patient and their symptoms, and may be more likely to attribute symptoms to an existing illness, rather than a new disease (Freeman 1984). Assessment by another doctor ('a fresh set of eyes') may allow for more accurate or earlier diagnosis, or referral. Another potential result of excess familiarity could be over-treatment; a patient who knows their doctor may be able to induce unnecessary treatments or investigation. This may lead to adverse outcomes for the patient as well as wasting resources (Freeman & Hjortdahl 1997).

2.4 An economic framework for understanding continuity of care

The doctor-patient relationship has been long considered an example of a principal-agent relationship (Arrow 1985; Evans 1984) and continuity of care has previously been identified as a mechanism to improve this relationship (Bonney, Magee & Pearson 2014; Wei et al. 2008a).

2.4.1 Principal-agent relationships.

When someone needs to make a decision, about which they have insufficient information or understanding to make on their own (and it is inefficient or too difficult for them to gain this information), they can seek the services of an agent to act on their behalf. The agent should be better informed than the principal and better equipped to make this decision on the principal's behalf, should act in the best interests of the principal and consistent with the principal's desires and preferences (Arrow 1985; Petersen 1993; Shapiro 2005). In a health care context, the principal is the patient and the agent is the doctor (or a GP in primary care), and the principal pays the agent for undertaking the agency role. Given that both the principal and the agent are utility maximisers but have different utility functions, two issues—information asymmetry and goal misalignment—may arise. These are collectively referred to as the 'principal-agent problem'.

2.4.1.1 *Information asymmetry*

The principal and the agent have different information available to them, and the information asymmetry may exist in both directions. The principal may have insufficient information about the problem or potential solutions, and this motivates their engaging an informed agent on their behalf. In the general practice setting, the GP may have greater information about disease processes and likely success of treatment options, while the patient may have greater information about the severity of their condition, and about their preference for care. The sharing of information between doctor and patient occurs over time, and potentially during multiple interactions.

In addition to information which is only available to either the principal or agent which might inform a decision, the principal also has limited information to determine the amount of effort the agent has used to provide him or her with the necessary information. Arrow terms this second type of information asymmetry as 'hidden action'; it is particular to the principal-agent problem, and results in an incentive for the agent to use minimal effort to receive payment (Arrow 1985).

2.4.1.2 *Goal misalignment*

As both the principal and the agent will be driven by at least some self-interest, there is potential for goal misalignment if they are motivated differently. In the traditional principal-agent relationship, the principal and agent have independent utility functions (McGuire, Henderson & Mooney 1988). In the doctor-patient relationship, both parties are anticipated to have improved patient health as components of their utility equation. So in the doctor-patient relationship, and other professional principal-agent relationships, the agent takes into account the principal's objectives (Evans 1984). At least moderate goal alignment is anticipated between a GP and patient, although the potential remains for the GP to incorrectly interpret a patient's objectives.

2.4.2 The doctor-patient relationship as an agency problem

Previous authors asserted that health care involves a complex agency relationship because, not only does the patient have insufficient information to make informed decisions, they are also unable to determine also the utility of a given decision (McGuire, Henderson & Mooney 1988). Mooney argued that patients are unable to be utility maximisers in the conventional sense because they have inadequate information to make health care decisions, and their values may be unstable (Mooney 2009).

Some authors have argued that the doctor-patient agency relationship is further complicated as doctors have multiple agency roles; as well as being an agent for their patients, they also play an agency role for the payers of the health system (Blomqvist 1991; Mooney 1992; Rice 2012; Scott & Jan 2011; Williams 1988). In health settings with a prominent gatekeeping role for primary care providers, or where the provider faces financial incentives from different sources, the conflict between these agency roles is potentially greater.

There is heterogeneity arising from both patient and doctor characteristics within the agency relationship, including patient willingness to delegate decision-making, and doctor acceptance of this delegation role. This further complicates the doctor-patient agency relationship. The agency relationship has therefore been studied in terms of both processes and outcomes. That is, not just getting the outcome right in terms of what the principal would do if fully informed, but doing so with sufficient information sharing and decision-making that reflect the principal's preferences (McGuire, Henderson & Mooney 1988).

2.4.3 Managing the principal-agent problem

In order to manage and evaluate the performance of the agent and assess whether value is being obtained, multiple approaches are available to the principal. These approaches include the use of contracts, performance management, and professional codes of conduct (Miller 2008; Petersen 1993). Within health care, it is often not possible to observe inputs (such as physician effort) or outputs (such as change in health status), and agency problems arise due to the inability of principals to contract for every action of the agent, and another approach to managing the principal-agent problem is through development of a long term or trusting relationship. These approaches are discussed in the following section.

2.4.3.1 Contracting and monitoring

Contracts specify performance criteria in order to reduce information asymmetry and the potential for goal misalignment, while monitoring permits the principal to better assess an agent's effort and performance (Eisenhardt 1989). Contracts may be less practical where outcomes are subject to random variation, and when they are less attributable to the effort of the agent. The quality of care provided by a GP is one input and genetics, lifestyle factors, and unpredictable responses to treatment may also influence health outcomes. The chronic nature of many conditions treated in primary care means that diseases are present over a prolonged time period, recovery is unlikely and it is difficult for patients to attribute health outcomes to a particular effort from a GP. These features of general practice makes contracting less feasible and the inability to create outcome-based contracts in health care is viewed by some authors as a particular characteristic feature of the doctor-patient agency relationship (Mooney & Ryan 1993).

2.4.3.2 Regulation and code of conduct

A regulatory framework or legislation can be introduced to encourage goal alignment between principals and agents. Such mechanisms exist within the Australian health system. For example, the Australian Health Practitioner Regulation Agency (AHPRA) oversees the national registration and accreditation scheme for health practitioners (including doctors) (Australian Health Practitioner Regulation Agency 2016), and most general practices complete accreditation based on the Royal Australian College of General Practioners (RACGP) standards (RACGP 2010).

Another mechanism to align patient and provider motivation is through the promotion of ethical standards, or moral codes. A strong code of professional ethics is encouraged at medical school, and promoted within professional bodies (Australian Medical Association 2006). This code is theorised to assist alignment of provider and patient motivation to be health maximizing, and there is evidence that doctors' and patients' utilities are at least interdependent, if not aligned (Mooney & Ryan 1993; Scott 2000). Although doctors are motivated by payment, ideally this should not override their ethical motivation, and both regulation and the code of conduct can support alignment of the goals of patients and providers.

2.4.3.3 Long-term relationship

In situations when performance management is less easily carried out by the principal, another approach to improve the agency relationship is through cooperation between agents and principals and the development of a long-term relationship with aligned objectives (Eisenhardt 1989). In a long-term relationship, the principal is able to observe the effort and performance of the agent over a longer period, and there is also the potential to achieve better goal alignment through the development of a bond. Such a situation may occur in primary health care, and continuity of care may reflect this approach. By creating a stronger bond between patient and doctor, continuity of care may encourage greater information sharing, trust, and improved adherence to recommendations. Continuity of care potentially provides a mechanism to strengthen the therapeutic doctor-patient relationship.

Continuity of care can be considered a non-contractual method for patients to reduce their risk of agency loss, or to reduce agency costs, and it may improve the principal-agent relationship in the absence of a financial incentive. Both relational and informational continuity can be considered as imperfect substitutes for complete information. In the primary care setting, greater information gathered over time, as well as the availability of previous information, has the potential to support GPs to be better agents, be better aligned to patient goals and allow patients to better estimate provider performance.

2.4.3.4 *Previous empirical research*

Continuity of care as a mechanism to reduce the agency problem has been conceptualised by previous authors (Donaldson 2001), and used as a framework for understanding patient behaviour in primary care settings (Bonney et al. 2014; Bonney, Magee & Pearson 2014; Scott & Vick 1999; Wei et al. 2008b).

Donaldson conceptualised continuity of care as a mechanism to increase information sharing and goal sharing, arguing that continuity of care has a particular role in creating a bond between patient and doctor, which patients hope will encourage the doctor to act more in the principal's interests (Donaldson 2001).

Scott and Vick (1999) investigated patient preferences for features of communication within the doctor-patient relationship, hypothesising that patients use communication within the doctor-patient relationship as a method to maximise their utility. A number of hypotheses were confirmed including that patients prefer more rather than less information, better rather than poorly explained information, and being listened to over not being listened to. The strongest identified patient preference was having sufficient time in the consultation to talk (Scott & Vick 1999). The results of this experiment are consistent with patients communicating with their doctors in order to reduce information asymmetry and goal misalignment.

A systematic literature review by Jung (2003) analysed patient characteristics associated with preferences for care and concluded that patients with poorer health status had a higher preference for seeing the same doctor on each visit, as did those who utilised more services. Older patients were more likely to prefer continuity of care with the same doctor, compared with younger patients, as well as being less comfortable with and having fewer expectations from a new doctor (Jung et al. 2003). These findings are consistent with the hypothesised value of continuity of care in reducing agency loss for these subgroups. Preference-based research has found heterogeneity in patient preferences; older patients prefer the doctor to take a greater role in decision-making, while younger female patients have greater preference for information sharing and shared decision-making (Vick & Scott 1998).

Bonney et al. (2014) considered the agency problem within Australian primary care in order to understand patient preferences for seeking care from a known versus unknown doctor (in this case a trainee doctor). The authors hypothesised that patients likely to gain more utility from a strong doctor-patient relationship would be those with higher health needs (such as patients with chronic diseases, poorer health or more complex medical history), and that these patients would have stronger preferences for seeing their regular doctor and for seeing one doctor only, be less willing to see a trainee doctor and less satisfied with trainee care. The authors found some evidence that supported their hypotheses, as patients with higher self-rated health and those older than 75 were more likely to have trust in doctors generally, while those placing greater importance on seeing one doctor only were female, had one or more chronic diseases and had been with the same GP for at least five years (Bonney et al. 2014).

Using a discrete choice experiment, Pedersen and colleagues (2012) evaluated whether Danish GPs provided care consistent with an agency role by comparing alignment between patient (n=698) and GP (n=969) preferences for organisational characteristics of general practices, including waiting time, length of consultation, opening hours, and distance to travel. They identified differences between preferences which suggest that GPs may not be ideal agents (Pedersen et al. 2012). It is possible that GPs had difficulty in imagining patient preferences rather than their own in this experimental situation.

This limited research suggests that continuity of care may be appropriately considered with an agency framework, and this approach is used as the theoretical basis for the research in this thesis. Two issues which are explored in this thesis relate to the structure and impact of the agency relationship. The first is exploring whether a principal-agent relationship can exist at a practice level. The second is understanding whether a stronger agency relationship leads to improved health outcomes.

2.4.4 Agency problem at the practice level

Most research into continuity of care and the principal-agent problem has been undertaken in the context of an individual provider. As practices get larger and team-based care becomes more common, managing the principal-agent problem at the practice level may also become an issue. As patients reduce the concentration of care they receive from one provider only, there may be the potential for reduced continuity and potentially reduced sense of responsibility by any single provider.

Having multiple agents may reduce the ability of the patient to observe the effort or performance of any given agent. This may exacerbate attempts to attribute care to a particular provider, and worsen agency problems. Some authors have raised concern about what has been termed 'collusion of anonymity' emerging in larger general practices (Freeman & Hughes 2010; Gray 1979). This term originally referred to fragmentation of care when patients move between multiple medical specialists but where no doctor takes responsibility for the patient overall (Balint 1957). A similar problem of fragmented care could occur in general practice if relational continuity of care is reduced and no one GP takes responsibility for the patient.

Other authors have argued that there may be the potential for multiple providers to monitor the performance of one another (assuming patient wellbeing is contained within their utility function). For example, Rochaix (1989) argued that in a situation with multiple principals and multiple agents, and where principals are able to seek a second opinion, the performance of agents may improve. There is a threat of principals moving to another agent after recognising lower quality care and this reduces the potential for shirking within a practice. This situation would hold so long as at least some of the principals are optimally informed, and when agents are unable to identify them (Rochaix 1989).

Practice-level agency has not been previously analysed in Australia. This is analysed in this thesis by measuring both GP and practice-level continuity of care.

2.4.5 Measuring the impact of agency

Measuring the effect of a strong patient relationship on health outcomes is not feasible for this research. However it is possible to measure the impact of this relationship on patient behaviour, including compliance. When a principal has a strong relationship or high levels of trust in the agent, then they are anticipated to be more likely to follow the advice of the agent. Within this thesis, health screening is explored as a proxy for the impact of the therapeutic doctor-patient relationship.

Health screening (such as Pap testing for prevention of cervical cancer) is a patient investment which does not provide immediate health benefits. As patients are without symptoms they are less able to estimate the value of participation (Cairns & Shackley 1992). Screening participation provides a potential measure of the impact of the agent in influencing the utility function of the principal. In the primary care setting it is atnicipated that patients within a stronger principal-agent relationship will be more likely to engage in screening, and that doctors may be more likely to recommend screening to those patients they have a stronger bond with.

2.5 Measuring continuity of care

Broadly speaking, there are two approaches to measuring continuity of care in health research. One approach is to use self-reported measures of continuity of care (obtained from patients or providers most commonly via a survey), while the second method uses estimates of health service utilisation (typically derived from administrative claims data sources) to calculate a continuity of care score. This second group of measures are sometimes known as objective measures of continuity of care because of their use of objective (rather than self-reported) data (Christakis et al. 2003; Gjevjon et al. 2014). These two types of measures will be referred to as subjective measures (for those derived from patient self-reports) and claims-based measures (to those derived from administrative claims data). Both types of measures may estimate continuity of care with a single doctor (personal continuity of care), or continuity of care with a health service (site continuity of care).

Over 30 measures of continuity of care have been identified in the literature and have been categorised by previous authors (Jee & Cabana 2006; Saultz 2003). There is no standard measurement instrument for considering continuity of care in any health setting. Consensus is lacking in terms of the most appropriate index of continuity of care and no index includes all possible dimensions of continuity (Haggerty et al. 2012; Jee & Cabana 2006). The most commonly used subjective and claims-based measures, and their advantages and disadvantages are described in the next section of this chapter.

2.5.1 Subjective measures of continuity of care

For subjective measures, a participant (usually a patient, but alternatively a health care provider) is surveyed about behaviour, experience, or preference for an aspect of care thought related to continuity of care. The simplest proxy for continuity is how often a patient sees the same clinician (Freeman & Hughes 2010), and measures based on self-reported patterns of GP attendance are commonly used in continuity research (Fan et al. 2005; Hjortdahl & Laerum 1992; Love et al. 2000). Attendance patterns or survey questions asking about the strength of the doctor-patient relationship, or sense of affiliation, are used as a proxy for relational or interpersonal continuity of care.

2.5.2 Claims-based measures of continuity of care

Claims-based measures of continuity of care use health service utilisation data to estimate a continuity score based on a mathematical formula. This score is used as a proxy measure for the strength of the relationship between patients and doctors or care facilities. Multiple claims-based measures have been proposed and developed since the 1970s (Bice & Boxerman 1977; Fortney et al. 2003; Hansen 1975; Steinwachs 1979) and are typically classified into four categories based on the concept they measure: duration of care (or longitudinality), density, dispersion and sequential measures (Jee & Cabana 2006). The most commonly used claims-based measures are a density measure, Usual Provider of Care (UPC), and a dispersion measure, Continuity of Care Index (COCI). Both measures are described in the following section.

2.5.2.1 Duration/longitudinality measures

Duration measures calculate the length of time a patient has been consulting a provider and are the simplest claims-based measures of continuity of care. Although simple to calculate, these measures have been criticised for focusing on one provider only, and for not quantifying frequency of contact or quality of the doctor-patient relationship (Reid, Haggerty & McKendry 2002). They are infrequently used alone in empirical research.

2.5.2.2 Density measures – UPC

Density measures calculate the proportion of care delivered by one provider, while also taking into account the total amount of care received. The most commonly used density measure is the Usual Provider of Care (UPC) (Breslau & Reeb 1975), which is calculated by dividing the number of visits to a usual or preferred provider by the total number of visits in a given period of time.

$$\text{UPC} = \frac{n}{N}$$

where n = visits with a single (usual) provider, and N = total number of visits.

UPC is scaled between 0 and 1, with 1 representing complete continuity with one provider, and decreasing values towards 0 suggesting less concentration of care with one nominated provider.

UPC is easy to calculate, and intuitive to understand. In the absence of a defined 'usual provider', the standard approach is to consider the most frequently or the most recently consulted provider as the usual provider (Ejlertsson & Berg 1984). Measures of UPC are unstable at low levels of utilisation as low users have greater variation in scores than high users. It is standard practice to exclude those with low visit counts from analyses using UPC, most typically those with less than three visits in the period of observation (Jee & Cabana 2006). Density measures are limited in estimating care with one provider only, and fail to account for care with multiple providers.

2.5.2.3 Dispersion measures – COCI

Dispersion measures take into account not only the number of visits but also the spread among providers, so that care with multiple providers may be measured. The most commonly used dispersion measure is the Continuity of Care Index (COCI) developed by Bice and Boxerman (Bice & Boxerman 1977). The formula for this measure is

$$\mathrm{COCI} = \frac{\sum_{i=1}^{M} n_j^2 - N}{N\,(N-1)}$$

where N = total number of visits, n_j= number of visits to one particular medical provider j, and M = total number of medical care providers. The medical provider could be a particular health service, or an individual provider.

COCI is also scaled between 0 and 1, with 1 indicating complete continuity (or minimum dispersion) with one provider being seen for every visit, and lower scores indicating visits to an increasing number of providers, down to 0 (which indicates single visits to multiple providers). Values other than 0 and 1 are less intuitively understood than for UPC. COCI is useful in understanding care patterns across multiple providers, rather than just the amount of care with one provider. Dispersion measures are also sensitive to changes in care for low frequency users of health services, and low visit counts are usually excluded.

2.5.2.4 Sequential measures

Sequential measures take into account the order in which care from providers is received. These measures are used when considering whether follow up is needed with a particular provider (Saultz 2003; Wasson et al. 1984). They are less commonly used and are not further discussed or used in this thesis.

2.5.3 Subjective or claims-based measures?

Claims-based measures can be easily calculated using routinely collected administrative claims data without the need for surveys. However, these measures have been criticised as inadequately representing the patient perspective (Bentler et al. 2014b; Uijen, Schers & van Weel 2010), and being unable to provide information about the quality of the doctor-patient relationship (Health Quality Ontario 2013; Nutting et al. 2003).

Subjective measures are considered by some authors as better reflecting the patient experience of care (Bentler et al. 2014c), but have been criticised for potential inaccuracy (Fan et al. 2005; Rodriguez et al. 2008) and for being prone to potential recall bias (Bradburn, Rips & Shevell 1987; Coughlin 1990). Recall bias arises when there is an error in information recall such that an event is forgotten, or an event is recalled which did not occur. Such bias is a feature of surveys of health service utilisation. Causes are multifactorial, including respondent socio-demographics (such as age), time frame of recall, questionnaire design, and type of event being recalled (Bhandari & Wagner 2006).

2.6 Continuity of care literature

There is a large body of empirical evidence originating from clinical medicine investigating the association between continuity of care and health outcomes. Most literature relates to primary care and particularly to continuity of care with a GP, although smaller bodies of literature have investigated continuity of care in a hospital setting, continuity of midwifery care (Homer 2016; Sandall et al. 2016), or continuity of mental health care (Sweeney et al. 2016).

Most early research used patient interviews or surveys to investigate the association between increased continuity of care and a variety of health-related metrics. Some studies reported positive findings including associations between increased continuity of care and improved patient satisfaction (Hjortdahl & Laerum 1992; Saultz & Albedaiwi 2004), improved health professional satisfaction, increased medication compliance (Brookhart et al. 2007) and increased uptake of preventative care (Menec, Sirski & Attawar 2005).

The increasing availability of administrative data has boosted the use of claims-based measures of continuity of care, which can be easily derived from such data. Most relevant studies investigate the association between the proportion of care with one provider and measure(s) of health outcome, health service usage, or health costs. Studies have investigated the association between continuity of primary care and secondary care utilisation and reported decreased emergency department attendance (Gill, Mainous & Nsereko 2000), or hospitalisation (Gill & Mainous 1998; Menec et al. 2006; Worrall & Knight 2011) and decreased mortality (Cho et al. 2015; Worrall & Knight 2011).

As better management of chronic disease in primary care has been theorised to slow increases in health costs, some authors have undertaken research in population subgroups with chronic diseases (Cho et al. 2015; Knight et al. 2009) to investigate the association between continuity of care and health costs (De Maeseneer et al. 2003; Raddish, Horn & Sharkey 1999).

Most of this empirical literature emerges from clinical medicine and even most recent analyses are cross-sectional in design (Barker, Steventon & Deeny 2017; Kohnke & Zielinski 2017; Napolitano et al. 2016). Although the results of these studies show positive associations between continuity of care and health outcomes, they are not able to provide any evidence of a causal relationship.

2.6.1 Higher quality research

A smaller body of methodologically superior research has utilised longitudinal data or modelling techniques to provide greater insights into the potential relationship between continuity of care and health outcomes. This research provides evidence indicating potential causality and reflects the empirical research undertaken for this thesis.

Early experimental research by Wasson et al. (1984) reported that men over 55 years of age who were randomised to receive all their care from one provider (continuity group) had significantly fewer emergency admissions than men who were allocated a new provider at each visit (discontinuity group) (20% in intervention group versus 39% in control group), and shorter lengths of stay in hospital (on average 15.5 days versus 25.5 days) (Wasson et al. 1984). This study appears to be the only published randomised controlled trial (RCT) and suggests a potential causal relationship between increased continuity of care and decreased secondary care utilisation.

Other early studies by Mainous and Gill (Gill & Mainous 1998; Mainous et al. 2004) and Christakis (Christakis et al. 2001; Christakis et al. 2000) are methodologically superior to cross-sectional analysis as they estimate continuity of care at a time period prior to the estimation of health outcomes. The results from these studies show a persisting association between higher levels of continuity of care and improved subsequent health outcomes, including decreased risk of hospitalisation (Christakis et al. 2001; Christakis et al. 1999; Gill & Mainous 1998), increased vaccination rates (Christakis et al. 2000) and improved quality of chronic disease management (Mainous et al. 2004).

The first systematic review of higher quality literature was published in 2010 and authored by van Walraven and colleagues (van Walraven et al. 2010). One hundred studies published between 1950 and 2008 were identified which investigated the association between continuity of care and health outcomes, but 82 were excluded because they measured continuity of care and health outcomes concurrently. The remaining 18 studies (including the one RCT reported by Wasson et al., and the work of Christakis et al., and Mainous and Gill described above) accounted for the temporal relationship between continuity of care and health outcomes by measuring continuity of care in a time period prior to measurement of health outcomes and were included in the review. Fifteen of the 18 studies used administrative data to calculate standard claims-based measures, most commonly including the COCI in eight studies, and the UPC in five studies. One study measured subjective continuity and two studies included less common claims-derived measures. The health outcomes reported were health service utilisation (ED or hospital attendance, nine studies), increased patient satisfaction (seven studies), medication compliance (one study) and one study analysing multiple measures of cardiovascular disease control blood pressure, diabetes and cholesterol control (van Walraven et al. 2010). In eight of the nine health service utilisation studies, higher provider continuity of care resulted in reduced ED usage or hospitalisation, while five of the seven patient satisfaction studies reported statistically significantly positive associations between increased continuity of care and increased patient satisfaction. The single compliance trial (Kerse et al. 2004) and single study analysing clinical care outcomes (Litaker et al. 2005) did not show a positive association between continuity of care and improved care. In this final study, the authors analysed whether patients within a health service who obtained all their care from one doctor or nurse had improved care outcomes (attaining diabetes, cholesterol or blood pressure targets) compared with patients who saw two or more doctors or nurses within the health service. The authors reported no significant improvement in clinical care for patients who obtained all the care from one provider compared with patients seeing multiple providers (Litaker et al. 2005).

Van Walraven et al. (2010) concluded that there was reasonable evidence of a relationship between increased continuity of care and improved patient satisfaction, and the potential for reduced resource utilisation. There were no studies considering preventative health (such as cancer screening rates) in this systematic review with a higher quality threshold for inclusion, and no studies from Australia.

2.7 Literature review

Within the next section of this thesis, an updated review of literature based on the van Walraven (2010) inclusion criteria is provided. Empirical literature published since 2008 which reported the results of studies investigating the association between continuity of care and health outcomes is included, specifically those which took into account the temporal link between continuity of care and health outcomes. A search of major Pubmed and of targeted health economics and primary care journals was conducted. Search criteria and results are provided in Section 10.1.1 in the Appendices.

Studies were included if they were experimental studies, observational studies, (cohort studies, before and after studies) or cross-sectional studies investigating the association between continuity of care and health outcomes, and were in English. Importantly, studies also needed to include temporality, either by estimating continuity of care at a time period prior to the period of measurement of health outcomes, or by taking into account the endogeneity of continuity of care.

Health outcomes included patient satisfaction, changes to health service utilisation, health care costs, or the quality of clinical care.

Additional literature which reported evaluations of differences between personal and site continuity of care (considered potentially relevant for the Australian setting), and literature from Australia was also collated, even if it failed to meet the higher methodological standard. The review of additional Australian cross-sectional literature is provided in the Appendices.

The search identified 18 studies (Bentler et al. 2014a; Chen & Cheng 2011; DuGoff, Bandeen-Roche & Anderson 2016; Enlow, Passarella & Lorch 2017; Geroldinger et al. 2018; Kao & Wu 2016, 2017; Lin & Wu 2017; Lin, Wu & Huang 2015; Liss et al. 2011; McCusker 2012; Nam et al. 2016; Pourat et al. 2015; Pu & Chou 2016; Reddy et al. 2015; Shin et al. 2014; Vogt, Koller & Sundmacher 2016; Weir et al. 2016) which met the inclusion criteria. One additional paper was identified which analysed the association between continuity of care, and potentially unnecessary medical procedures, and considered temporality in the sensitivity analysis (Romano, Segal & Pollack 2015). The 19 studies are summarised in Table 4 below.

Sixteen of the nineteen studies are retrospective cohort studies analysing administrative claims data. The remaining literature includes one prospective cohort study of an infant cohort (Enlow, Passarella & Lorch 2017), an analysis of the effect of losing a regular doctor on patient satisfaction and the quality of clinical care (Reddy et al. 2015), and a before and after analysis of the introduction of a financial incentive to encourage continuity of care at a practice (Pourat et al. 2015). Fifteen of the nineteen empirical papers took into account the temporality of continuity of care by detailing a time period when continuity of care was estimated prior to the measurement of health outcomes (Bentler et al. 2014a; DuGoff, Bandeen-Roche & Anderson 2016; Enlow, Passarella & Lorch 2017; Geroldinger et al. 2018; Kao & Wu 2016, 2017; Lin & Wu 2017; Lin, Wu & Huang 2015; Liss et al. 2011; McCusker 2012; Nam et al. 2016; Pu & Chou 2016; Romano, Segal & Pollack 2015; Vogt, Koller & Sundmacher 2016; Weir et al. 2016). The remaining papers consider temporality by incorporating longitudinal modelling techniques (Chen & Cheng 2011), using instrumental variable (IV) techniques to consider the endogeneity of continuity of care on health outcomes (Pu 2016), or by reporting the results of natural experiments analysing the impact of an incentive designed to encourage site continuity (Pourat et al. 2015), and that of the loss of a regular provider on satisfaction and quality of care (Reddy et al. 2015).

Studies were excluded if they failed to meet any of the inclusion criteria. This included review articles, evidence about preference-based research, and commentary/opinion pieces without empirical analysis.

The characteristics of the included studies are summarised in Table 4 below in terms of country context, study setting (primary care, hospital or population), sample size and study type.

Table 4: Characteristics of studies included in literature review

Author	Year	Study	Location (general population, GP practice, hospital outpatient) and visits analysed	Setting (State, country)	Sample size	Population
Bentler	2014	Retrospective cohort study	Community sample, general population, GP visits	Iowa, USA	2,620 Medicare beneficiaries	65 and over
Chen	2011	Retrospective cohort study	Outpatient, disease related doctor visits	Taiwan	48,107 at baseline	Type I or Type II DM
DuGoff	2016	Retrospective cohort	GP and specialist visits	Five states in the USA	1,254	65+ with DM + one other chronic disease
Enlow	2017	Prospective birth cohort	Primary care visits	Philadelphia, USA	17,773	Birth cohort
Geroldinger	2018	Retrospective cohort study	General population, GP and all doctor visits	Austria	51,717	Prescribed diabetes drugs
Kao	2016	Retrospective cohort study	Outpatient, disease related doctor visits	Taiwan	3,356	Patients with asthma over 65 years of age
Kao	2017	Retrospective cohort study	Outpatient, disease related doctor visits	Taiwan	3,395	Patients with asthma over 65 years of age
Lin	2015	Retrospective cohort study	Outpatient, disease related doctor visits	Taiwan	3,015	Newly diagnosed COPD patients from sample population

Author	Year	Study	Location (general population, GP practice, hospital outpatient) and visits analysed	Setting (State, country)	Sample size	Population
Lin	2017	Retrospective cohort	Outpatient, disease related doctor visits	Taiwan	2,199	Newly diagnosed COPD patients from sample population
Liss	2011	Survey date linked to administrative data	Primary care network, GP visits	Washington State, USA	3,224	Medicare insurance recipients (ie 65+) with DM or CAD
McCusker	2012	Retrospective cohort study	Population sample, All visits to GP and other specialist doctors	Quebec, Canada	367,315	Adults
Nam	2016	Retrospective cohort study	Outpatient clinic nsurance sample –	Korea	30,474	Adults with hypertension
Pourat	2015	Before and after study using admin data	Primary care practice	California, USA	4,191 in pre-period 5,837 in post period	Previously uninsured adults aged 21-64 in insurance program
Pu	2016	Retrospective cohort study	Outpatient, disease related HT and DM visits	Taiwan	331,506 people with HT, 82,181 with DM	Sample of DM and HT patients
Reddy	2015	Retrospective cohort study	Veterans affairs primary care practices	Philadelphia, USA	510,875 total 45,370 patients with loss of primary care provider	Veterans affairs population - 96% male, average age 67
Romano	2015	Retrospective cohort study	Outpatient, GP and specialist visits	USA - Medicaid population	1,208,150 potentially avoidable procedures performed in 2008	USA Medicaid (65+)

Author	Year	Study	Location (general population, GP practice, hospital outpatient) and visits analysed	Setting (State, country)	Sample size	Population
Shin	2014	Retrospective cohort study	Primary care practice, disease related visits	Korea	48,347 patients	Adults with newly diagnosed hypertension DM or hypercholest-erolemia
Vogt	2016	Retrospective cohort study	Population, GP and other doctor visits	Germany	382,118	Adults aged 35 and over with heart failure
Weir	2016	Retrospective cohort study	Population, GP visits	USA	285,231	Newly diagnosed diabetics adults

Notes- HT- hypertension, DM – diabetes mellitus, COPD – chronic obstructive pulmonary disease, CAD- coronary artery disease

An outline of each study is provided in the following section. Further details about the continuity of care measures used in each research and related concepts are detailed in Table 5, and full data extraction from each study is provided in Table 32 in the Appendices.

2.7.1 Description of included literature

Bentler (2014) analysed the association between 13 continuity of care measures (12 measures calculated using administrative data including UPC and COCI, and a self-developed 13th subjective continuity of care scale) and three outcome measures (ED attendance, hospitalisation and mortality) in a USA primary care population (n=1,219) aged 65 years or older. A survey provided subjective estimates of continuity of care, and objective continuity of care of GP visits was calculated using claims data from the two years before completion of the survey. Health outcomes were measured in the five years following the survey. The analysis of these data failed to find a positive association between any of the 12 claims-based measures of continuity of care and the three outcome measures, while increased subjective continuity of care was associated with reduced emergency department attendance and mortality. The results indicated *increased* mortality rates for people in the highest tertile of continuity measured by UPC and COCI, compared with the lowest tertile. The authors were unable to recommend a particular continuity of care measure (and advocated for future researchers to use both subjective and claims-based measures) (Bentler et al. 2014a). Although this paper provides additional information about multi-dimensional scales, the subjective measure included has not been used by other researchers. The association between increased continuity of care and increased mortality is the only such finding within this literature review and potentially reflects the small sample size.

Chen and Cheng (2011) analysed the association between continuity of outpatient care, and health service utilisation and costs over a seven-year period for a sample of 48,107 patients in Taiwan with diabetes mellitus. The authors created a seven-year panel model, calculated a continuity score using COCI and used generalised estimating equations (GEE) to analyse the association between COCI (stratified into three groups – high, medium, low) for diabetes-related outpatient visits, and diabetes-specific health service usage and costs. Patients in the high COCI or medium COCI tertiles were significantly less likely to have a diabetes-related ED attendance or hospitalisation than those in the lowest group COCI group. Subsequent estimation of costs suggested that diabetes-related pharmaceutical expenses and health services expenses were significantly lower in the high continuity group compared to the low continuity group

(Chen & Cheng 2011). The use of the panel accounts for unobserved patient heterogeneity and strengthens these results beyond a cross-sectional association. The coding of clinical activity within the claims data permitted the analysis of disease-related activity, but not all health administrative data will allow this. For example, it does not appear possible using Australian Medicare data.

DuGoff et al. (2016) analysed the association between continuity of primary care (considering GP and other specialist doctor visits measured using UPC, COCI and the less commonly used known provider continuity- KPC) in a six-month period and ED or inpatient use in the following year, in a cohort of 1,254 adults aged over 65 with multiple chronic diseases (DM plus at least one other condition) and with at least three physician visits in the six-month run-in period. Although the authors reported lower ED or inpatient attendance for patients seeing the same physician in unadjusted models, once the models were adjusted for the number of chronic diseases and other covariates, UPC and COCI in tertiles were not predictive of the composite outcome. Although this study measured continuity of care in a prior time period to outcome measurement, this was over a shorter time period than most analyses and continuity scores were estimated including visits to both GPs and other doctors. (DuGoff, Bandeen-Roche & Anderson 2016).

Enlow et al. (2017) analysed the association between the UPC of primary care visits (in quartiles) for the first 12 months of a prospectively constructed birth cohort of 17,733 infants and measures of health care utilisation (ED visits, all-cause hospitalisation, ambulatory care sensitive hospitalisation – ACSH[2]) and preventative care outcomes (immunisation, screening for lead exposure) in the following 24 months. Although bivariate analysis showed that children in the lowest quartile of UPC had significantly lower immunisation rates and were more likely to have had all cause hospitalisation, ACSH and ED visits, the full regression model indicated that only the relationship between UPC and ACSH was significant. Sensitivity analysis incorporating COCI showed statistically-increased ED utilisation in the lowest quartile of COCI, compared with the highest COCI quartile (Enlow, Passarella & Lorch 2017).

Geroldinger et al. (2018) utilised insurance claims data to analyse a sample of 51,117 Austrian adults prescribed diabetes medication, and provided Cox regression models to investigate the association between continuity of primary care visits measured by COCI and UPC in year one, and all-cause mortality in the subsequent two years. The authors reported an analysis of continuity of GP visits, as well as continuity of all medical contacts, including diagnostic testing such as pathology and radiology contacts. Results of the univariate analysis of GP visit continuity showed that compared with the lowest tertile COCI group, those with the highest GP visit continuity (COCI=1) had reduced mortality rates, although this was not significant in the full model. In the analysis of continuity of all primary care contacts, those in the highest continuity group had significantly *increased* mortality. Although not anticipated by the authors, this finding could be explained by the inclusion of diagnostic testing contacts within this second continuity measure. Patients with the highest continuity using this second metric may

[2] ACSH ─ ambulatory care sensitive hospitalisations are hospital admissions considered responsive to the improved quality of primary care, such as complications related to poorly controlled diabetes or asthma.

be having less monitoring, or less provision of necessary multidisciplinary care, and this lack of appropriate care may be leading to mortality increase. The authors reported similar results using UPC as the measure of continuity of care.

Four studies investigated the relationship between continuity of outpatient care and disease-related hospitalisation or emergency department attendance in a Taiwanese population from a random sample of one million insurance beneficiaries (Kao & Wu 2016, 2017; Lin & Wu 2017; Lin, Wu & Huang 2015). Lin and Wu (2017) and Lin, Wu and Huang (2015) both analysed a sample of patients newly diagnosed with chronic obstructive pulmonary disease (COPD), while Kao and Wu (2016) and Kao and Wu (2017) investigated adults over 65 with a diagnosis of asthma. Lin, Wu and Huang (2015) studied a population of 3,015 patients newly diagnosed with COPD and counted COPD-related ambulatory visits to calculate COPD-related COCI in the first two years following diagnosis (excluding those with two or fewer visits in the two year period), before measuring COPD-related avoidable hospitalisations in year three. COCI was calculated in tertiles, and results showed that those with the highest COCI (COCI=1) were less likely to have COPD hospitalisation than patients in middle or lowest tertiles, even after controlling for age and chronic disease count.

In the second of these Taiwanese studies, Lin and Wu (2017) analysed COPD-related ambulatory visits in one year and two years after COPD diagnosis and calculated one- and two-year COCI for 2,199 patients with at least three visits in the first year post-COPD diagnosis. The odds of having a COPD-related hospitalisation in the subsequent year was significantly lower for people in the high COCI tertile group than for those in the low or medium tertiles and the difference in the odds ratios was greater after two years (Lin & Wu 2017).

Kao and Wu (2016) and Kao and Wu (2017) reported two analyses of the same population of asthmatic adults aged 65 and over. In an approach similar to that of Lin and Wu (2017), Kao and Wu (2016) investigated the association between COCI for asthma-related ambulatory visits in the first year of analysis, and disease-related hospitalisation in the second year for a sample of 3,356 asthmatic adults. The odds of asthma-related admission in year two was lower for adults in the highest COCI tertile compared with the medium and lowest tertile, and this difference between the highest and lowest COCI groups was statistically significant at $P<0.05$ threshold. Kao and Wu (2017) provided a very similar analysis to their 2016 study, investigating rates of asthma-related emergency department attendance in an asthmatic adult population and reports significant differences in ED attendance between the highest and lowest continuity groups. As noted with the study by Chen and Cheng (2011), the absence of clinical coding within Australian claims data renders replication of these disease specific Taiwanese studies unfeasible using Australian Medicare data.

Liss et al. (2011) conducted a survey of patient-reported care coordination in a US Medicare population (age 65 or older) with at least one of three chronic conditions (diabetes, coronary artery disease, or congestive heart failure). The survey measured patient demographics and experiences of care (including care coordination), and the survey data were linked to health service utilisation data from the preceding year. Using the COCI as the measure of continuity, the results indicated a relationship between higher continuity of care in the preceding year and patient reports of better care coordination. Further analysis suggested differences between patients with high (10 or more) and low frequency of specialist attendances. There was no association between COCI and care coordination for high specialist users, potentially indicating that for high complexity patients, the impact of relational continuity with a GP is reduced by the high number of specialist visits (Liss et al. 2011).

McCusker (2012) analysed emergency department attendance in a population sample of Canadian adults with claims data during a two year baseline period, and measured both claims-based continuity (using UPC) and subjective affiliation with a particular GP or specialist based on a self-developed algorithm of whether patients had two or more visits to a doctor, and whether they had a screening examination recorded (McCusker 2012). Continuity and affiliation were measured in the first two years of the study and emergency department usage was measured in the subsequent three years. The results suggested that there was no significant association between increased UPC (measured in tertiles) and decreased odds of subsequent ED visits except for patients with more than 24 visits over a two-year period. An association between increased affiliation with a family physician and decreased emergency department attendance was reported suggesting that there they may be different results obtained using different meausures of continuity of care (McCusker 2012).

Nam et al. (2016) analysed the association between continuity of ambulatory care visits and hospital admission in a Korean population of patients with hypertension. The authors analysed site continuity of hypertension-related clinic visits according to COCI, and hospitalisations with hypertension as the primary diagnosis as the study outcome. Less than 1% of the sample were recorded having a hypertension-related hospital admission and patients were classified into high and low continuity groups based around a threshold of COCI=0.75. Compared with the high continuity group, the authors reported significantly higher rates of hospitalisation for patients in the low continuity group. Most Korean primary care is provided by medical specialists (rather than GPs) working in solo outpatient clinics, and these results may be less relevant to the Australian setting.

Pourat et al. (2015) reported an analysis of a natural experiment in a Californian primary care population after the introduction of a financial penalty for patients attending a practice other than their registered practice. The researchers used a lagged prediction methodology to measure attendance patterns (estimating site continuity of care according to UPC in an initial six month period), before measuring emergency department attendances and hospitalisations in a subsequent six month period. Results indicated that patient attendance at one practice increased from 31.4% of the sample before the policy was introduced to 69.6% in the year after introduction of the policy. The authors reported an association between increased site continuity of care and decreased ED or hospital attendances, but found no statistically significant evidence of an impact of increased site continuity on ED visits or hospitalisation rates after the policy was introduced (Pourat et al. 2015). The data did not allow the estimation of personal continuity of care. The six month time period of analysis is potentially insufficient to detect significant differences in ED usage or hospitalisation.

Pu and Chou (2016) analysed the association between COCI and ED utilisation in people with diabetes and hypertension in a Taiwanese insurance sample. In addition to measuring COCI in the year prior to ED utilisation, an instrumental variable (IV[3]) approach was used to account for the endogeneity of continuity of care. COCI was modelled as a continuous variable from 0-1. The proposed IV was the averaged COCI of family members who had the same diseases as the included subject. For patients with diabetes, models presuming exogeneity of COCI estimated the marginal effect of COCI changing from 0 to 1 on decreasing ED attendance at 12.6%. This effect was larger (14.8%) in models controlling for endogeneity. For patients with hypertension, smaller but significant findings were reported, with ED usage decreasing by 4.4% in the uncorrected model, and by 7.6% in the IV analysis. These results suggest that failing to control for endogeneity of continuity of care may underestimate the potential impact of continuity care (Pu & Chou 2016).

Reddy (2015) analysed the performance of 11 preventative and routine care metrics (such as blood pressure being treated to target or having appropriate diabetic screening) and patient satisfaction in a population of US Veterans Affairs patients (characterised by information continuity made possible through a shared electronic health record) following 'turnover' of their primary care providers (for example, due to death or retirement of their GP). The authors compared care outcomes for 45,370 patients who had provider turnover, with 510,875 patients whose provider did not change. Continuity of care (UPC) was measured for the year before turnover, which was

[3] Instrumental variable (IV) analysis permit controlling for endogeneity within models and is discussed more fully within Chapter 6 of this thesis.

followed by measurement of patient experience and completion of ambulatory tasks. There was a significant decrease in satisfaction among patients with provider turnover compared with those without turnover. Compared to patients whose provider did not turnover, those with high UPC before turnover had significantly lower levels of achievement of recommended LDL cholesterol and blood pressure targets in the following year (with no significant change for the remaining seven clinical measures) (Reddy et al. 2015). This study provides some evidence that in the absence of provider continuity, information continuity may support high quality care. The cause of provider turnover potentially confounds the findings, as doctors in their final year before retirement, or who are in the year before death, may not provide standard care.

Romano et al. (2015) explored the issue of unnecessary medical care by examining the relationship between continuity of care (UPC, COCI and SeCon modelled as continuous explanatory variables within regression models) and the odds of having one of 17 potentially overused or unnecessary procedures. In a sensitivity analysis, the authors measured continuity of care in the first six months, and procedural use in the following six months. Overall, the odds of having any of the 17 procedures was significantly reduced with increased continuity. A 0.1 increase in the continuity score (on a scale of 0-1) was associated with significantly reduced odds of having one of the 17 procedures (OR=0.993; 95% CI 0.990-0.995). However, six of the 17 procedures were significantly more likely to occur in patients with higher continuity (Romano, Segal & Pollack 2015). These procedures included the two screening tests (ultrasound tests for carotid artery stenosis, and blood tests for detection of Helicobacter pylori) and the single monitoring test (pathology testing of digoxin levels in blood). As in the study by

Pourat et al. (2015), the six-month observation period was potentially insufficient to estimate the effect of continuity of care, and a longer duration of observation may be more informative.

Shin and colleagues (2014) measured continuity of primary care clinic visits using COCI (coded as a dichotomous variable around the median and as a continuous variable) for two years and health service use, disease complications, costs of care and mortality in the subsequent five years in a Korean population newly diagnosed with diabetes, hypertension or high cholesterol levels. The results indicated a statistically significant reduction in both inpatient and outpatient costs for patients with above median continuity compared to those with below median continuity, even after controlling for age, gender, income, comorbidity and number of outpatient visits. The authors also found an association between lower continuity of care and increased risk of myocardial infarction or stroke, and higher mortality rates (Shin et al. 2014). As noted already, the structure of the Korean primary care system may limit the relevance of these results.

Vogt et al. (2016) analysed a sample of 382,118 German adults over the age of 35 with heart failure to test the association between continuity of GP care (using UPC, COCI and SeCON) in the first year, and disease-related hospital admissions in the subsequent year. There was an inverse association between increasing continuity of care and odds of subsequent hospitalisation for heart failure, although this was not significant. The modelling of continuity of care as continuous variable is a less common approach in recent literature and potentially limits the usefulness of this analysis

In a USA population of 285,321 newly-diagnosed diabetics consisting of commercially- and Medicare-insured patients, Weir et al. (2016) analysed the association between UPC in the two years after diagnosis of diabetes, and hospitalisation or death in year three. Results indicated significantly decreased hospitalisation or mortality for those patients with UPC score greater than 0.75, compared with those with lower UPC scores. The authors also report a trend for decreased likelihood of death or hospitalisation over tertiles of UPC (Weir et al. 2016).

2.7.2 Study characteristics

2.7.2.1 Context

Most of the empirical research originates in the USA (Bentler et al. 2014a; DuGoff, Bandeen-Roche & Anderson 2016; Enlow, Passarella & Lorch 2017; Liss et al. 2011; Pourat et al. 2015; Reddy et al. 2015; Romano, Segal & Pollack 2015; Weir et al. 2016), with the remainder from Taiwan (Chen & Cheng 2011; Kao & Wu 2016, 2017; Lin & Wu 2017; Lin, Wu & Huang 2015; Pu & Chou 2016), Korea (Nam et al. 2016; Shin et al. 2014), Germany (Vogt, Koller & Sundmacher 2016), Austria (Geroldinger et al. 2018) and Canada (McCusker 2012). There was no Australian research which met the inclusion criteria.

2.7.2.2 Sample populations

Most studies include population subgroups who more frequently use health services and are potentially more likely to benefit from higher levels of continuity of care. These include older patients (Bentler et al. 2014a; DuGoff, Bandeen-Roche & Anderson 2016;

Kao & Wu 2016; Liss et al. 2011; Romano, Segal & Pollack 2015) and patients with one chronic disease (Chen & Cheng 2011; DuGoff, Bandeen-Roche & Anderson 2016; Kao & Wu 2016, 2017; Lin & Wu 2017; Lin, Wu & Huang 2015; Nam et al. 2016; Pu & Chou 2016; Shin et al. 2014; Vogt, Koller & Sundmacher 2016; Weir et al. 2016), or multiple chronic diseases (DuGoff, Bandeen-Roche & Anderson 2016). One study investigated continuity of care for a birth cohort (Enlow, Passarella & Lorch 2017).

2.7.3 Methodological issues

There is marked heterogeneity within the literature in terms of how continuity of care is measured, at what threshold continuity is achieved, and which health outcome measures are examined.

2.7.3.1 How is continuity measured?

The measures used within the literature in this review are summarised in Table 5 below. Most studies used administrative claims data to estimate continuity of care scores with the most commonly reported measures of continuity being COCI (twelve articles) and UPC (nine articles). The remaining articles utilised less common claims-based measures (KPC, MMCI, SeCon) or measured continuity of care subjectively, or both (Bentler et al. 2014a; McCusker 2012). Seven of the studies included multiple continuity measures (Bentler et al. 2014a; DuGoff, Bandeen-Roche & Anderson 2016; Geroldinger et al. 2018; McCusker 2012; Romano, Segal & Pollack 2015; Shin et al. 2014; Vogt, Koller & Sundmacher 2016), most commonly UPC and COCI.

Table 5: Continuity of care measures and other concepts used within studies.

Author	Year	Continuity of care measures used					Other concepts
		Subjective	*UPC*	*COCI*	*Secon*	*Others*	
Bentler	2014	x	x	x	x	MMCI + 9	
Chen	2011			x			
Dugoff	2016		x	x		KPC	
Enlow	2017		x				
Geroldinger	2018		x	x			
Kao	2016			x			
Kao	2017			x			
Lin	2015			x			
Lin	2017			x			
Liss	2011			x			
McCusker	2012	x	x				Affiliation
Nam	2016			x			
Pourat	2015						
Pu	2016			x			
Reddy	2015		x				Loss of provider
Romano	2015		x	x	x		Unnecessary care
Shin	2014			x		MMCI, MFPC	
Vogt	2016		x	x	x		
Weir	2016		x			MCI	
TOTAL		2	9	14	3		

2.7.3.2 Continuity of care with whom?

Twelve studies investigated the proportion or concentration of care with one doctor (personal continuity of care), most commonly with a GP (Bentler et al. 2014a; Enlow, Passarella & Lorch 2017; Liss et al. 2011; Shin et al. 2014). Other studies investigated combined GP and specialist doctor care (DuGoff, Bandeen-Roche & Anderson 2016; Romano, Segal & Pollack 2015; Weir et al. 2016), with one investigating continuity of all medical contacts in addition to continuity of GP visits (Geroldinger et al. 2018).

Three studies investigated site continuity of care (Chen & Cheng 2011; Nam et al. 2016; Pourat et al. 2015).

2.7.3.3 How is continuity achieved?

There was little consistency in the threshold at which a patient could be considered to have continuity of care or how to differentiate between high and low continuity. The commonest approach used was to classify participants according to their continuity of care score into three categories: typically high, medium and low continuity of care, and compare health outcomes associated with each of these categories (Chen & Cheng 2011; DuGoff, Bandeen-Roche & Anderson 2016; Geroldinger et al. 2018; Kao & Wu 2016, 2017; Lin & Wu 2017; McCusker 2012). Some authors classified participants into high and low continuity of care groups based around a cut-off such as 75% of care with one provider (Nam et al. 2016; Weir et al. 2016) or around the median score (Shin et al. 2014), while others used four categories based on continuity of care score (Enlow, Passarella & Lorch 2017). Fewer authors have modelled continuity as a continuous variable (Pu & Chou 2016; Romano, Segal & Pollack 2015; Shin et al. 2014; Vogt, Koller & Sundmacher 2016) with some authors using multiple methods (Bentler et al. 2014a; Shin et al. 2014; Vogt, Koller & Sundmacher 2016). One natural experiment modelled the impact of losing a regular provider on the subsequent quality of primary care (Reddy et al. 2015). This review highlights the lack of consistency in modelling of continuity of care. Even for studies which utilised claims data, some subjectivity exists in determining how continuity of care is achieved.

The period of time over which continuity of care was calculated also varied. While most authors estimated annual measures of continuity of care (Bentler et al. 2014a; Chen & Cheng 2011; Enlow, Passarella & Lorch 2017; Geroldinger et al. 2018; Kao & Wu 2016, 2017; Liss et al. 2011; Nam et al. 2016; Pu & Chou 2016; Reddy et al. 2015; Vogt, Koller & Sundmacher 2016), some authors calculated continuity over a six-month time period (DuGoff, Bandeen-Roche & Anderson 2016; Romano, Segal & Pollack 2015), while other researchers calculated continuity over two years (Lin, Wu & Huang 2015; McCusker 2012; Shin et al. 2014; Weir et al. 2016).

2.7.3.4 Which outcomes are measured?

Included studies have been classified according to the outcome measures used. Table 6 lists the outcome measures and summarises the findings according to whether positive, equivocal or negative findings have been reported, noting that most of the studies have multiple outcome measures. A positive interaction between continuity of care and outcomes would include improved quality of care, improved patient satisfaction, increased completion of preventative health tasks, decreased usage of other health services, or decreased costs.

Eleven of the nineteen studies (58%) investigated the association between continuity of care and hospitalisation (Bentler et al. 2014a; Chen & Cheng 2011; DuGoff, Bandeen-Roche & Anderson 2016; Enlow, Passarella & Lorch 2017; Kao & Wu 2016; Lin & Wu 2017; Lin, Wu & Huang 2015; Nam et al. 2016; Pourat et al. 2015; Vogt, Koller & Sundmacher 2016; Weir et al. 2016), eight (42%) evaluate the association between increased continuity of care and emergency department attendance (Bentler et al. 2014a;

Chen & Cheng 2011; DuGoff, Bandeen-Roche & Anderson 2016; Enlow, Passarella & Lorch 2017; Kao & Wu 2017; McCusker 2012; Pourat et al. 2015; Pu & Chou 2016), while mortality was the only other outcome measure investigated in more than 20% of the studies (21%) (Bentler et al. 2014a; Geroldinger et al. 2018; Shin et al. 2014; Weir et al. 2016). The remaining outcome measures were included in at most two of the studies. Two studies considered multiple indicators of quality of care (Romano 2015, Reddy 2015).

Table 6: Research articles classified according to outcome measures, and whether significant findings reported

Outcome	Positive	Equivocal	Negative
Emergency department attendance	4	4	
Hospitalisation (ambulatory care sensitive or all-cause)	7	4	
Mortality	2	1	1
Cost (hospitalisation, all costs)	2		
Immunisation (childhood immunisation, influenza vaccination)		2	
Clinical outcomes/Quality of care[4]	1	1	
Screening (screening for lead exposure in children, inappropriate procedures)	1	1	
Well-coordinated care	1		
Patient satisfaction	1		

Positive indicates a statistically significant increase in desired health outcome, such as reduced emergency department attendance, reduced cost, or increased provision of appropriate care (such as immunisation or screening). Equivocal indicates non-significant result. Negative indicates statistically significant decrease in desired health outcome. Most studies have multiple outcome measures.

[4] Two studies (Reddy et al. 2015; Romano, Segal & Pollack 2015) have included multiple clinical processes, and reported partial positive associations between increased continuity and positive outcomes 2/9 in Reddy (2015) and 3/17 for Romano (2015).

2.7.4 Results

Results of this review of a limited set of the empirical literature are inconsistent and it is difficult to draw conclusions. However, all of the studies reported at least one statistically significant positive finding.

While some papers reported significant positive findings between increased continuity of care and all measured outcomes (Chen & Cheng 2011; Lin & Wu 2017; Lin, Wu & Huang 2015; Pu & Chou 2016; Shin et al. 2014; Weir et al. 2016), most studies with multiple outcome measures reported partial significant findings (Bentler et al. 2014a; DuGoff, Bandeen-Roche & Anderson 2016; Liss et al. 2011; Reddy et al. 2015; Vogt, Koller & Sundmacher 2016). For example, McCusker (2012) reported reductions in ED attendance associated with high continuity of care, but for high practice attenders only, while Liss (2011) reported improvement in coordination associated with increased continuity for low frequency specialist attenders only.

Most of the research analysed the association between continuity of primary care visits and secondary care utilisation or costs. The most common approach was to investigate the association between continuity of care with one doctor (most commonly UPC and COCI), and secondary care utilisation in populations with one or more chronic diseases (Chen & Cheng 2011; DuGoff, Bandeen-Roche & Anderson 2016; Kao & Wu 2016, 2017; Lin & Wu 2017; Lin, Wu & Huang 2015; Nam et al. 2016; Vogt, Koller & Sundmacher 2016). This potentially reflects the research priority to provide evidence of the theorised relationship between improved chronic disease management in primary care and potential cost savings to the health system. Two studies reported no positive association between the most commonly used measures of continuity in primary care and rates of secondary care utilisation (Bentler et al. 2014a; DuGoff, Bandeen-Roche & Anderson 2016).

The results regarding quality of care are less clear, with the three studies investigating the association between continuity of care and measures of clinical care providing inconsistent results (Enlow, Passarella & Lorch 2017; Reddy et al. 2015; Romano, Segal & Pollack 2015). Regarding screening, Enlow et al (2017) reported significantly increased rates of screening for anaemia and lead exposure in children who were in the highest quartile of continuity in the first year of life compared with children in the lowest quartile. However, Reddy et al (2015) reported no significant differences in colorectal or breast screening after the loss of a regular provider. These two studies also analysed immunisation rates and neither study reported significant differences in immunisation rates according to continuity of care in their controlled models. Regarding meeting treatment targets, Reddy reported significantly reduced achievement for 2 out of 7 processes after loss of a regular provider with no change for the remaining five. Romano et al (2015) reported an overall decrease in the odds of having one of 17 unnecessary procedures for patient with continuity of care. However patients with continuity of care in this study indicated a significant increase in the three screening or monitoring tests included.

Seven of the nine studies focusing on a population with chronic disease reported statistically significant positive associations between disease-specific continuity of care and disease-specific health outcomes using COCI or UPC as metrics (Chen & Cheng

2011; Kao & Wu 2016, 2017; Lin & Wu 2017; Lin, Wu & Huang 2015; Nam et al. 2016; Pu & Chou 2016) with one study reporting no significant differences (DuGoff, Bandeen-Roche & Anderson 2016), and one study reporting no significant difference using COCI and UPC but a significant difference using the less commonly-used sequential continuity of care measure (Vogt, Koller & Sundmacher 2016). As the seven studies reporting positive results were all conducted in Taiwan and Korea, further international research is needed to investigate whether this relationship is context specific or generalisable.

Two of the three studies investigating site continuity of care reported an association between increased continuity of disease related visits, and decreased hospitalisation or ED attendance (Chen & Cheng 2011; Nam et al. 2016), while the third study showed that although increased site continuity of care was associated with decreased hospitalisation or ED attendance, introduction of an incentive to encourage site continuity of care had no significant impact on subsequent hospitalisation or emergency department attendance (Pourat et al. 2015).

2.7.5 Conclusions

There is only a small body of continuity of care literature which takes account of temporality or endogeneity of continuity of care, thus providing evidence of a potential relationship between continuity of care and health outcomes.

Most of the research reviewed here analysed administrative and clinical data derived from large insurance databases. Beyond this similarity in data sources, methodological heterogeneity in how continuity of care is estimated and categorised is observed, a finding which is similar to previous research (Jee & Cabana 2006; Saultz & Lochner 2005; van Walraven et al. 2010). All but two of the studies in this review used measures of continuity of care derived from administrative claims data. The use of these measures rather than self-reported measures appears to be driven by ease of calculation rather than any superior validity. The variety of modelling techniques suggest that subjectivity exists in determining how continuity of care is achieved even for measures derived from objectively collated claims-based data. There was a trend for more recent authors to use more complex modelling of continuity, including three or more continuity subgroups, rather than modelling a binary or continuous continuity of care variable. In terms of the choice of continuity measures, authors are increasingly incorporating multiple measures of continuity within analyses, rather than a single measure.

A wide range of health outcomes are measured and although all studies reported at least some positive significant findings, overall results are inconsistent. There appears to be a trend for studies to find an association between increased continuity of care and decreased secondary care utilisation, and related cost reduction. Given the small amount of evidence, further conclusions are difficult to draw. Further research is needed to understand the association between continuity of care and quality of care.

2.8 Implications for this thesis

This literature review highlights the small volume of evidence which has considered site continuity. Nearly all the literature has estimated continuity of care with one doctor, with only three studies within this literature review investigating site continuity of care and one analysing both personal and site continuity of care. Understanding and differentiating between site continuity and personal continuity is highly relevant in the Australian primary care system, which encourages choice, and places no restrictions on patients seeking care from multiple providers or at multiple locations.

In this thesis, the Saultz hierarchy is used as a framework for understanding continuity of care in Australian general practice as it reflects a potential hierarchy of continuity moving from low level continuity obtained when seeking care from multiple providers, through site continuity of care (where informational continuity between providers is potentially important) to personal continuity of care (where relational or interpersonal continuity of care may add value). While it is recognised that there is the potential for patients to have a relationship with other practice members (such as practice nurses, or reception staff), these are not formally considered within this framework. Furthermore, there is the potential that any difference between care for patients with personal and site continuity, could be due to inadequate informational continuity, rather than a particular benefit from relational continuity (i.e. the relationship may not improve care, but the lack of information worsens it).

The literature review identifies both an absence of Australian research and multiple unanswered research questions.

To re-cap, the four questions explored within the subsequent empirical chapters of this thesis are as follows:

- Is multiple practice attendance a common behaviour in Australia, indicating that investigation of both personal and site continuity of care are warranted Chapter 3)?
- Are demographic and workforce pressures changing personal continuity of care and increasing care focused around a practice (site continuity of care) (Chapter 4)?
- What patient and practice factors are associated with personal and site continuity of care (Chapter 5)?
- Is there an association between continuity of care and improved health outcomes in the Australian setting (Chapter 6)?

The following chapter addresses the first of these questions.

3 Chapter 3 – The Prevalence of Multiple General Practice Attendance[5]

3.1 Introduction

As outlined in Chapter 1, Australians are able to consult multiple general practitioners (GPs) and multiple general practices in accessing primary care services, and have unrestricted subsidised access to general practice services through Medicare. Given this unrestricted access, it is potentially important to consider care with one GP as well as care around a practice. The research in this chapter investigates the prevalence of multiple practice attendance, in order to understand if interrogation of both personal and site continuity of care is warranted in subsequent empirical chapters of this thesis. This information cannot be calculated using Medicare data, and a survey is utilised to answer this question.

3.1.1 Context

Australia's primary health care system lacks features which may encourage both personal and site continuity of care, such as patient enrolment with a GP or practice, or through routine information sharing. In many countries, patients are enrolled with a single general practice and are encouraged to seek all their primary care from this practice (with limited exceptions), thus enforcing continuity of care at a practice level (Kalucy et al. 2009). High levels of general practice computerisation exist in Australia,

[5] An analysis based on the results of this Chapter has been submitted for peer review and published in the Australian Journal of General Practice (Wright et al. 2018) and may be accessed online at https://www.racgp.org.au/AJGP/2018/May/How-common-is-multiple-general-practice

permitting the sharing of medical records between GPs within a practice. However there is currently no capacity for practices to routinely share consultation information with each other, or with the national electronic health record, 'MyHealthRecord' (Australian Digital Health Agency 2018).

This analysis examines the extent to which site continuity of care (care provision contained within one general practice) is currently achieved in Australia as evidenced by patients' use of single or multiple general practices. This research analyses utilisation patterns according to patients' demographic characteristics, health status and other variables identified in related literature. According to the conceptual framework outlined in Chapter 2, it is anticipated that survey respondents with greater utility from having continuity of care would be more likely to be single practice attenders. Such respondents are anticipated to be older, with chronic health conditions or in worse self-reported health.

3.1.2 Existing literature

While many studies have investigated the association between continuity of care with a single doctor, and better health outcomes, the literature review in Chapter 2 highlights the small volume of evidence which has considered site continuity of care. The research by Pourat et al (2015), Chen and Chen (2011) and Nam (2016) were the only studies investigating site continuity of care contained within the earlier literature review.

Even fewer studies have both investigated personal and site continuity. Given the potential importance of these different levels of continuity in understanding continuity of care in Australia, this limited literature is reviewed below, even if it is cross-sectional.

A cross-sectional analysis by O'Malley and colleagues (1996) examined the association between appropriate ambulatory care in a paediatric population, and patient reported attendance with a usual provider and usual clinic. The authors found that children with either a regular provider, or a usual clinic, were more likely to have age-appropriate visits for ambulatory care, and were higher users of ambulatory care, than those children without a usual provider or clinic. Relative to children without a usual care site, those with a usual care site and a usual provider had a 15% increase in probability of having appropriate care (although a 61% increase in overall use of ambulatory care) (O'Malley & Forrest 1996). These results suggest positive associations with either personal or site continuity of care, but no statistical significant difference between the two levels of continuity.

Mainous and Gill (1998) investigated the association between both personal and site continuity of care (dichotomised at 50% of visits with one provider or clinic measured in first year of data), and subsequent hospitalisation in second year. The authors reported that the rate of hospitalisation of patients with high provider and high clinic continuity (9.8%) was significantly less than patients with high clinic but low provider continuity (13.4%) or patients with less than 50% continuity at both provider and institutional level (14.0%), and concluded that continuity with one doctor appears to provide more cost-effective care (Mainous & Gill 1998).

Mainous et al. (2004) analysed the association between self-reported continuity of care (with a usual GP as well as a usual practice) and measures of diabetes, blood pressure and cholesterol control in a population of diabetic patients chosen from the general population (n=1400). Results indicated that patients with either a usual place or usual provider had better glycaemic control than those without a usual site of care, after controlling for multiple confounders. There was no statistically significant difference in lipid control or BP control, and there was no additional benefit in glycaemic control from having a usual provider, over that from having a usual site of care (Mainous et al. 2004). This study indicated limited benefits of continuity of care in managing chronic disease, and suggested there may be benefit associated with site continuity without additional benefits from personal continuity.

Atlas (2009) investigated a primary health network (13 practices treating 169,024 patients over two years) and tested whether patients linked to a particular provider were considered as 'my patient' by the providers. The authors found increased rates of appropriate preventative care and chronic disease monitoring for patients who were provider-connected compared to those who were practice-connected. A statistically significant difference in quality of care persisted after adjustment for multiple patient and provider characteristics, and stratification according to usage of GP services. This suggests the potential for additional benefit in personal continuity, above that obtained from site continuity of care (Atlas et al. 2009).

Chan (2012) measured UPC, COCI, and SeCON in a Taiwanese population with multiple chronic diseases, as well as developing a novel measure of integrated continuity of care (ICOC) by combining UPC, COCI and SeCON scores. The authors calculated continuity of care related to the most frequently treated chronic condition, and also continuity related to all chronic disease care. The authors evaluated both personal and site continuity of care, and analysed the association between these continuity measures, and hospitalisation rates and ED attendance. After adjustment for demographics, health status and practice characteristics, results indicated that increased site continuity measured by UPC, COCI and ICOC was associated with decreased ED utilisation and hospitalisation, and results were consistent when continuity of care was measured for one chronic condition, or for all chronic diseases. Regarding personal continuity of care, increased continuity of care for most frequently treated chronic condition was associated with decreased ED usage or hospitalisation, while increased rates of secondary care utilisation were associated with increased continuity of care for all chronic diseases. These results suggest some differences between institutional and provider level effects, although should be treated with caution due to the study context. Taiwan lacks family physicians and most patients in this study accessed care through hospital run outpatient settings with different specialist physicians. Higher concentration of specialist care (as opposed to generalist care) may increase access to hospital services and there may be incentives for a hospital-based specialist to refer a patient to ED or for admission.

In summary, of the five research articles investigating both personal and site continuity, two analyses reported benefit of provider continuity but not for site continuity in terms of hospitalisations (Mainous & Gill 1998) and preventative care (Atlas et al. 2009); two studies reported benefit of both personal and site continuity but no significant differences between these two levels of continuity in terms of the quality of care provided (Mainous et al. 2004; O'Malley & Forrest 1996), and one study indicated benefit of site continuity but not personal continuity in decreasing ED or hospitalisation rates (Chan et al. 2012). Given this limited research and inconsistent findings, further research measuring both personal and site continuity is indicated to better understand the differences between these two levels of continuity and their association with health outcomes.

Two additional studies have investigated practice-level patterns of primary care usage in Australia (Britt H et al. 2014; McRae et al. 2011). An investigation by Britt et al. (2014) of 7,799 general practice patients reported that 7.8% of patients identified having a regular practice other than the one they were currently attending (Britt H et al. 2014). This research provides an estimate of the prevalence of multiple practice attendance in a general practice setting, but population estimates are not known.

An analysis of a telephone survey of 1,146 adults by McRae et al. (2011) investigated the characteristics of multiple practice attenders and found that 57% of survey respondents reported always attending the same GP, 32% reported usually attending the same GP, and 11% reported often going to a different GP than the one last consulted. This last group was considered by the authors to be lacking affiliation with a usual practice and potential multiple practice users. A comparison of affiliated patients with the remaining respondents showed that non-affiliated patients were significantly more likely to be younger, living in a non-metropolitan setting, working, and having worse self-assessed health (McRae et al. 2011).

Previous research has indicated that convenience, speed of appointment and cost are important reasons for multiple GP attendance, and there is evidence of differentiation in patients' reasons for choosing to attend both male and female GPs (Britt et al. 1996; Harrison, Britt & Charles 2011), such as when some women prefer to seek routine gynaecological care from a female GP (Stewart & Thistlethwaite 2010). It appears reasonable to assume that multiple practice attenders may share characteristics of multiple GP attenders found in previous research, including younger age, female gender, higher education level, and more frequent user of health services (National Health Performance Authority 2015; Veale et al. 1995). This assumption is tested within this analysis.

Practice-level data are not routinely available from Medicare. This motivates the use of a health survey within this research to understand if multiple practice general practice attendance is a common pattern of primary care utilisation. If this is uncommon behaviour, then it would not appear useful to investigate personal and site continuity of care in the subsequent empirical chapters of this thesis. The characteristics of multiple practice attenders are investigated to determine if attendance patterns are consistent with benefits of the therapeutic doctor-patient relationship.

3.1.3 Research question

What is the prevalence of multiple practice attendance?

3.2 Data and methods

This research analyses data from an online survey of 2,477 Australian adults which focused on health care attitudes and behaviour. It was administered in July 2013, as part of a research program approved by the University of Technology Sydney's Human Research Ethics Committee (HREC). The sample was recruited using from an online panel of Australians at least 16 years of age (http://www.pureprofile.com/au). The survey has been previously described (De Abreu Lourenco et al. 2015) and, to date, publications have reported results relating to bulk-billing rates, preferences for care and the quality of GP services (De Abreu Lourenco et al. 2015; Kenny et al. 2016; Mu et al. 2017). The key variable of interest for this study is whether respondents reported attending more than one general practice in the previous 12 months. Explanatory variables relate to respondent perceptions of having a usual GP and a usual general practice, together with patient demographic, health service utilisation and general practice characteristics reported in previous Australian primary care research (McRae et al. 2011). All included variables are summarised and described in Table 7 together with summary statistics and comparisons of survey demographics with the Australian population. Survey non-responses were highest for questions about practice characteristics and household income. These missing data have been excluded from the logistic regression.

Table 7: Variables used within survey analysis, summary statistics and comparison with Australian Bureau of Statistics (ABS) Population Statistics (ABS 2011a, 2012; National Health Performance Authority 2015).

Variable name	Variable definition	No. in survey	% (SD)	ABS data
Practice usage				
Multiple practice attender	1 = attended more than one practice in last 12 months; 0 = no	2,477	0.28 (0.45)	NA
Usual practice	1 = usually attend the same general practice; 0 = no	2,477	0.9 (0.3)	NA
Usual GP	1 = usually see same GP at practice 0 = no	2,477	0.8 (0.4)	NA
Age		2,471		[6]
Under 30*	1 = 16-29 years of age; 0 = otherwise		0.15 (0.36)	0.25
30-39	1 = 30-39 years of age; 0 = otherwise		0.23 (0.42)	0.16
40-49	1 = 40-49 years of age; 0 = otherwise		0.21 (0.41)	0.18
50-59	1 = 50-59 years of age; 0 = otherwise		0.19 (0.39)	0.15
60-69	1 = 60-69 years of age; 0 = otherwise		0.16 (0.37)	0.13
70 plus	1 = 70 years of age or older		0.06 (0.24)	0.11
Gender	1 = Female gender; 0 = Male gender	2,463	0.52 (0.5)	0.51
Country of birth	1 = Australian-born; 0 = born in another country	2,471	0.73 (0.44)	0.72
Married/de facto	1 = married or living with de facto; 0 = other marital status (single, widowed, divorced, separated)	2,424	0.52(0.50)	
Place of residence		2,357		
Major city*	1= living in major metropolitan city		0.77 (0.42)	0.63
Inner regional	1= living in inner regional location		0.15 (0.36)	0.2
Outer regional	1= living in outer regional location		0.07 (0.25)	0.17
Remote	1= living in remote location		0.01 (0.07)	
Highest educational attainment		2,444		
Less than HSC	1 = did not complete high school certificate (HSC)		0.15 (0.35)	0.25
Higher School Certificate	1 = HSC completion, without further qualification		0.17 (0.38)	0.18
Certificate/Diploma	1 = have post high school qualification (eg TAFE)		0.32 (0.47)	0.31
University Graduate*	1 = have university degree or higher		0.36 (0.48)	0.23
Income status		2,115		
Low	1 = total household income less than $40,000		0.29 (0.45)	0.26
Medium	1 = total household income between $40,000 and $79,900		0.29 (0.46)	0.27
High	1 = total household income between $80,000 and $149,900		0.32 (0.47)	0.29
Very High*	1 = total household income greater than $149,900		0.1 (0.29)	0.18

[6] Note age bracket of 15-29 in 2011 census

Variable name	Variable definition	No. in survey	% (SD)	ABS data
Employed	1 = employed (part time or fulltime); 0= other (student, retired, not working)	2,386	0.81 (0.39)	
Concession card holder	1= has a health care card, pensioner concession card, seniors card or Department of Veterans' Affairs Card; 0 = no concession card	2,473	0.46 (0.5)	
Private Health Insurance (PHI)	1 = has private hospital health insurance	2,295	0.55 (0.5)	0.47
Self-assessed health		2,477		
Excellent*	1 = excellent health; 0 = otherwise		0.08 (0.28)	0.19
Very Good	1 = very good health; 0 = otherwise		0.34 (0.47)	0.36
Good	1 = good health; 0 = otherwise		0.38 (0.48)	0.3
Fair	1 = fair health; 0 = otherwise		0.15 (0.36)	0.11
Poor	1 = poor health; 0 = otherwise		0.05 (0.21)	0.04
Chronic disease sufferer	1= if yes for any of list of chronic diseases[7]; 0 = no for all chronic diseases	2,477	0.6 (0.49)	0.5
Smoker	1 = current smoker; 0= non-smoker or ex-smoker	2,257	0.23 (0.42)	0.15
GP visits in last year		2,477		
None	1= no GP visits in previous 12 months		0.07 (0.26)	0.15
One	1 = 1 GP visit in previous 12 months		0.15 (0.36)	0.14
2-3 GP visits*	1 = 2 or 3 GP visits in previous 12 months		0.41 (0.49)	0.32
4-11 GP visits	1 = 4-11 GP visits in previous 12 months		0.3 (0.46)	0.29
12 or more visits	1= 12 or more GP visits in previous 12 months		0.06 (0.24)	0.12
Emergency department user last 12 months	1 = attended emergency department (ED) in last 12 months; 0 = no ED attendances	2,477	0.19 (0.39)	0.14
Home visits	1 = had home visit from GP in last 12 months; 0 = otherwise	2,477		
Number of GPs in practice		2,197		
1 or 2 GPs*	1= 1 or 2 GPs in practice		0.22 (0.41)	NA
3 - 5 GPs	1 = 3-5 GPs in practice		0.4 (0.49)	
6- 10 GPs	1= 6-10 GPs in practice		0.3 (0.46)	
More than 10 GPs	1= more than 10 GPs in practice		0.09 (0.28)	
Practice has bulk-billing	1- practice offers bulk-billing always or sometimes; 0 = no bulkbilling offered at practice	2,351	0.88 (0.33)	

Notes: * Indicates base case in logistic regression analysis for categorical variables
**For practice characteristics, 'don't know' was a response option. 'Don't know' respondents were coded as missing (and omitted) in logistic regression, and included within sensitivity analysis within most common category
NA- no available data

[7] List of chronic diseases: asthma, cancer, chronic obstructive pulmonary disease, chronic pain, depression or another mood disorder, diabetes, heart disease, high blood pressure or Other chronic disease

Bivariate analysis (using chi-square tests) was used to assess associations between multiple practice attendance and respondent and practice characteristics. Logistic regression models were analysed, with multiple practice attendance as the binary dependent variable. The logit model is chosen over probit as it allows easier interpretation of coefficients as a log-odds ratio (Cameron & Trivedi 2009; Long & Freese 2006). The model expresses an odds ratio for multiple practice attendance controlling for other variables and reports a 95% confidence interval (CI). Results are considered statistically significant if they are outside of this 95% range. Respondents with fewer than two self-reported GP visits were excluded from the logistic regression as they could not logically have attended more than one practice. Once excluding these respondents and those with missing data, there were 1,274 responses included in the logistic regression. These results are reported in Table 8. The data were analysed using Stata version 14 (Statacorp 2017).

A separate subgroup analysis is made of patient reported reasons for attending multiple practices.

3.3 Results

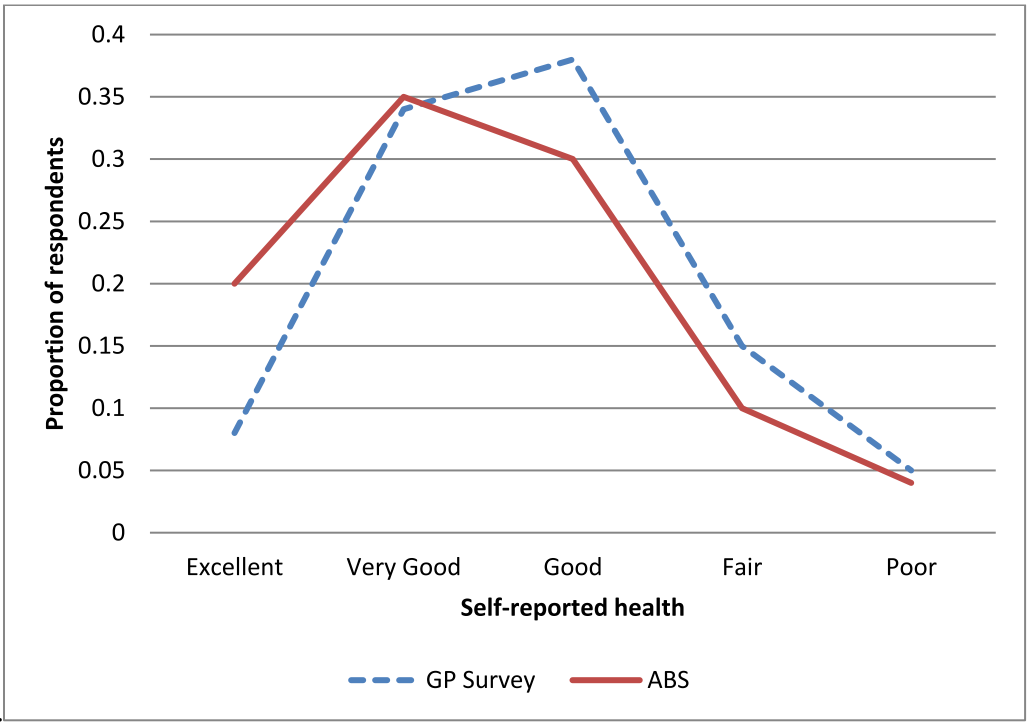
3.3.1 Sample characteristics

The majority of respondents were aged less than 50 years of age (59%), with 6% being over 70 years of age. Most respondents were Australian-born (79%), lived in major cities (77%), were employed (81%) and had private health insurance (55%). The majority of respondents rated their health as good or better (80%), although 60% reported having one or more chronic health condition.

Over 93% of respondents reported attending a GP in the previous 12 months with most respondents reporting either 2-3 visits (40%), or 4-11 visits (31%), in the previous years. Most respondents attend a practice with four or more GPs (79%), with 9% attending a practice that has more than 10 GPs. Most respondents reported having a usual GP (80%) and over 90% of respondents reported having a usual general practice.

While the demographic profile of the survey sample was comparable to the Australian population in terms of gender, the sample was underrepresented in the youngest (16-24 years) and oldest (75 years and over) age groups compared with ABS data (ABS 2011a). A smaller proportion of survey respondents reported excellent health compared with the Australian population (ABS 2012) (refer Figure 2 below).

Figure 2 - Self-reported health. GP survey respondents (n=2477) versus Australian Bureau Statistics (ABS) population data



This potentially reflects the underrepresentation of the youngest (and generally healthier) age group, but may indicate a less healthy sample population. The survey population also included a smaller proportion of both non-GP attenders and high GP attenders (12 or more visits in a year) than the Australian population (National Health Performance Authority 2015).

As shown in Table 7, 28% of the total 2,477 survey respondents reported attending more than one general practice in the previous twelve months. After excluding survey respondents with less than two GP visits (22% of sample), 610 of the remaining 1,920 respondents (31.8%) report attending multiple general practices in the last 12 months.

3.3.2 Does having a usual GP or practice affect multiple practice attendance behaviour?

After excluding respondents with less than two GP visits, 86.9% of single practice users identified both a usual GP and usual practice, compared to 84.7%% of multiple practice users. A higher proportion of multiple practice users reported not having a usual practice (21.0%), compared to single practice users (1.93%), and the logistic regression results in Table 8 show that respondents who had a usual practice were statistically significantly less likely to report multiple practice attendance (OR 0.06; 95% CI 0.03-0.11).

Having a usual GP was reported by 86.1% of single practice users and 80.3% of multiple practice users. The logistic regression results showed no statistical difference in likelihood of multiple practice attendance associated with having a usual GP (OR 1.14; 95% CI 0.76-1.75). This result appears consistent with patients having a preference for a usual GP even when they use more than one practice.

Table 8: Association between Multiple Practice Usage and Explanatory Variables (Bivariate Analysis on Left and Logistic Regression results on right)

Variable name	Bivariate analysis		Logistic regression	
	Proportion of multiple practice users	Chi2 (probability of statistical difference)	Odds ratio of multiple practice attendance (SE)	95% confidence intervals
GP attendance				
Usual practice	0.243	118.4 (p<0.001)***	0.058***(0.020)	0.030 -0.114
Usual GP	0.274	0.351 (0.554)	1.141(0.245)	0.750 -1.737
Age		117(p<0.001)***		
Under 30*	0.422		1	0.520 -1.308
30-39	0.372		0.825(0.194)	0.381 -0.992
40-49	0.247		0.614*(0.150)	0.239 - 0.673
50-59	0.216		0.401***(0.106)	0.206 - 0.647
60-69	0.166		0.365***(0.107)	0.171 - 0.751
70 plus	0.129		0.359**(0.135)	0.520 - 1.308
Female	0.306	11.78 (0.001)**	1.237(0.18)	0.930 - 1.645
Australian-born	0.272	0.610 (0.435)	0.950(0.154)	0.691 - 1.305
Married/de facto	0.263	2.3 (0.128)	0.900(0.136)	
Place of residence		34.0 (<0.001)***		
Major city*	0.3		1	
Inner regional	0.161		0.618*(0.127)	0.413 - 0.925
Outer regional	0.2		0.479*(0.16)	0.248 - 0.924
Remote	0.31		1.231(0.96)	0.267 - 5.679
Highest educational attainment		26.81 (p<0.001)***		
Less than HSC	0.219		1.019(0.235)	0.648 - 1.601
High School Certificate	0.23		0.638*(0.137)	0.419 - 0.972
Certificate/Diploma	0.257		0.861 (0.152)	0.609 - 1.216
University Graduate*	0.335		1	
Income status		18.20 (p<0.001)***		
Low	0.23		0.703(0.214)	0.386 - 1.278
Medium	0.267		0.759(0.200)	0.453 - 1.272
High	0.328		0.921(0.222)	0.574 - 1.478
Very H\high*	0.33		1	
Employed	0.267	4.61 (0.32)	1.255(0.243)	0.859 - 1.835
Concession card holder	0.253	5.91 (0.015)*	0.814(0.149)	0.568 - 1.166
Private Health Insurance	0.288	3.75 (0.053)	1.046(0.162)	0.772 - 1.416
Self-assessed health		4.68 (0.322)		
Excellent*	0.325		1	
Very good	0.281		1.243(0.395)	0.666 - 2.318
Good	0.27		1.227(0.393)	0.654 - 2.300
Fair	0.247		0.986(0.351)	0.491 - 1.983
Poor	0.298		1.338(0.582)	0.570 - 3.139
Chronic disease	0.6 (0.49)	0.04 (0.847)	1.117(0.187)	0.804 -1.551
Smoker	0.23 (0.42)	5.90 (0.015)*	1.160(0.196)	0.833 - 1.615
GP visits in last year		84.7 (p<0.001)***	[8]	
None	0.04			

[8] Variable omitted from logistic regression

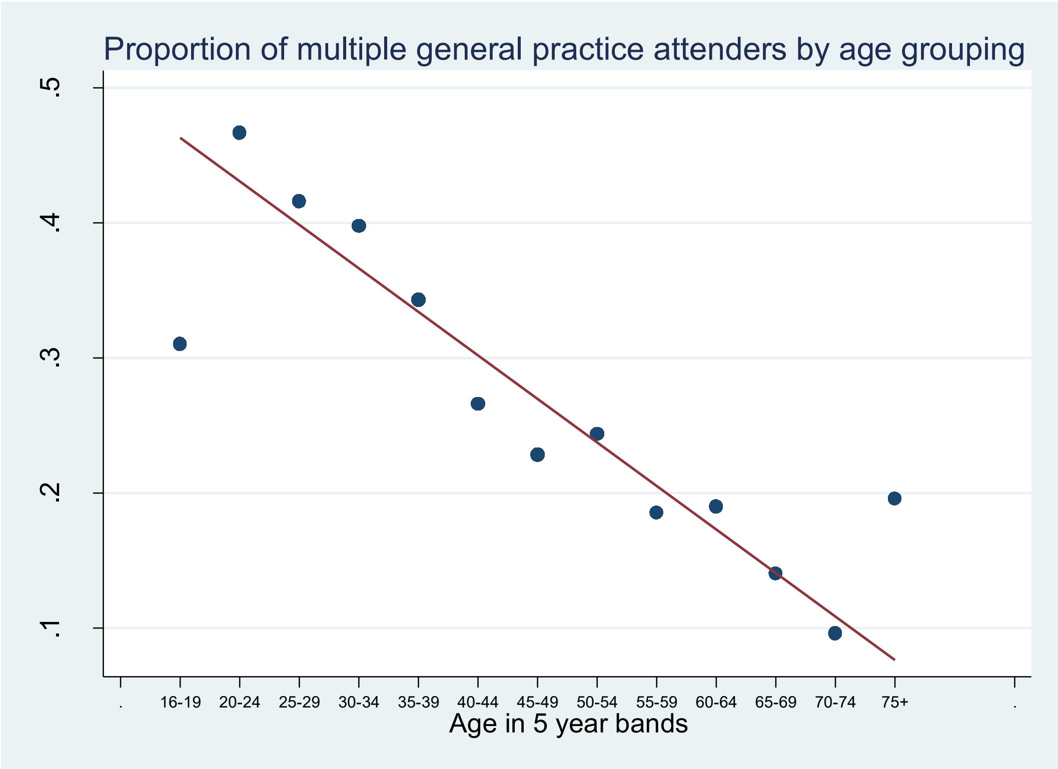
Variable name	Bivariate analysis		Logistic regression	
GP visits in last year				
One	0.175		iii*	
2-3 GP visits*	0.317		1	
4-11 GP visits	0.317		1.126(0.171)	0.836 -1.518
12 or more visits	0.327		1.211(0.333)	0.706 - 2.077
Emergency department user last 12 months	0.394	39.4 (<0.001)***	1.564**(0.264)	1.124 - 2.177
Home visits	0.5	56.9 (<0.001)***	1.742*(0.419)	1.087 -2.790
Number of GPs in practice	0.228	2.19 (0.53)		
1 or 2 GPs*	0.408		1	
3 - 5 GPs	0.282		0.969(0.180)	0.674 - 1.394
6- 10 GPs	0.08		0.660*(0.133)	0.445 - 0.978
More than 10 GPs	0.228		0.558*(0.156)	0.323 - 0.967
Practice has bulk-billing	0.28	0.21 (0.643)	0.753(0.175)	0.477 - 1.189
Logistic regression statistics			N	1274
			Pseudo R2	0.1526
			LR Chi2	239.76
			Prob>Chi2	1403.3
			AIC	1588.7

Logistic regression results are reported in odds ratios (OR) and standard error (SE) in parentheses. An OR >1 indicates an increased odds of multiple practice attendance, and significance stars (* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$) are provided for ease of interpretation.

3.3.3 The influences of patient demographic characteristics

Bivariate analysis of the characteristics of the survey sample revealed a strong trend for older respondents to be less likely to attend more than one practice. While 42% of the under 30 age group reported attending multiple practices, only 12.9% of respondents aged over 70 reported doing so (p<0.01). This association is shown in Figure 3 below. In the logistic regression (controlling for other patient sociodemographic, health and practice variables), older age was associated with significantly reduced odds of attending multiple general practices. Compared with an individual aged less than 30, respondents between 60 and 69 years had, on average, an odds ratio (OR) of 0.34 of being a multiple practice attender (95% CI, 0.20-0.59).

Figure 3 - Scatterplot of association between increasing age and decreasing multiple practice attendance and trend line.



Logistic regression results showed that respondents living in metropolitan areas had greater odds of multiple practice attendance, compared with respondents from inner regional (OR 0.60: 95% CI, 0.40 - 0.89) and outer regional locations (OR 0.48: 95% CI, 0.25-0.92). This potentially reflects a decreased availability of alternative general practices in non-metropolitan areas. Compared to university graduates, respondents with lower educational attainment had a decreased odds of multiple practice usage, although this was only significant for those who had completed their high school education without further study (OR 0.64; 95% CI,0.42-0.97).

While bivariate analysis suggested greater rates of multiple practice attendance by women and significant differences relating to income, these differences were not significant after controlling for other variables in the logistic regression. No statistically significant differences relating to country of birth, employment status, private health insurance status, concession card status, country of birth, or health status (either self-reported or presence of chronic disease) were found in the logistic regression.

3.3.4 Health service utilisation and practice characteristics

Respondents who reported attending an emergency department in the last 12 months had significantly increased odds of being a multiple practice user (OR 1.56: 95% CI- 1.12 – 2.17), as were those people who had home visits (OR 1.77: 95% CI- 1.11 – 2.82). Logistic regression results reported no significant association between reporting a higher number of GP visits and multiple practice attendance. This finding differs from previous research which suggested a relationship between seeing multiple GPs and higher numbers of GP visits, and suggests there may be different drivers for multiple GP and multiple practice attendance.

Compared with respondents attending practices with one or two doctors, there was a statistically significant decrease in the odds of multiple practice attendance for respondents whose practices have six-10 doctors (OR 0.65; 95% CI 0.44-0.96) or 10 or more doctors (OR 0.55; 95% CI 0.32-0.96). This provides evidence that larger practices may be better able to manage the demands of their patient population within the practice. There was no significant association between multiple practice usage and whether a practice offered bulk-billing.

3.3.5 Sensitivity analysis

Results were robust to sensitivity analysis omitting the income variable (with a high number of missing variables) and including single GP attenders and non-GP attenders in the analysis (refer Table 33 in the Appendices).

3.3.6 Why did patients attend multiple practices?

Patients who attended more than one practice in previous year were asked to select a reason for multiple practice attendance. The numbers and reasons for multiple practice attendance are listed below (survey participants were able to select multiple responses to this question).

The most commonly reported reasons for attending multiple practices was related to the availability of doctors (43.3%), location of practice being convenient (28.9%), opening hours (28.1%), and being able to access bulk-billing (20%). An additional 82 patients entered free text information to explain multiple practice attendance. These responses were analysed and the most common free text responses were related to recently moving house as reason for multiple practice attendance (n=17), followed by inability to get appointment at regular practice (n=13). A further subset described dissatisfaction with a previous GP or the need for a second opinion (n=11). These responses provide some evidence of patient discretion in choosing when to attend a usual practice, versus a non-usual practice. For example, “My regular doctor is working reduced hours”; “I see her for important health issues and ongoing treatment, for general ailments”; “I see a bulk billing practice"; "I can get in on the day"; and "Went to a doctor I have seen since I was a child for important tests, other doctor that is closer for minor issues".

3.4 Discussion

The results from this study show that multiple general practice attendance is common in the Australian setting, with over 25% of the survey sample reporting attendance at more than one practice in the previous year. This suggests higher rates of multiple practice attendance than have been reported previously (Britt H et al. 2014; McRae et al. 2011). This may have important implications for health policy, as a substantial portion of general practice care is provided away from a patient's usual practice.

Although most survey respondents only reported attending one practice, a significant proportion also reported multiple practice use. The finding that single and multiple practice users were equally likely to identify a usual GP could well be interpreted as most Australians believe that they are receiving sufficient continuity of care from having a usual GP, even if they seek care from multiple practices. In Australia, the usual GP does not routinely receive notification about any 'non-usual' practice attendance nor do they receive any information about the nature of the consultation, if not volunteered by the patient subsequently. Without such information-sharing between practices, health information may be lost, potentially leading to worse health outcomes. The finding that multiple practice use is most common in the youngest age groups (anticipated to have lower complexity of care) potentially means this information loss and suggested sequelae is insignificant, but this presumption needs testing.

These results also show that the characteristics of multiple GP attenders reported in previous research (McRae et al. 2011; Veale et al. 1995) and those of multiple practice users are similar, including being younger, and being more highly educated than single practice/GP users. The variety of reasons for multiple practice attendance—for improved access, to reduce cost, and for convenience—are also similar to those reported for multiple GP users. However, an association between increased number of GP visits and multiple GP attendance reported in previous research (National Health Performance Authority 2015) did not extend to multiple practice use. Being able to differentiate between multiple practice visits and multiple GP visits is one of the strengths of this research. Attending another practice—when care from the usual practice is unavailable or less preferred—potentially acts as a substitute for usual GP care rather than increasing health service utilisation. This is consistent with the patient-reported reasons for attending multiple practices, with access to convenient appointments and convenience of practice location being the most commonly cited reasons. However, the association between increased rates of emergency department attendance and home visits and multiple practice use suggest that single and multiple practice users may have different patterns of health service utilisation. Increasing health care utilisation has implications for the allocation of limited health resources and the association between multiple general practice use and other health service utilisation could be investigated further using administrative data, facilitated by access to practice-level Medicare data.

Limitations of this research include the potential for recall bias in terms of self-reports of health status and health service utilisation, and the under-representation of older

Australians among the survey respondents. Given the cross-sectional nature of this analysis, only associations can be reported.

Although an association was found between decreased multiple practice attendance and increasing age, there was no evidence to support the prediction that respondents with worse health (either reporting presence of a chronic disease or having worse self-reported) were less likely to attend multiple general practices.

3.5 Conclusion

Results from this survey suggest that although most Australian patients have a usual GP and usual practice, a significant minority of patients seek care from multiple general practices. Multiple practice attendance is more common in younger patients, and in patients with higher educational attainment. Multiple practice attenders are as likely as single practice users to report having a usual GP.

These findings support the decision to investigate personal and site continuity of care throughout the remainder of this thesis.

Given this decision, Medicare claims data appears inappropriate to measure continuity of care in Australia. Medicare claims data does not record practice-level activity, and is unable to provide estimates of site continuity of care. Furthermore, the review of the literature in Chapter 2 suggests that subjective measures of continuity of care may better reflect the doctor-patient relationship than claims-based measures.. For these reasons, the Australian Longitudinal Study on Women's Health (ALSWH) is the data source used within the remaining empirical chapters within this thesis. ALSWH is the largest

Australian data source permitting subjective estimation of both personal and site continuity of care, and is described in the next chapter.

4 Chapter 4 – Data Used in Empirical Analyses

4.1 Introduction

This chapter describes the data sources used within the remaining empirical chapters of thesis. The main data source is survey data from the Australian Longitudinal Study on Women's Health (ALSWH). This longitudinal data provides a rich source of demographic, health status and health service utilisation measures, including measures of GP and general practice attendance from which estimates of personal and site continuity of care are calculated. ALSWH provides data for the analyses in chapters 4, 5, 6 and 7 of this thesis.

Medicare administrative data is linked to over 90% of ALSWH participants. Medicare data provides individual patient-level claims data, but no information regarding claims is available at a practice level and no data are recorded about the clinical content of consultations. The absence of practice-level data and clinical information limits the usefulness of Medicare in investigating continuity of care. However a small number of variables of Medicare-derived variables are included within empirical analyses within this thesis to increase the robustness of findings and as part of sensitivity testing.

In addition to a general description of the ALSWH, summary statistics for women from the ALSWH sample are presented and changes in demographics and personal and site continuity of care are reported. To test the concordance between different measures of personal continuity of care, a comparison between survey derived measures of personal continuity of care and continuity of care estimated using the Medicare claims data is provided.

4.2 Australian Longitudinal Study on Women's Health (ALSWH)

The Australian Longitudinal Study of Women's Health (ALSWH) is a longitudinal cohort study of over 58,000 Australian women. ALSWH arose from the 1989 Australian Women's Health Policy Statement, which called for research examining factors which might influence the health of women, including physical and mental health issues (Commonwealth Department of Community Services and Health 1989). The ALSWH was granted ethical clearance by the Universities of Newcastle and Queensland (Ethics approvals H0760795 and 2004000224) on 26 July 1995.

4.2.1 Sample selection and representativeness

Beginning in 1996, three age cohorts of women were randomly selected from the database of the Health Insurance Commission (HIC), which administers Medicare, the Australian national public health insurer[9]. The three age cohorts were: women born between 1973 and 1978 (aged 18 to 23 years at enrolment, the ALSWH 'young cohort'), those born between 1946 and 1951 (aged 45 to 50 years at enrolment, the 'mid cohort') and those born between 1921 and 1926 (aged 70 to 75 years at enrolment, the 'older cohort').[10] Women in rural and remotes areas (defined by the Australian

[9] The HIC database includes all Australian citizens and permanent residents.
[10] In 2012-13, a fourth cohort of women was enrolled consisting of women born between 1989 and 1995 (aged 18 to 23 years, denoted as the ALSWH 'new young cohort'). Data from women in the old and new young cohorts are not analysed within this thesis, as they do not provide information about GP and practice attendance.

Standard Geographic Classification Remoteness Areas – Australian Institute of Health and Welfare criteria) were sampled at twice the rate of other women to provide statistical power for analysis of of women living outside metropolitan areas.

For the first survey conducted in 1996, surveys and information packs were sent by the HIC to 106,000 women who were members of the eligible age cohorts. Survey 2 was sent to the middle cohort in 1998, two years after the initial survey. The following year (1999), a second survey was sent to the older cohort, and in 2000 (four years after the first survey), a second survey was sent to the young cohort. Since that time, the young and mid cohorts have been surveyed every three years. The first five surveys for the three initial cohorts were administered by mail (with an option for telephone completion). An option to complete the survey online has been offered to the young cohort since Survey 6 (administered in 2012) and for the middle cohort since Survey 7 (administered in 2013) (Women's Health Australia 2014).

Response rates from the initial survey are uncertain as the research team cannot determine whether all women received an invitation. However, estimates of the response rates to the initial survey are reported as 41-42% for the 1973-78 cohort (n = 14,247), 53-56% for the 1946-51 cohort (n = 13,716), and 37-40% for the 1921-26 cohort (n = 12,432) (Dobson et al. 2015). The total sample size for Survey 1 was 40,395 women. At baseline, the ALSWH cohorts were broadly representative of Australian women in terms of marital and employment status, although they included a higher proportion of university-educated and Australian-born women than the population statistics reported by the ABS (Australian Bureau of Statistics 1996). The composition of the initial cohorts is summarised in Table 9 below and has been extensively reported elsewhere (Brown et al. 1999; Dobson et al. 2015; Lee et al. 2005).

Table 9: Sociodemographic characteristics of ALSWH cohorts at baseline (1996) and comparison with general population statistics from ABS in percentages

	Young	ABS	Mid	ABS	Older	ABS
Country of birth						
Australia	88.6	77.8	69	62.6	68.5	66.4
Other English speaking	3.5	4.1	13.9	11.6	12.4	11
Other European	1.3	1.6	8.7	11	9.7	12.7
Asian	3.6	10.6	4.3	8.2	1.8	3.3
Other/not stated	3	6	4.2	6.5	7.6	6.5
Marital status						
Married	8.2	9	75.1	73	54.7	48.9
Separated/divorced	0	1.1	13.2	18.7	6.3	6.8
Widowed	0	0.2	2.1	2.7	35.2	39.9
Never married	79	89.8	3.9	5.6	3.2	4.4
De facto (not collected by ABS)	12	NA	5.7	NA	0.6	NA
Aboriginal/Torres Strait Islander						
Non-Indigenous	97.9	94.9	98.1	96.7	91.6	93.7
Aboriginal or TSI	1.6	2.7	0.8	1.1	0.3	0.4
Not stated	0.5	2.5	1.1	2.1	8.1	5.9
Highest educational qualification completed						
No post school qualification	69.8	69.3	63.1	61.8	79.8	70.4
Trade/Apprenticeship	2.4	7.9	3.5	7	3.7	2.7
Certificate/Diploma	15.1	6	15.9	8.7	7.3	3.3
University Degree	12.1	7.7	16.3	11.6	4	2.4
Other (not stated, inadequately described)	0.6	9.1	1.2	10.8	5.2	21.2
Current employment status						
Employed full-time	31.3	32.4	36.1	36	NA	
Employed part-time	19.2	26.4	30.1	28.5	NA	
Worked (without pay)/ employed (other)	1.9	1.3	7	2	NA	
Unemployed	6.4	10.5	1.9	4	NA	
Total not in labour force	39.4	26.3	21.6	27	NA	
Not stated	1.8	2.7	3.3	2.5	NA	

* adapted from Brown et al, 1999, and ALSWH website. Comparison with Australian Census data, 1996 (Australian Bureau of Statistics 1996). Employment status questions not asked in ALSWH old cohort

Consent was sought from ALSWH participants to link survey data with other administrative datasets, including Medicare Benefits Schedule (MBS), Pharmaceutical Benefits Scheme (PBS) and mortality statistics. MBS data are described more fully within Section 4.4.2.

4.2.2 Survey structure

For this thesis, variables pertaining to patient demographics, health status, health service utilisation, and health satisfaction (including satisfaction with access to health services) are included in the empirical analyses.

Each ALSWH survey can be identified by a cohort identifier and a survey number. For most analyses in the thesis, ALSWH survey data will be analysed in a panel structure using the wave variable as an indicator of time. Structural and content differences exist between the ALSWH surveys. These differences exist between surveys for a particular age cohort, as well as different questions for each age cohort. These changes are documented within the ALSWH data dictionary (available from data custodians and at https://www.alswh.org.au/for-researchers/data/data-dictionary), and permit mapping of questions between surveys. Changes have included additions, omissions, deletions or changes to survey questions, and response options. These changes were more pronounced in the first three survey waves, but have continued in some categories, most notably in the Medical History and the Health Service Utilisation categories. A classification and detailed analysis of these changes is provided in the Appendices in Section 10.3. The approach to choosing each variable and choices in transformation are discussed in the Section 4.2.3.

Derived variables

The ALSWH Data Dictionary describes additional derived variables available for researchers using the ALSWH data. These derived variables include: classification of women in weight categories based on their body mass index (BMI), calculated using height and weight data at each survey; summary scores of screening instruments (such as the Centre for Epidemiological Studies Depression Score); and variables being weighted for the characteristics of the survey population (such as physical and mental health scores for the SF-36 multicomponent health scale).

Some derived variables overcome some of the inconsistencies of survey questions as outlined above. For example, questions about alcohol consumption have been inconsistent between surveys and between cohorts, in terms of the quantity and nature of alcohol consumed. To overcome this, two derived variables have been developed by the ALSWH custodians, which convert reported alcohol consumption into categories listed in the National Health and Medical Research Council Guidelines (National Health and Medical Research Council 2001).

4.2.3 Variable selection for this thesis

Continuity of general practice care is the main variable of interest throughout this thesis and is considered as both an outcome variable (in Chapter 5) and an explanatory variable (in chapters 6 and 7). Other variables have been chosen based on previous Australian health services and international continuity of care research (Maarsingh et al. 2016; McRae et al. 2011) and are summarised in Table 10.

4.2.3.1 Continuity of care

Continuity of care is estimated from the ALSWH data using responses to questions regarding patient self-reported attendance at the same general practice and with the same GP, an approach used by previous authors (Fan et al. 2005; Hjortdahl & Laerum 1992; Love et al. 2000).

From Wave 2 of the ALSWH onwards, women in the young and middle cohorts only were surveyed about their health service utilisation and whether they had consulted with any of a selection of health practitioners (e.g. GP, hospital doctor, physiotherapist, naturopath) in the previous 12 months. Women were also asked about their behaviour in seeking general practice care from one location and from one person. An example question (from Survey 6 of the Young cohort) is shown in Figure 4 below.

Figure 4 - Sample ALSWH question for measuring continuity of general practice care.

Q15 When you go to a General Practitioner: *(Mark one on each line)*

		Always	Most of the time	Sometimes	Rarely or never
a	Do you go to the same place?	☒	☒	☒	☒
b	Do you usually see the same doctor?	☒	☒	☒	☒

Source ALSWH, 2015

For both questions the survey responses were coded on a four-option scale: ‘always’, ‘most of the time’, ‘sometimes’ and ‘rarely or never’. Reponses to these two ALSWH survey questions are used to categorise GP attendance into three mutually exclusive categories, to estimate subjective continuity of care at both a GP and practice level. Women who report always attending the same GP are classified as having personal continuity of care. Women who do not always attend the same GP are further classified according to their response to the practice attendance question. Women who report always attending the same practice (but not attending the same GP) are classified as having site continuity of care. The remaining women (not always seeing the same GP and not always attending the same practice) are classified as having reduced continuity of care, as they potentially obtain care from multiple GPs in multiple practice locations.[11].

In Chapter 5, this classification of self-reported continuity of care is used as a dependent variable in an analysis of the predictors of continuity of care, while in hapters 6 and 7, personal and site continuity of care are used as explanatory variables in analyses of utilisation of cancer screening services.

4.2.3.2 Patient demographics

Individual-level sociodemographic characteristics obtained from ALSWH survey considered within this thesis include country of birth (coded as Australian-born or otherwise) and state of residence in Australia (eight state and territory indicators). A derived variable indicating urban/rural location has been categorised by ALSWH into five categories based on the Accessibility/Remoteness Index of Australia (ARIA) classification (major city, inner regional, outer regional, remote and very remote) (ABS 2011b). Marital status was assessed using six categories within ALSWH surveys

[11] The majority of multiple general practice users considered within the GP Survey analysis of Chapter 3 will be contained within the reduced continuity category. However, women who see the same GP in multiple locations are also multiple practice attenders (with personal continuity) and this terminology is avoided for subsequent analyses

(married, de facto, separated, divorced, widowed, never married), and a dummy variable created for married or otherwise. Highest educational attainment was classified into six groups in the ALSWH and recoded into four categories for this thesis (less than high school completion, high school completion, completion of trade/diploma, university completion) due to small numbers in some groups. A proxy measure for income was used based on a five-category response to the survey question, 'How do you manage on the income you have available?' (impossible, difficult all of the time, difficult some of the time, not too bad, easy)[12]. Employment status is categorised using a derived ALSWH variable measuring labour force participation (not in labour force, employed, unemployed). ALSWH respondents were asked if they had private hospital insurance, insurance for extra ancillary services and whether they were in possession of a concessional health care card, which has considered by previous authors a proxy for socioeconomic status (Byles et al. 2017; Charles, Valenti & Britt 2003)

Additional variables about living arrangements are included, to take into account the potential effect of household composition on a woman's continuity of care-seeking behaviour. ALSWH participants were also asked about their living arrangements, whether they lived alone, with partners, children or others. Three dummy variables are coded indicating whether women live with a partner, with their children, or alone.

[12] A direct income question was asked in waves 2 and 3 of mid cohort only and further, was subject to large missing values making it not appropriate for selection.

4.2.3.3 Health status and medical history

Multiple ALSWH survey questions pertaining to health status, and health variables are included within this thesis.

Women were surveyed about the presence of a list of medical conditions (chronic diseases and cancer diagnoses). A count of common chronic health conditions was developed to measure the presence of multimorbidity (defined as the presence of two or more of chronic medical conditions), as well as an indicator variable for the presence a cancer diagnosis. The diseases included to determine the measures of multimorbidity were cardiovascular disease (hypertension, ischaemic heart disease, stroke, thrombosis), respiratory disease (asthma, chronic obstructive pulmonary disease) diabetes mellitus, osteoporosis, arthritis (arthritis/rheumatism from Wave 3, and specifically osteoarthritis and rheumatoid arthritis from Wave 5), psychiatric disease (depression, anxiety or other psychiatric disorder), chronic infectious diseases (HIV, hepatitis B or C), and other chronic diseases (additional information in the Appendices)[13]. Condition counts permit classification of respondents according to whether they have one chronic disease, or at least two chronic diseases (indicating multimorbidity). Other condition counts are used as exclusion criteria for later empirical analyses. For example women are excluded from the Pap testing analysis of Chapter 7 if they report having a hysterectomy, or a previous history of cervical cancer.

[13] There is some changes in coding of diseases which makes consistent coding impossible. For instance, precise coding for arthritic conditions (osteoarthritis and rheumatoid arthritis) did not begin until Survey Wave 3, and was previously coded as 'arthritis'. From Wave 3 coding has become more consistent. Other changes are discussed in the Appendices.

Self-assessed health is recorded in each survey using the 36-item short form health survey (SF-36). A generic health status measure which provides two summary physical health and mental health scores (Ware & Sherbourne 1992), and has been validated for use in the Australian population (McCallum 1995; Mishra & Schofield 1998). The physical and mental health summary scores are recoded into quintile groups and used in Chapter 5 in order to investigate whether health status is a predictor for continuity of care. The endogeneity of health status in estimating continuity of care is considered to potentially bias estimates, and health status variables are considered only in sensitivity analyses in the later empirical chapters.

Additional health behaviour and health status variables utilised by overseas continuity of care researchers including measures of smoking, alcohol consumption, and morbidity measures are also included within analyses. The inclusion of additional behavioural variables has been proposed as a way to control for different health-seeking behaviours which may correlate with continuity of care-seeking behaviour (Maarsingh et al. 2016). Data about smoking status, alcohol consumption, weight and height are available from nearly all ALSWH surveys[14], although with changes to questions and response coding for smoking status and alcohol consumption (refer to Appendices). Responses to smoking status questions are coded into three groups (current smoker, ex-smoker, never smoked), while responses to alcohol use questions have been coded by data custodians based on National Health and Medical Research Council guidelines (National Health and Medical Research Council 2001) and are used in this thesis as a dummy variable

[14] Alcohol consumption questions were altered in Wave 3 and included within a food frequency questionnaire. An ALSWH derived variable is provided.

indicating risky drinking. Weight and height measures are used to calculate body mass index (BMI) for each woman and women are classified into one of four clinically-distinct groups based on BMI (underweight, acceptable weight, overweight, obese).

4.2.3.4 Access and satisfaction variables

ALSWH participants report their satisfaction with access to general practice and other services, including access to number of GPs and the hours of their preferred practice[15] on a five-item scale, with 'Don't know' as the sixth response option. Women were asked to rate their satisfaction with access to a doctor who bulk-bills them, and this is included a proxy for cost of services. Access to Pap tests or mammography services are considered as proxies for access to screening services.

Women in the young cohort only are also surveyed about their satisfaction with the personal manner (courtesy, respect, sensitivity, friendliness) of the GP at their most recent GP visit. The satisfaction with the GP's personal manner variable is included in an instrumental variable (IV) analysis of Pap testing rates for women in the young cohort (in Chapter 6). All access and satisfaction variables are recoded from a five-item scale to dummy variables, according to whether women report good or better access (i.e. good, very good or excellent), or otherwise (fair or poor).

[15] In each ALSWH survey question ask women to rate their satisfaction with access to services on a five-item scale, with 'Don't know' as the sixth response option. There are large numbers of 'Don't know' in ALSWH survey waves 1 and 2. Where women supply a response to these variables in later waves, 'don't know' responses are recoded as per this later response (assuming that early absent response is due to not having accessed services and being unable to rate their access). This approach reduces missing values and improves precision of the analysis but assumes that there is no change in access levels between earlier wave and later response.

4.2.3.5 *Health service utilisation*

In addition to indicators of attendance with the same GP and the same practice, other health service usage variables included patient self-reported number of attendances with a GP, a hospital doctor (in an outpatient clinic or emergency department) or specialist doctor over past twelve months. All visit counts were initially coded into five categories (zero visits, 1-2 visits, 3-4 visit, 5-6 visits, 7 or more visits), with changes in count categories from ALSWH Wave 3 surveys onwards. To estimate the number of GP visits, later surveys were recoded back to the original categorical values in order to maximise the useable data for regression analysis. For specialist doctor and hospital doctor visits, visits counts were recoded as a binary yes/no variable.

Women who reported zero GP visits in the previous 12 months were excluded from most analyses as it seemed illogical that women could have experienced continuity of care without any reported visits and this is a standard approach in continuity of care research.

4.2.3.6 *Cancer screening*

Women were surveyed about when they most recently had preventative screening services, including mammography and Pap tests. Each ALWSH survey asks women when they last had a Pap test, and the mid cohort women are asked when they last had a mammogram. Responses to these questions are used to estimate cancer screening rates compared with recommended guidelines. Survey participants are also asked if they have ever had an abnormal Pap test or abnormal mammogram, and these data are used as explanatory variables in the analyses of cancer screening services in chapters 6 and 7.

4.2.3.7 Other variables

Other variables incorporated into most of the analyses included a unique participant identifier, a survey wave indicator and a cohort (mid or young) indicator. All variables taken from ALSWH survey data and used in this thesis are summarised in Table 10 below.

Table 10: ALSWH survey variables used within this thesis

Variable name	Description	Variable categories and reference categories where applicable
Identifying variables		
Patient ID	NA	Unique patient identifier
Wave	NA	Survey wave (1-7)
Cohort	NA	Cohort identifier (yng- 1973-1978 cohort; mid- 1945-49 cohort)
Continuity variables		
Regular practice attendance	When you go to a General Practitioner: Do you go to the same place?	1 = Always 2 = Most of the time; 3 = Sometimes; 4 = Rarely or Never. Recoded to binary variable 1 = all care from one practice 0 = otherwise
Regular GP attendance	When you go to a General Practitioner: Do you usually see the same doctor?	1 = Always 2 = Most of the time; 3 = Sometimes; 4 = Rarely or Never. Recoded to binary variable 1 = all care from one GP 0 = otherwise
Continuity of care	Pattern of care categorised according to self-reported GP and practice attendance	2 = personal continuity of care (all care provided by one GP); 1 = site continuity of care (all care from one practice but different GPs); 0 = neither site nor personal continuity*
Demographics		
Age	Age coded to 1/10 of a year (and categorised in decades	1=20-29.9*; 2= 30-39.9; 3=40-44.9; 4=50-59.9; 5=60-69.9
Age squared		Considered within regression analysis to consider non-linear associations between age and outcomes variables
State	State of residence in Australia	1 = NSW*; 2 = Vic; 3 = Qld; 4 = SA; 5 = WA; 6 = Tas; 7 = ACT; 8 = NT
Australian-born	Country of birth	1 = Australia*; 0 = other country of birth

Variable name	Description	Variable categories and reference categories where applicable
ARIA group	Residence coded according to Accessibility/remoteness index of Australia (ARIA)	1 = major city*; 2 = inner regional; 3 = outer regional; 4 = remote or very remote
Married	Marital status	1 = Married or living with de facto*; 0 = otherwise
Education	Highest educational attainment	1 = did not complete Higher School Certificate (HSC)*; 2 = HSC completion; 3 = Trade/Diploma; 4 = University Graduate
Income	Ability to cope with available income	1 = impossible; 2 = difficult all the time; 3 = difficult some of the time; 4 = not too bad; 5 = easy*
Employed	Labour force participation	1= labour force (full time, casual or part-time) *, 0=not in labour force
PHI	Possession of private health insurance (PHI)	1 = private health insurance holder; 0 = without PHI *
Health care card	Possession of concessional health care card	1 = health care card (HCC) holder; 0 = without HCC *
Health behaviour		
BMI group	WHO BMI categories	1 = Underweight; 2 = Normal weight*; 3 = Overweight; 4 = Obese
Smoking	Smoking status recoded from survey question, as per NHF and AIH guide	0 = Never-smoked*; 1=Ex-smoker; 2 =Smoker
Alcohol	Pattern of alcohol consumption based on NHMRC guidelines	1 = risky or high-risk drinker based on NHMRC guidelines; 0 = low risk or non-drinker*
Access and satisfaction		
GP numbers	Number of GPs	Availability of Number of GPs Good or bette r= 1*; Fair or Poo r= 0
GP hours	Hours of access to GP	Hours of GP access Good or better = 1*; Fair or Poor = 0
Access to female GP	Access to a female GP	Access to female GP Good or better = 1*; Fair or Poor = 0
Access to bulk-billing	Availability of bulk-billing	Good or better = 1*; Fair or Poor = 0
Access to Pap smear	Access to Pap smear	Pap smear access considered Good or better 1 = Yes*; 0 = No
Access to mammograms	Access to mammogram	Mammogram access considered Good or better 1 = Yes*; 0 = No
Personal manner of GP	Patient rating of personal manner of last GP seen	Good or better=1*; Fair or Poor = 0 (asked only of women in the young cohort)
Past medical history		
Self-reported health	In general would you say your health is	1 = poor; 2 = fair; 3 = good; 4 = very good; 5 = excellent*

Variable name	Description	Variable categories and reference categories where applicable
Multimorbidity	Count of chronic health conditions from Past Medical History	0 = None*; 1 = 1 chronic condition; 2 = 2 or more chronic conditions (i.e. multimorbidity)
Cancerdx	Count of cancer diagnoses in Past Medical History	Binary variable indicating previous cancer diagnosis 1 = Yes; 0 = No*
Abnormal Pap test	Previous abnormal Pap test	1 = Yes; 0 = No*
Abnormal mammogram	Previous abnormal mammogram	1 = Yes; 0 = No*
Last Pap test	When did you last have a Pap test?	Two years or less = 1; More than two years=0
Last mammogram	When did you last have a mammogram?	Two years or less =1; More than two years = 0
SF-36pc	Physical health summary score from SF-36	Transformed into 5 quintiles continuous variable range 0=100. Highest quintile as reference group
SF-36mc	Mental health summary score from SF-36	Transformed into 5 quintiles continuous variable range 0=100 Highest quintile as reference group
Living arrangements		
Live alone	Who lives with you? I live alone	1 = Yes; 0 = No
Lives with partner	Who lives with you? Partner/spouse	1 = Yes; 0 = No
Lives with children	Who lives with you? Own children	1 = Yes; 0 = No
Health service utilisation		
Number of GP visits	How many times have you consulted the following people for your own health in the last 12 months? Family doctor or another general practitioner	0 = None (excluded from regressions); 1 = Once or twice; 2 = Three or four times; 3 = Five or six times; 4 = Seven or more times
Specialist visit	How many times have you consulted the following people for your own health in the last 12 months? A specialist doctor	Recoded to binary variable. 0 = None; 1 = 1 or more
Hospital Doctor	Have you consulted the following services for your own health in the last 12 months? A hospital doctor (eg. in outpatients or casualty)	Binary variable for consulting a doctor in a hospital in the last 12 months 1 = Yes; 0 = No
Last Pap test	Pap smear within past two years	1 = Yes; 0 = No
Last mammogram	Mammogram within past two years	1 = Yes; 0 = No

*Indicates reference category in logistic regression

Abbreviations: AIH, Australian Institute of Health; ARIA, Accessibility/remoteness index of Australia; BMI, Body Mass Index; NHF, National Heart Foundation; NHMRC, National Health and Medical Research Council; NSW, New South Wales; SF-36, 36 item Short Form Health Survey; WHO, World Health Organisation.

4.2.4 Missing data and data transformation

ALSWH survey data is characterised by low levels of missing data, and data custodians seek to actively code omissions in order to reduce data loss.

A small number of variables were not coded in every wave. Possession of a health care card (HCC), is first asked about in Wave 3 ALSWH surveys. Labour force participation was not assessed until Wave 3 of the young ALSWH cohort. These variables have been used, and where necessary recoded for the purpose of the regression analyses. Missing values for HCC status for Wave 2 are coded as per responses in Wave 3. This permitted data from an additional wave to be available for the regression analysis but presumes stable HCC status for women.

Access variables (such as access to mammography services) are characterised by high numbers of missing values or 'Don't know' responses until Wave 3. For these variables, earlier missing values are coded as per responses in later waves (assuming that the early missing values preceded a woman's knowledge of access). Although this assumption reduces variation within the data, it maximises the useable data in the analyses. For other demographic and health utilisation variables, missing data were coded as per the previous wave.

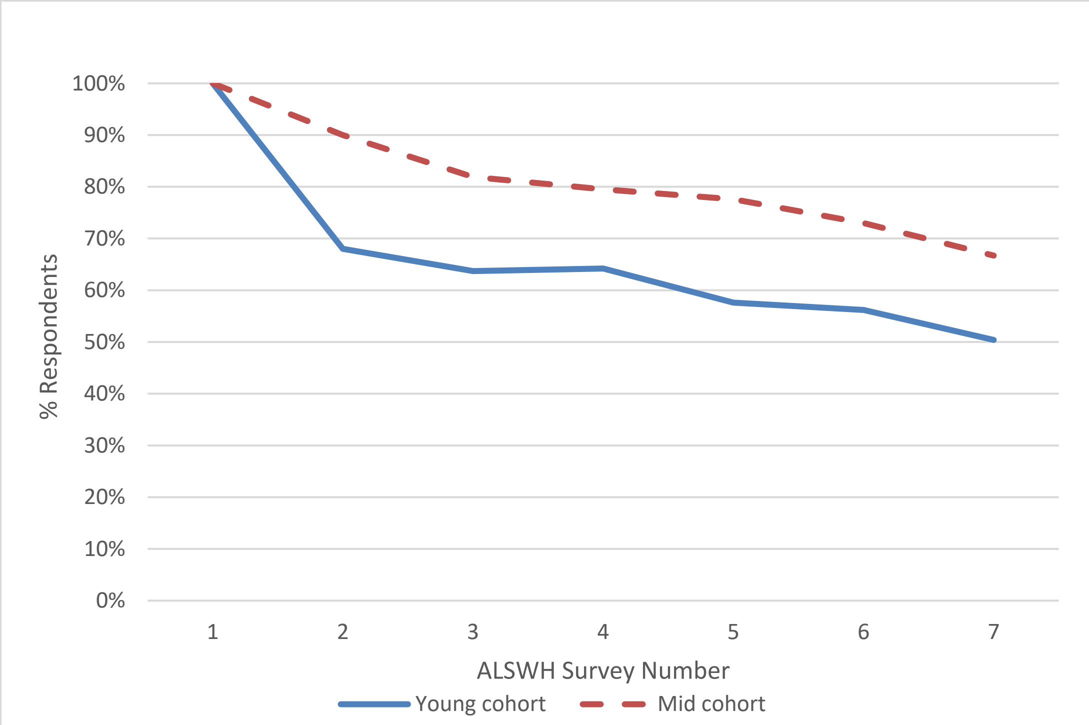
For a number of variables (such as variables related to access to health services, for example mammograms or choice of GPs) a binary yes/no variable was created from a five-item Likert scale. For these variables, respondents who rated access as good or better (good, very good or excellent) were given a score of 1, while respondents rating access as fair or poor were given a score of 0.

Other data transformation included pooling of categories with small numbers where appropriate, so as to maximise the power of the analysis. This was only performed where a theoretical justification for pooling was available.

4.2.5 Attrition within ALSWH sample

Attrition was an early issue for the ALSWH cohorts, most significantly in the young cohort between Surveys 1 and 3. Retention rate for the 1973-78 cohort for Survey 1 was 68% (n=9690) and for Survey 3 was 64% (n=9074). The primary reason for the low response rate in Wave 2 of the young cohort was inability to contact 20% of the women. Since Survey 3, retention has approached 80% for the remaining participants, with many non-respondents returning after missing a wave (Lee et al. 2005; Young, Powers & Bell 2006). Response rates for the young and mid cohorts are shown graphically in Figure 5 below. More detailed information including reasons for non-response is provided in the Appendices.

Figure 5 - Survey response rates for middle and young ALSWH cohorts



The majority of women have completed all surveys (seven for the middle cohort and six for the young cohort) with a higher retention rate in the mid cohort (68%) than the young cohort (52%). In the young cohort, a further 18.8% of women completed all but one of the surveys (most commonly the Wave 2 survey). Over 82% of the young cohort, and 95% of the middle cohort have completed at least four surveys. The number of surveys completed by women in each cohort is categorised and shown in Table 11 below.

Table 11: ALSWH respondents classified according to number of surveys completed

	Middle cohort (1946-51)		Young cohort (1973-78)	
Surveys completed	**Frequency**	**Percent of Total**	**Frequency**	**Percent of Total**
1	685	0.88	2344	4.06
2	1726	2.22	2986	5.17
3	2253	2.89	4302	7.45
4	3464	4.45	7164	12.41
5	5490	7.05	10860	18.81
6	11220	14.4	30066	52.09
7	53060	68.11	NA	
Total	77898	100	57722	100

The effect of attrition within the ALSWH cohort has been previously analysed (Powers & Loxton 2010; Powers et al. 2015). Powers et al. (2015) compared the characteristics of ALSHW survey respondents who dropped out after the first survey, with those of persisting survey respondents, including rates of multiple known health related associations (such as the association between mental health problems and self-reported health status). The authors reported that women who dropped out of survey were more likely to be younger, less educated and less likely to be studying than persistent survey responders. Despite these differences, the authors estimated that relative rates of health associations were remarkably similar, concluding that the loss of these participants had minimal effects on estimates of association and did not seriously bias results (Powers et al. 2015).

As questions about GP attendance patterns are not asked until the Wave 2 surveys, the effect of early attrition on continuity of care estimates cannot be determined. Subsequent attrition of the ALSWH cohort is taken into account in this thesis in multiple ways. First, attrition within each wave is considered within in Chapter 5 by comparing predictors of continuity of care for women who attrited in a given wave with those who responded to each survey. Second, the results from the research reported in chapters 5, 6 and 7 provide a comparison of both balanced and unbalanced samples in order to consider the potential effect of attrition within each analysis.

4.2.6 Summary demographic statistics of ALSWH cohorts

Data from 1996-2012 are analysed in this thesis, comprising the first seven waves of data from the ALSWH mid cohort and the first six waves of data from the ALSWH young cohort. These two cohorts are analysed as they alone have been surveyed repeatedly about their behaviour in seeking care from both a GP and a general practice, and responses to these questions are used to calculate measures of personal and site continuity of care, the focus of this research[16]. As these survey questions about GP and practice attendance behaviour are not asked until Wave 2 ALSWH surveys, Wave 1 observations are dropped from empirical analyses, although patient demographic information obtained in Wave 1 is utilised.

The following section describes summary statistics for respondents to each ALSWH survey wave (including Wave 1 demographic data in order to provide comparison with subsequent samples), it describes changing demographics through the ALSWH survey waves, and differences between the two age cohorts. Summary statistics are shown in Table 12 below and summary statistics for the separate age cohorts are shown in Table

[16]Women in the Old and New Young Cohorts have not been asked these general practice attendance questions and are not considered further within this thesis.

35 in the Appendices. Self-reported GP attendance patterns (used to estimate subjective continuity of care) are reported at the end of this section.

4.2.6.1 Full ALSWH sample

The average age of respondents in the pooled data from both cohorts is 43.4 years, with the majority of responses indicating that women are married (69.5%) and born in Australia (83.9%). Most women report living in either major cities (44.1%) or inner regional locations (34.7%). New South Wales is the most common state of residence for women in the sample (28.1%), with Victoria (24.8%) and Queensland (22.2%) each being the location of residence for more than 20% of women in the sample.

The majority of women have completed a high school education (68.6%), with over 25% of women graduating from university. Survey responses indicate that the majority of women are in the labour force (72.3%) and have private hospital health insurance (53.9%). Over 70% of women report living with their partner, and over 30% are living with their children.

Regarding health status, most respondents indicate they have never smoked (58.0%), with ex-smokers (24.2% of responses) outnumbering current smokers (17.6%). Over 50% of women report being in excellent or very good health (51.1%), with 12.0 % of responses indicating fair or poor health. Over 60% of the sample report having at least one chronic medical condition with 28.5% reporting one condition, and a further 34.4% of responses reporting two or more chronic medical conditions indicating multimorbidity.

In terms of health service utilisation, over 90% of women in the sample reported seeing a GP in the previous 12 months, with smaller proportion reporting seeing a medical specialist (43.6%) and a doctor in a hospital (20.4%). Regarding GP visits, women in the survey most commonly reported one or two visits (31.09% of women in the sample), then three or four visits (30.5%), with a smaller proportion reporting seven or more visits in the last year (14.4% of the sample).

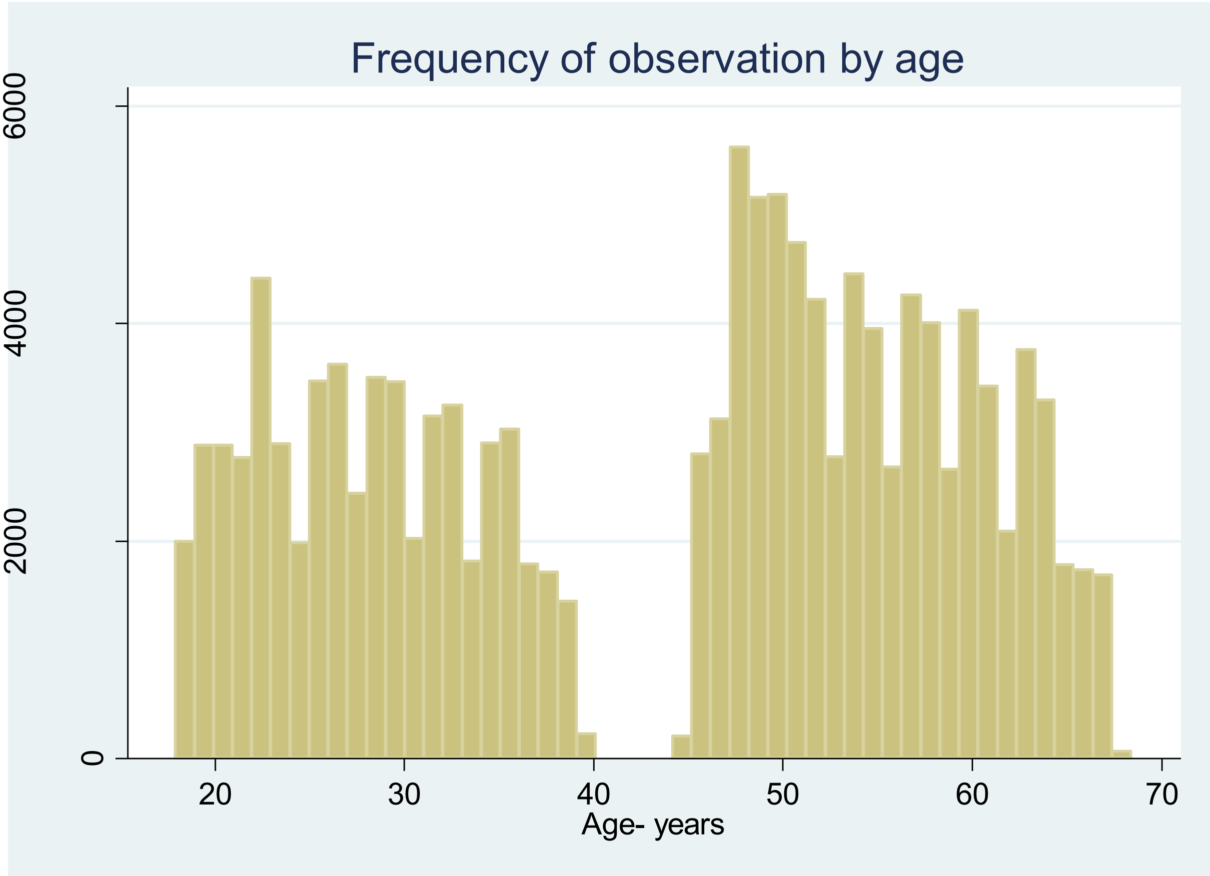
The majority of women rate their access as good or better in terms of the choice of GPs (67.8%), the number of GPs they can consult (74.7%) and whether they can see a female GP (74.0%). Just over half of respondents rate their access to bulk-billing service as good or better (58.4%).

4.2.6.2 Differences between the young and middle cohorts

While over 77.3 % of the middle cohort are Australian-born, that percentage is over 90% for the younger cohort of women (92.7%). A higher proportion of the young cohort are located within major cities (54.6%) compared with the middle cohort (36.4%). With regards to educational status, the younger cohort has higher educational attainment, with 37.5% of these women reporting a university degree, compared with 15.9% of the middle cohort. Mean SF-36 scores are similar in both cohorts, although the women in the middle cohort are more than twice as likely to report having multiple chronic medical conditions (44.5%) compared with the young cohort (20.4%). Regarding access variables, the middle cohort are more satisfied with all of these indicators except for bulk-billing access, where the women in the young cohort have higher satisfaction (71.6%) than the middle cohort (61.9%). In terms of living arrangements, while more of the young cohort live with their children (38.36%) than the middle cohort (23.81%), the middle cohort are more likely to live with a partner (78.65%) than the younger women (57.33%).

The distribution of age for the women in the first six waves of data is shown in Figure 6 below. The absence of overlap between the two age cohorts creates some difficulty in making assumptions about some age effects. To overcome this, multiple approaches are used to consider the age of women, including analysis of each age cohort separately, and including age squared as variable within most regression models to take into consideration a potential non-linear relationship between age, continuity of care, and health service utilisation.

Figure 6 - Distribution of ALSWH survey respondent age (pooled data waves 1-7).



4.2.6.3 Panel data

A comparison of summary statistics in each ALSWH survey wave is shown in Table 12 below. An increasing proportion of women become married or partnered through the survey waves, increasing from 52% in wave 1 to 78% in Wave 5. Women are obtaining higher levels of educational attainment, with the proportion of women graduating from university increasing from 13% in Wave 1, to 34% in Wave 6. The proportion of women in the workforce peaked in Wave 2 at 79% and decreased to less than 70 % by Wave 6, as women in the mid cohort reached retirement age and some in the young cohort have potentially left the workforce while having children.

The proportion of women in possession of health care cards, and private health insurance increased through each survey wave, while variables related to state of residence, country of birth, urban/rural location have changed little.

Table 12: Summary statistics for each ALSWH survey wave

ALSWH survey wave and years	1- 1996 (M1 and Y1)	2- 1998 (M2) 2000(Y2)	3- 2001(M3) 2003 (Y3)	4- 2004(M4) 2006(Y4)	5- 2007(M5) 2009(Y5)	6 2010(M6) 2012(Y6)	7 (mid only- 2013)
Age (years)	33.91 (13.49)	38.56 (12.47)	41.36 (12.48)	44.2 (12.47)	47.83 (12.36)	50.72 (12.38)	64.78 (1.47)
Australian-born	0.84(0.37)	0.84(0.37)	0.84(0.36)	0.85(0.36)	0.84(0.36)	0.85(0.36)	0.78(0.41)
Married	0.52(0.5)	0.66(0.47)	0.73(0.45)	0.77(0.42)	0.78(0.41)	0.78(0.42)	0.75(0.43)
State of residence							
New South Wales	0.29(0.45)	0.29(0.45)	0.28(0.45)	0.28(0.45)	0.27(0.45)	0.27(0.45)	0.29(0.45)
Victoria	0.25(0.43)	0.25(0.43)	0.25(0.43)	0.25(0.43)	0.25(0.43)	0.25(0.43)	0.24(0.42)
Queensland	0.22(0.41)	0.22(0.41)	0.22(0.41)	0.22(0.42)	0.23(0.42)	0.23(0.42)	0.22(0.42)
South Australia	0.08(0.28)	0.08(0.28)	0.09(0.28)	0.09(0.28)	0.09(0.28)	0.09(0.28)	0.09(0.29)
Western Australia	0.09(0.29)	0.09(0.29)	0.09(0.29)	0.09(0.29)	0.1(0.29)	0.1(0.29)	0.09(0.29)
Tasmania	0.04(0.19)	0.04(0.2)	0.04(0.19)	0.04(0.19)	0.04(0.19)	0.04(0.19)	0.04(0.21)
Northern Territory	0.01(0.12)	0.01(0.12)	0.01(0.11)	0.01(0.11)	0.01(0.1)	0.01(0.11)	0.01(0.1)
Australian Capital Territory	0.02(0.12)	0.02(0.12)	0.02(0.13)	0.02(0.13)	0.02(0.13)	0.02(0.13)	0.01(0.11)
Urban/rural location							
Major city	0.44(0.5)	0.41(0.49)	0.44(0.5)	0.46(0.5)	0.46(0.5)	0.46(0.5)	0.38(0.49)
Inner regional	0.34(0.47)	0.36(0.48)	0.35(0.48)	0.33(0.47)	0.34(0.47)	0.34(0.47)	0.4(0.49)
Outer regional	0.17(0.38)	0.19(0.39)	0.18(0.38)	0.17(0.38)	0.17(0.37)	0.16(0.37)	0.19(0.39)
Remote or very remote	0.04(0.2)	0.04(0.2)	0.04(0.19)	0.04(0.19)	0.03(0.18)	0.03(0.17)	0.03(0.17)
Highest Education attainment							
Did not complete HSC	0.33(0.47)	0.33(0.47)	0.32(0.47)	0.3(0.46)	0.31(0.46)	0.25(0.43)	0.38(0.49)
HSC completed	0.36(0.48)	0.2(0.4)	0.18(0.38)	0.17(0.37)	0.16(0.36)	0.16(0.37)	0.19(0.4)
Trade or diploma	0.19(0.39)	0.22(0.41)	0.23(0.42)	0.24(0.42)	0.23(0.42)	0.25(0.43)	0.22(0.41)
University graduate	0.13(0.33)	0.25(0.43)	0.28(0.45)	0.29(0.46)	0.3(0.46)	0.34(0.47)	0.2(0.4)
Ability to cope with available income							
Impossible	0.03(0.17)	0.02(0.14)	0.01(0.12)	0.02(0.13)	0.02(0.13)	0.02(0.14)	0.02(0.12)
Always difficult	0.14(0.34)	0.13(0.34)	0.1(0.3)	0.11(0.31)	0.11(0.31)	0.11(0.32)	0.09(0.28)
Sometimes difficult	0.31(0.46)	0.29(0.46)	0.29(0.45)	0.28(0.45)	0.26(0.44)	0.27(0.44)	0.22(0.41)
Not bad	0.39(0.49)	0.4(0.49)	0.41(0.49)	0.41(0.49)	0.42(0.49)	0.42(0.49)	0.48(0.5)
Easy	0.14(0.34)	0.15(0.36)	0.19(0.39)	0.18(0.39)	0.2(0.4)	0.18(0.38)	0.2(0.4)
In workforce	0.74(0.44)	0.79(0.41)	0.79(0.4)	0.76(0.43)	0.73(0.45)	0.69(0.46)	0.45(0.5)

ALSWH survey wave and years	1- 1996 (M1 and Y1)	2- 1998 (M2) 2000(Y2)	3- 2001(M3) 2003 (Y3)	4- 2004(M4) 2006(Y4)	5- 2007(M5) 2009(Y5)	6 2010(M6) 2012(Y6)	7 (mid only- 2013)
Private health insurance	0.39(0.49)	0.4(0.49)	0.56(0.5)	0.59(0.49)	0.65(0.48)	0.67(0.47)	0.68(0.47)
Health Care Card holder	NA	0.16(0.37)*	0.19(0.39)	0.2(0.4)	0.21(0.41)	0.24(0.43)	0.48(0.5)
Smoking/drinking							
Never smoked	0.53(0.5)	0.57(0.5)	0.59(0.49)	0.59(0.49)	0.6(0.49)	0.61(0.49)	0.62(0.48)
Ex-smoker	0.22(0.41)	0.21(0.41)	0.22(0.41)	0.25(0.43)	0.28(0.45)	0.29(0.45)	0.3(0.46)
Smoker	0.26(0.44)	0.22(0.42)	0.19(0.39)	0.16(0.37)	0.13(0.33)	0.1(0.3)	0.08(0.27)
Risky drinker	0.05(0.23)	0.05(0.21)	0.04(0.19)	0.05(0.22)	0.05(0.23)	0.06(0.23)	0.06(0.24)
Weight (Body Mass Index)							
Underweight	0.06(0.23)	0.04(0.19)	0.03(0.16)	0.02(0.15)	0.02(0.13)	0.02(0.13)	0.01(0.11)
Ideal weight	0.59(0.49)	0.54(0.5)	0.49(0.5)	0.46(0.5)	0.43(0.5)	0.41(0.49)	0.35(0.48)
Overweight	0.22(0.42)	0.26(0.44)	0.28(0.45)	0.29(0.46)	0.3(0.46)	0.31(0.46)	0.34(0.47)
Obese	0.13(0.33)	0.16(0.37)	0.2(0.4)	0.22(0.42)	0.24(0.43)	0.26(0.44)	0.3(0.46)
Access							
GP opening hours	NA	0.75(0.44)	0.7(0.46)	0.7(0.46)	0.7(0.46)	0.73(0.44)	0.82(0.39)
GPs number to choose from	NA	0.79(0.41)	0.75(0.43)	0.72(0.45)	0.7(0.46)	0.73(0.44)	0.83(0.38)
GP bulk-billing	NA	0.68(0.47)	0.52(0.5)	0.47(0.5)	0.56(0.5)	0.6(0.49)	0.76(0.43)
Female GP	NA	0.73(0.45)	0.71(0.45)	0.72(0.45)	0.73(0.44)	0.77(0.42)	0.85(0.36)
Living arrangements							
Lives alone	0.07(0.25)	0.06(0.24)	0.09(0.29)	0.1(0.3)	0.12(0.32)	0.13(0.33)	0.18(0.39)
Lives with partner	0.54(0.5)	0.66(0.47)	0.81(0.39)	0.77(0.42)	0.78(0.42)	0.78(0.42)	0.74(0.44)
Lives with children	0.35(0.48)	0.38(0.49)	0.17(0.38)	0.27(0.44)	0.3(0.46)	0.34(0.47)	0.02(0.16)
Self-assessed health							
Excellent	0.13(0.33)	0.13(0.33)	0.12(0.32)	0.13(0.34)	0.13(0.33)	0.12(0.32)	0.09(0.29)
Very good	0.37(0.48)	0.38(0.49)	0.39(0.49)	0.4(0.49)	0.4(0.49)	0.4(0.49)	0.37(0.48)
Good	0.38(0.49)	0.37(0.48)	0.37(0.48)	0.36(0.48)	0.35(0.48)	0.36(0.48)	0.4(0.49)
Fair	0.1(0.3)	0.11(0.31)	0.11(0.31)	0.1(0.3)	0.1(0.3)	0.1(0.3)	0.12(0.33)
Poor	0.01(0.12)	0.01(0.12)	0.01(0.12)	0.01(0.11)	0.01(0.12)	0.02(0.12)	0.02(0.13)
Chronic disease count							
No chronic diseases	0.4(0.49)	0.38(0.49)	0.49(0.5)	0.4(0.49)	0.36(0.48)	0.35(0.48)	0.190 (0.392
1 chronic disease	0.33(0.47)	0.31(0.46)	0.3(0.46)	0.31(0.46)	0.3(0.46)	0.28(0.45)	0.269(0.444)
Multimorbidity	0.27(0.44)	0.31(0.46)	0.21(0.41)	0.29(0.45)	0.35(0.48)	0.37(0.48)	0.541(0.498)
Cancer diagnosis	0.09(0.28)	0.09(0.28)	0.02(0.15)	0.08(0.27)	0.11(0.31)	0.12(0.32)	0.26(0.44)
Mental health summary score	46.27 (12.32)	46.74 (12.33)	47.47 (12.07)	48.39 (11.87)	49.05 (11.64)	50.27 (11.62)	51.29 (11.02
Physical health summary score	49.16 (8.98)	48.95 (9.24)	48.30(9.49)	47.73 (9.65)	47.37 (9.97)	45.77 (10.36)	45.24 (10.43

ALSWH survey wave and years	1- 1996 (M1 and Y1)	2- 1998 (M2) 2000(Y2)	3- 2001(M3) 2003 (Y3)	4- 2004(M4) 2006(Y4)	5- 2007(M5) 2009(Y5)	6 2010(M6) 2012(Y6)	7 (mid only- 2013)
Health service utilisation							
0 GP visits in last year	0.07(0.26)	0.06(0.25)	0.06(0.24)	0.06(0.23)	0.05(0.23)	0.04(0.21)	0.03(0.19)
1-2 GP visits	0.34(0.47)	0.28(0.45)	0.28(0.45)	0.34(0.47)	0.33(0.47)	0.32(0.46)	0.3(0.45)
3-4 GP visits	0.26(0.44)	0.35(0.47)	0.31(0.46)	0.29(0.45)	0.3(0.45)	0.3(0.46)	0.31(0.46)
5-6 GP visits	0.15(0.36)	0.16(0.37)	0.2(0.4)	0.15(0.36)	0.15(0.36)	0.16(0.37)	0.18(0.38)
7 or more GP visits	0.15(0.35)	0.13(0.33)	0.13(0.33)	0.14(0.35)	0.14(0.35)	0.14(0.35)	0.15(0.36)
Specialist doctor in last year	0.35(0.47)	0.45(0.49)	0.37(0.48)	0.45(0.49)	0.47(0.49)	0.49(0.5)	0.54(0.49)
Hospital doctor in last year	0.21(0.4)	0.18(0.39)	0.19(0.39)	0.19(0.39)	0.21(0.41)	0.21(0.4)	0.21(0.41)
n	27952	22008	20281	19912	18612	17726	9123

All figure represent proportion of sample in each category (standard deviation in brackets), except for age (years) and SF-36 Mental Health and SF-36 Physical Health summary scores. HSC: higher school certificate. NA: Question not asked in this ALSWH survey. * Health care card entitlement asked of Y2 and not M2.

There has been little change in self-reported health status through the survey waves with over 85 % of women reporting being in good or better health in every survey wave. There has been a gradual increase in SF-36 mental health summary scores through the survey waves, and a corresponding decrease in SF-36 physical health score. The proportion of women reporting having a chronic disease increased between waves 1 and 7, while the proportion of women who report being smokers has gradually decreased. Between survey waves 1 and 7, the proportion of women reporting zero GP visits in the previous year decreased from 0.07 to 0.03 and the number of GP attendances have slightly increased, with the commonest response for GP attendances shifting from one to two visits in Wave 1, to three or four visits in Wave 7.

4.2.6.4 Final sample

The maximum sample included in the empirical analyses of this thesis is all women in the mid and young ALSWH surveys responding to waves 2 to 7 and answering questions about patterns of GP attendance. Wave 1 observations are dropped from empirical analysis as they do not include estimates of patient GP attendance patterns from which measures of personal and site continuity of care are calculated. This provides 107,696 observations. As the benefits of continuity are considered to require ongoing contact with a health provider, respondents are excluded from most analyses if they report no GP visits in any survey (but are included in alternative models as part of robustness checks). This leave a sample of 101,478 observations from 24,713 women. In subsequent chapters, smaller samples are analysed (due to exclusion criteria). Relevant changes in summary statistics are discussed in each empirical chapter, with full summary statistics provided in the Appendices.

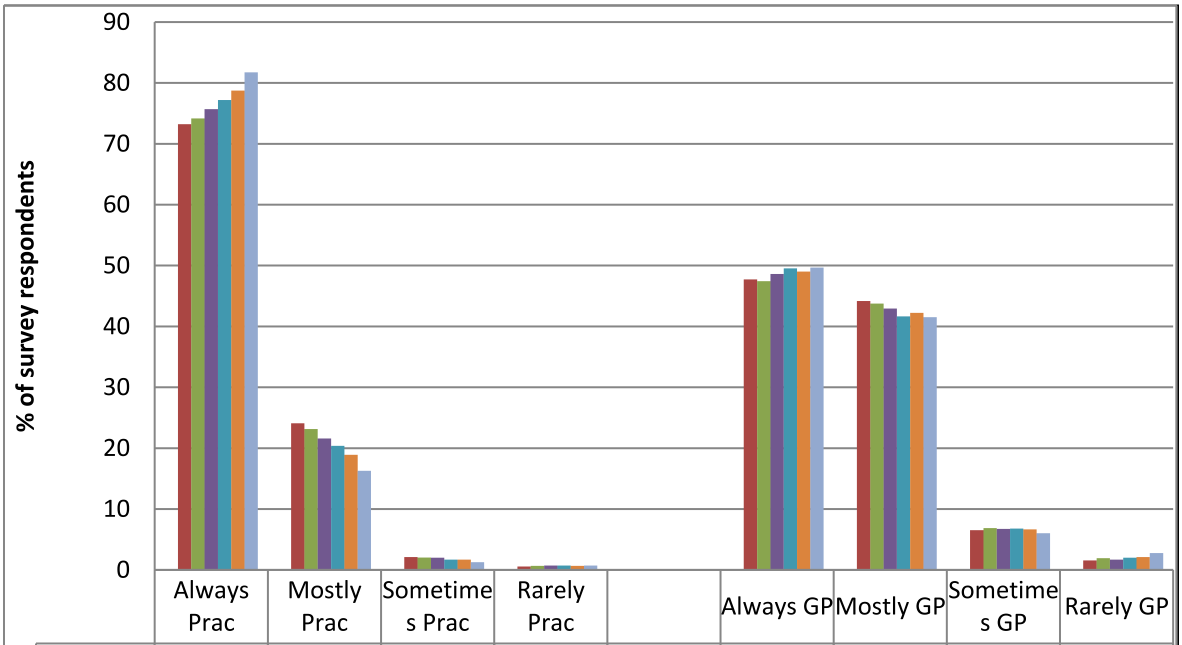
4.2.6.5 Same practice and same GP attendance measures

The following section describes summary statistics for responses to GP and practice attendance for each ALSWH survey. Responses to these questions are categorised to provide estimates of personal and site continuity of care for the purpose of subsequent analysis.

ALSWH Mid cohort

Across the six waves of survey data from wave 2 to 7, an average of 76.58% of respondents reported always attending the same general practice, and 20.92 % reported attending the same practice most of the time. The proportion of women reporting always attending the same practice increased in every survey wave (from 73.22% in Wave 2 to 81.73% in Wave 7) (refer to left half of Figure 7 below). The proportion reporting attending the same practice most of the time and sometimes had a corresponding decrease, with the most of time group decreasing from 24.08% of the cohort in Wave 2, to 16.29% in Wave 7. In the most recent wave, over 80% of women reported seeking all their care from one practice.

Figure 7 - Self-reported attendance with same GP and practice through ALSWH survey waves (ALSWH mid cohort)



	Always Prac	Mostly Prac	Sometimes Prac	Rarely Prac		Always GP	Mostly GP	Sometimes GP	Rarely GP
Wave 1	0	0	0	0		0	0	0	0
Wave 2	73.22	24.08	2.12	0.57		47.73	44.18	6.53	1.55
Wave 3	74.17	23.13	2.03	0.67		47.44	43.76	6.87	1.93
Wave 4	75.69	21.58	2	0.73		48.62	42.95	6.74	1.69
Wave 5	77.2	20.37	1.7	0.73		49.55	41.65	6.8	2
Wave 6	78.74	18.92	1.68	0.66		49	42.24	6.66	2.11
Wave 7	81.73	16.29	1.27	0.71		49.68	41.51	6.03	2.78

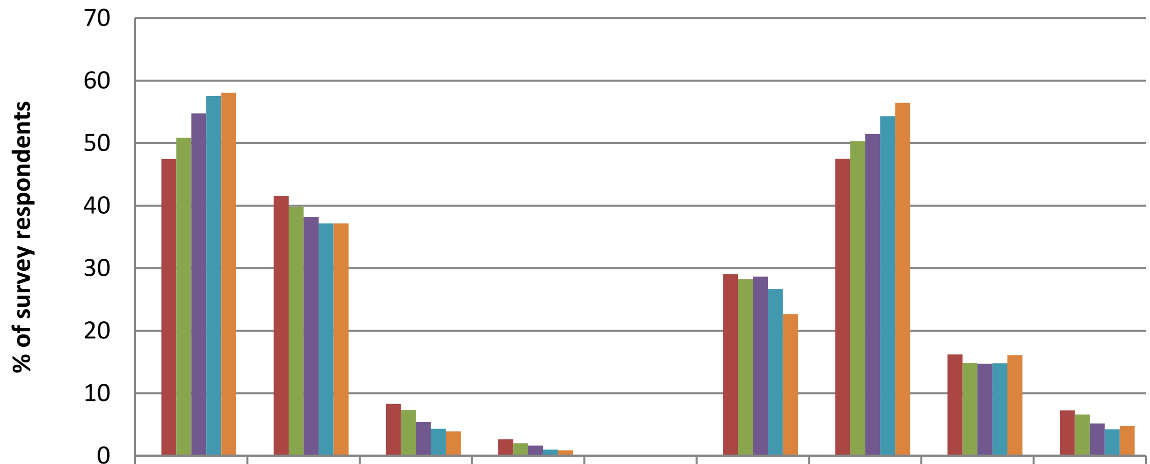
On average, 48.62% of women in the mid cohort sample reported always seeing the same GP, with an additional 42.78% reporting that they attended the same GP most of the time. Smaller numbers reported that they sometimes (6.62% of responses) or rarely/never (1.98%) see the same GP. As shown on the right half of Figure 7 above, analysis of regular GP attendance through the survey waves reveals a small increase in women reporting always attending the same GP, and a corresponding decrease in those attending the same GP most of the time. There was also a small increase in the proportion of women who said they rarely or never saw the same GP (from 1.55% of cohort in Wave 2, to 2.78% of cohort in Wave 7).

Young cohort

On average, 53.44% of the young cohort reported always attending the same practice, with an additional 38.89% reporting attending the same practice most of the time. The proportion of women reporting always attending the same practice increased in every survey wave (from 47.46% in Wave 2 to 58.05% in Wave 6), with all the other categories decreasing in size through each survey wave.

Nearly half (48.62%) of respondents reported always seeing the same GP. An additional 42.78% reporting that they attended the same GP most of the time, with smaller numbers reporting only sometimes (6.62% of responses) or rarely/never (1.98%) seeing the same person. Analysis of regular GP attendance through the survey waves reveals a gradual decrease in women reporting always attending the same GP, from 29.04% in Wave 2 to 22.66% in Wave 6. There is also a drop in the proportion of women who report rarely or never seeing the same GP from 7.26% in Wave 2 to 5.78% in Wave 6, with an increase in women reporting seeing the same GP most of the time. These changes are shown graphically in Figure 8 below.

Figure 8 - Self-reported attendance with same GP and practice through ALSWH survey waves (ALSWH young cohort)



	Always Prac	Mostly Prac	Sometimes Prac	Rarely Prac		Always GP	Mostly GP	Sometimes GP	Rarely GP
Wave 1	0	0	0	0		0	0	0	0
Wave 2	47.46	41.57	8.32	2.66		29.04	47.51	16.2	7.26
Wave 3	50.87	39.8	7.31	2.02		28.25	50.3	14.85	6.61
Wave 4	54.77	38.18	5.43	1.62		28.65	51.46	14.72	5.17
Wave 5	57.53	37.17	4.31	1		26.68	54.3	14.8	4.23
Wave 6	58.05	37.16	3.91	0.88		22.66	56.45	16.11	4.78

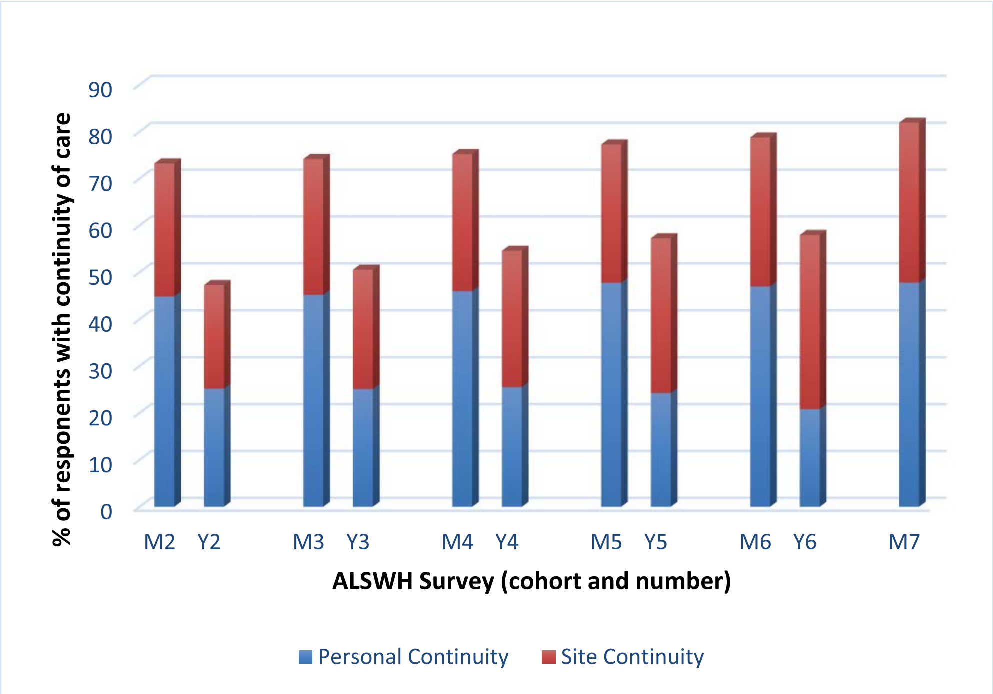
Cohort comparisons

Descriptive analysis shows that patient self-reported behaviour in seeking care from one GP and one practice has changed, and differs between the cohorts. In both cohorts, the proportion of women who reported always attending the same practice increased over time, and at a similar rate, an average 2% increase for each survey wave. For the middle cohort, the proportion of women who reported always attending the same GP increased on average around 0.4% in the three years between each survey wave, while for the young cohort (aged 18-23 during the first survey wave) the proportion of women who reported always attending the same GP decreased on average 1.3% each survey.

4.2.6.6 *Classification of continuity of care*

Responses to these GP and practice attendance questions permit the classification of women according to continuity of care. As discussed earlier, women are classified into one of three mutually-exclusive groups: personal continuity of care (always seeing the same GP), site continuity of care (always attending same practice but seeing multiple GPs), and reduced continuity (neither personal nor site continuity). The proportion of women with either site or continuity of care in each ALSWH survey is shown in Figure 9 below.

Figure 9 - Percentage of women with personal and site continuity of care for each ALSWH survey wave

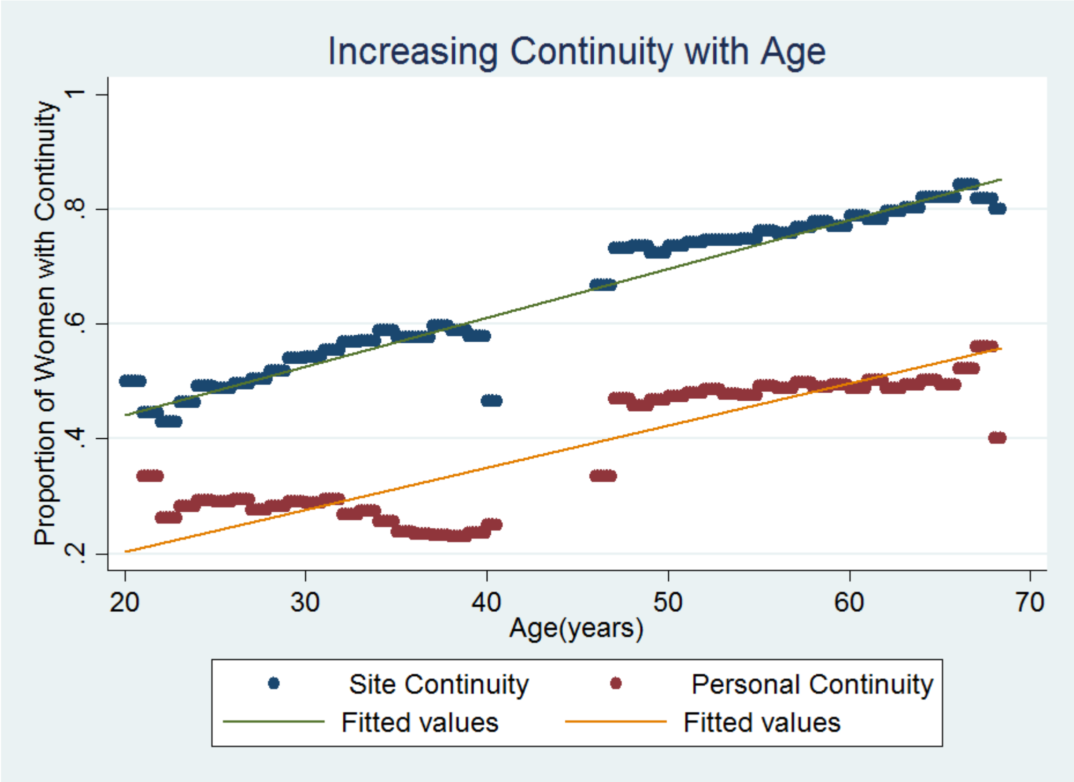


An increasing proportion of respondents in each cohort are classified as having an element of continuity of care (either site continuity of personal continuity of care) through each survey wave, indicating that the proportion of women with reduced continuity of care is decreasing over time. The total proportion of respondents with any continuity of care is always higher for women in the mid ALSWH cohort compared to those in the young cohort, and respondents in the mid cohort reported higher levels of personal continuity of care. This finding is consistent with women being more likely to seek continuity of care due to increasing health needs as they age, but this association may be confounded by other differences between the cohorts, such as financial means or flexibility in being to attend appointments. Further analysis is needed to determine if these changes are an age effect or a time effect, and this is reported in the following Section.

4.2.7 Changing continuity over time

The association between continuity of care and age is shown for both cohorts in Figure 10 below. The trend line for site continuity (the upper line in Figure 10) appears to travel through both age cohorts, suggesting that over time and with increasing age, Australian women are obtaining more site continuity of care. However for personal continuity, there appears to be a shift in the trend line (the lower line in Figure 10) between the oldest women within the young cohort, and the youngest women in the middle cohort. The proportion of women in the young cohort reporting personal continuity is decreasing as they age, while for the mid cohort this proportion is very slowly increasing.

Figure 10 - Association between site continuity, personal continuity and age (combined ALSWH middle and young cohorts).



In order to better understand the changes in continuity of care with increasing age and over time, the association between continuity of care and age within each wave is analysed. Given that the ALSWH age cohorts have a six-year age band, and the surveys have been completed on average at three-yearly intervals, there is some overlap in ages between surveys. For example, there were 2,033 women aged 56 in the fourth survey wave of the mid cohort in 2004, while a different 2,009 women were aged 56 in the fifth survey wave in 2007. Comparison of the proportion of women with site and personal continuity for women of the same age in different surveys allows an analysis to be undertaken regarding whether continuity is changing over time. The results of such an analysis is shown graphically in Figure 11 and Figure 12 below. Figure 11 shows the association between site continuity and age for each survey wave. The data for the young cohort (in the left half of Figure 11) indicates no trend for women of the same age to have increasing site continuity of care in later survey waves. Similar findings are shown in the right half of Figure 11 for the mid cohort women).

Figure 11 - Association between site continuity and age through ALSWH survey waves

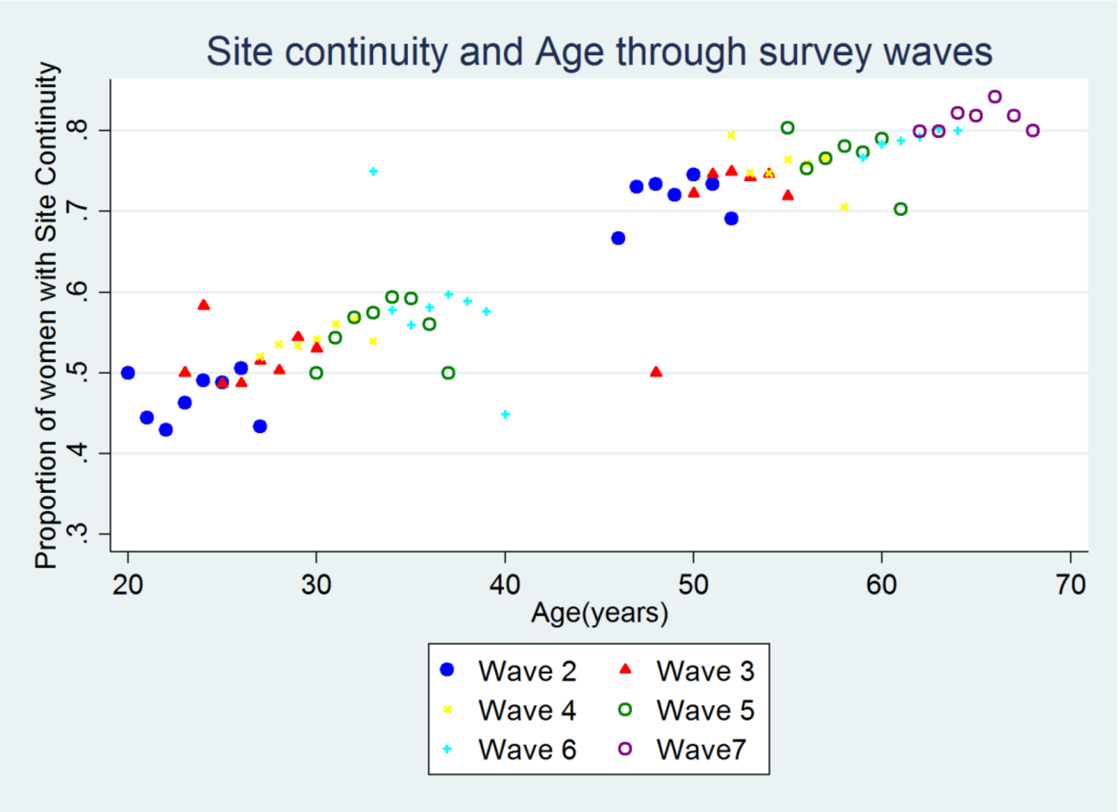
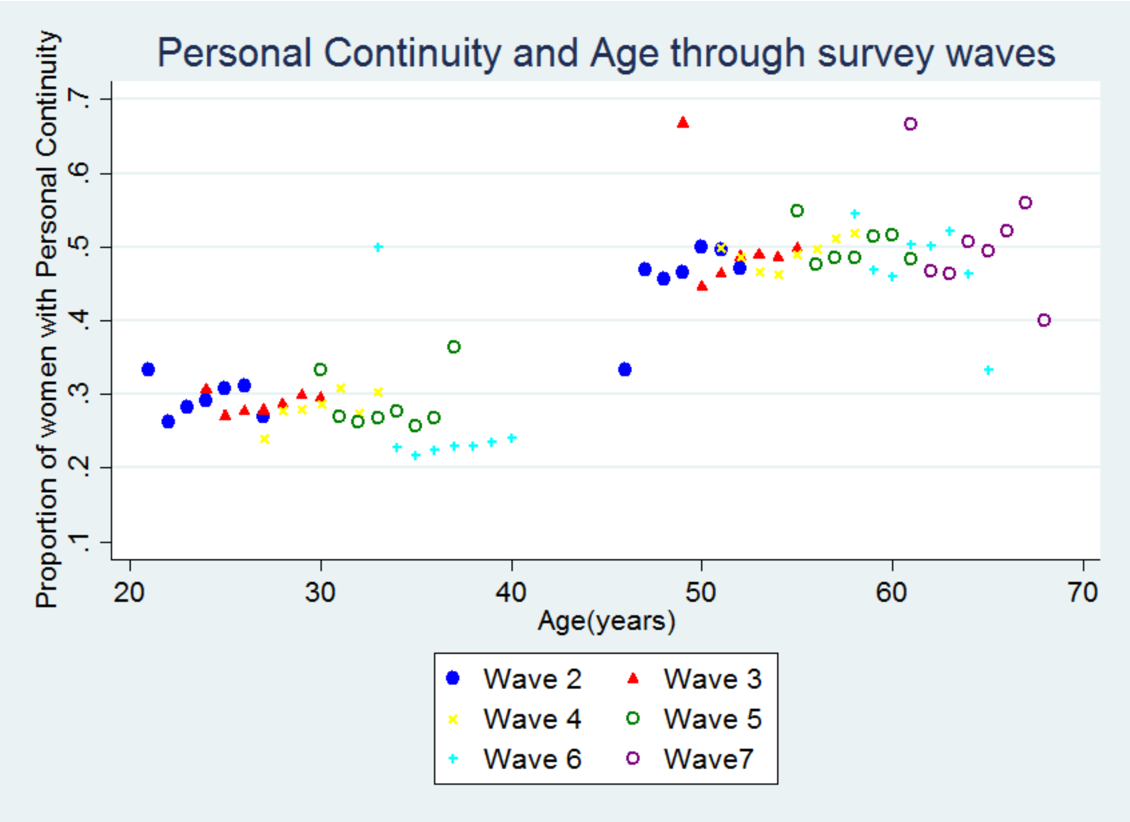


Figure 12 shows the association between personal continuity and age, and indicates that through the survey waves, a decreasing proportion of women of the same age have personal continuity. This pattern is found in both the young and middle cohort but is more marked in the young cohort.

Figure 12 - Association between personal continuity and age through ALSWH survey waves



These results indicate that there is an age effect for increasing site continuity in both cohorts, and for personal continuity in the older cohort as women age. There is also a time effect for decreasing personal continuity for both cohorts. These results suggest that trends for site continuity and personal continuity differ. While site continuity is gradually increasing with age and time, personal continuity is decreasing for women of the same age over time, particularly for the young cohort of women. Patient characteristics associated with personal and site continuity of care are analysed further in the next chapter of this thesis, in order to understand which characteristics are associated with personal and site continuity of care for Australian women.

4.3 Linked data

One of the advantages of utilising ALSWH data is that it is linked to administrative datasets, including mortality (through registries of Births, Deaths and Marriages), pharmaceutical reimbursement, and claims data from Medicare.

Multiple iterations of data linkage consent have occurred for ALSWH participants and are well documented (Dobson et al. 2015; Young, Dobson & Byles 2001). Consent for data linkage was expressly sought in March 1997 and in September 1999, with 56% of women consenting to data linkage until 2001. In September 2001, new prospective consent was sought for data until 2016, with 43% of participants consenting. From the end of 2004, participating women were notified about a planned transition to opt-out of consent for future data linkage. Retrospective opt-out data linkage for all Medicare data from 1996 (year of study enrolment) was approved in September 2012, including those women who had ceased participating but had not refused consent at any time. Medicare data have been linked to over 90% of ALSWH participants using deterministic linkage, based on individual Medicare identification numbers (Dobson et al. 2015). Just over one thousand women from the ALSWH mid cohort (1,007) and 789 from the ALSWH young cohort opted out of data linkage (Women's Health Australia 2018).

4.4 Medicare administrative data

The Australian national health insurer, Medicare, collects administrative data about health service utilisation for the purposes of reimbursement through the Medicare

Benefits Scheme (MBS). The MBS is updated quarterly and can be accessed online (Department of Health 2017b).

For each clinical service claimed under Medicare, a record is made of the date of service (date), an item number representing the service provided (item number), the identifying number of the servicing provider (provider number), as well as the cost of the service and amount reimbursed to patients by Medicare.

As described in Chapter 2, measures of continuity of care can be estimated from administrative claims data (including Medicare). These measures use a formula to calculate a personal continuity of care score based on a patient's number of visits and number of providers seen in a given time period. Although Medicare data does not provide practice-level data which would allow estimation of site continuity of care, the estimates of personal continuity derived from it can be compared with those derived from survey responses.

The Medicare variables used to calculate measures of personal continuity of care in this thesis are annual number of GP consultations and annual number of GPs seen. Their use enables the calculation of annual measures of personal continuity of care. The two most commonly used claims-based measures identified within the empirical literature are used in this thesis—the Usual Provider of Care (UPC) index (Breslau & Reeb 1975), and Bice-Boxerman Continuity of Care Index (COCI) (Bice & Boxerman 1977). Both UPC and COCI provide a value bounded between 0 and 1.

Medicare data does not include clinical coding, and the content of general practitioner consultations cannot be determined from Medicare data. However some clinical activity can be estimated from pathology tests ordered by GPs, which is recorded in MBS data for the purpose of remunerating pathologists[17]. This includes Pap testing as a screening test to detect cervical cancer; Medicare estimates of Pap testing are included in Chapter 7 of this thesis. MBS data also records data about other procedures, such as hysterectomy, or mastectomy. These data are used to exclude women from the study sample, as such procedures render women ineligible for cancer screening tests in the analysis in Chapter 7. These variables are described more fully in Chapter 7.

4.4.1 Variables of interest

Annual number of GP consultations

GP consultations are identified from item number descriptors contained within the Medicare Benefits Schedule (MBS). Category 1 of the MBS includes GP consultation services, and these can be identified separately from consultation services with other medical practitioners. These item numbers permit estimation of how many GP-related clinical services a patient uses[18]. This information is used to construct claims-based measures of continuity of care, to exclude low frequency attenders from some analyses, and to take into consideration heterogeneity in the empirical research.

[17] The exception to this is the Victorian Cytology Service (VCS), a government-funded health promotion charity which analyses around 50% of the Pap tests in Victoria (Victorian Cytology Service 2016). VCS activity is not recorded in Medicare statistics (and Victorian women are subsequently excluded from this analysis).

[18] MBS item numbers 1-98, 700-758, and 16,500 are included as GP item numbers. A full description of GP item numbers is included in the Appendices.

Annual number of GPs seen

A location-specific individual provider number is also recorded in Medicare statistics to identify the provider of a clinical service at a specific location. The provider number can be used to count the number of consultations a patient had with an individual GP at a given location, and also permits calculation of how many GPs a patient has seen within a time period.

A practice-level indicator to identify whether a patient consulted a specific general practice is not provided in the Medicare statistics. The Department of Health acknowledges the potential benefits of practice-based information, and the current limitations of the existing data in understanding the associations and activities of practices and individual providers (Department of Health 2015). Another limitation of estimating continuity of care using Medicare data is that women who see the same GP in multiple locations will have reduced estimates of personal continuity of care compared with women seeing the same GP in the same location. These issues have limited the usefulness of Medicare data to this thesis, which, as a result, focuses on the ALSWH survey data to estimate personal and site continuity of care.

For more information about Medicare data capacity and constraints, see Srinavasan et al (2016) and for more detailed information about Medicare data and ALSWH cohort see Byles et al (2017).

4.4.1.2 Data transformation

Raw MBS data was cleaned by coding GP consultation items. Annual number of GP visits was estimated for women in the ALSWH dataset, and provider numbers were used to estimate the number of visits to each provider. Medicare data and continuity measures were recorded over a single calendar year to be consistent with subjective measures of continuity derived from ALSWH survey.

4.4.2 Medicare Summary statistics

Summary statistics for the number of GP visits, and claims-based personal continuity of care scores using UPC and COCI are provided in Table 13 below. As discussed in Chapter 2, UPC and COCI are bounded between 0 and 1 with higher scores indicating increased continuity of care with one doctor.

Table 13: Annual personal continuity of care scores (UPC and COCI), and GP visit statistics for women in ALSWH mid and young cohort

	UPC		COCI		GP visits	
Year	mean	SD	mean	SD	mean	SD
2000	0.65	(0.25)	0.45	(0.36)	5.90	(6.17)
2001	0.66	(0.24)	0.46	(0.35)	6.01	(6.29)
2002	0.67	(0.24)	0.47	(0.36)	5.86	(6.25)
2003	0.67	(0.24)	0.48	(0.36)	5.76	(6.37)
2004	0.68	(0.24)	0.48	(0.35)	5.82	(5.74)
2005	0.68	(0.24)	0.49	(0.35)	5.77	(5.52)
2006	0.68	(0.24)	0.49	(0.35)	5.82	(5.55)
2007	0.68	(0.24)	0.49	(0.35)	5.88	(5.53)
2008	0.68	(0.23)	0.49	(0.35)	6.06	(5.70)
2009	0.68	(0.23)	0.49	(0.34)	6.23	(5.79)
2010	0.68	(0.24)	0.49	(0.35)	6.22	(5.59)
2011	0.68	(0.24)	0.49	(0.35)	6.27	(5.61)
2012	0.68	(0.24)	0.49	(0.35)	6.45	(5.87)

Note: Figures indicate mean with standard deviation (SD) in parentheses. UPC- usual provider continuity, COCI- Bice Boxerman continuity of care index.

Between 2000 and 2012, the mean number of annual GP visits per woman was steady, between five and seven. Over this time, the mean personal continuity of care as measured by both UPC and COCI, marginally increased for women in the ALSWH sample between 2000 and 2005, and has been stable until 2012.

4.4.3 Comparing self-reported and claims-based estimates of personal continuity

In order to compare subjective measures of continuity of care with measures calculated using claims data, agreement between continuity measures within the same individuals are evaluated. Agreement between the two measures of personal continuity of care is assessed by comparing subjective continuity of care estimated by self-reported attendance with the same GP from the ALSWH survey, and values estimated by GP attendances recorded in the Medicare data. Current Medicare data do not permit the estimation of site continuity. The availability of such data would permit further analysis of the concordance between claims-based and subjective measures of continuity of care at a practice level.

4.4.3.1 Comparing self-reported GP attendance, with UPC and COCI.

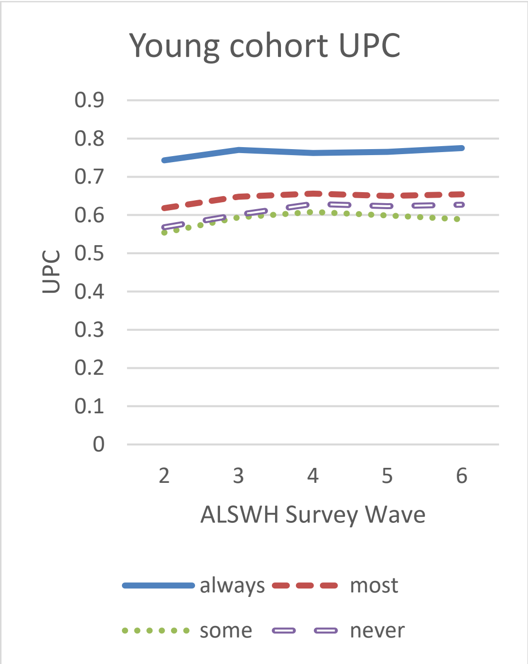
First, the mean and distribution of claims-based continuity of care scores (UPC and COCI) is analysed according to the categories of self-reported attendance with the same GP derived from the ALSWH surveys.

The mean value of UPC and COCI for women in each category of self-reported GP attendance is calculated for each ALSWH survey and for both cohorts. Pooled data (from waves 2 to 6) indicate that the average value of UPC for women who say they always see the same GP is 0.78, with the results for women in the mid cohort being higher (UPC=0.82) compared with women in the young ALSWH cohort (0.75) For women who report seeing the same GP most of the time, the average UPC is lower at 0.65, and for women who report seeing the same doctor sometimes, the average UPC is lower at 0.60. For the 3% of women in the ALSWH sample who report rarely seeing the same GP the average the average UPC is 0.62.

The average continuity scores for the women in each ALSWH age cohort are shown in the graphs in Figure 13 and Figure 14 below. The average UPC is lower for the younger cohort of women in all the subjective continuity categories. These results suggest that women in the mid cohort may be more accurate in recalling when all their care is from the same GP than women in the young cohort.

There is little difference in average UPC across the three lower subjective continuity categories (seeing the same GP most of the time, sometimes or rarely/never). These results are shown in Figure 13 and suggest that subjective reports of attendance with the same GP may be poor predictors of UPC, particularly for women in the young cohort.

Figure 13 -- Mean UPC for each category of self-reported attendance with same GP



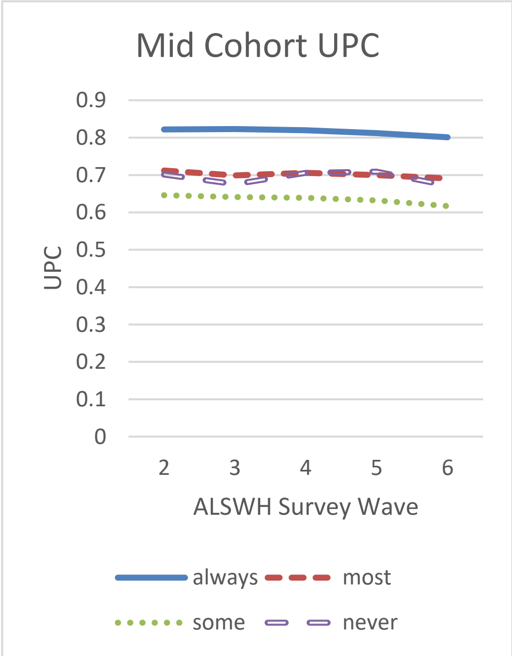
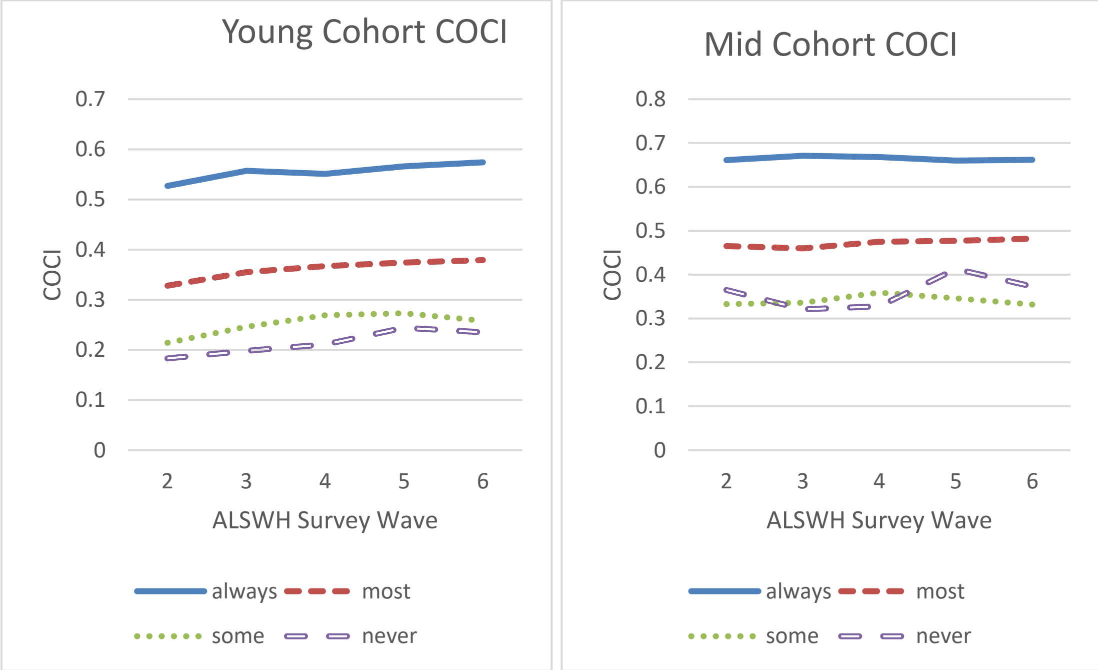


Figure 14 - Mean COCI according to self-reported attendance with same GP



Comparing the results for UPC in Figure 13 and COCI in Figure 14 indicates a lower maximum continuity score and a greater spread of values between the subjective continuity categories when using COCI. Mean COCI for women in the young age cohort was lower than for women in the mid ALSWH cohort across all self-reported survey categories, as reported with the analysis of UPC scores.

4.4.3.2 Comparing concordance using contingency table

A further analysis is undertaken to compare the agreement between women who report receiving all their care from one GP, with objective measures of GP attendance. This more formal assessment includes contingency tables comparing Cohen's kappa (Cohen 1960) and the comparison of sensitivity and specificity against a gold standard, as recommended by previous researchers (Kriegsman et al. 1996; Landis & Koch 1977). The calculations used in this formal comparison are shown in Table 14 below in the form of a 2 x 2 table comparing patient self-reported GP attendance with Medicare claims data.

Table 14: Calculations used in analysis of agreement between subjective and claims-based measures of continuity

	Admin data		
Self-report	**Continuity present**	**Continuity absent**	**Total**
Continuity present	*a*	*b*	*a+b*
Continuity absent	*c*	*d*	*c+d*
	a+c	*b+d*	
Interpretation			
Sensitivity		*a/a+c*	
Specificity		*d/b+d*	
Kappa		*(2(ad - bc))/((a + b)(b + d) + (c + d)(a + c))*	

Cohen's kappa allows the estimation of reliability of different raters or ratings (McHugh 2012). There is no standard interpretation, although previous authors suggest that less 0.2 indicates slight concordance and scores between 0.2 and 0.4 indicate weak concordance, with higher levels indicating moderate or strong concordance (Landis & Koch 1977).

These results are shown in Table 15 below for women with at least three Medicare visits in any year. The sample is limited to these women because of the instability of claims-based measures at low visit counts.

Table 15: Comparing survey self-report of having all care from one GP with Medicare data (women with three or more visits in Medicare data)

		Medicare data			
Survey data		Continuity present	Continuity absent	Total	
Continuity present		9127	23614	47696	
Continuity absent		4507	43189	32741	
Total		13634	66803	80437	
True D defined as UPC=1				**95% CI**	
Sensitivity		Pr(+| D)	56.81%	56.39 - 57.23	
Specificity		Pr(-|~D)	68.08%	67.68 - 68.47	
Positive predictive value		Pr(D |+)	33.22%	32.82 - 33.62	
Negative predictive value		Pr(~|D -)	84.94%	84.63 - 85.24	
Agreement	**Expected Agreement**	**Kappa**	**SE**	**Z**	**Prob>Z**
65.04%	56.14%	0.2028	0.003	68.43	0

Pr – probability. UPC- usual provider continuity

These results indicate that over 41% of women in this sample report always going to the same doctor while Medicare administrative data suggests that only 17% of women obtained all their GP care in the previous year from one provider. The sensitivity of 57% indicates the percentage of true positive results (those women with complete care from one GP in Medicare data who self-reported always seeing the same GP in their survey response). The specificity of 68% indicates the percentage of true negatives out of all negative responses, and can be interpreted as the ability of the survey response to correctly identify those women who did not receive all care from one provider. According to these results, there appears at best weak concordance between administrative and self-reported measures of continuity of care, at least as this pertains to receiving all care from one GP in this sample.

These results suggest that patient estimates of personal continuity provide different results compared with estimates derived from health service utilisation data Potentially patients with a usual GP or a stronger doctor-patient relationship may overestimate the proportion of care they receive from their preferred provider, and may be more likely to self-report higher attendance levels with that provider. Alternatively, patients with a regular provider may be less likely to recall consultations with a non-usual provider. These results suggest that claims-based and subjective measures may be capturing different aspects of care.

4.5 Conclusion

The results of the analysis of cross-sectional data reported in Chapter 3 support the investigation of both personal and site continuity. The ALSWH surveys provides a large panel data source including demographic health status and health service utilisation variables, and importantly permit estimation of personal and site continuity of care. The use of ALSWH data restricts the analysis in subsequent chapters to a sample of women.

Continuity of care appears to be changing for women within the ALSWH sample. An increasing proportion of women are obtaining site continuity of care as they age, while personal continuity of care is becoming less common for younger women. The associations between continuity of care and other patient and health system characteristics is investigated in the next chapter of this thesis.

Women who report receiving all their care from one GP in the ALSWH survey, on average received nearly 80% of their GP visits from one GP according to Medicare statistics, while women who reported rarely or never seeing the same GP on average received over 60% of their care from the same GP. These results suggest that patient recall may be limited in accurately describing patterns of GP attendance.

The level of agreement between self-reported GP attendance and continuity measures derived from claims data is weak. These results are consistent with the limited international literature which reports at best modest correlation between subjective and claims-based measures of continuity of care and subjective overestimation of the proportion of care with one provider compared with claims data (Nyweide 2014; Rodriguez et al. 2008). While claims-based measures accurately reflect health service utilisation, they may not fully capture the doctor-patient relationship. As this relationship is central to the understanding of continuity of care, subjective measures of continuity of care are used in the remainder of this thesis.

5 Chapter 5 – Predictors of Continuity of Care for Australian Women

5.1 Chapter summary

In this chapter, data from the Australian Longitudinal Study on Women's Health (ALSWH) will be used to compare the characteristics of women who experience continuity of care with women who do not have continuity of care. In order to strengthen this analysis an extended list of patient and health service access characteristics are included.

To provide greater understanding of the potential differences between women experiencing continuity of care with a GP and continuity of care with a general practice, additional analysis is provided to evaluate potential differences in characteristics between women experiencing personal and site continuity of care.

The results of these analyses indicate that there are multiple patient characteristics associated with continuity of care. Furthermore there are significant differences between the characteristics of women with personal continuity of care and women with site continuity of care and analyses which do not investigate both levels of continuity of care will fail to detect these differences.

5.2 Background and motivation

This research seeks to understand the characteristics of women who experience continuity of care in Australian primary care. As discussed in Chapter 2, most international research, and known published Australian studies, have utilised cross-sectional data to investigate patient characteristics associated with personal continuity of care. The research undertaken and reported in this chapter extends the literature by investigating both personal and site continuity of care, using longitudinal data and including an expanded list of explanatory variables.

Following the conceptual framework described in Chapter 2, it is anticipated that patients with increased utility in a strong doctor-patient relationship will be more likely to seek continuity of care.

5.2.1 Previous literature

Previous research investigating the predictors of personal continuity of care in primary care has reported that people who have continuity of care are more likely to be older (Hetlevik & Gjesdal 2012; Jatrana, Crampton & Richardson 2011; McRae et al. 2011; Overland, Yue & Mira 2001; Veale et al. 1995), while decreased levels of personal continuity of care have being associated with being in the workforce (as opposed to retired or student) (Baker & Jeffers 2016; Jatrana, Crampton & Richardson 2011; McRae et al. 2011) and with increasing educational attainment (Jatrana & Crampton 2009; McRae et al. 2011; Veale et al. 1995). Some authors have associated increased continuity of care with female gender (Bonney et al. 2014; Hetlevik & Gjesdal 2012), some others with male gender (Veale et al. 1995), while most have not reported significant gender-related differences (Jatrana, Crampton & Richardson 2011; McRae et al. 2011; Overland, Yue & Mira 2001). Gender cannot be considered within the current analysis as the ALSWH sample is restricted to women.

The published literature is inconsistent regarding association between income and continuity of care. US authors have reported an association between increasing continuity of care and higher income in a paediatric population (Christakis et al. 2004), while New Zealand (NZ) authors found that higher continuity of care was associated with lower income patients (Jatrana, Crampton & Richardson 2011). Differences in the costs to patients of general practice services in the US and NZ health systems potentially confound this association.

Some previous authors have also investigated health status as a potential predictor of continuity of care, reporting an association with increased continuity of care and the presence of chronic health conditions (Bonney et al. 2014; Jatrana, Crampton & Richardson 2011). The evidence for an association between continuity of care and self-reported health status has been less consistent with some results showing an association between better self-reported health and consulting the same GP (Jatrana, Crampton & Richardson 2011), some suggesting that such consultations are associated with worse self-reported health (McRae et al. 2011), and others finding no significant association (Veale et al. 1995). This association is likely to be confounded by the two-way relationship between health status and continuity of primary care, and this endogeneity is taken into account in the research reported in Chapter 6 of this thesis.

Most previous authors have reported that more frequent GP attendance is associated with decreased personal continuity of care (Christakis et al. 2004; McRae et al. 2011; Veale et al. 1995) although a Norwegian general practice study reported an association between increased continuity of care and increased numbers of GP visits (Hetlevik &

Gjesdal 2012). The Norwegian primary care system utilises a personal list system and encourages everyone to have a personal GP, understanding that if their GP is absent, they will usually be seen by a colleague within the practice. In this setting, patients with chronic diseases would be anticipated to have increased visits, and increased continuity of care, while less frequent attenders may be more likely to attend multiple GPs.

People with chronic health conditions or with worsening health may require care more urgently or unpredictably, particularly if their condition is unstable. If a preferred or usual doctor is unavailable, personal continuity of care will be reduced. However if a patient seeks all their care within a practice, site continuity will be maintained. By considering both personal and site continuity of care within this analysis, differences between site continuity and personal continuity may be detected.

5.3 Research Questions

This research seeks to answer the following questions:

- How do the characteristics of women who experience continuity of general practice care, compare with those of women who do not have continuity of care?
- How do the characteristics of women who experience continuity of care with a practice (site continuity of care) compare with those of women who have continuity of care with single GP (personal continuity of care)?

The research in this Chapter investigates patient and practice characteristics associated with personal and site continuity of care. Obtaining continuity of care is a choice and is influenced by the utility of having continuity over not having continuity. In this analysis independent variables may be classified as barriers or enablers to having personal and site continuity of care. Based on this framework it is anticipated that those characteristics associated with greater potential for information asymmetry between patient and health provider (such as having multiple complex health conditions or by having lower health literacy) would be enablers associated with increased utility of continuity of care. Conversely, those characteristics associated with improved information sharing or access (such as higher educational attainment, or increased supply of GPs as in metropolitan centres) could be potential barriers for continuity of care. For example, a woman who is more highly educated may feel more able to make health decisions without the input from a doctor, and place higher value on access to services or the costs of care, than on continuity of care. Alternatively a patient with a lower level of educational attainment and lower health literacy, may place greater value on having the doctor assist in their health decision-making processes and be more likely to perceive value in continuity of care. As the potential benefits associated with personal continuity of care (related to the stronger therapeutic doctor patient relationship) are hypothesised to differ from the benefits of site continuity of care (which centre on improved informational continuity of care) it is anticipated that patient and practice characteristics associated with personal and site continuity of care may differ. For example, a patient without chronic diseases who attends the GP infrequently may place little value in a strong doctor patient relationship, but may perceive utility from having their information stored in one location. Such a patient's characteristics (having low number of annual GP visits, having no chronic health conditions) would be expected to be associated with site continuity of care but not with personal continuity of care. These potential differences in factors associated with personal and site continuity of care are tested within this analysis.

5.4 Data and methodology

5.4.1 Data

This analysis utilises individual-level data from the ALSWH mid and young cohorts for all women answering questions about patterns of GP attendance in waves 2 to 7.

5.4.1.1 Outcome measures

As described in Chapter 4, responses to GP and practice attendance questions within the ALSWH surveys permit classification of women into three mutually exclusive groups: personal continuity, site continuity or reduced continuity. These categories of continuity of care are used as outcome variables within two regression analyses and permit differentiation between personal continuity of care (care provided from one GP), and site continuity of care (care provided within one practice but by multiple GPs).

5.4.1.2 Main variables of interest

Patients with greater utility from a strong principal-agent relationship are anticipated to seek/prefer continuity of care. Such patients are thought to have more complex medical histories (including patients with multiple chronic health conditions and older patients), and potentially to report worse health status or be more frequent users of health services. These are the main variables of interest for this analysis.

5.4.1.3 Covariates

An extended list of demographic, health status, health service utilisation, and access variables are incorporated into the model to comprehensively consider associations with continuity of care in Australia, and to reduce omitted variable bias.

Demographic variables have been previously summarised in Chapter 4 and relate to country of birth, region of living, Australian state or territory, education, employment status, income, and possession of private health insurance. Health care card possession entitles holders to discounts and assistance with medical expenses, and a variable about health care card status is included as a proxy for socioeconomic status (Charles, Valenti & Britt 2003). Variables about a woman's living arrangements are included, to consider the potential influence of household composition on a woman's continuity of care-seeking behaviour.

Self-assessed health is included within the model by incorporating physical and mental summary scores from the SF-36 Health Survey, which have been calculated for ALSWH respondents based on age specific norms of Australian women (Mishra & Schofield 1998). Additional health status variables include a marker for single chronic disease, a marker for multimorbidity (two or more chronic diseases), and a marker of previous cancer diagnosis. Variables for weight, smoking status and alcohol consumption are included to potentially control for different health-seeking behaviours which may correlate with behaviour in seeking continuity of care (Maarsingh et al. 2016).

Access to GP services is expected to correlate with patient ability to obtain continuity of care (particularly in the Australian context without financial incentives for practice enrolment or for patients to obtain care in the one location). Variables considering the number of GPs a woman has to choose from, the hours when a GP is available, and access to bulk-billing (care provided without out of pocket cost) are incorporated within the model, as well as the availability of a female GP if desired.

A full list of included variables is provided Table 16 below.

Table 16: Variables included within regression models

Variable name	Description	Variable description and categories
Continuity of care	Pattern of care categorised according to self-reported GP and practice continuity	2 = personal continuity of care (all care provided by one GP); 1 = site continuity of care (all care from one practice but different GPs); 0= neither site nor personal continuity*
Age	Age coded to 1/10 of a year and categorised in decades	1 = 20-29.9*; 2 = 30-39.9; 3 = 40-44.9; 4 = 50-59.9; 5 = 60-69.9
Age squared		Considered within regression analysis to consider non-linear associations between age and outcomes variables
Wave	ALSWH Survey wave (2-7)	2*, 3, 4, 5, 6,-7
Cohort	Age cohort of women	Y = young cohort (women born between 1973-78); M= middle cohort (women born between 1946- 51)
Covariates		
State	State of residence in Australia	1 = NSW*; 2 = Vic; 3 = Qld; 4 = SA; 5 = WA; 6 = Tas; 7 = ACT; 8 = NT
Australian-born	Country of birth	1 = Australia*; 0 = other country of birth
ARIA group	Residence coded according to Accessibility/remoteness index of Australia (ARIA)	1 = major city*; 2 = inner regional; 3 = outer regional; 4 = remote or very remote
Married	Marital status	1 = Married or living with de facto*; 0 = other

Variable name	Description	Variable description and categories
Education	Highest educational attainment	1 = did not complete Higher School Certificate (HSC)*; 2 = HSC completion; 3 = Trade/Diploma; 4 = University Graduate
Income	Ability to cope with available income	1 = impossible; 2 = difficult all the time; 3 = difficult some of the time; 4 = not too bad; 5 = easy*
Employed	Labour force participation	2 = labour force (full time, casual or part-time); 1 = unemployed; 0 = not in labour force*
PHI	Possession of hospital private health insurance (PHI)	1 = private health insurance holder; 0 = without PHI *
HCC	Possession of concessional health care card	1 = health care card (HCC) holder; 0 = without HCC *
Smoking	Smoking status	0 = Never-smoked*; 1 = Ex-smoker;2 = Smoker
Alcohol	Pattern of alcohol consumption based on NHMRC guidelines	1= risky or high risk drinker based on NHMRC guidelines; 0 = low risk or non-drinker*
BMI group	WHO BMI categories	Weight categorised according to body mass index (BMI group) 1 = Underweight; 2 = Normal weight*; 3 = Overweight; 4 = Obese
Multimorbidity	Count of chronic health conditions from Past Medical History	0 = None*; 1 = 1 chronic condition; 2 = 2 or more chronic conditions (i.e. multimorbidity)
Cancer	Previous cancer diagnosis	1 = Yes; 0 = No*
Number of GP visits	How many times have you consulted the following people for your own health in the last 12 months? Family doctor or another general practitioner	0 = None (excluded from regressions); 1 = Once or twice; 2 = Three or four times; 3 = Five or six times; 4 = Seven or more times
Specialist visit	How many times have you consulted the following people for your own health in the last 12 months? A specialist doctor	Recoded to binary variable. 0 = None; 1 = 1 or more
Hospital doctor	Have you consulted the following services for your own health in the last 12 months? A hospital doctor (eg. in outpatients or casualty)	Binary variable for consulting a doctor in a hospital in the last 12 months 1 = Yes; 0 = No
SF-36pc	Physical health summary score from SF-36	Transformed into 5 quintiles continuous variable range 0 = 100. Highest quintile as reference group

Variable name	Description	Variable description and categories
SF-36mc	Mental health summary score from SF-36	Transformed into 5 quintiles continuous variable range 0 = 100 Highest quintile as reference group
GP numbers	Number of GPs	Availability of Number of GPs Good or better=1*; Fair or Poor = 0
GP hours	Hours of access to GP	Hours of GP access Good or bette = 1*; Fair or Poor = 0
Access to female GP	Access to a female GP	Access to female GP Good or better = 1*; Fair or Poor = 0
Access to bulk-billing	Availability of bulk-billing	Good or better = 1*; Fair or Poor = 0
Live alone	Who lives with you? I live alone	1 = Yes; 0=No *
Lives with partner	Who lives with you? Partner/spouse	1 = Yes; 0=No *
Lives with children	Who lives with you? Own children	1 = Yes; 0 = No*

Notes: Reference case in models indicated with asterisk *

5.4.2 Modelling approach

Two regression analyses are undertaken to understand patient behaviour in seeking care with the same GP or a practice, and to test the association between continuity of care, the variables of interest and the rich list of covariates.

The hypothesis of this analysis is that women have increased utility associated with continuity of care and that the utility gain associated with continuity of care will be greater for women with more complex health conditions, such as increasing age, multimorbidity or worse self-reported health. It is not possible to observe a woman's utility. However it is possible to observe a woman's continuity of primary care.

The first analysis (Analysis One) compares women who report seeking all their care from one provider or one practice (women who 'have' any continuity of care), with the remaining women.

Analysis One seeks to model the probability of a woman reporting any continuity of care (*y,)*

$$y = \begin{cases} 1 & \text{if a woman reports always seeing same GP, or always attending same practice} \\ 0 & \text{if otherwise} \end{cases} \quad (1)$$

as a function of explanatory health status, health service utilisation and demographic variables. The probability of observing $y_i = 1$ is given by

$$P(y_i = 1 \mid \boldsymbol{X_i}) = F(\beta_0 + \boldsymbol{HLTH_i \beta_1} + \boldsymbol{X_i \beta_2} + \varepsilon_i + t) \qquad (2)$$

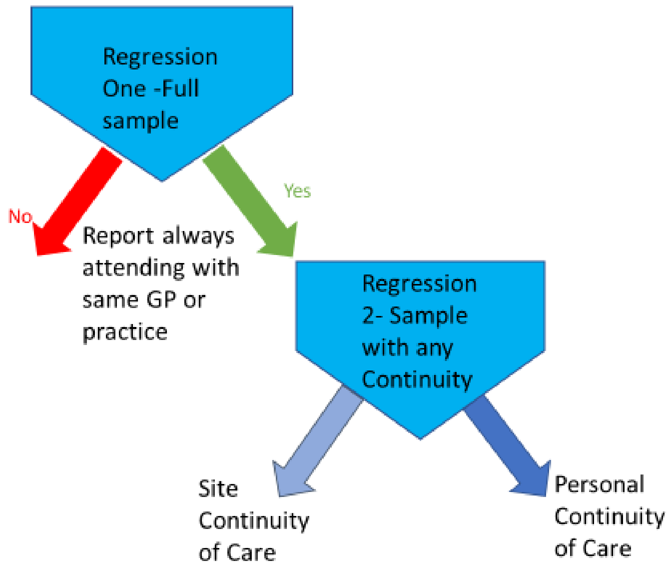
where y_i is the probability of a woman having continuity of care, $\boldsymbol{HLTH}$ is a vector of the health variables of interest (self-reported physical and mental health from the SF-36 score, presence of a chronic disease or multimorbidity, number of visits to GP, whether seen a specialist or hospital doctor in previous 12 months), and $\boldsymbol{X_i}$ is a vector of other covariates (demographics, health behaviours, access variables) which may influence health care-seeking behaviour, ε_i indicates idiosyncratic error and t is an indicator of each survey wave. F (.) represents a cumulative distribution function, typically the logistic or normal distribution.

The second analysis (Analysis Two) considers only the sub-group of women who report having any continuity of care, (i.e. y = 1 in equation (1) above), and compares the characteristics of women who have continuity of care with a provider (personal continuity), with those women reporting continuity of care with a practice (site continuity)

$$y = \begin{cases} 1 & \text{if a woman has personal continuity of care} \\ 0 & \text{if a woman has site continuity of care} \end{cases} \quad (3)$$

as a function of the same explanatory health status, health service utilisation and demographic variables in equation (2). A flow chart of the two regression analyses is shown in Figure 15 below.

Figure 15 – Two-stage approach of analysing predictors of continuity of care



Both regressions model the probability of a woman reporting continuity of care as a function of explanatory health status, health service utilisation and demographic variables using a binary outcome variable. Although the outcome variables and samples differ, both regressions estimate the same equations.

Assuming that error terms are uncorrelated with the regressors within this model allowing estimation using ordinary least squares (OLS). However, given that the dependent variable has a binary outcome, the predicted probabilities from an OLS model may be outside the range of 0,1. Commonly used approaches to analyse binary outcome variables include logit or probit models and logit is preferred due to the ease of interpretation of odds ratios within logit models (Cameron & Trivedi 2009; Long & Freese 2006).

A pooled logistic regression model is used to estimate equation (2) and odds ratios are reported. This model reports heteroscedasticity-consistent standard errors estimated using the White covariance matrix estimator (White 1980). The model is estimated using combined data from ALSWH mid and young cohorts.

Equation (2) fails to take advantage of the panel nature of data (repeated observations with the same individuals) and assumes that multiple observations on the same individual are independent. Panel data has multiple advantages over cross-sectional data such as reduced collinearity among variables, increased efficiency and the ability to study dynamic relationships and control for individual heterogeneity (Baltagi 2008).

Using the same explanatory variables as in equation (2), a random-effects panel model is specified as follows:

$$P(y_{it} = 1 \mid \boldsymbol{X_{it}}) = F(\beta_0 + \boldsymbol{HLTH_{it}\beta_1} + \boldsymbol{X_{it}\beta_2} + \varepsilon_{it} + \mu_i) \qquad (4)$$

where y_{it} denotes outcome for individual *i* at a particular time point *t* , $\boldsymbol{HLTH_{it}}$ is a vector of regressors of interest such as age and health status, $\boldsymbol{X_{it}}$ is a vector of other explanatory regressors such as education, income, and access to GP services, μ_i denotes time-invariant individual heterogeneity, while ε_{it} indicates idiosyncratic errors.

The model is estimated using combined data from ALSWH mid and young cohorts as well as separately for each cohort.

In the random effects (RE) model, variation across entities is assumed random (and uncorrelated with variables in the model), such that the individual error term is not correlated with the explanatory variables $\boldsymbol{X_{it}}$. This assumption may not be satisified in this panel meaning that estimates will not be consistent.

There are likely to be unobserved patient-level characteristics which correlate with a woman's likelihood of having continuity of care, (such as health literacy or preference of seeing the same GP). These unobserved characteristics may confound the association between continuity of care and observed patient characteristics. A large range of covariates are used to mitigate the possible impact of unobserved heterogeneity, although results will still likely suffer from omitted variable bias. Consideration is given to the fixed effects (FE) estimator in order to accommodate individual-level heterogeneity but is omitted due to the incidental parameters problem. The incidental parameters problem is an issue encountered with the use of a non-linear outcome variable (such as fixed effects logit model) with panel data, most commonly with small time series (T) and large number of observations (Greene 2002; Lancaster 2000). The use of panel fixed effects logit with the binary outcome variable would provide an inconsistent estimator.. The FE model is utilised in the analysis within Chapter 7.

Odds-ratios from the random effects model are reported. In Analysis One, effects favouring any continuity of care (personal or site continuity of care) are reflected in an odds ratio greater than one, while an odds ratio between 0 and 1 indicate decreased odds of reporting continuity of care. In Analysis Two, effects favouring personal continuity of care over site continuity are reflected in an odds ratio greater than one, while an odds ratio between 0 and 1 indicates increased odds of site continuity of care.

A comparison of random effects and OLS is provided using the Breusch-Pagan Lagrange multiplier. Rejecting the null hypothesis of this tests suggests that variance across models is significantly different and that random effects are present (Breusch & Pagan 1980), and supports use of the panel model.

For both sets of regressions analyses, results of five regression models are reported. Results from the pooled logistic regression model are provided as a starting point, before the panel RE logistic regression model is reported to compare coefficients between the pooled and panel model and confirm the choice of panel RE as the preferred model. Then the results of the RE logistic regression model of the balanced sample (balanced RE) are shown to test for the effect of attrition within the model. Finally, the results of the panel RE logistic regression output for the separate ALSWH age cohorts is provided in order to assess for differences between the ALSWH young and middle age cohorts, and the full sample.

5.4.2.1 Sample considerations

As described previously, Wave 1 observations, and observations when respondents report having no GP visits are omitted. This leaves a sample of 101,478 observations from 24,713 women. There are small numbers of missing data for women within demographic variables. These are coded per previous response if available. The largest number of observations which cannot be coded relate to the SF-36 score and health status variables, and after excluding these missing observations 87,893 observations from 23,661 women are included within Analysis One.

For the regression analysis, categorical variables have been coded as a series of multiple dummy variables. Physical and mental health scores on the SF-36 were coded into quintiles based on distribution and run as five dummy variables within the regression analyses. This allowed for a more meaningful categorisation of health status in the analysis, and to take account of a potential non-linear relationship between continuity and health status.

Age and square of age have been included to consider the potential non-linear relationship between continuity of care and age.

The majority of attrition within the ALSWH sample occurred between the Wave 1 and Wave 2 surveys. Survey questions about GP attendance patterns are not asked until Wave 2 and it is not possible to account for this attrition between Waves 1 and 2. In order to examine attrition from Wave 2, two approaches are provided. Firstly, results for the balanced and unbalanced panel are compared,-assuming that observations are missing at random. Secondly, attrition within each wave was considered by running Analysis One, and comparing those respondents who attrited in a given wave with those women who responded to the survey (provided in Table 41 in the Appendices).

All models also report Akaike's information criteria (AIC) and Schwarz's Bayesian information criteria (BIC) in order to compare the quality of the pooled and panel models, with the lower AIC and BIC being preferred. Data analysis was completed using Stata 14 (Statacorp 2017) with additional applications used for graphical interpretation (Jann 2014).

5.5 Results

The summary statistics for the full cohort have been previously described in Chapter 4. The demographics of this sample of women are consistent with the full sample, and are provided in Table 40 in the Appendices.

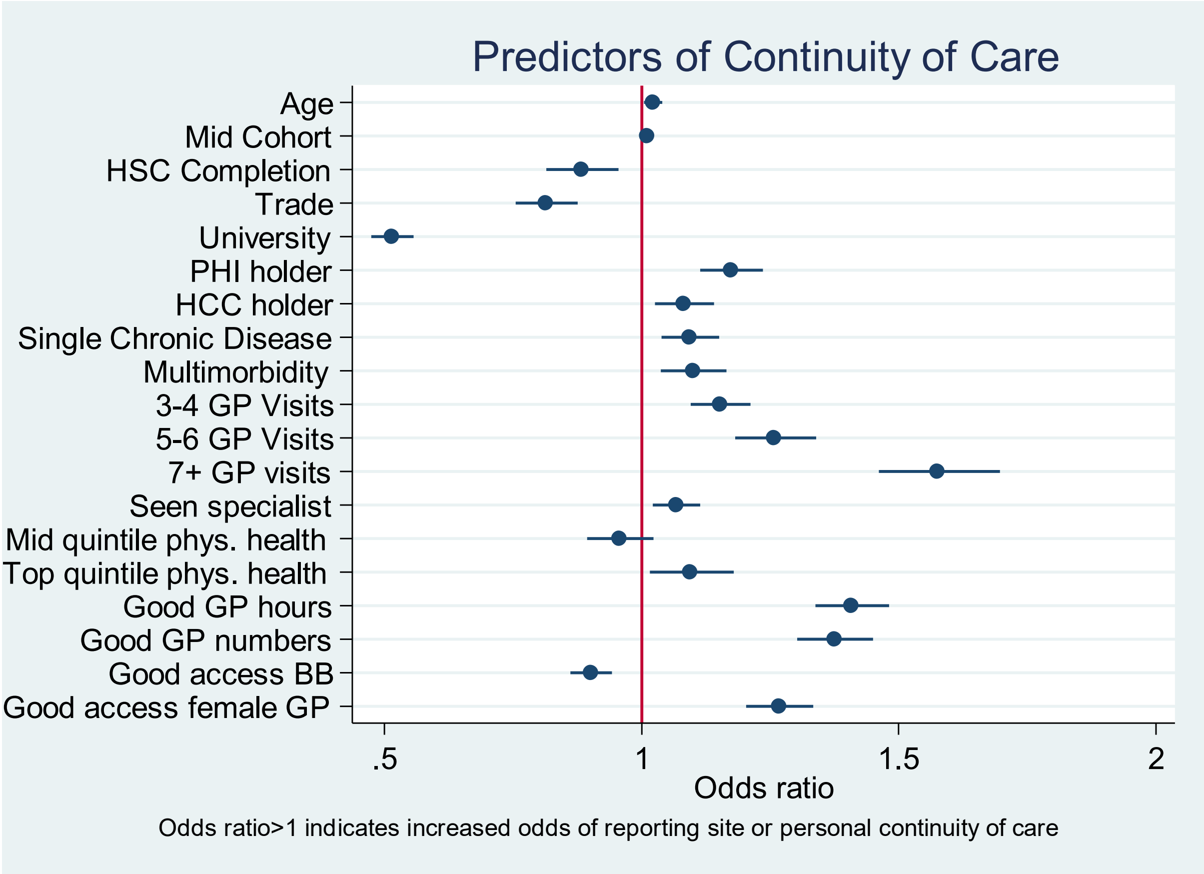
5.5.1 Comparison of women with any continuity of care, with women without continuity of care (Analysis One)

Analysis One compares women who have any continuity (either site continuity or personal continuity) with those women who do not report of continuity of care with either a GP or general practice.

Pooled logistic regression of the combined young and mid cohorts (Model 1) shows multiple statistical differences between women reporting any continuity of care, and those women without continuity of care. There is no significant association with age identified in the pooled results, although marginal significance of age squared, suggesting that an association between age and increased continuity of care increases significantly for older women. There is a significant cohort effect, such that women in the mid ALSHW cohort have a 1.5% increased odds of having continuity of care if they are in the mid cohort, compared with women in the young ALSWH cohort ($p<0.01$). This pooled logistic regression model also suggests a significant time effect with women in waves 3 to 5 having increased odds of continuity of care compared with women in survey Wave 2.

In Model 2 (panel RE logistic regression) panel random effect logistic regression, the wave variable drops out of this model and a significant association between increasing age and having continuity of care is reported. On average, women have a 2.2% increased odds of reporting continuity of care for each year of age. Other than these age effects, the results of Models 1 and 2 are consistent and the Model 2 results are discussed because they better utilise the panel nature of the data (despite being subject to the restrictions of the random effects model), and the results of the Breusch Pagan Lagrande test suggest the presence of random effects.

A selection of significant results from the preferred model (panel RE logistic regression) is shown in the forest plot in Figure 16 below with full results provided in Table 17 below. Additional models assessing attrition are included in the Appendices and suggest that attrition from Wave 2 has not influenced results of interest in subsequent waves.



Note: Results indicate OR and 95% confidence interval. Result plotted to right of unity (red vertical line in Figure above) indicates increased odds of having any continuity of care (personal or site). Result plotted to left of unity indicates decreased odds of having any continuity of care. Selected regression results only. Full model contains age, age squared, cohort indicator, ALSWH wave indicator, education, income, urban/rurality, state/territory, Australian-born, marital status, labour force participation, household composition, PHI, HCC, smoking, alcohol, BMI, chronic disease, multimorbidity, cancer diagnosis, number of GP visits, other doctor visits, SF-36 physical and mental health summary scores, satisfaction with GP hours, GP numbers, female GP, access to bulk-billing.

Figure 16 - Plot of selected findings from Model Two of Regression Analysis One

Regarding patient demographics, there was a trend for women to be less likely to report having continuity of care with increasing educational attainment. Compared with women who had not completed their HSC, women had significantly decreased odds of having continuity of care if they had a graduate certificate, diploma, or were university graduates ($p<0.001$). University-educated women had odds of 0.51 (95% CI; 0.47-0.56) of having continuity of care, significantly different compared with women with no secondary school qualifications ($p<0.001$). Women with private health insurance and women with health care cards were both significantly more likely to have continuity of care than women who did not have private health insurance nor health care cards ($p<0.05$). There were multiple state-based differences between women reporting continuity of care and women without continuity, reported in Table 17 below.

Compared with women in New South Wales (NSW), women in the Northern Territory (NT) and Queensland (Qld) had statistically significantly decreased odds of having continuity of care ($p<0.05$), while the opposite was the case for women in South Australia (SA) and Tasmania. Compared to women in capital cities, women living in regional areas of Australia had an increased odds of having continuity ($p<0.001$). Women who were born in Australia were significantly more likely to have continuity of care than those women who were born overseas ($p<0.001$), and women who are married were more likely to have continuity of care than women who were not married ($p<0.001$). Women who were in the labour force were significantly less likely to have continuity than women who were not in the labour force ($p<0.001$)

Regarding health status and health service utilisation there were multiple significant differences between women with continuity of care and those without. There was a trend across quintiles of SF-36 scores for women who reported better mental health to have increased odds of having continuity of care, and an association for women in the highest quintile of physical health to have significantly increased continuity of care compared to the lowest quintile ($p<0.05$) There was also a trend for women with one or more self-reported chronic medical conditions to have increased odds of continuity of care, than women without self-reported medical conditions. There was a significant trend for women to have an increasing odds of having continuity of care as their number of GP visits increased; with women reporting seven or more GP visits in the previous year having an odds ratio of 1.58 (95% CI- 1.46-1.70) of having continuity of care compared to those women with one or two GP visits. Women who reported seeing a hospital doctor in the previous year were significantly less likely to have continuity than women who had not seen a hospital doctor (OR=0.86 ;95% CI 0-83- 0.90 $p<0.001$). Women who were classified as risky drinkers were significantly less likely to have continuity of care ($p<0.001$) than other women, and women who were overweight and obese were had significantly increased odds of having continuity of care than women of ideal weight ($p<0.001$).

The association between continuity of care, and access to GP services also displayed multiple significant findings. Women who reported good or better availability of GPs (through sufficient opening hours and sufficient number of GPs) were significantly more likely to report having continuity of care, than those women with fair or poor GP availability ($p<0.001$) and a similar finding was found for access to female GPs. These findings would be consistent with women having greater potential to meet their preference for having continuity of care with improved availability of GPs. With regard to access to bulk-billing, women who reported good or better access to bulk-billing were significantly *less* likely to report having continuity of care. One explanation for this association between less bulk-billing and increased continuity of care, is that although increased GP availability increases continuity of care, this is counterbalanced by a preference for reduced costs, which reduces continuity of care. Women are potentially obtaining continuity with their preferred provider, but in the face of increased out-of-pockets costs (perhaps because their preferred doctor is less available, or more expensive), women may prefer to seek care from another provider, thus reducing continuity of care. Finally, with regard to living arrangements, there was a statistically significant increased odds of continuity of care for women who lived with their children compared to women who did not live with their children ($p<0.001$), and for women living with a partner compared to those women not living with a partner ($p<0.05$). No significant effects were found for measures of financial means, or presence of a cancer diagnosis in Models 1 and 2. The results of panel RE model of the balanced sample (Model 3) were broadly consistent with Model 2 suggesting no problem with attrition from Wave 2 onward in subsequent results.

Table 17: Logistic Regression results for Analysis One predicting probability of women having any continuity of care (site or personal) compared with women not reporting any continuity of care

Variable	Model 1 Pooled logistic	Model 2 Panel RE logistic	Model 3 Panel RE logistic (balanced panel)	Model 4 Panel RE logistic (mid cohort)	Model 5 Panel RE logistic (young cohort)
Age	1.002	1.022*	1.028*	0.900^{+}	1.284***
	(0.009)	(0.009)	(0.012)	(0.057)	(0.054)
Age squared	1.000*	1.000^{+}	1.000	1.001*	0.996***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Marker for older cohort	1.015**	1.010***	1.014***		
	(0.006)	(0.003)	(0.004)		
Wave 3	1.102**				
	(0.034)				
Wave 4	1.148***				
	(0.047)				
Wave 5	1.147*				
	(0.063)				
Wave 6	1.095				
	(0.077)				
Wave 7	1.172^{+}				
	(0.110)				
Victoria	0.997	1.010	0.977	1.065	0.984
	(0.021)	(0.037)	(0.052)	(0.061)	(0.048)
Queensland	0.910***	0.890**	0.902^{+}	0.860**	0.899*
	(0.020)	(0.034)	(0.049)	(0.048)	(0.046)
South Australia	1.216***	1.264***	1.235**	1.219*	1.289***
	(0.039)	(0.068)	(0.092)	(0.097)	(0.094)
Western Australia	1.077*	1.098^{+}	1.036	1.037	1.131^{+}
	(0.033)	(0.056)	(0.077)	(0.081)	(0.077)
Tasmania	1.584***	1.805***	1.934***	1.693***	1.864***
	(0.077)	(0.142)	(0.218)	(0.194)	(0.202)
Northern Territory	0.734***	0.639***	0.780	0.707*	0.529***
	(0.055)	(0.074)	(0.128)	(0.119)	(0.088)
ACT	1.144*	1.188^{+}	1.124	1.291	1.125
	(0.069)	(0.115)	(0.150)	(0.226)	(0.128)

Variable	Model 1 Pooled logistic	Model 2 Panel RE logistic	Model 3 Panel RE logistic (balanced panel)	Model 4 Panel RE logistic (mid cohort)	Model 5 Panel RE logistic (young cohort)
Australian born	1.152***	1.243***	1.299***	1.222***	1.377***
	(0.026)	(0.050)	(0.077)	(0.062)	(0.101)
Inner regional	1.464***	1.533***	1.448***	1.342***	1.697***
	(0.028)	(0.046)	(0.060)	(0.060)	(0.069)
Outer regional	1.255***	1.276***	1.165**	1.130*	1.404***
	(0.030)	(0.049)	(0.062)	(0.063)	(0.076)
Remote Australia	0.985	0.957	0.864	0.841+	1.030
	(0.045)	(0.068)	(0.084)	(0.086)	(0.102)
Married	1.136***	1.208***	1.136*	1.238**	1.179**
	(0.035)	(0.048)	(0.065)	(0.084)	(0.061)
Education- HSC completion	0.910***	0.882**	0.917	0.904+	0.809**
	(0.023)	(0.036)	(0.053)	(0.049)	(0.058)
Education -Trade/Diploma	0.859***	0.813***	0.824***	0.797***	0.771***
	(0.021)	(0.031)	(0.044)	(0.041)	(0.052)
Education- University Graduate	0.611***	0.514***	0.528***	0.577***	0.464***
	(0.015)	(0.021)	(0.030)	(0.034)	(0.032)
Income impossible	0.986	0.907	0.934	0.940	0.923
	(0.063)	(0.075)	(0.109)	(0.111)	(0.108)
Income Always difficult	1.002	0.964	0.946	0.977	0.970
	(0.032)	(0.042)	(0.057)	(0.065)	(0.057)
Income Some difficulty	0.961	0.909**	0.894*	0.870**	0.950
	(0.024)	(0.031)	(0.041)	(0.045)	(0.043)
Income Not too bad	1.010	0.963	0.971	0.926+	1.003
	(0.023)	(0.029)	(0.039)	(0.041)	(0.042)
In workforce	0.839***	0.828***	0.843***	0.842***	0.868**
	(0.018)	(0.024)	(0.033)	(0.032)	(0.039)
Unemployed	0.772***	0.760***	0.747**	0.691**	0.803*
	(0.041)	(0.054)	(0.080)	(0.093)	(0.069)
Hospital insurance	1.154***	1.173***	1.145***	1.149***	1.193***
	(0.020)	(0.031)	(0.042)	(0.046)	(0.042)
Health Care card Holder	1.077***	1.082**	1.082*	1.113**	1.040
	(0.023)	(0.030)	(0.041)	(0.040)	(0.045)
Ex smoker	0.899***	0.893***	0.922+	0.985	0.787***
	(0.017)	(0.027)	(0.039)	(0.043)	(0.034)
Smoker	0.972	0.942	0.921	1.129*	0.800***
	(0.022)	(0.035)	(0.051)	(0.069)	(0.037)

Variable	Model 1 Pooled logistic	Model 2 Panel RE logistic	Model 3 Panel RE logistic (balanced panel)	Model 4 Panel RE logistic (mid cohort)	Model 5 Panel RE logistic (young cohort)
Risky drinker	0.889***	0.844***	0.899	0.841*	0.822*
	(0.031)	(0.044)	(0.065)	(0.060)	(0.063)
Underweight	1.076	1.015	0.971	0.819	1.102
	(0.053)	(0.073)	(0.101)	(0.117)	(0.089)
Overweight	1.118***	1.126***	1.090*	1.088*	1.156***
	(0.021)	(0.031)	(0.041)	(0.044)	(0.045)
Obese	1.278***	1.312***	1.239***	1.281***	1.338***
	(0.028)	(0.045)	(0.059)	(0.063)	(0.065)
1 chronic disease	1.099***	1.093***	1.097**	1.129**	1.066+
	(0.022)	(0.029)	(0.039)	(0.046)	(0.036)
Multimorbidity	1.110***	1.099**	1.104*	1.176***	1.022
	(0.025)	(0.033)	(0.044)	(0.052)	(0.043)
Cancer diagnosis	0.951+	0.942	0.926	0.918+	1.154
	(0.029)	(0.037)	(0.047)	(0.040)	(0.119)
GP visits- 3 or 4	1.122***	1.152***	1.117**	1.206***	1.123**
	(0.022)	(0.030)	(0.039)	(0.045)	(0.041)
GP visits- 5 or 6	1.203***	1.258***	1.180***	1.226***	1.289***
	(0.029)	(0.040)	(0.051)	(0.058)	(0.056)
GP visits- 7 or more	1.441***	1.575***	1.456***	1.501***	1.620***
	(0.042)	(0.060)	(0.075)	(0.085)	(0.083)
Seen specialist in last year	1.038*	1.068**	1.039	0.986	1.153***
	(0.018)	(0.024)	(0.030)	(0.031)	(0.036)
Seen hospital doctor in last year	0.868***	0.856***	0.860***	0.787***	0.899**
	(0.018)	(0.022)	(0.030)	(0.031)	(0.031)
SF36 physical health	0.962	0.952	0.947	0.973	0.932
second lowest quintile	(0.024)	(0.031)	(0.041)	(0.044)	(0.044)
SF36 physical health	0.966	0.957	0.930	0.960	0.958
middle quintile	(0.025)	(0.033)	(0.043)	(0.048)	(0.046)
SF36 physical health	1.024	1.000	0.987	1.050	0.960
second highest quintile	(0.028)	(0.036)	(0.048)	(0.056)	(0.047)
SF36 physical health	1.111***	1.095*	1.076	1.231***	1.015
highest quintile	(0.031)	(0.041)	(0.056)	(0.072)	(0.050)
SF36 mental health	1.047+	1.052	1.012	1.007	1.084+
second lowest quintile	(0.026)	(0.034)	(0.045)	(0.048)	(0.048)
SF36 mental health	1.129***	1.131***	1.082+	1.061	1.175***
middle quintile	(0.029)	(0.038)	(0.050)	(0.052)	(0.055)

Variable	Model 1 Pooled logistic	Model 2 Panel RE logistic	Model 3 Panel RE logistic (balanced panel)	Model 4 Panel RE logistic (mid cohort)	Model 5 Panel RE logistic (young cohort)
SF36 mental health	1.209^{***}	1.227^{***}	1.177^{***}	1.244^{***}	1.171^{**}
second highest quintile	(0.032)	(0.043)	(0.056)	(0.063)	(0.058)
SF36 mental health	1.392^{***}	1.396^{***}	1.332^{***}	1.410^{***}	1.357^{***}
highest quintile	(0.037)	(0.051)	(0.066)	(0.076)	(0.067)
GP hours	1.368^{***}	1.407^{***}	1.399^{***}	1.416^{***}	1.379^{***}
	(0.027)	(0.036)	(0.049)	(0.054)	(0.049)
GP numbers	1.321^{***}	1.374^{***}	1.355^{***}	1.404^{***}	1.351^{***}
	(0.027)	(0.037)	(0.050)	(0.056)	(0.051)
Bulk-billing	0.923^{***}	0.901^{***}	0.874^{***}	0.938^{+}	0.887^{***}
	(0.016)	(0.021)	(0.027)	(0.032)	(0.028)
Female GP	1.200^{***}	1.267^{***}	1.253^{***}	1.152^{***}	1.395^{***}
	(0.023)	(0.033)	(0.044)	(0.044)	(0.051)
Lives alone	1.048	1.049	1.010	1.036	0.965
	(0.033)	(0.046)	(0.061)	(0.070)	(0.060)
Live with partner	1.076^{*}	1.075^{+}	1.108^{+}	1.010	1.012
	(0.032)	(0.041)	(0.059)	(0.057)	(0.053)
Live with children	1.257^{***}	1.314^{***}	1.241^{***}	0.966	1.552^{***}
	(0.027)	(0.038)	(0.050)	(0.047)	(0.061)
n observation	87893	87893	49713	51474	36419
N women	23661	23661			
AIC	97709.4	91485.1	49771.4	46430.3	44846.8
BIC	98281.8	92020.0	50273.8	46925.9	45323.0

Notes Exponentiated coefficients; Standard errors in parentheses Significance: $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. OR>1 indicates increased odds of having any continuity of care (personal or site). OR<1 indicates decreased odds of any continuity of care. Reference categories (OR=1) are omitted. Base case is women from NSW, major city, did not complete HSC, copes easily with available income, is not in workforce, non-smoker of normal weight, with no chronic diseases, and sees GP 1-2 times a year, no visits to specialist or hospital, is in the lowest quintile for SF-36 physical and mental health scores, reports poor/fair access to number of GPs, choice of GPs, bulk-billing, and female GP and does not live alone, or with partner or children.

5.5.1.1 Cohort Comparisons

Results of the panel RE model of the pooled data from both age cohorts (Model 2) produced broadly consistent findings with the regression analysis of each cohort separately (Model 4 for the middle cohort and Model 5 for the young cohort), including significant associations related to being Australian-born, state of residence, marital status, educational attainment, employment status, health insurance status, and health service utilisation. There were a small number of interesting differences between the age cohorts. The significant associations related to multimorbidity, increased physical health score, and increased odds of reporting continuity of care were restricted to women in the ALSWH mid cohort, and an association between decreased income status and decreased continuity of care was significant for these women. An association between decreased continuity of care and being a smoker was limited to the younger cohort of women, as was the association between decreased continuity of care and decreased access to bulkbilling. The significant association between living with children and increased odds of continuity of care was also limited to women in the young cohort.

These differences suggest that for the young women, access to bulk-billing is a greater influence of GP attendance pattern than it is for the older women, and would be consistent with them having less financial means, or placing less priority on obtaining continuity of care.

5.5.1.2 Sensitivity testing

Additional models considering age within quintiles, and including self-assessed health using a five-item Likert scale (rather than SF-36 scores) were broadly consistent. The comparison between balanced and unbalanced panel models provided consistent results, and models considering attrition within each wave did not find significant differences.

In summary, the results of Analysis One suggest multiple differences in demographics, health status and health service utilisation between women who reporting having all their care from one provider or one practice, compared with women who do not have this continuity of care. Compared with previously published literature, no significant effect of age is found once the potential non-linear association between age and continuity of care is considered and multiple health status indicators are included. Potentially, age is a proxy for other health status markers which have been accounted for in the extended list of explanatory variables within this analysis. Results related to health status are interesting in reporting improved mental health scores associated with increased continuity of care. Potential explanations for this association include that continuity of care may be associated with greater discussion of mental health issues leading to improved patient wellbeing, or women with better mental health place a greater emphasis on having continuity of care.

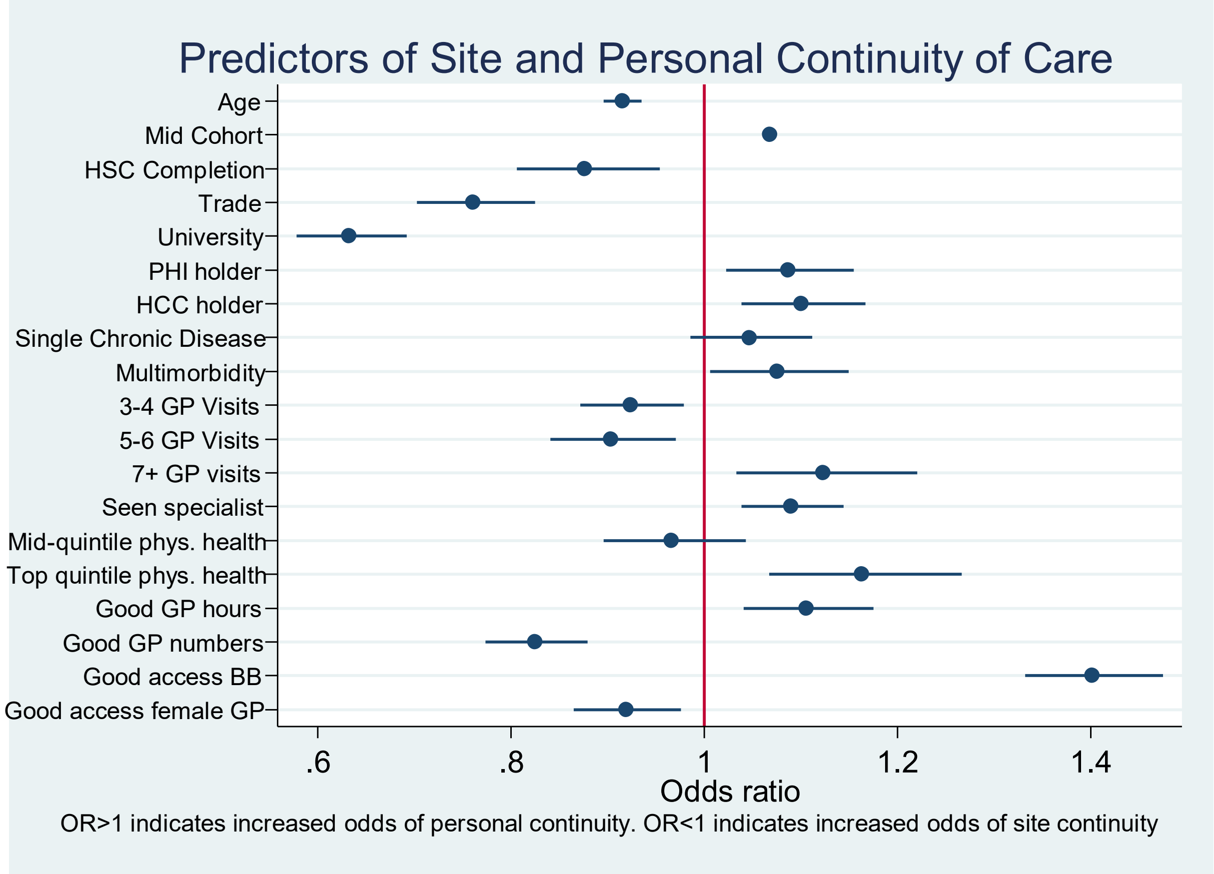
Analysis One is unable to discriminate between the associations of personal continuity and site continuity of care. Potentially for some women, having a regular practice where they seek all their care may provide sufficient continuity of care to meet their health needs. While for other women, having personal continuity of care may be important. These ideas are explored further in the analysis of the next regression

5.5.2 Comparison of women with personal continuity and women with site continuity (Analysis Two)

To further understand patient characteristics associated with site and personal continuity of care, and to determine if there are different characteristics associated with personal and site continuity of care, a second series of regression models are reported for the subgroup of women reporting continuity of care. There are 70,475 observations for 21,612 women indicating either site or personal continuity of care, and after missing values are dropped, there are 61,049 observations within this analysis. As in Analysis One, the outcome variable is a binary outcome, the preferred model is the panel RE logistic regression model, and results are reported in odds ratios. An odds ratio greater than 1 indicates an increased odds of having personal continuity of care, while an odds of less than 1 indicates decreased odds of having personal continuity of care, indicating an increased odds of having site continuity of care.

Multiple statistically significant associations are again reported, although fewer than in Analysis One. A plot of selected significant results from the panel RE logistic regression is shown in Figure 17 below. The results for the variables of interest for additional models (including a model of the balanced panel and models for the separate age cohorts) are reported in Table 18 below, and the full results are provided in Table 42 in the Appendices.

Figure 17 - Plot of selected findings from panel RE logistic Regression Analysis Two - comparison of site continuity (L of unity) and personal continuity (R of unity) for subgroup with continuity.



Note: Results indicate OR and 95% confidence interval. Result to R of unity indicates increased odds of having personal continuity (and decreased odds of having site continuity), Result to L of unity indicates decreased odds of having personal continuity/increased odds of having site continuity. Selected regression results only. Full model contains age, age squared, cohort indicator, ALSWH wave indicator, education, income, urban/rurality, state, Australian-born, marital status, labour force participation, household composition, PHI, HCC, smoking, alcohol, BMI, chronic disease, multimorbidity, cancer diagnosis, number of GP visits, Other doctor visits, SF-36 physical and mental health summary scores, satisfaction with GP hours, GP numbers, female GP, access to bulk-billing

There is a trend towards increased site continuity of care with each year of age and a strong cohort effect towards personal continuity of care, such that women in the ALSWH mid cohort have 6.8% increased odds of reporting having personal continuity of care compared with the young ALSWH cohort.

Analysis of demographic variables has shown that there was a significant trend for decreasing personal continuity of care with increasing educational attainment (p-<0.001). Women with private health insurance and women with health care cards both had an increased odds of personal continuity of care, compared to women without these forms of insurance. ($p<0.001$). Compared with women in NSW, women in Victoria, SA, WA and Tasmania had decreased odd of having personal continuity ($p<0.001$). Women who are married had a decreased odds of personal continuity compared to non-married women ($p<0.01$) as did women born in Australian compared to those born overseas ($p<0.01$). Compared with women with continuity in metropolitan areas, women in all non-metropolitan settings (regional, and remote areas) had a decreased odds of having personal continuity. Women within the lowest two quintiles for self-reported financial means had significantly increased odds of having personal continuity of care, compared with the highest quintile. There were no significant associations found regarding marital status, alcohol consumption, past history of cancer, or seeing a hospital doctor in the last 12 months.

Analysis of the relationship between continuity of care and health service utilisation revealed multiple associations. Regarding GP visits, there was a significant trend towards site continuity with increasing visits, other than for the most frequent users (seven or more annual visits) who had significantly increased personal continuity of care compared to those women with one or two GP visits ($p<0.01$). A significant association between personal continuity of care and seeing a specialist was also found ($p<0.01$). Previous authors have reported an association between increasing number of visits, and decreasing personal continuity of care, but have not considered site continuity. Analysis One showed a trend for women to be more likely to have either site or personal continuity of care with increasing GP visits. Discriminating between personal and site continuity of care shows that site continuity of care is associated with increased GP visits (which would be reflected as decreasing personal continuity in previous literature). However, beyond seven visits a year, personal continuity of care increases significantly. This potentially indicates that when patients need more GP care, they will seek to maintain continuity of care in one location even if personal continuity is not maintained. Potentially, patients with the highest health needs need to make more visits and place increasing importance on personal continuity of care.

Regarding access, while women who report greater access to a number of GPs are less likely to report personal continuity (suggesting that greater choice permits seeing other doctors in same practice), those women with greater hours of access to their GP reported higher personal continuity. And although results from Analysis One showed good access to bulk-billing was associated with lower levels of continuity of care, for those women who do have continuity, there is a significant association between good access to bulk-billing and increased personal continuity of care. This is consistent with women choosing non-regular care if it is cheaper, but if there is no price differential women would prefer to see the same GP. Of women with continuity of care, women who live with children had significantly decreased odds of personal continuity of care ($p<0.001$). This is consistent that for these women, continuity of care around a practice and its associated increased access is more important, when potentially their children may need more rapid care.

Regarding health status, women in the highest quintile of self-reported physical health were significantly more likely to have personal continuity of care compared with women in the lowest quintile ($p<0.01$), and women with multiple chronic diseases were significantly more like to have personal continuity than women with no chronic diseases ($p<0.05$), although this association was limited to the young ALSWH sample. Compared with women with an ideal weight, women with continuity categorised in the highest and lowest weight categories had significantly increased odds of having personal continuity of care, as did women who smoked.

Table 18: Selected variables of interest for logistic regression estimating probability of women having personal continuity (OR>1) versus women having site continuity (OR<1).

Variable	Model 6 Pooled logistic	Model 7 Panel logistic RE	Model 8 Panel RE logistic - balanced	Model 9 Panel RE logistic - mid	Model 10 Panel RE logistic- young
Age	0.963***	0.915***	0.931***	1.127*	1.206**
	(0.010)	(0.010)	(0.014)	(0.068)	(0.072)
Age squared	1.001***	1.001***	1.000**	0.999*	0.996***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Marker for older cohort	1.007	1.068***	1.060***		
	(0.006)	(0.004)	(0.005)		
1 chronic disease	1.028	1.047	0.995	1.023	1.074
	(0.023)	(0.032)	(0.041)	(0.042)	(0.051)
Multimorbidity	1.096***	1.075*	1.047	1.050	1.166**
		(0.027)	(0.037)	(0.047)	(0.046)
GP visits- 3 or 4	0.940**	0.924**	0.920*	0.948	0.879*
	(0.020)	(0.027)	(0.036)	(0.035)	(0.045)
GP visits- 5 or 6	0.919**	0.903**	0.904*	0.923^{+}	0.840**
	(0.024)	(0.033)	(0.043)	(0.043)	(0.051)
GP visits- 7 or more	1.085**	1.123**	1.078	1.047	1.196**
	(0.033)	(0.048)	(0.060)	(0.057)	(0.082)
Seen specialist in last year	1.052**	1.090***	1.121***	1.033	1.237***
	(0.019)	(0.027)	(0.036)	(0.031)	(0.054)

Variable	Model 6 Pooled logistic	Model 7 Panel logistic RE	Model 8 Panel RE logistic - balanced	Model 9 Panel RE logistic - mid	Model 10 Panel RE logistic- young
Seen hospital Dr in last year	1.022	1.019	1.003	0.983	1.070
	(0.023)	(0.031)	(0.040)	(0.038)	(0.051)
SF36 physical health	0.950^{+}	0.946	0.969	0.924^{+}	1.013
second lowest quintile	(0.025)	(0.034)	(0.045)	(0.041)	(0.066)
SF36 physical health	0.979	0.966	0.944	0.946	1.034
middle quintile	(0.027)	(0.038)	(0.048)	(0.046)	(0.068)
SF36 physical health	0.982	0.972	1.028	0.959	1.021
second highest quintile	(0.028)	(0.040)	(0.055)	(0.050)	(0.068)
SF36 physical health	1.199^{***}	1.163^{***}	1.190^{**}	1.127^{*}	1.254^{***}
highest quintile	(0.036)	(0.051)	(0.070)	(0.065)	(0.085)
SF36 mental health	1.020	1.029	1.041	1.015	1.057
second lowest quintile	(0.029)	(0.040)	(0.053)	(0.049)	(0.067)
SF36 mental health	0.996	1.014	1.006	1.030	0.993
middle quintile	(0.028)	(0.040)	(0.052)	(0.051)	(0.065)
SF36 mental health	0.993	1.005	1.003	1.022	0.972
second highest quintile	(0.028)	(0.040)	(0.053)	(0.051)	(0.067)
SF36 mental health	1.071^{*}	1.083^{+}	1.045	1.055	1.141^{+}
highest quintile	(0.030)	(0.044)	(0.057)	(0.055)	(0.077)
n	61049	61049	35477	40587	20462

Notes Exponentiated coefficients; Standard errors in parentheses Significance: $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ Note OR>1 indicates increased odds of having personal continuity (and decreased odds of having site continuity), OR<1 indicates decreased odds of having personal continuity/increased odds of having site continuity. Selected results only. Full model provided in Table 42 in the Appendix. Reference categories (OR=1) are omitted. Base case is women from NSW, major city, did not complete HSC, copes easily with available income, is not in workforce, non-smoker of normal weight, with no chronic diseases, and sees GP 1-2 times a year, and is in the lowest quintile for SF-36 mental and physical health.

5.5.2.1 Cohort comparisons

Regarding age, the separate analysis of mid and young ALSWH age cohorts (Models 9 and 10) suggest that within each ALSWH age cohort there is an increasing odds of having personal continuity of care with age, however the polynomial age squared suggest that as women are ageing the significant effect is lessening. This age effect is no longer significant once the cohort effect is included in the model of the full sample of women in Model 6 and indicates the usefulness of comparing the separate age cohorts within this thesis. Overall women are more likely to have personal continuity if they are older, and as they age, but the association towards increasing personal continuity is less for older women than younger women. These results are consistent with the earlier analysis of summary statistics reported in Chapter 4 of this thesis which suggest site continuity of care is increasing for all women, and that older women are more likely to report personal continuity than younger women. Interestingly once controlling for a broad range of demographics, the association between increasing age and continuity of care is stronger in young women, who are potentially increasing from a lower level of continuity of care.

Table 19 reports all variables associated with significantly increased continuity of care in Analysis One, and classifies them according to whether they were associated with significantly increased personal continuity, significantly increased site continuity (also indicating reduced personal continuity), or with no significant findings in Analysis Two.

Table 19: Variables associated with increased continuity of care in Analysis One, classified according to whether associated with significantly increased personal or site continuity of care or neither in Analysis Two

Increased Personal Continuity of Care	Increased Site Continuity of care	No significant trend
PHI Highest physical health HCC Obesity Specialist doctor Better GP hours Bulk-billing Multimorbidity 7+ GP visits	Australian-born Non-metropolitan setting Higher education status 3-6 GP visits Female GP Live with children Age Not working	Mental health status One chronic illness

Increasing age is associated with increasing site continuity, as is living in any location (inner regional, outer regional and remote) compared to the referenced metropolitan location. Women with private health insurance and health care cards have results favouring personal continuity, as did respondents with multiple chronic diseases and high usage of GP services.

Results are broadly consistent across the middle and young cohorts (Models 9 and 10 in Table 42 above), with fewer differences between the women in either ALSWH age cohort found in this analysis than in Analysis One**.**

5.6 Discussion

The results of this analysis provide a number of insights into the characteristics of Australian women who have continuity of general practice care.

Even after controlling for a rich selection of co-variates, women with one or more chronic health conditions have significantly increased odds of having continuity of care. Furthermore, women with multiple chronic conditions had significantly increased odds of having personal continuity of care. This suggests that these women (potentially with more complicated health needs) perceive a potential benefit from having both personal and site continuity. One potential explanation for these findings is that continuity of care is being obtained by women who are anticipated to gain the greatest utility from a therapeutic doctor-patient relationship, such as those women who are more frequent GP users and those with chronic diseases. However, there could be other potential explanation and causality cannot be inferred using this observational data.

The findings that women are more likely to have continuity of care when they are married, have private health insurance and when they are not working are consistent with previous Australian and international research (Baker & Jeffers 2016; Jatrana, Crampton & Richardson 2011; McRae et al. 2011; Veale et al. 1995). The association with increasing education and decreasing continuity of care has been reported by previous authors (Nutting et al. 2003). For women with higher educational attainment, increased health literacy may reduce perceived need for an agent within the doctor-patient relationship.

Analysis of the relationship between continuity of care and health service utilisation revealed multiple associations. Increased personal and site continuity of care was associated with increased usage of GP and specialist doctor services, and decreased levels of hospital doctor usage. Previous authors have reported an association between increasing number of visits, and decreasing personal continuity of care, but have not considered site continuity. Similar to previous literature, Analysis One finds an association between increased continuity of care and increasing GP visits. Discriminating between personal and site continuity of care in Analysis Two shows that site continuity of care is associated with increased GP visits until six visits a year beyond which personal continuity of care increases significantly. Potentially for these women, as they increase their use of health services they seek care within a practice and have the benefit of a shared record, thus maintaining site continuity of care even if personal continuity is reduced. For the most frequent attenders, potentially an additional benefit is found in having a stronger doctor-patient relationship, and personal continuity of care increases.

The large survey size and the long-term nature of the study add robustness to these findings in Australian women. However as the ALSWH data is limited to women, generalisability of these findings to the male population is not possible. Furthermore, the ages of the cohorts limit applicability to older women, who potentially may have different continuity seeking behaviour. While the ALSWH sample was reasonably representative of the Australian population at baseline, with attrition the survey population has become healthier, more highly educated and less culturally diverse than the Australian population. This may further limit the generalisability of these findings to the general population. Attrition between Wave 2 and Wave 3 was considered in the models, but as the dependent variable was not measured until Wave 2, it is not possible to estimate the effect of early attrition on these results.

This research has included a rich list of covariates derived from the ALSWH related to patient, practice and access characteristics. There are potentially additional unobserved variables which may influence a woman's ability to obtain continuity of care and omitted variable bias is a limitation The ALSWH nature provides no information about the quality of care provided by GPs, nor characteristics of practices, such as their size or what type of services are offered, and other potentially important variables have not been included within this model. If these unobserved variables are missing at random then the assumptions of the random effects model hold. Although the broad consistency across the models gives some reassurance about the robustness of the models, the random effect model relies on strong assumptions. These assumptions are unable to be tested within this analysis, but fixed effects models and instrumental variables are used to control for unobserved heterogeneity in the next two empirical chapters within this thesis.

As well as demographic factors, these results reveal the importance of supply side variables on women seeking continuity. Those women with better self-reported access to services were more likely to report continuity of care. Interestingly those women with better access to bulk-billing were less likely to report having continuity of care. This finding is consistent with existing preference research which suggests patients may be willing to forgo continuity of care to avoid health costs, particularly when they consider the reason for consultation less serious (Kenny et al. 2016), and supports anecdotal evidence that patients may ‘shop around’ to avoid GP fees. The results of Analysis Two showing access to bulk-billing and good opening hours are both associated with increased personal continuity may indicate that women would seek more personal continuity if it could be obtained with bulk-billing. These findings are consistent with women choosing an appointment with their preferred GP if available, but an earlier appointment with any GP in a practice may be adequate, particularly if the earlier appointment is at lower cost. One potential explanation could be that women are seeking site continuity to improve access and cost, and for most women this is sufficient continuity of care (particularly those women living with children). However given the endogeneity of variables in this model and the use of observational data, these results indicate associations and causal effect cannot be inferred.

The association between health status and continuity of care was more complex and less easily interpreted, a finding voiced by previous authors (Bayliss et al. 2017; McRae et al. 2011). The use of SF-36 summary scores has permitted differentiation between mental health and physical health, a potential improvement over the use of a five-item Likert-like scale. Within this analysis there was a trend for increasing continuity of care for women with increasing mental health and an association with the highest reported physical health. Previous New Zealand research suggested increased rates of practice affiliation for patients who have poor self-reported health status compared with good health (Jatrana & Crampton 2009), while Australian research (McRae et al. 2011) reported that patients who were in excellent/very good/good self-reported health were more likely to have a single GP, while an American study found no significant association (Bayliss et al. 2017). Potentially, patients with poorer health may require more urgent care, and in the absence of enforced continuity through registration, and because of cost or access barriers, Australian patients may seek care at other providers and this may influence the association between continuity of care and health status. Self-reported health is potentially both an explanatory variable correlating with continuity of care-seeking behaviour, and an outcome related to receipt of continuity of care. This issue of endogeneity of health status in continuity of care research will be examined in the next empirical chapter of this thesis.

Overall, there are fewer significant findings for the younger cohort of women compared to the middle cohort. The associations between chronic disease and multimorbidity are less apparent, but the age effect for site continuity is persistent. This is unsurprising given the lower burden of disease in the younger population. Furthermore, the finding that site continuity is significantly higher for women in the age group who have children, could mean that the health needs of their children are influencing their GP attendance patterns, and suggests that information sharing (such as a shared health record within a practice) provides them with sufficient continuity of care and that obtaining continuity with one provider is considered less important.

ALSWH participants are surveyed approximately every three years. Given this long time frame, it is unclear whether additional factors influence patient continuity of care-seeking behaviour in the intervening period. Analysis of more regular data may permit a more robust understanding of whether continuity seeking behaviour is fixed.

There are potentially unobserved patient-level and provider characteristics which may confound the association between reported patient characteristics and a woman's likelihood for having continuity of care. These might include additional variables which are not available from the ALSWH survey data, or otherwise unobserved characteristics, such as patient preference for seeking a doctor who they know. For instance, the results of the analysis of the GP Survey indicated that a general practice with a larger number of GPs may have more capacity to provide all care within the practice. This would increase the likelihood of a women having site continuity of care. However practice size is not reported in the ALSWH data. In order to lessen the impact of any correlated errors, an extended list of covariates was included in these analyses but results will still likely suffer from omitted variable bias.

Considering both personal and site continuity of care in the models provides additional insight. For example, for women who live with their children there is a strong trend for having continuity of care, but towards having site continuity of care. While for women in the best physical health and women with private health insurance, an association is found for continuity of care in general, and particularly for having personal continuity of care. These findings suggest that site continuity and personal continuity may be associated with different patient characteristics and failing to consider both personal and site continuity of care within Australia may overlook these differences.

5.7 Conclusion

These findings suggest that most women prefer to obtain continuity of care by attending one primary care practice. However, a subset of the population, who are more likely to be high frequency attenders with multiple chronic diseases, potentially perceive an additional benefit if they receive personal continuity from one GP. Given the observational nature of the data, these results indicate associations rather than causation. The impact of these different levels of continuity of care on health screening will be reported in chapters 6 and 7 of this thesis in analyses that control for the endogeneity of continuity of care.

The next empirical chapter of this thesis investigates the association between continuity of primary care and the quality of care.

6 Chapter 6 – Continuity of care and cancer screening

6.1 Chapter summary

Chapter 6 reports the first of two analyses of the relationship between continuity of primary care and the quality of primary care. In this analysis, preventative cancer screening is used as a proxy for the quality of primary care.

The aim of the research reported here is to investigate the extent to which different levels of continuity of care (personal continuity, site continuity, reduced continuity) are associated with rates of Pap testing and mammography according to Australian guidelines. It is predicted that women with continuity of care will report increased rates of cancer screening compared to women with reduced continuity of care. Using self-reported information collected from women in the mid and young ALSWH cohorts, regression models are constructed to estimate rates of Pap testing and mammography for women according to continuity of care type, and taking into account patient demographics, access to health services and practice characteristics. Panel data models are utilised, and instrumental variables are used to control for the endogeneity of personal continuity of care.

The results of the logistic regressions indicate that compared to women with reduced continuity of care, women with either site or personal continuity of care are statistically significantly more likely to report participating in Pap test and mammography screening. The IV regression results indicate that women in the young ALSWH cohort with personal continuity of care report statistically significant increased rates of Pap testing compared to women with site continuity of care, or women with reduced continuity of care. These results suggest that personal and site continuity are associated with increased rates of cancer screening in Australian women.

6.2 Background and motivation

It is important to investigate the relationship between different patterns of primary care attendance and health care utilisation, as this has implications for health policy, particularly in terms of how to best structure the Australian health system to maximise efficiency. Preventative screening is considered a core role of primary care, and early detection and treatment of cancers is a priority for governments and for medical professional organisations (National Preventative Health Taskforce 2009; RACGP 2016; The Cancer Council Australia 2007). This research focuses on the association between continuity of primary care and two cancer screening tests: Papanicolaou smear testing ('Pap test') for early detection of cervical cancer; and mammography (an imaging test of compressed breast tissue) for early detection of breast cancer.

The Australian National Cancer Screening Program was introduced in 1991, and at that time, recommended second-yearly screening by Papanicolaou smear (Pap test) for all women between the ages of 18 and 69 who have ever been sexually active, for early detection of cervical cancer (National Health and Medical Research Council 2005)[19], and second-yearly breast cancer screening using mammography for asymptomatic

[19] A review of the National Cervical Screening Program was completed in 2013 (Commonwealth of Australia 2013) and recommended a number of changes to the screening program– including starting screening from the age of 25 years, and converting from second yearly cytology (Pap) testing to five-yearly cervical screening including liquid cytology and partial HPV testing. This policy change does not cover the timeframe of the data used in this analysis.

women aged between 50 and 69 years of age (expanded to women aged between 50 and 74 years of age since 2013)[20]. Mammography services (known as BreastScreen) and cervical screening services are coordinated by each state or territory, with each Australian state currently operating a state-based screening register. A National Cancer Screening Register was due to become operational in 2017, but is delayed due to difficulties with data migration (Murphy 2017).

6.2.1 Cervical cancer and cervical screening in Australia

In 2012, cervical cancer was the fourth most common cancer diagnosed worldwide (International Agency for Research on Cancer 2014). In Australia, cervical cancer was the 14th most commonly diagnosed cancer in women in 2013, and caused death at an age standardised rate of 1.8 per 100,000 women (AIHW 2017b). Since the introduction of the program, a woman's risk of cervical cancer diagnosis before the age of 75 has halved from 1.00% to 0.5% (AIHW 2017b),

Most cervical cancer screening in Australia is conducted by general practitioners within community-based practices during routine consultations. Medicare subsidises GP and specialist visits for any health reason, including for individual health screening and health promotion, and (with few exceptions) there is no specific GP remuneration for

[20] Women over 40, and women aged over the target range (over 70 years of age until 2013, and currently those above 75 years of age) are not routinely recalled but are able to self- request a free screening mammography from BreastScreen.

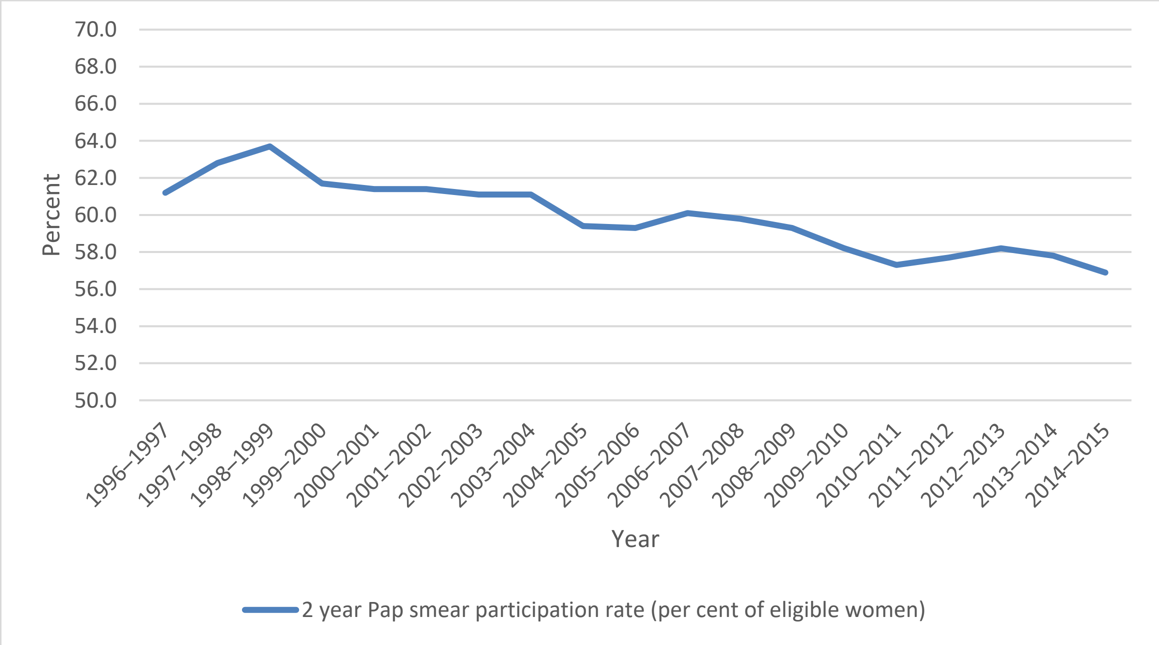
performing Pap tests[21]. There is the potential for out-of-pocket costs associated with GP consultations, including those where a Pap smear was performed.

Cervical cancer prevention has been enhanced by the introduction of the National Human Papilloma Virus (HPV) vaccination program. HPV is considered the precursor to development of all cervical cancers, and the HPV vaccine provides immunity against the strains of HPV which most commonly cause cervical cancer—HPV 6/11/16 and 18 (Clifford et al. 2003). Girls aged between 12 and 13 have received funded vaccines since January 2007, and boys commenced vaccination in 2013. An additional catch-up program provided offered immunisation to women under 27 years of age from 2007 until 2009 (Garland, Skinner & Brotherton 2011). Evidence suggests the immunisation provides up to 90% reduction in HPV infection (Garland et al. 2016; Gertig et al. 2013; Osborne et al. 2015). Decreasing prevalence of HPV infection (secondary to the immunisation program) has prompted a review of the screening program, and from 2018, all women between 25 and 74 years of age will be invited to have a five-yearly Cervical Screening test, which includes liquid cytology smear testing and HPV strain analysis (Cancer Institute NSW 2017a; Commonwealth of Australia 2013) [22].

[21] Incentives within the Practice Incentives Program exist for GPs to complete smear on women who have not had a smear for over four years. Separate remuneration is also available for practice nurses to complete Pap testing on behalf of a medical practitioner.

As shown in Figure 18 below, there has been a gradual decline in Pap test participation rates since 2000 (AIHW 2017b), and 2015-16 figures indicate that the participation rate for women aged between 20-69 years of age is 56.3% (AIHW 2017b).

Figure 18 – Two-yearly Australian population Pap test participation rates (1996-2015)[23]



Source: AIHW 2017b

Figures from 2015-16 suggest that Pap test participation increases from 40% of eligible women aged 20-24 year of age up to a maximum of over 62% of eligible women aged between the ages of 45 and 54, before declining to 54% of women in the 65-69 year age bracket (AIHW 2017a).

[23] Eligible population of women aged between 21-69 who have been sexually active. Note there are minor changes in calculation of eligible population between 2003-04 making direct comparison of participation rates prior to this difficult.

6.2.2 Breast cancer and preventative screening

Breast cancer is the second most commonly diagnosed cancer in Australian women (after bowel cancer) and the second most common cause of cancer death (after lung cancer) with over 75% of cancers occur in women over 50 (AIHW 2016a, 2016b).

BreastScreen offers free mammographic screening every two years for asymptomatic women in the target age range [24]. This organised (as opposed to opportunistic) screening is characterised by invitations/reminders being sent to women within the eligible age categories, recall of women with detected abnormalities, and coordination of further treatment (clinical assessment, biopsy or specialist intervention) if necessary. Australian women of all ages are also advised to be aware of the normal appearance of their breasts, and to promptly report any changes to their general practitioner (Cancer Australia 2015). Since 2015, routine clinical examination or breast self-examination is no longer recommended, since the International Agency for Research on Cancer concluded that there was inadequate evidence to support examination as an intervention to decrease breast cancer mortality (Lauby-Secretan et al. 2015).

No referral is required to attend BreastScreen Australia clinics and attendees do not need to have a regular GP. However GPs and general practice nurses are encouraged to increase women's confidence in breast screening by helping them to understand the benefits and limitations of mammography and to encourage ongoing participation

[24]BreastScreen initially targeted women aged between 50 and 69 years of age, and since July 2013 has expanded to include women aged between 50 and 74 years of age. Women over 40, and those women over the target range are not routinely recalled but are able to self- request a free screening mammography from BreastScreen.

(Cancer Institute NSW 2017b). BreastScreen produce a range of resources including GP referral pads (despite them not being strictly necessary), information sheets, and posters which can be used to increase awareness within a practice. If a woman nominates a GP, the GP will be provided with the results of screening tests. GPs (and practice nurses) have a role in reinforcing the benefits of the screening program opportunistically during other consultations. Practice staff (GPs, practice nurses, or administrative staff) may add a recall or reminder to patient records within their practice-based systems advising women to return for a regular review and practices may display information encouraging mammography within the waiting room. This sharing of information between patient and GP, along with the education and reinforcing role about the benefits of mammography, are all theorised to be more likely to occur when women have continuity of care.

A 2009 evaluation report concluded that BreastScreen Australia is broadly available, accessible and acceptable to many women, and estimated that the program had reduced mortality from breast cancer in the target group by 21-28% (BreastScreen Australia Evaluation Advisory Committee 2009). These results are comparable with the 20% estimated breast cancer mortality effect of screening mammography suggested by World Health Organisation (World Health Organisation 2014) and the predicted 30% reduction in breast cancer deaths estimated by Hall et al. in the initial cost utility assessment of the planned Australian mammography program (Hall et al. 1992). The Australian mortality reduction was achieved with a participation rate of 56%, (noting the program has never reached the target participation rate of 70% of eligible women). Most recent available information reports a BreastScreen participation rate for women aged 50-69 years of 54.0%, having fallen slightly from nearly 57% in 2000-01. The highest participation within the target age range is 59.5% for women aged 65-69 years, with lower rates for women aged between 60-64 (58.6%), 55-59 (53.1%) and 50-54 (48.9%) years of age (AIHW 2016b).

6.2.3 Existing literature

Existing research into primary care cancer screening

Previous researchers have investigated barriers and enablers to Pap testing and mammography in the Australian context (Byles et al. 2014; Cockburn et al. 1992; Fiebig et al. 2009; Heywood, Firman & Ring 1996; Munro et al. 2014; Stewart & Thistlethwaite 2010) and internationally (Bowser et al. 2017; Gannon & Dowling 2008; Jepson et al. 2000; Jia et al. 2013; Oscarsson, Wijma & Benzein 2008; Sutton & Rutherford 2005).

A doctor's recommendation is a strong motivator for a woman to participate in breast cancer screening (Meissner et al. 2007; Roman et al. 2014; Villani & Mortensen 2013) and Pap testing (Coughlin et al. 2005; Fiebig et al. 2009; Nguyen et al. 2002; Peterson et al. 2008; Roman et al. 2014; Sabatino et al. 2008), and is consistent within the role of the general practitioner in health promotion and disease prevention (Calnan 1995; Peckham, Hann & Boyce 2011; World Health Organization 2008).

Commonly identified patient-related barriers to Pap testing include increased age (Byles et al. 2014; Cockburn et al. 1992; Jia et al. 2013; Kaida, Colman & Janssen 2008; Nguyen et al. 2002; Oscarsson, Wijma & Benzein 2008), lower educational attainment

(Jia et al. 2013; Nguyen et al. 2002; Sutton & Rutherford 2005), not having a partner (Cockburn et al. 1992; Nguyen et al. 2002; Olesen et al. 2012), as well as a feeling that smears are not necessary because women believe they are healthy (Oscarsson, Wijma & Benzein 2008) or because women have had previous unpleasant experiences (Oscarsson, Wijma & Benzein 2008; Stewart & Thistlethwaite 2010).

Practitioner and health service barriers for Pap testing include male gender of doctor or nurse (Heywood, Firman & Ring 1996; Nguyen et al. 2002; Stewart & Thistlethwaite 2010), and presence of any/higher financial cost of smear testing (Jepson et al. 2000; Peterson et al. 2008; Stewart & Thistlethwaite 2010), while telephone invitations and reminders to screen have been found to increase participation (Everett et al. 2011). There are potential out-of-pocket costs for women in Australia, both related to the analysis of the Pap test, and the associated GP consultation which may act as a disincentive to Pap testing. Barriers to screening may differ between age groups, with younger women reporting practical difficulties (such as difficulty in making an appointment), or thinking screening was unnecessary after the HPV vaccine, while older women may not realise the need for screening beyond menopause, or have made a decision not to participate in screening (Munro et al. 2014; Waller et al. 2012).

Previous authors have considered predictors of mammography using ALSWH data (Byles et al. 2014; Leung et al. 2014). Leung et al. analysed data from waves 3 to 6 of the ALSWH in order to understand patterns of breast screening, and their potential effect on breast cancer survival in rural and urban locations, and reported that 77% of women in the target age range had a mammogram in the past two years. Compared to women in metropolitan areas, women in remote and inner regional areas were statistically significantly more likely to report having a mammogram in the past two years. There was no significant difference in participation for women living in outer regional areas and metropolitan areas (Leung et al. 2014). Byles et al. (2014) examined factors related to mammography and Pap testing and reported that women were more likely to have a mammogram and less likely to have a Pap test with increasing age, but more GP visits were associated with increased odds of screening regularly.

Continuity of care and health screening

The literature review in Chapter 2 identified one study investigating the association between continuity of care and cancer screening which consider temporality of continuity of care. The research by Reddy (2015) analysing the impact of losing a regular GP (through relocation or retirement) included the receipt of mammographic screening as an outcome. While there was a significant decrease in patient experience measures[25]* for those 9% of the population who lost their regular GP in the previous year compared to the remaining sample, there was no statistically significant difference in terms of receipt of mammography (88.9 % with GP loss versus 88.3% without GP loss, p=0.69), (Reddy et al. 2015).

A small body of additional literature considers the association between patterns of primary care attendance and cancer screening. A large Canadian primary care cohort study (Menec, Sirski & Attawar 2005) investigated the association between the

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[25] These experience measures included how well doctors/nurses communicate, rating of personal doctor/nurse, getting needed care, overall rating of Veterans Affairs (VA) health care, and ability to get care quickly.

proportion of care delivered by one GP and the likelihood of having appropriate preventative health care, including Pap testing and mammography for women aged between 50 and 69 years of age. Women were classified into high and low continuity according to whether more than 75% of their care was provided by one GP (with a sensitivity analysis at 50% of care), and results showed significantly higher Pap testing rates for women with more than 50% or 75% of their care from one provider, and higher mammography rates for women with more than 50% of care from one provider, but no significant difference at the 75% level.

As discussed in Chapter 3, results of the New York telephone survey by O'Malley et al. (1997) reported significantly increased rates of mammography for women with a regular practice or regular GP compared to women with neither, and significantly increased rates of Pap testing for those women with a regular GP above women without a regular clinician (O'Malley et al. 1997), while Atlas et al. (2009) reported statistically increased rates of mammography and Pap testing for those patients with a regular GP, compared to patients with a regular practice but without a regular GP ($p<0.001$). More recently Dreiher et al. (2012) reported no association between continuity of care (considered within quartiles of UPC and COCI) and mammography in an Israeli general practice setting (Dreiher et al. 2012).

As identified in Chapter 5, continuity of care may be endogenous to quality of care and this endogeneity potentially biases results. No published literature has considered endogeneity of personal continuity of care, or endogeneity of continuity of care in an Australian primary care setting and its association with cancer screening. However, a small body of research has been published which uses IV estimates and other approaches to account for the endogeneity of having a usual site of care (having a particular clinic, health centre, doctor's office, or other place attended when sick) and its association with preventive screening.

In an analysis comparing the association between having a usual site of care and receipt of preventive health tests (blood pressure checks, cholesterol checks, immunisation, mammography and Pap tests), Ettner (1996) used the length of time at current address as an IV (based on the assumption that people who had lived in an area for a longer period of time would be more likely to have identified a usual source of care) in a population of 230,498 women aged over 18. Prior to using IV correction, having a usual site of care was associated with significantly increased rates of mammography, blood pressure monitoring and cervical screening. After IV correction, the significant association between having a usual site of care and screening increased for mammography and Pap tests, but was no-longer significant for blood pressure (Ettner 1996). The research does not investigate personal continuity of care.

Xu (2002) reported rates of receipt of preventative health services in an adult population (n=15501) according to whether respondents report having a regular doctor (and a regular site of care), a regular site of care (without regular doctor), or neither. In an approach which utilises a Heckman correction model (Heckman 1976) to account for the endogeneity of having a regular site versus a regular provider, the author estimates the differences in rates of preventative service receipt (including Pap test and mammogram). While Xu reported significant differences in screening rates for blood pressure and cholesterol, there were no significant differences in rates of mammography and Pap tests (Xu 2002).

The limited longitudinal research considering continuity of care and cancer screening or controlling for the endogeneity of care within models is an evidence gap and the focus of this analysis.

The results of the limited studies to date are inconclusive. While some studies have reported significantly increased screening associated with having a usual practice (Ettner 1996) others have reported statistically significantly increased rates of appropriate screening for women with personal continuity compared to those with site continuity (Atlas et al. 2009). Yet other studies have reported that patterns of care have no effect on increasing cancer screening rates (Dreiher et al. 2012; Reddy et al. 2015; Xu, Dowd & Abraham 2016). Finally, much of the research is cross-sectional in design, thus providing no information about causality.

There is uncertainty about whether site continuity of care and personal continuity of care are associated with increased cancer screening in combination, or whether any association holds for site continuity or personal continuity individually. While previous authors have considered either site or personal continuity, few papers have considered both levels of continuity and no published literature from Australia has been found. This evidence gap is the focus of this research.

This analysis extends the existing evidence by using longitudinal data and instrumental variables and clearly considering differences between site continuity, personal continuity, and reduced continuity of care in the analysis. This current research also expands on previous analysis of ALSWH data by Leung et al. (2014) and Byles et al. (2014) through inclusion of additional (and more recent) waves of data, and consideration of access variables and health service utilisation patterns (most notably continuity of care).

6.3 Research questions

This research seeks to understand if there is an association between continuity of primary care, and cancer screening by answering the following research questions:

- What are the rates of recommended cancer screening tests (mammograms and Pap tests) for women with personal or site continuity of care compared with women without continuity of care?
- Do women with personal continuity of care have significantly different rates of recommended cancer screening tests compared with women with site continuity?

6.4 Conceptual model

The decision to screen is assumed to provide greater utility through the prospect of improved long-term health outcomes. Women's participation in screening will be based on a host of factors including their preferences, their knowledge of screening benefits, their access to care as well as the recommendations and advice of their agent (i.e. the GP). Building on the previous chapters in this thesis, the hypothesis in this chapter is that greater continuity of care encourages a stronger doctor/patient relationship, and should therefore lead to improved screening participation, holding all other factors constant.

Given that screening participation is not influenced by health status or symptoms, screening behaviour potentially provides an indication of the value of agency in the doctor-patient relationship.

Although it is not possible to observe a woman's utility directly, we can observe whether a woman chooses to screen regularly. Following an approach used by Birch et al (2007), let V* be the difference between utility with screening and utility without screening. This difference is not observed, but is assumed to arise from the model:

$$V^* = X'\beta + \mu$$

where μ has a normal distribution, with mean zero and variance one. X is a vector of variables that includes the strength of the agency relationship. For those women where V* is positive, the model is estimated on them choosing to screen and when V* is zero or negative they choose not to screen (S).

$$S = \begin{cases} 1 & \text{if } V^* > 0 \\ 0 & \text{if } V^* \leq 0 \end{cases}$$

The model accounts for a range of personal characteristics that may help explain a woman's decision as well as the strength of the agency relationship as proxied by the continuity of care variable.

6.5 Data sources

Once again this research uses individual-level data from women in the mid and young ALSWH cohorts. Analysis starts from Wave 2, when continuity of care measures are available, although participant demographic data from Wave 1 are utilised.

6.5.1 Variables included with this analysis

6.5.1.1 Pap test and mammogram (outcome variables)

The outcomes variables relate to whether women report having a cancer screening test (Pap test or mammogram) within Australian recommended timeframe. Each ALSWH survey asks women when they last had a Pap test, and women in the mid ALSWH cohort are asked when they last had a mammogram. Responses to these questions permit calculation of a binary outcome variable based on whether women report having a Pap test or mammogram in the last two years, the guideline recommended time for preventative screening (RACGP 2016).

6.5.1.2 Variable of interest (continuity of care)

As in previous chapters, self- reported attendance with same GP and same practice is used to calculate subjective measures of personal and site continuity of care and women are classified into one of three categories in each survey (personal continuity, site continuity and reduced continuity). In this analysis dummy variables are included in the model indicating whether women have site continuity of care or personal continuity of care.

6.5.1.3 *Other variables*

Previous research into preventative screening and continuity of care has guided variable selection and exclusion criteria (Atlas et al. 2009; Labeit & Peinemann 2017; Saultz & Lochner 2005; Xu, Dowd & Abraham 2016). As well as variables known or suspected to affect continuity of care, a rich set of control variables from ALSWH are included. These are described and detailed in Table 20 below.

Sociodemographic characteristics include respondent age, urban/rural location of residence, Australian state of residence, highest educational attainment, marital status, measures of income status, employment status, possession of private health insurance, and possession of pension/concession card status.

Access to services and GP availability are potentially important factors in screening. Survey participants report their satisfaction with access to GP and other services—satisfaction with access to Pap test services, access to mammography, having a doctor who bulk-bills them, and access to a sufficient choice of GPs and the hours of their preferred practice[26]. These variables are included as proxies for access to general practice and screening services. Potentially women with a greater choice of GPs may have increased site continuity if these GPs are co-located, or report decreased continuity if they the GPs are in another location. Access to bulk-billing potentially influences

[26] In each ALSWH survey question ask women to rate their satisfaction with access to services on a five-item scale, with 'don't know' as the sixth response option. There are large numbers of 'don't know' in ALSWH survey waves 1 and 2. Where women supply a response to these variables in later waves, 'don't know' responses are recoded as per this later response (assuming that early absent response is due to not having accessed services and being unable to rate their access). This approach reduces missing values and improves precision of the analysis but assumes that there is no change in access levels between earlier wave and later response.

continuity in multiple ways. If increased access to bulk-billing is available within a patient's preferred practice, then increased bulk-billing would be anticipated to be associated with increased site continuity of care. However, if bulk-billing was more available at alternative practices, then a reduction in site continuity of care is anticipated. Access to a female doctor has previously been associated with increased mammography and cervical screening rates (Ince-Cushman et al. 2013; Lurie et al. 1993), and survey respondents also rate their access to a female GP, and this is included within the model. Women in the young cohort were surveyed about their satisfaction with the personal manner (courtesy, respect, sensitivity, friendliness) of the GP at their most recent GP visit. These access and satisfaction variables are recoded from a five-item scale to dummy variables, according to whether women report good or better access (ie good, very good or excellent), or otherwise (fair or poor). The satisfaction with GP personal manner variable is included as an instrumental variable as a subsequent analysis of women in the young cohort.

A previous abnormal test (mammogram or Pap test) may influence subsequent screening behaviour. An indicator for a previous abnormal test is included within the model (and models which exclude women reporting previous abnormal screening tests are provided as part of sensitivity testing). All variables used within the analyses of this chapter are summarised in.Table 20 below.

Table 20: Variables used within model - description and categories

Variable name	Description	Variable description and categories
Continuity of care	Pattern of care categorised according to self-reported GP and practice continuity	2 = personal continuity of care (all care provided by one GP); 1 = site continuity of care (all care from one practice but different GPs); 0 = neither site nor personal continuity*
Pap test	Pap test within past two years	1 = Yes; 0 = No
Abnormal Pap test	Previous abnormal Pap test	1 = Yes; 0 = No*
Access to Pap tests	Access to Pap test	Pap test access considered Good or better 1 = Yes*; 0 = No
Mammography	Mammogram within past two years	1 = Yes; 0 = No
Abnormal mammogram	Previous abnormal mammogram	1 = Yes; 0 = No*
Access to mammogram	Access to mammography	Mammography access considered Good or better 1 = Yes*; 0 = No
Previous breast cancer**	Previous breast malignancy	1 = Yes; 0 = No*
Previous mastectomy**	Previous surgical removal of entire breast	1 = Yes; 0 = No*
Previous lumpectomy	Previous breast lump removal	1 = Yes; 0 = No*
Access to female GP	Access to female GP	Female GP access considered Good or better 1 = Yes*; 0 = No
Access to bulk-billing	Access to bulk-billing services	Bulk-billing access considered Good or better 1 = Yes*; 0 = No
Number of GPs	Self-rated access to quantity of GPs	Access to number of GPs considered Good or better 1 = Yes*; 0 = No
GP hours	Self-rating of hours of GP	GP hours considered Good or better 1 = Yes*; 0 = No
Age	Age coded to 1/10 of a year and categorised in decades	1 = 20-29.9*; 2 = 30-39.9; 3 = 40-44.9; 4 = 50-59.9; 5 = 60-69.9
Cohort	Age cohort of women	Y = young cohort (women born between 1973-78); M = middle cohort (women born between 1946- 51)
State	State of residence in Australia	1 = NSW*; 2 = Vic; 3 = Qld; 4 = SA; 5 = WA; 6 = Tas; 7 = ACT; 8 = NT
Australian born	Country of birth	1 = Australia*; 0 = other country of birth
ARIA group	Residence coded according to Accessibility/remoteness index of Australia (ARIA)	1 = major city*; 2 = inner regional; 3 = outer regional; 4 = remote or very remote
Married	Marital status	1 = Married or living with de facto*; 0 = otherwise
Education	Highest educational attainment	1 = did not complete Higher School Certificate (HSC); 2 = HSC completion*; 3 = Trade/Diploma; 4 = University Graduate

Variable name	Description	Variable description and categories
Income	Ability to cope with available income	1 = impossible; 2 = difficult all the time, 3 = difficult some of the time; 4 = not too bad; 5 = easy*
Employed	Labour force participation	1 = labour force (full time, casual or part-time)*; 0 = not in labour force
HCC	Possession of concessional health care card	1 = health care card (HCC) holder; 0 = without HCC *
BMI group	WHO BMI categories	Weight categorised according to body mass index (BMI group) 1 = Underweight; 2 = Normal weight*; 3 = Overweight; 4 = Obese
Smoking	Smoking status	0 = Never-smoked*; 1 = Ex-smoker; 2 = Smoker,
Alcohol	Pattern of alcohol consumption based on NHMRC guidelines	1 = risky or high risk drinker based on NHMRC guidelines; 0 = low risk or non-drinker*
Health Status	5 dummy variables for self-reported health status based 5 Likert scale	Excellent = 5*; Very good = 4; Good = 3; Fair = 2; Poor =1
Multimorbidity	Presence of chronic diseases	0 = None*; 1 = 1 chronic condition; 2 = 2 or more chronic conditions (ie multimorbidity)
Cancer	Previous cancer diagnosis (other than breast cancer)	1 = Yes; 0 = No*
GP Visits	GP visits in last 12 months	0 = None (excluded from regression); 1 = Once or twice*; 2 = Three or four times; 3 = Five or six times; 4 = Seven or more times
Personal manner of GP	Patient rating of personal manner of last GP seen	Good or better=1*; Fair or Poor = 0 (asked only of women in the young cohort)

*Indicates reference category in logistic regression
** Women with history of previous breast cancer or previous mastectomy are excluded from mammography.ample Women with previous history of cervical cancer, hysterectomy or never been sexually active are excluded from Pap test sample.

6.5.2 Sample

All women from the mid- and young ALSWH cohorts are aged between 18 and 69 years of age (the recommended ages for Pap test screening) between waves 2 and 6 (between 1998 and 2012) and this is the period of analysis. Women between 50 and 69 years of age were also eligible for free screening mammography, and women from the mid ALSWH are within this age range between Wave 2 and Wave 6.

Survey respondents are excluded from Pap test analysis once they report having a hysterectomy (asked of women in mid cohort only), if they reported not ever having had sexual intercourse (asked of women in the young cohort in waves 2 and 3 only), or if they report a diagnosis of cervical cancer. These groups of women are not considered part of the cervical screening target population.

Women in the mid cohort only were surveyed about history of previous breast disease (including breast cancer), breast surgery (mastectomy, lumpectomy and breast biopsy), cervical cancer and hysterectomy. Women with a breast cancer diagnosis will typically have additional mammographic follow-up, and are excluded from BreastScreen services for at least five years. Women who report previous breast cancer or mastectomy (complete breast removal as part of breast cancer treatment) are excluded from the mammogram sample for this analysis.

To examine the potentially confounding effects of self-reported health status and health risk behaviours (smoking, alcohol, weight), these variables are excluded from the main model, but subsequent extended models including these variables are provided in Table 47 and Table 48 in the Appendices.

Demographic information is coded as per Wave 1, if not asked in subsequent waves. Missing values for demographic information are coded as per subsequent waves in order to maximise the sample size and reduced data driven limitations. As outlined in

Chapter 4, observations are excluded from analysis if women report no GP visits, as it appears illogical to have continuity of care in the absence of doctor-patient interactions.

6.5.3 Estimation methods

Appropriate screening participation is analysed using a non-linear model expressing the probability of having recommended screening (Pap test or mammogram) in the previous two years, as a function of continuity of care and multiple patient and practice characteristics.

A simple binary choice regression model is provided in equation (1):

$$Prob(y_i = 1|\boldsymbol{X_i}, COC_i) = F(\beta_0 + \boldsymbol{COC_i\beta_1} + \boldsymbol{x_i\beta_2} + \delta_t + u_i) \ (1),$$

$$where\ y = \begin{cases} 1 & \text{if a woman reports guideline appropriate test} \\ 0 & \text{if otherwise} \end{cases}$$

In equation (1), $\boldsymbol{COC_i}$ denotes a vector of continuity of primary care (personal, site or no continuity) for a woman i, and $\boldsymbol{x_i}$ is a vector of covariates (such as age, location of residence, access to screening services). Common models for binary outcome variables include logit and probit. As women are surveyed three-yearly, women will be observed on multiple occasions. Within the initial pooled analysis, wave dummy variables δ_t are included to consider Australian wave-specific conditions or variation of data collection Observations within individuals are assumed to be not independent leading to serial correlation with error term u and robust standard errors will be reported (Wooldridge 2010). A logistic regression model is used to estimate equation (1).

Equation (1) does not take advantage of the panel nature of the data and this is provided in equation (2)

$$Prob(y_{it} = 1|\boldsymbol{X_i}, COC_{\boldsymbol{i}}) = F(\beta_0 + \boldsymbol{COC_{it}\beta_1} + \boldsymbol{x_{it}\beta_2} + \mu_i + \varepsilon_{it}) \ (2),$$

where $\boldsymbol{COC_{it}}$ denotes patient's continuity of primary care at a particular time point *t*, $\boldsymbol{x_{it}}$ is a vector of regressors such as age and health status, μ_i denotes time-invariant individual heterogeneity, while ε_{it} indicates idiosyncratic errors (Wooldridge 2010). A random effects (RE) logistic regression model is used to estimate equation (2), which makes the assumption that variation across entities is assumed random (and uncorrelated with variables in the model), such that individual error terms (both μ_i *and* ε_{it}) are not correlated with the explanatory variables x_{it}. This assumption may not be satisfied in this panel meaning that estimates will be inconsistent.

There are likely to be unobserved patient-level characteristics which correlate between continuity of care and preventative screening rates (such as preference for seeing a regular GP). These unobserved characteristics may confound the association between continuity of care and health screening. Expanded models controlling for multiple health status and behavioural variables is provided to consider this (refer Table 47 in the Appendices), although will still likely suffer from omitted variable bias.

This individual-level heterogeneity can be accommodated using a fixed effects estimator. However, given awareness of the incidental parameter problem in use of binary outcome measures (Greene 2002; Lancaster 2000), the random effects estimator is chosen as the preferred model given the panel structure of the data.

The issues of endogeneity of continuity of care remain. The effect of endogeneity is to bias estimates when there is correlation between explanatory variable and the error term in the model (Wooldridge 2000). In this example, if there are additional factors which may influence both the propensity to have continuity of care and likelihood of screening then this endogeneity can bias estimates of the effect of continuity of care on cervical cancer screening. For example, if a patient who is more concerned about her health is more likely to see the same doctor and also more likely to enagage in screening, this would positively bias the coefficients on the *COC* variable. Alternatively, if a woman who was more concerned about her health attended multiple doctors for reassurance, this would downwardly bias the coefficient of personal continuity of care in the model.

One approach to control for this endogeneity is to use an instrumental variable (IV).

IV methods can address confounding by 'instrumenting' to isolate variance not associated with an endogenous variable. IV methods rely on finding an appropriate variable z_i which correlates with the endogenous variable but not with the error term.ε_i. These exclusion and relevance assumptions are shown in equations 3 and 4 below.

$$\mathrm{Cov}(z_i, \varepsilon_i)=0 \qquad (3)$$

$$\mathrm{Cov}\ (z_i, x_i) \neq 0 \qquad (4)$$

The IV estimator can be obtained using a two-stage least squares (2SLS) approach. With the 2SLS approach, the explanatory variable x_i is initially regressed on the instrumental variable(s) z_i in a first-stage regression. The prediction of $\hat{x}_i$ from this regression is used as a covariate for a second regression model estimating y_i instead of the original x_i (Angrist, Imbens & Rubin 1996).

The relevance and endogeneity of the instrumental variable needs to be considered. Assessment of relevance (or strength) of the instrument can be assessed by first-stage F-statistic (Stock & Staiger 1997), with a value above 10 suggesting no problem with weak instruments), and endogeneity of the variable can be assessed by the Durbin Wu test. In the presence of a weak instruments, additional diagnostic approaches can be considered (Moreira 2003; Olea & Pflueger 2013; Stock, Yogo & Wright 2002).

A number of potential instruments were considered for this analysis.

1. Within the ALSWH survey women were asked to rate a number of health system characteristics, and a rating of overall outcomes of medical care was considered a potential candidate IV. This variable is considered a proxy for the quality for GP care and anticipated to correlate with continuity of care (as women with improved outcomes of care may consider they have a higher quality doctor and would be anticipated to prefer to see this doctor resulting in higher GP continuity). As Pap testing is an infrequent screening test, it is not anticipated to correlate with rating of medical care outcomes directly, although this is difficult to prove. Potentially if women who are more satisfied with their health outcomes are also more likely to have Pap tests, this IV becomes endogenous.
2. Survey respondents were asked about their living arrangements, including whether they live with children. As indicated in Chapter 4 of this thesis, women

who are living with children are significantly more likely to have continuity of primary care, and potentially having children increases continuity-seeking behaviour at both a provider- and practice-level. The exclusion criteria is difficult to justify with this IV, as potentially living with children may directly influence Pap testing (women may be more concerned about their health and the importance of screening after child birth, or have increased awareness of screening after child birth) and not only indirectly through the effect of living with children on continuity of care.

3. Women were asked to rate their access to a choice of GPs (choice of GPs). Choice of GPs may be a proxy for access and may affect continuity of care. Women within this analysis are anticipated to have a preferred provider and potentially respondents with greater satisfaction with their choice of GPs will be more able to choose their preferred doctor. However, we cannot determine whether better-rated choice indicates increased access to any doctor (and potentially reduced continuity of care), or better access to preferred provider (and increased continuity of care) and this IV is not pursued.
4. Additional individual and aggregated geographic IVs have been used by previous authors (Chetty, Friedman & Saez 2013) but as survey data is aggregated to state and urban/rural location level, similar appropriate instruments could not be identified.

These instruments were not pursued due to the issues outlined.

Another potentially appropriate instrumental variable for personal continuity of care is available in the young cohort of women only. The women in this cohort were asked about their satisfaction with the personal manner of the doctor they most recently consulted. The response to this question is anticipated to correlate with personal continuity of care, as women who rate their doctor's manner more highly are anticipated to prefer to see this doctor (over other doctors) more than women who rate their doctor's manner at lower levels. The assumption of this instrument is that the effect of the doctor's personal manner on screening participation only operates through its effect on continuity of care. This instrument appears relevant and is chosen for the IV analysis. Although this variable appears an appropriate instrument for personal continuity of care, it is unclear what the impact of a doctor's manner on site continuity will be. Around 2.5% of women in the sample who are classified as having personal continuity of care seek their care from the same GP in multiple locations. For these women it is anticipated that improved GP manner would be associated with reduced site continuity of care, while for women obtaining all their care from the same GP in the same practice the reverse association is expected. For this reason uninstrumented site continuity of care is reported in the regression models.

Logistic regression models express an odds ratio of having appropriate screening and the standard error (other than the IV output which utilise OLS and report coefficients). Results are considered statistically significant if they are outside of the 95% confidence interval and significance indicators are reported. Data was analysed using Stata version 14 (Statacorp 2017). Cluster robust errors are reported (although these are based on weaker assumptions than the random effects model (Cameron & Trivedi 2009).

6.6 Results

6.6.1 Summary statistics

6.6.1.1 **Pap testing**

The characteristics of women in the Pap testing sample are similar to the whole sample described in Chapter 4. These women have an average age of 36.8 in Wave 2 (range 20.6-53.1) and this increases to an average of 48.5 (range 32.8-65.1) by Wave 6. Personal demographics are stable other than for gradually increasing educational attainment through the survey waves. The proportion of women with private health insurance increases from 38% in Wave 2 up to 68% in Wave 6. Summary statistics for the continuity of care and cancer screening variables are shown in Table 21 below and for all included variables in Table 44 in the Appendices.

The proportion of women reporting site continuity increases in each survey wave, while the rate of personal continuity remains stable (with a reduction in the reduced continuity group). The proportion of women who report having an abnormal Pap test increases in the early waves, but decreases as women drop out from the analysis due to exclusion criteria (most commonly after reporting hysterectomy). Over 90% of women report good or better access to Pap test services in each wave, with lower levels of satisfaction for GP service characteristics, such as access to a female GP, or number of GPs, where less than 75% of women report good or better satisfaction. Over 90% of responses indicated good or better patient satisfaction with the personal manner of the GP- discussed further in the instrumental variable analysis in Section 6.6.2.2. Summary statistics of panel data indicating between and within variation of variables of interest are reported in Table 59 in the Appendix.

Table 21: Summary statistics of variables of interest in Pap test sample for ALSWH survey waves 2-6 (summary statistics for all variables are provided in the Appendices)

Variable	2	3	4	5	6	Pooled
Pap test in last two years	0.797 (0.402)	0.817 (0.386)	0.788 (0.409)	0.787 (0.41)	0.773 (0.419)	0.793 (0.405)
Personal continuity of care	0.338 (0.473)	0.337 (0.473)	0.346 (0.476)	0.349 (0.477)	0.325 (0.468)	0.339 (0.473)
Site continuity of care	0.255 (0.436)	0.278 (0.448)	0.296 (0.456)	0.321 (0.467)	0.354 (0.478)	0.299 (0.458)
Reduced continuity of Care	0.406 (0.491)	0.385 (0.487)	0.358 (0.48)	0.33 (0.47)	0.321 (0.467)	0.362 (0.481)
Abnormal Pap test previously	0.242 (0.428)	0.259 (0.438)	0.289 (0.454)	0.23 (0.421)	0.219 (0.413)	0.249 (0.432)
Good access to Pap tests	0.936 (0.244)	0.932 (0.251)	0.932 (0.253)	0.93 (0.255)	0.936 (0.245)	0.933 (0.249)
Satisfied with manner of GP	0.884 (0.32)	0.901 (0.299)	0.901 (0.299)	0.912 (0.283)	0.928 (0.258)	0.904 (0.294)

Analysis of the pooled data shows that 79.3%, of women report having a Pap test in the last two years. Women in the mid cohort report higher rates of Pap test participation in each survey wave (average 84.0%) compared with women in the young cohort (average 75.2%). For both age cohorts, self-reported Pap testing increased initially, before slowly decreasing between waves 3 and 6. A comparison of rates of self-reported Pap test rates according to self-reported continuity are shown in the lower half of Table 22 below.

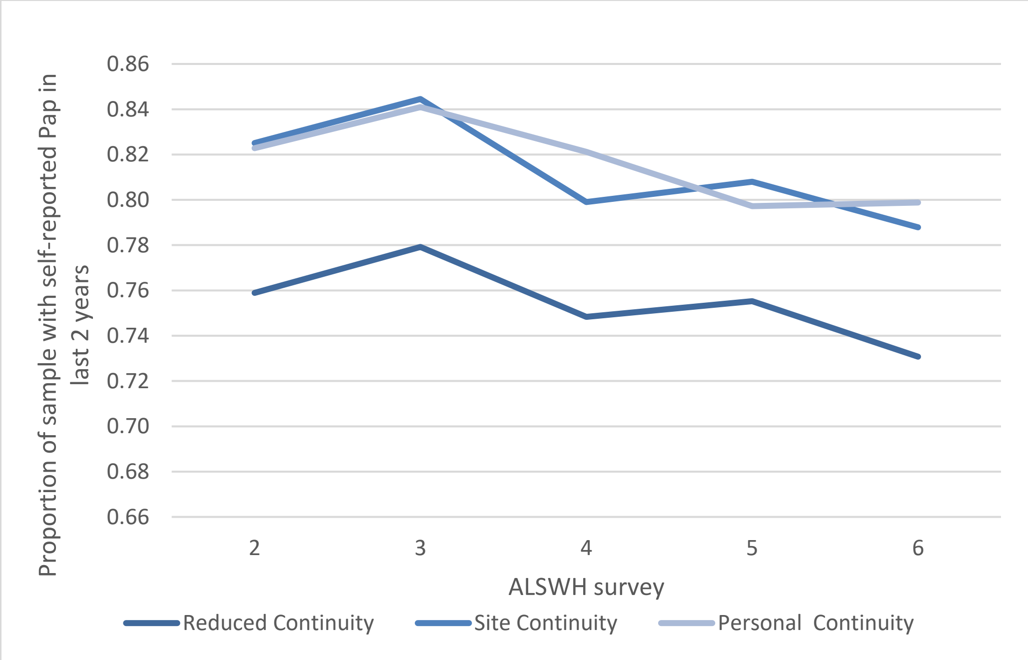
Table 22: Proportion of women in each wave reporting Pap test in last two years

Variable	2	3	4	5	6	Pooled
Pap testing classified by age cohort						
Mid cohort	0.847 (0.36)	0.867 (0.37)	0.836 (0.37)	0.829 (0.376)	0.818 (0.386)	0.84 (0.367)
Young cohort	0.752 (0.432)	0.775 (0.418)	0.748 (0.434)	0.748 (0.434)	0.733 (0.442)	0.752 (0.432)
Pap testing classified according to continuity of care category						
Personal continuity	0.823 (0.381)	0.841 (0.366)	0.821 (0.383)	0.797 (0.402)	0.799 (0.401)	0.817 (0.387)
Site continuity	0.825 (0.380)	0.845 (0.362)	0.799 (0.401)	0.808 (0.394)	0.788 (0.409)	0.812 (0.391)
Reduced continuity	0.759 (0.428)	0.78 (0.415)	0.748 (0.434)	0.755 (0.430)	0.731 (0.444)	0.756 (0.429)
Excluding abnormal Pap test	0.787 (0.41)	0.788 (0.409)	0.763 (0.425)	0.777 (0.416)	0.763 (0.425)	0.776 (0.417)

Results indicate proportions with standard deviation in parentheses.

The proportion of women reporting Pap testing in last two years is greater for women with either site continuity or personal continuity, compared to women with reduced continuity. On average, personal continuity is associated with the highest rate of Pap testing (81.7%) compared with site continuity (81.2%), than women with reduced continuity (75.6%). Women who have not had a previously abnormal smear participate at lower rates than women who report having a previous abnormal smear. Decreasing Pap testing rates are observed in all continuity of care categories through ALSWH survey waves, and this is shown graphically in Figure 19 below.

Figure 19 - Proportion of women reporting Pap testing in previous two years classified according to continuity of care



The instrumental variable analysis is restricted to women in the ALSWH young cohort because the question about satisfaction with GP manner was not asked of women in the ALSHW mid cohort. Summary statistics for the sample of women included in the IV analysis in provided in Table 46 in the Appendices.

6.6.1.2 Mammography analysis

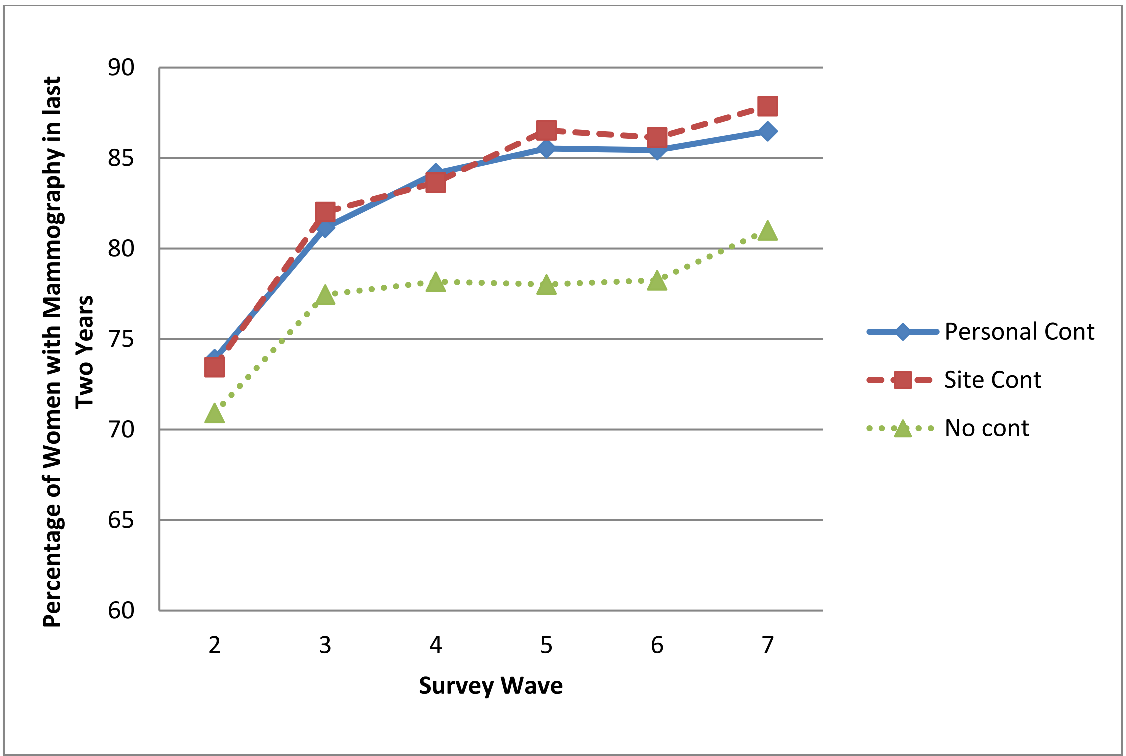
The mammography analysis is restricted to women in the ALSWH mid cohort, as only these women are in the recommended age range for screening. Summary statistics for these women are provided in Table 45 in the Appendices.

There has been a gradual increase in the proportion of women in the overweight and obese categories, and a corresponding decline in women of normal weight. Regarding health service utilisation, there has a been a slight increase in the number of GP visits reported, with the proportion of women reporting three or four visits increasing from 25% to 32 % through the survey waves, with a corresponding reduction in those women reporting 0 visits or 1-2 GP visits. There is little change in self-reported health status between waves, and over 85% of women reported good or better health in every wave. The proportion of women reporting a previous diagnosis of breast cancer has increased from 11% in Wave 2, to 21% in Wave 7.

Overall, 82% of women reported having a mammogram within the last two years. The proportion of women reporting having a mammogram in the previous two years increases in each survey wave, from 73% in the 1998 survey (Wave 2) to 86% in the 2013 survey (Wave 7). Continuity of care cannot be determined from Wave 1, but between Wave 2 and Wave 7, site continuity increases steadily from 27% to 34%, while personal continuity drops from 46% in Wave 2 to 45 % in Wave 3, before gradually increasing to 48% by Wave 7. The proportion of women without either site or personal continuity decreases from 26% in Wave 2 to 18% in Wave 7. The proportion of women in the workforce has decreased from a peak of 77% in Wave 3, to 45% by Wave 7. Mammography rates are higher for women with previous breast cancer in every wave. Observations from these women are excluded from the regression analysis after breast cancer diagnosis. Reporting of breast biopsies and abnormal mammograms has also increased over time (noting that questions about abnormal mammography were not asked in Wave 2).

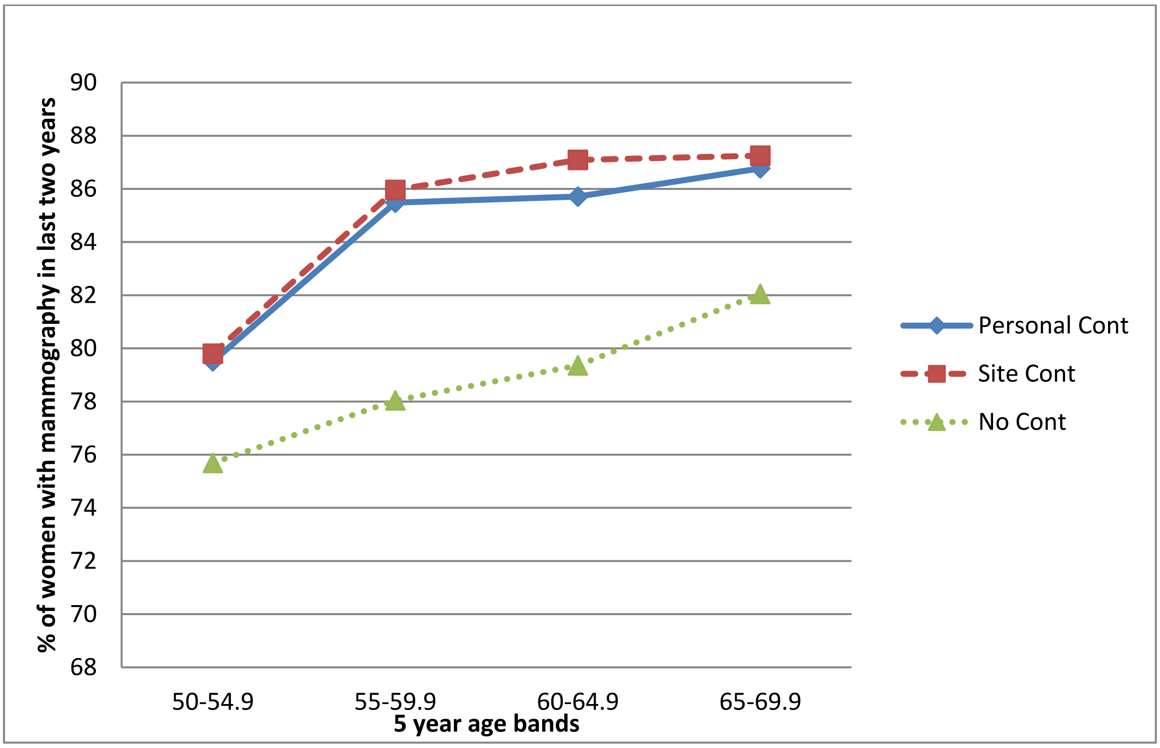
Bivariate analysis of the association between mammography and continuity of care suggests an association between increased mammography rates at recommended intervals for women with either continuity with a practice or with a provider, compared to women with no continuity. The number of women reporting having a mammogram in the last two years with site continuity is greater than for those with personal continuity of care. Graphical representation of mammography according to continuity categories through survey waves is shown in Figure 20 below, revealing higher rates of mammography for women with either personal or site continuity compared to women with neither, in every survey wave.

Figure 20 – Percentage of women reporting mammogram in previous two years classified according to continuity of care



Rates of mammography according to five-year age brackets are shown in Figure 21 below. Rates of mammography are lowest for the women aged less than 55, and increase on average in the subsequent five year bands and is highest for women aged between 65 and 69.9 years. The rates of mammography are lower for women without either site or personal continuity of care in all age categories. These results suggest that the ALSWH cohort have higher mammography rates than the Australian general population (AIHW 2016b) and that rates of mammography are increasing as women age.

Figure 21 - Percentage of Women with Mammography according to 5-year Age Bands



6.6.2 Regression results

After omitting women with self-reported hysterectomy, women with cervical cancer, women not yet sexually active, women with no GP visits in the previous year, wave 1 observations (where continuity of care cannot be calculated) and observations after

2012 and women with missing data, there are 63,117 observations from 16,162 women within Pap testing regression analysis.

After omitting observations from women who report having breast cancer or a history of mastectomy and women with missing data, there are 35,478 observations provided by 10,554 women from the ALSWH mid cohort within mammography regression analysis.

As the coefficients in logistic regression models have no direct interpretation, Table 23 reports the odds-ratio results of six regression models. An odds ratio greater than 1 indicates an increased odds of having screening in the past two years, while an odds ratio less than 1 indicates a reduced odd of screening. The first five models provide results for the five models for the Pap test analysis, and Model 6 provides results of preferred model of the mammography analysis. Results will focus on Model 2 (logistic panel RE random effects model of the full sample) as the preferred model for Pap testing as Model 2 reflects the panel nature of the data, contains the highest number of observations, increasing the precision of the estimates, and the Breusch Pagan Lagrange multiplier test suggests the presence of random effects. Model 3 (logistic Panel RE of the balanced panel), is provided to consider the effect of attrition within the panel while models 4 and 5 permit comparison of results for each ALSWH age cohort. Model 6 (logistic panel RE of mammography testing) includes women from the ALSWH mid-age cohort only and these results permit comparison with Pap testing results for women in this age cohort shown in Model 5. Further regression models of the mammography sample (balanced panel, expanded model including health variables, and model excluding women with abnormal mammogram) are provided in Table 48 in the Appendices.

The results of models 1, 2 and 3 provide broadly consistent results, and suggest that the rich control variables used may mitigate the effects of unobserved individual effects. The similarity between the results for Model 2 and Model 3 reduce concern about possible effects of attrition from the panel in this analysis.

Table 23: Logistic Regression Models of Cancer Screening Participation – odds ratio results.

Variable	Model 1 Pooled logistic Pap tests	Model 2 Panel logistic RE Pap tests	Model 3 Panel logistic RE Pap test Balanced	Model 4 Panel logistic RE Pap test (young)	Model 5 Panel logistic RE pap (mid)	Model 6 Panel logistic RE mammo. (mid)
Personal Continuity	1.170***	1.234***	1.259***	1.191***	1.295***	1.367***
	(0.0297)	(0.0415)	(0.0562)	(0.0498)	(0.0737)	(0.0823)
Site continuity	1.162***	1.204***	1.221***	1.166***	1.251***	1.382***
	(0.0295)	(0.0394)	(0.0520)	(0.0446)	(0.0749)	(0.0887)
Wave 3	0.959	0.978	0.998	0.968	0.999	0.850*
	(0.0355)	(0.0421)	(0.0574)	(0.0458)	(0.0930)	(0.0624)
Wave 4	0.771***	0.749***	0.804**	0.729***	0.773**	0.862+
	(0.0320)	(0.0371)	(0.0534)	(0.0454)	(0.0736)	(0.0737)
Wave 5	0.776***	0.739***	0.840*	0.738***	0.714***	0.833+
	(0.0373)	(0.0421)	(0.0632)	(0.0597)	(0.0697)	(0.0888)
Wave 6	0.695***	0.645***	0.690***	0.638***	0.646***	0.770*
	(0.0363)	(0.0408)	(0.0570)	(0.0520)	(0.0790)	(0.0935)
Wave 7	0.603***	0.519***	0.523***		0.497***	0.749*
	(0.0437)	(0.0438)	(0.0551)		(0.0662)	(0.102)
Thirties	0.905*	0.878**	0.807**	0.898+		
	(0.0373)	(0.0443)	(0.0546)	(0.0573)		
Forties	1.178**	1.310***	1.485***	0.296+	0.877	
	(0.0667)	(0.0938)	(0.146)	(0.187)	(0.121)	
Fifties	1.365***	1.508***	1.753***		0.974	
	(0.0494)	(0.0755)	(0.119)		(0.0862)	

Variable	Model 1 Pooled logistic Pap tests	Model 2 Panel logistic RE Pap tests	Model 3 Panel logistic RE Pap test Balanced	Model 4 Panel logistic RE Pap test (young)	Model 5 Panel logistic RE pap (mid)	Model 6 Panel logistic RE mammo. (mid)
Sixties	1.452***	1.580***	1.646***		1	
	(0.0878)	(0.119)	(0.161)			
Victoria	1.152***	1.184***	1.187**	1.159**	1.245**	0.948
	(0.0319)	(0.0503)	(0.0673)	(0.0569)	(0.0979)	(0.0776)
Queensland	1.009	1.013	0.988	1.031	0.984	1.348***
	(0.0286)	(0.0438)	(0.0574)	(0.0518)	(0.0772)	(0.116)
South Australia	1.235***	1.330***	1.240**	1.301***	1.404**	1.202
	(0.0508)	(0.0843)	(0.102)	(0.0975)	(0.158)	(0.139)
Western Australia	0.969	0.989	0.919	0.884^{+}	1.224^{+}	1.067
	(0.0376)	(0.0597)	(0.0734)	(0.0600)	(0.143)	(0.123)
Tasmania	1.049	1.073	1.119	1.018	1.204	0.937
	(0.0608)	(0.0951)	(0.133)	(0.108)	(0.189)	(0.151)
Northern Territory	1.065	1.105	1.120	0.989	1.296	0.462**
	(0.110)	(0.164)	(0.213)	(0.170)	(0.350)	(0.129)
ACT	0.937	0.957	0.866	0.930	1.081	0.718
	(0.0750)	(0.112)	(0.136)	(0.111)	(0.315)	(0.187)
Australian-born	1.010	1.024	0.982	1.060	0.995	1.126
	(0.0309)	(0.0506)	(0.0668)	(0.0760)	(0.0713)	(0.0827)
Inner regional location	1.000	1.006	0.926	1.018	1.000	1.083
	(0.0249)	(0.0361)	(0.0436)	(0.0435)	(0.0648)	(0.0737)
Outer regional location	1.026	1.032	0.940	1.112^{+}	0.944	1.466***
	(0.0321)	(0.0479)	(0.0570)	(0.0624)	(0.0765)	(0.129)
Remote/very remote	1.123^{+}	1.116	1.030	1.188^{+}	1.025	3.060***
	(0.0697)	(0.0996)	(0.123)	(0.121)	(0.169)	(0.586)
Married	1.519***	1.609***	1.622***	1.630***	1.537***	1.359***
	(0.0349)	(0.0529)	(0.0721)	(0.0619)	(0.0970)	(0.0911)
HSC	0.972	0.994	1.007	1.109	0.979	0.981
	(0.0320)	(0.0484)	(0.0677)	(0.0775)	(0.0741)	(0.0786)
Trade Diploma	1.006	1.032	0.995	1.217**	0.906	0.813**
	(0.0315)	(0.0481)	(0.0630)	(0.0806)	(0.0661)	(0.0615)
University	1.055^{+}	1.127*	1.047	1.328***	0.975	0.669***
	(0.0339)	(0.0548)	(0.0679)	(0.0891)	(0.0799)	(0.0577)
Income impossible	0.909	0.869	0.848	0.906	0.785	0.509***
	(0.0710)	(0.0854)	(0.116)	(0.108)	(0.133)	(0.0880)

Variable	Model 1 Pooled logistic Pap tests	Model 2 Panel logistic RE Pap tests	Model 3 Panel logistic RE Pap test Balanced	Model 4 Panel logistic RE Pap test (young)	Model 5 Panel logistic RE pap (mid)	Model 6 Panel logistic RE mammo. (mid)
Always difficult	0.879**	0.863**	0.905	1.004	0.649***	0.627***
	(0.0346)	(0.0447)	(0.0621)	(0.0619)	(0.0594)	(0.0619)
Sometimes difficult	0.981	0.964	1.025	1.021	0.862*	0.772**
	(0.0310)	(0.0405)	(0.0546)	(0.0513)	(0.0637)	(0.0614)
Not too bad	1.032	1.032	1.088+	1.049	0.996	0.952
	(0.0302)	(0.0389)	(0.0508)	(0.0486)	(0.0637)	(0.0653)
Employed	0.947*	0.918*	0.900*	0.880**	0.968	0.885*
	(0.0254)	(0.0325)	(0.0419)	(0.0422)	(0.0528)	(0.0518)
Unemployed	0.878*	0.890	0.870	0.827*	1.166	0.883
	(0.0553)	(0.0725)	(0.103)	(0.0715)	(0.257)	(0.181)
Private hospital insurance	1.408***	1.483***	1.389***	1.443***	1.513***	1.749***
	(0.0316)	(0.0475)	(0.0585)	(0.0547)	(0.0871)	(0.112)
Concession card holder	1.097***	1.083*	1.146**	1.044	1.136*	1.124+
	(0.0295)	(0.0375)	(0.0533)	(0.0491)	(0.0603)	(0.0687)
Good GP hours	0.977	0.975	0.939	0.979	0.953	0.919
	(0.0262)	(0.0327)	(0.0406)	(0.0394)	(0.0555)	(0.0562)
Good GP numbers	0.874***	0.862***	0.874**	0.875**	0.844**	0.850*
	(0.0250)	(0.0313)	(0.0415)	(0.0382)	(0.0534)	(0.0539)
Good bulk-billing access	0.785***	0.789***	0.823***	0.792***	0.792***	0.863**
	(0.0178)	(0.0235)	(0.0317)	(0.0278)	(0.0423)	(0.0461)
Good female GP access	1.350***	1.408***	1.423***	1.343***	1.525***	1.197**
	(0.0360)	(0.0477)	(0.0616)	(0.0545)	(0.0902)	(0.0720)
Good Pap test access	2.760***	3.475***	3.516***	2.852***	5.492***	-
	(0.103)	(0.171)	(0.235)	(0.157)	(0.537)	
Prev. abnormal Pap test	1.653***	1.675***	1.603***	1.637***	1.735***	-
	(0.0432)	(0.0557)	(0.0697)	(0.0630)	(0.107)	
Fifty-five	-	-	-	-	-	1.115
						(0.106)
Sixty	-	-	-	-	-	1.043
						(0.147)
Sixty-five	-	-	-	-	-	0.920
						(0.178)
Previous abnormal mammogram	-	-	-	-	-	2.022***
						(0.153)

Variable	Model 1 Pooled logistic Pap tests	Model 2 Panel logistic RE Pap tests	Model 3 Panel logistic RE Pap test Balanced	Model 4 Panel logistic RE Pap test (young)	Model 5 Panel logistic RE pap (mid)	Model 6 Panel logistic RE mammo. (mid)
Good mammography access	-	-	-	-	-	7.986^{***}
						(0.712)
Previous lumpectomy/biopsy	-	-	-	-	-	1.101
						(0.0909)
N	63117	63117	40545	30331	32786	35478
AIC	62035.8	59398.6	35694.3	24566.2	34431.4	23464.3
BIC	62370.7	59742.6	36021.5	24882.3	34742.2	23794.9

Notes Exponentiated coefficients; Standard errors in parentheses. Significance: $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Note OR>1 indicates increased odds of having screening test in recommended timeframe. OR<1 indicates decreased odds of having screening test in recommended timeframe. Reference categories (OR=1) are omitted. Base case is women from NSW, major city, did not complete HSC, copes easily with available income, is not in workforce, do not have private health insurance or health concession card, poor or fair access to number of GP, choice of GPs, female GP, bulk-billing, access to relevant screening test, no previous abnormal screening test. Age reference case is less than 30 for Pap test analysis, and greater than 50 but less than 55 for mammogram analysis

In Model 2 (panel logistic random effects estimator), women with personal continuity have a statistically significant greater odds ratio of 1.23 (95% CI 1.16-1.32) of reporting having a Pap test in last two years compared with women with reduced continuity after controlling for other patient demographic and access variables; women with site continuity are 1.20 times more likely to report having a Pap test in last two years compared with the reduced continuity group (95% CI 1.13-1.28). There is no statistically significant difference in Pap testing found between women with personal continuity and women with site continuity.

Compared to women who report only fair or poor access, women who reported good or better access to a female GP had a significantly higher odds of reporting a Pap test in the last two years (OR- 1.41; 95% CI 1.32-1.50), as did women reporting good or better access to Pap test services (OR 3.48; 95% CI 3.15-3.83). Good access to a number of

GPs, and good or better access to bulk-billing were both associated with significantly decreased odds of reporting Pap test in last two years.

Compared with responses from the first wave of data, there is a trend for women to have decreasing odds of reporting Pap testing in the previous two years through each successive wave. Compared to women in their twenties, women in their thirties had decreased odds of reporting Pap tests, while women over 50 and 60s had significantly increased odds of reporting screening participation.

Compared with women in New South Wales, women from Victoria and South Australia are statistically significantly more likely to report having a Pap smear in last two years. Women who were married were significantly more likely to have a Pap test than women who were not married (OR 1.61; 95%; CI 1.51-1.72), and women with private health insurance were also significantly more likely to report timely screening than women without such insurance (OR 1.48; 95% CI 1.39-1.58). There were no significant differences (at p= 0.05 threshold) found according to country of birth (Australian or otherwise), location of residence (capital city, provincial or remote location), income status education, or possession of a concessional health care card.

Regarding access to GP services, women who reported good or better access to a number of GPs, were significantly less likely to reporting having a Pap test, then women reporting fair or poor access. A similar finding was reported for access to bulk-billing services, with those women with better access to bulk-billing reporting lower levels of Pap testing.

A comparison of women in the two ALSWH age cohorts is shown in models 4 and 5 in Table 23. The association between increased continuity of care (both personal and site) and increased Pap testing is found for women in both age cohorts. While most other significant findings are consistent, additional significant associations between increasing education, employment status and Pap test participation are found in the young cohort. Women in the young cohort who have completed a university education are significantly more likely to report having a Pap test in last two years compared with women who have not completed their high school certificate (OR 1.32; 95% CI 1.12-1.45). Good or better access to Pap test services is the strongest predictor of Pap test participation for women in the full sample (OR 3.48) and is of greater magnitude for women in the middle cohort (OR 5.50) compared with women in the younger cohort (OR 2.86).

6.6.2.1 Comparison of mammography and Pap testing (mid ALSWH cohort)

Results for the analyses of mammography and Pap testing for women in the mid cohort (models 5 and 6 in Table 23) are consistent in terms of the association between increased guideline recommended testing and personal or site continuity (compared to women with reduced continuity of care). The magnitude of association between increasing continuity of care and screening is greater for mammography than Pap testing, and once again, there is no statistically significant differences in screening rates between women with site continuity of care and women with personal continuity of care. As with Pap testing, increased mammography was associated with being married, having private health insurance, having a previous abnormal test, and good self-reported access to screening services. There are some interesting state-based differences in screening rates. Compared with women in New South Wales, women in Queensland were significantly more likely to report having a mammogram, while women from Victoria and South Australia were significantly more likely to report Pap testing.

The greater magnitude of association related to mammography compared with Pap tests potentially indicates that for these women (or their doctors) more value is placed on mammography. Another potential explanation is that mammography figures may include more non-screening tests than the Pap test figures. Survey data does not differentiate between screening investigations (such as a mammogram with Breastscreen or a screening Pap test in an otherwise healthy woman) from diagnostic tests (such as investigation of a breast lump or irregular vaginal bleeding). There was a trend for women with lower financial means to report reduced mammography compared with women in the highest self-assessed financial means category. Screening mammograms are provided without cost by BreastScreen , but potentially these figures are picking up non-screening mammograms which are not delivered without cost (and cannot be distinguished from the survey data). Such a trend was not seen in the Pap testing analysis. These results could also be accounted for by transational costs of screening. Women with less financial means may have greater difficulty in getting time off work, or face greater relative costs in getting to screening services.

For both mammography and Pap testing, women were significantly less likely to report screening when they had good or better access to bulk-billing GP services, while there was no association found related to the hours that the GP practice was open. Potentially women with increased access to bulk-billing may be attending multiple practices to access bulk-billing and this would be consistent with the findings of the previous Chapter 5 of thesis which suggested that increased access to bulk-billing was associated with significantly reduced continuity of care of care. Potentially women may be preferring to access reduced costs for GP services over having continuity of care with a single practice, and are potentially receiving less encouragement to screen across these multiple locations. Access to a female GP was associated with increased screening for both tests, but of greater significance for Pap tests. This is consistent with the female GP having an additional impact on reducing anxiety in having Pap tests, as well as having an increased impact in recommending testing.

6.6.2.2 Instrumental variable analysis

Women in the young cohort were surveyed about their satisfaction with the manner of the GP they most recently saw. Women who rate their doctor's manner highly are anticipated to return to this doctor where possible (other factors being equal) and this measure is expected to be correlated with personal continuity of care. The variable shows modest correlation with personal continuity of 0.23, and in the expected direction, such that increasing number (i.e. worse rating of GP manner) is associated with decreased odds of having personal continuity. A linear probability model (LPM) is reported due to limited options for IV analysis using panel data with a binary outcome variable. The GP manner is used as an instrument for personal continuity, and the comparison between the un-instrumented panel regression output (Model 7), an instrumented pooled OLS (Model 8), and instrumented panel IV estimation (Model 9) is reported in Table 24 below. The coefficients shown for models 8 and 9 are from the instrumented second stage of the 2SLS analysis with full results of both stages of the 2SLS provided in the Appendices. The interpretation of these coefficients indicates a partial effect moving from the un-instrumented analysis (assuming an exogenous personal continuity of care variable) to the analysis including the instrumented endogenous personal continuity of care.

Table 24: Regression results from Instrumental Variable Analysis (young cohort)

Variable	Model 7 Panel regression	Model 8 Pooled OLS IV regression	Model 9 Panel IV regression
Personal continuity	0.027***	0.230***	0.218***
	(-0.006)	(-0.045)	(-0.052)
Site continuity	0.024***	0.098***	0.095***
	(-0.005)	(-0.017)	(-0.02)
Wave 3	-0.018**	-0.025***	-0.020**
	(-0.006)	(-0.007)	(-0.007)
Wave 4	-0.058***	-0.071***	-0.063***
	(-0.009)	(-0.009)	(-0.009)
Wave 5	-0.057***	-0.068***	-0.061***
	(-0.012)	(-0.012)	(-0.012)
Wave 6	-0.075***	-0.083***	-0.075***
	(-0.012)	(-0.012)	(-0.012)
Thirties	-0.016+	-0.011	-0.016+
	(-0.009)	(-0.01)	(-0.009)
Forties	-0.185	-0.171+	-0.169
	(-0.117)	(-0.101)	(-0.116)
Victoria	0.024***	0.035***	0.030***
	(-0.007)	(-0.006)	(-0.007)
Queensland	0.003	0.009	0.006
	(-0.007)	(-0.007)	(-0.008)
South Australia	0.031**	0.037***	0.036***
	(-0.01)	(-0.009)	(-0.01)
Western Australia	-0.021*	-0.017*	-0.019+
	(-0.01)	(-0.009)	(-0.01)

Variable	Model 7 Panel regression	Model 8 Pooled OLS IV regression	Model 9 Panel IV regression
Tasmania	0.006	0.004	0.001
	(-0.015)	(-0.013)	(-0.015)
Northern Territory	0.001	0.025	0.022
	(-0.024)	(-0.024)	(-0.025)
Australian Capital Territory	0.005	0.005	0.003
	(-0.017)	(-0.016)	(-0.017)
Australian-born	-0.011	-0.020*	-0.017
	(-0.01)	(-0.009)	(-0.011)
Inner regional location	0.012+	-0.001	0.001
	(-0.006)	(-0.006)	(-0.007)
Outer regional location	0.023**	0.011	0.013
	(-0.008)	(-0.008)	(-0.008)
Remote/very remote	0.034*	0.035*	0.031*
	(-0.014)	(-0.014)	(-0.015)
Married	0.044***	0.038***	0.035***
	(-0.006)	(-0.006)	(-0.006)
HSC	0.015	0.020*	0.021+
	(-0.01)	(-0.009)	(-0.011)
Trade Diploma	0.019+	0.026**	0.024*
	(-0.01)	(-0.009)	(-0.01)
University	0.036***	0.055***	0.056***
	(-0.01)	(-0.01)	(-0.011)
Income impossible	-0.026	-0.039*	-0.028
	(-0.019)	(-0.019)	(-0.019)
Always difficult	-0.011	-0.019*	-0.013
	(-0.009)	(-0.009)	(-0.009)
Sometimes difficult	-0.007	-0.009	-0.007
	(-0.007)	(-0.007)	(-0.007)
Not too bad	0.002	-0.001	0.001
	(-0.006)	(-0.007)	(-0.006)
Employed	-0.017**	-0.006	-0.01
	(-0.007)	(-0.007)	(-0.007)
Unemployed	-0.024+	-0.025+	-0.02
	(-0.013)	(-0.013)	(-0.014)
Private hospital insurance	0.053***	0.050***	0.048***
	(-0.005)	(-0.005)	(-0.006)
Concession card holder	-0.001	-0.006	-0.004

Variable	Model 7 Panel regression	Model 8 Pooled OLS IV regression	Model 9 Panel IV regression
	(-0.007)	(-0.007)	(-0.007)
Good GP hours	-0.005	-0.018**	-0.016*
	(-0.006)	(-0.006)	(-0.006)
Good GP numbers	-0.018**	-0.020**	-0.020**
	(-0.006)	(-0.006)	(-0.006)
Good bulk-billing access	-0.029***	-0.037***	-0.030***
	(-0.005)	(-0.005)	(-0.005)
Good female GP access	0.041***	0.039***	0.036***
	(-0.006)	(-0.006)	(-0.006)
Good Pap test access	0.186***	0.175***	0.171***
	(-0.01)	(-0.009)	(-0.011)
Previous abnormal Pap test	0.062***	0.074***	0.063***
	(-0.005)	(-0.005)	(-0.005)
N	33826	33741	33741
R-sq	0.008		
Adj R-sq.		0.007	
First stage F statistic of full model	-	F = 567.44 P=<0.0001	F=470.09 P<0.0001
Partial F statistic of instrument in First stage regressions		F= 40.48 P<0.0001	F=29.86 P<0.0001
IV diagnostics			
Durbin-Wu-Hausman test (H_0= regressor is exogenous)	-	Chi-sq = 21.43 P= <0.0001	
Anderson-Rubin Wald test	-	F= 26.98 P<0.0001	F=6.79 P<0.0001

Notes Exponentiated coefficients; Standard errors in parentheses. Significance: $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ Reference categories are omitted. Base case is women with reduced continuity of care, aged between 20 and 29.99, from NSW, living in major city, did not complete higher school certificate, copes easily with available income, and is not in workforce.

Women who have personal or site continuity of care are significantly more likely to report recommended Pap testing compared with women with reduced continuity in all three models. The magnitude of the coefficients in the panel instrumental variable analysis (Model 9) increase for both continuity variables, most notably for personal continuity. This suggests that subject to the robustness checks below, the endogeneity present in models 1 to 6 may be generating downwards-biased results for personal continuity, and thereby underestimating the impact of personal continuity on cancer screening. In the IV analysis of the panel data (Model 9), the increase in Pap test participation conditional on moving from no continuity to personal continuity is estimated at 0.22 % (95% CI; 0.11.6-0.32.0). The increase in Pap test participation conditional on moving from no continuity to site continuity is 0.095 (95% CI 0.056-0.134).

6.6.2.3 IV diagnostics

Robustness checks for the exogeneity and relevance of the instrument used in Model 9 are also presented in Table 24 above. The Durbin Wu Hausman test statistic was 21.43, confirming the endogeneity of the continuity of care variable, and the relevance of the instrument was confirmed both theoretically and statistically from the output of the first stage regression. Stock and Yogo (2005) (Stock & Yogo 2005) provide a set of population parameters which define a weak instrument. Given the magnitude of the first-stage F- statistic, there appears to be no problem with weak instruments. Further testing for overidentification (e.g. Sargan statistic or Hansen's test) or under-identification is not indicated as this model is exactly identified. These IV results suggest failure to consider the endogeneity of personal continuity in this model downwardly biases the estimate of association between increased personal continuity of care and Pap test participation. The exclusion criteria is more difficult to argue, and unable to be formally tested. If there are mechanisms for satisfaction with GP manner to influence screening likelihood other than through its effect mediated through increased continuity of care, this would violate the exclusion criteria. For instance if women who are more satisfied with the manner of their GP also thought that their GP provided a less uncomfortable Pap test, or a higher quality Pap test then this may influence screening rates by another route. However this cannot be tested with the available data.

6.6.2.4 Sensitivity testing

As a previous abnormal screening test may potentially motivate subsequent increased participation, these women are excluded from the analysis as part of sensitivity testing. These results indicate a persisting significant association between having personal or site continuity of care and increased Pap test participation and increased mammography (reported in Table 47 and Table 48 respectively in the Appendices).

Expanded models including self-reported health status, smoking status and patient weight were analysed in order to reduce potential for omitted variable bias and the significance of the outcome of interest was unchanged. These results are also provided in the Appendices. Comparisons between the output of balanced and unbalanced panels were performed and suggest no problem with attrition in these analyses.

6.7 Discussion

The results of this analysis provide evidence of a relationship between self-reported continuity of care with either a GP or a practice, and increased rates of compliance with cancer screening guidelines, at least pertaining to Pap testing and mammograms.

Statistically significant differences in screening associated with continuity of care have been found, after controlling for multiple patient and provider characteristics.

This analysis finds few significant differences in screening according to whether women have site continuity of care or personal continuity of care. These findings are similar to those of previous researchers which suggested that in the absence of personal continuity, preventative screening rates may not drop if sufficient information systems are in place (Reddy et al. 2015).

The results of the IV analysis of Pap testing for the young cohort of women are an exception to this, and suggest that after controlling for the endogeneity of personal continuity of care in the model, there are significant increases in Pap testing rates associated with site continuity of care, and further significant increases associated with personal continuity of care. These results suggest that failing to control for endogeneity of continuity of care downwardly biases estimates of both personal and site continuity of care, and may fail to detect a significant increase in screening associated with personal continuity of care over site continuity of care. The selection of suitable instruments is always open to debate, but the instrument used appears logical and passes standards of formal testing.

These results are consistent with the trust within the therapeutic doctor-patient relationship encouraging screening behaviour, and that failing to consider the endogeneity of continuity of care will underestimate the effect of this encouragement.

Rates of Pap testing and mammography participation in the survey sample are greater than those reported in national reported data, even after excluding women who would be considered inappropriate for screening program. For instance, these results suggest that 82% of the ALSWH cohort are having mammography every two years while BreastScreen participation rates are estimated at less than 55% (AIHW 2016b). One explanation for this could be the potential inclusion of non-screening tests within the ALSWH survey data and in the analysis. Although women with previous cancer are excluded from this analysis, all non-screening tests are not able to be excluded using the available data. For instance women with intermittent breast tenderness or increased anxiety may be having multiple non-screening mammograms with normal results. Such normal tests will be included within these results. Secondly, although the ALSWH cohort was representative of the Australian population, with multiple waves and attrition the women in the cohort have become healthier, better educated (and potentially more compliant) than the general population (Young, Powers & Bell 2006). This survivor bias potentially increases mammography rates compared with a general population sample. Additionally, ALSWH figures rely on self-report, and over-reporting of screening procedures and underestimation of intervals between screening procedures from self-reports has been recognised as a potential issue (Birch et al. 2007; Gordon, Hiatt & Lampert 1993; Rauscher et al. 2008). This form of social response bias is known to vary by age and ethnicity and warrants consideration within this analysis, although tests such as mammography are considered less prone to recall bias, than clinical examinations (Cronin et al. 2009). This issue is tested within the next chapter of this thesis, where, the availability of Medicare data permits differentiation between screening and diagnostic Pap tests, expands options for analysis and permits a comparison of administrative and self-reported Pap testing rates. One of the limitations of this model relates to the three year gap between survey data, and because current continuity is regressed on past-reported screening behaviour. This mismatch in timing has the potential to result in some measurement error. The use of Medicare data in the next chapter of this thesis permits closer matching of timing between continuity of care and screening and reduces this error. ..

The beneficial effect of personal continuity is likely to be due to a complex interaction of patient and provider factors, and the personal manner of the GP is just one of these. Factors identified by previous authors which may explain the effect of continuity of care on improved screening include increasing patients' trust in the doctor (Mainous et al. 2001) improving patient-centeredness (Scholl et al. 2014) and increased patient satisfaction with the doctor (Baker et al. 2003), and with their care (Adler, Vasiliadis & Bickell 2010). It is likely that these other factors are combined within the significant IV estimation results. Further analyses which separately account for these other factors would assist in decomposing this therapeutic value of continuity of care, but is not possible using the current data set.

This research adds to existing literature by including both personal continuity of care and site continuity of care in the models. By using panel data and including a broad range of covariates, using instrumental variables to consider endogeneity, this research overcomes some of the limitations of the existing literature. It reinforces an association between increased continuity of care (both at a GP and a practice-level) and cancer screening.

The finding that participation in recommeneded screening tests was associated with decreased self-rated access to bulk-billing and to a number of GPs is interesting. One explanation for this is that for women who engage in screening, cost is less of a barrier than the choice of female GP or access to services.

A number of other findings may have policy implications. The variability of screening rates between States warrant further analysis to assess if these are due to program differences. The increased rate of mammography among rural women suggests that previous attempts to improve access in rural and remote setting are having a positive effect. The association of decreased screening rates for women with the worst self-reported health suggests that increasing awareness among this group may be a priority.

6.8 Conclusion

The results reported above suggest that continuity of care (with either a GP or a practice) is associated with increased rates of cancer screening among Australian women aged between 20 and 69 after controlling for patient and health care characteristics and for the endogeneity of personal continuity of care.

Furthermore, these results suggest that failing to control for the endogeneity of continuity of care may underestimate the effect of continuity of care on cancer screening. These results provide an advance to the current continuity of care literature and add to existing knowledge by evaluating both personal and site continuity of care and the use of a novel instrument. The appropriateness of an IV is always open to debate, however the instrument chosen has passed standard testing and appears relevant.

These results rely on both self-reported screening participation and also self-reported attendance with the same GP and practice. In Chapter 7, Medicare administrative data is used to investigate the potential limitations of using self-reported ALSWH data.

7 Chapter 7 – Medicare Data, Continuity of Care and Pap Smear Testing

7.1 Chapter summary

Chapter 7 reports the results of a second analysis of Pap test participation for women in the Australian Longitudinal Study on Women's Health (ALSWH) sample. In this analysis, two problems encountered with using ALSWH survey data are considered. First, the issue of recall bias in overestimating Pap test participation is investigated by combining Medicare administrative data and ALSWH survey information. A comparison is made between Pap testing rates using Medicare data and those estimated from the survey data. Second, the Medicare data are used to estimate time to retest for women who are overdue for Pap testing. The use of continuous outcome variables expands the options for data analysis and random effects (RE) and fixed effects (FE) regression models are estimated. This analysis permits consideration of unobserved heterogeneity within the model. Using 12 years of survey information and linked administrative data, models are constructed to estimate rates of Pap testing for women according to continuity of care categories, and the number of months until next Pap test for women who are overdue for a Pap test according to guidelines.

The results show significantly increased rates of guideline-recommended Pap testing for women with either site or personal continuity of care compared to women with reduced continuity of care. The use of the same instrumental (IV) as in the previous chapter provides consistent evidence that failing to consider the endogeneity of continuity of care potentially underestimates the effect of continuity of care on cancer screening. The analysis of women who are overdue for their Pap tests shows that compared to women with reduced continuity of care, women with either site or personal continuity of care have a statistically significant reduction in time to retest. In this sample, women with personal continuity of care who are overdue their Pap test, on average, retest 2.1 months earlier than women with reduced continuity of care, and women with site continuity retest on average 2.7 months earlier than women with reduced continuity of care. Although this is consistent with a therapeutic effect associated with personal and site continuity of care, the clinical significance of this difference in Pap testing is questionable.

Although the results using the Medicare data indicate persistent significant differences in Pap testing associated with personal and site continuity of care, they are of reduced magnitude compared with the findings using survey data reported in the previous chapter.

7.2 Introduction

The results reported in Chapter 6 suggested that women in the ALSWH cohort were significantly more likely to participate in Pap testing and mammography screening compared with the Australian population. The differences were attributed to a combination of potentially inaccurate recall (exacerbated by justification bias), healthy survivor effect, and the inability of survey data to differentiate between screening and diagnostic Pap tests. The overestimation of screening participation has been reported by previous authors (Bowman, Sanson-Fisher & Redman 1997; Tumiel-Berhalter, Finney & Jaen 2004), but it is not anticipated to vary according to continuity of care.

In the research reported in this chapter, an attempt is made to overcome these data limitations by using Medicare data. While Medicare data does not record the content of general practice consultations, Pap testing is recorded in Medicare statistics in order to remunerate pathologists. The service date of Pap testing recorded within the Medicare database can be used to determine when a woman has a Pap test. As the Medicare statistics do not record similar information for mammography or other cancer screening tests, this analysis is limited to Pap testing.

The availability of 12 years of Medicare data permits estimation of time between Pap tests for women in the ALSWH sample, and increases options for modelling Pap test participation, including models which may control for individual heterogeneity.

7.3 Research questions

This research seeks to further ascertain if continuity of primary care has a therapeutic value, in this case being associated with increased rates of Pap testing.

The research questions considered within this analysis are:

- Do the associations between increased Pap test participation and increased personal and site continuity persist when administrative data are used to estimate Pap test participation (rather than the patient self-reported measures of participation utilised in Chapter 6)?
- Are models consistent after controlling for individual heterogeneity using fixed effect panel data analysis?

- For women who are overdue for Pap testing, is there any association between continuity of care (personal and/or site) and time to repeat screening?

7.4 Data and methods

7.4.1.1 ALSWH

This research again uses data from the first six waves of young and mid cohorts of the Australian Longitudinal Study on Women's Health (ALSWH), to provide patient demographic and access variables. The variables included in this analysis have been previously described in Chapter 4, and summarised in Table 51 in the Appendices.

7.4.1.2 Medicare data

Currently, over 90% of participants in the ALSWH have consented to have their survey data linked to Medicare administrative data. Medicare data records service activity (including Pap testing in order to remunerate pathologists) and service date. This permits estimation of time between Pap tests and Pap test participation rates for women in the ALSWH sample.

Outcome variable

Pap testing

Pap smear testing is recorded as a procedure in the Medicare statistics to provide remuneration for pathologists analysing the test[27]. Two item numbers are listed in the

[27] The exception to this is the Victorian Cytology Service (VCS), a Government-funded health promotion charity which analyses around 50% of the Pap tests in Victoria (Victorian Cytology Service 2016). VCS

Medicare Benefits Schedule (MBS): item number 73053 is indicated for women having a screening Pap test, while item number 73055 is indicated for women diagnosed with previous abnormalities, or with symptoms potentially suggestive of cervical cancer (see Appendices for full description). The remuneration is the same for both item numbers so there is no financial incentive for pathologists to preferentially bill one item. This analysis focuses on the screening Pap tests (item 73053), as women with diagnostic smears are advised to test at shorter time frames than women having screening tests, and symptoms or previous disease may alter the behaviour of these women in seeking care from the same GP or practice.

Pap smear items and date of services were utilised to calculate a measure of time to Pap test for each woman. The number of days between Pap tests, and months between Pap tests were calculated.

Three measures of Pap test participation were calculated (described below and in Table 25)

1. Women were classified according to whether they were recorded as having had a Pap test within the previous 24 months which is the recommended guideline interval between Pap tests (RACGP 2016)[28].
2. A 27-month testing period was also created—this is the threshold utilised by state registries before they classify a woman as overdue for Pap testing (Cancer

activity is not recorded in Medicare statistics (and Victorian women are subsequently excluded from this analysis).

[28] As already detailed, the Australian National Cervical Screening Program has changed with new recommendations introduced in December 2017.

Institute NSW 2015). It is also a more pragmatic cut-off than the 24-month/two-year threshold and is the preferred outcome variable used in subsequent regression models (discussed further in Results).

3. For women who have not had a Pap test recorded in Medicare statistics within 27 months, an analysis of the number of months taken to resume Pap testing is modelled.

Table 25: Outcome variables used in Medicare data analysis of Pap testing

Variable Name	Description	Data Source
24 month Pap	Pap smear completion in previous 24 months (1=Yes, 0=No)	Medicare Data
27 month Pap	Pap smear completion in previous 27 months (1=Yes, 0=No)	Medicare
monthsover	Months overdue smear for women have not had smear in previous 24 months.	Medicare

Other variables of interest

Subjective measures of personal and site continuity are derived from ALSWH survey responses as described in previous chapters of this thesis[29]. Continuity of care measures and other variables are unchanged from the analysis of the association between continuity of care and Pap testing described in the Chapter 6. Other covariates included are measures of access to Pap smear services, access to general practice services, and patient demographics (age, highest educational attainment, state of residence, urban/rural location, marital status, employment status, possession of private health insurance, health care card possession and are derived from ALSWH survey, and

[29] As previously note, survey questions permitting calculation of continuity of care begin in wave 2 of ALSWH surveys.

dummy variables for each year of observation). All variables are described in Table 51 in the Appendices.

7.4.2 Estimation approach

As in Chapter 6 of this thesis, we assume that women who choose to screen do so because they derive greater utility in screening compared to not screening.

The initial analysis of Medicare derived Pap testing classifies women according to whether a Pap test is recorded in the previous 27 months. The availability of panel data from both survey and Medicare administrative data motivates the use of panel data methods once again. In order to provide a panel data structure for this analysis, an annual measure of whether a woman reports having a Pap test in the last 27 months is modelled. Panel data has multiple advantages over cross-sectional data such as reduced collinearity among variables, increased efficiency and the ability to control for individual heterogeneity (Baltagi 2008). The effect of unobserved heterogeneity can either be assumed to be random, fixed, or mixed (a combination of random and fixed). Panel data has the advantage of blending inter-individual differences and intra-individual differences (Hsiao 2007) and permits modelling of more complex and dynamic interactions (Baltagi 2008). In order to compare Pap testing participation estimated from MBS data with the analysis using survey data reported of Chapter 6, the probability of a woman having a Pap test within 27 months, as a function of continuity of care and multiple patient characteristics is modelled as follows.

$$P(Y_{it} = 1 \mid \boldsymbol{X_{it}}) = F(\beta_0 + \ COC_{it}\beta_1 + \boldsymbol{x_{it}\beta_2} + \mu_i + \varepsilon_{it}) \ (1),$$

where

$$Y = \begin{cases} 1 & \text{if a woman has Pap test recorded within last 27 months} \\ 0 & \text{if otherwise} \end{cases} \qquad (2)$$

and COC_{it} denotes patient's continuity of primary care at a particular time point *t*, $\boldsymbol{x_{it}}$ is a vector of regressors such as age, health, ethnicity, country, gender or taste in seeking care, and u_i is an individual specific and time-invariant error component while ϵ_{it} represents an idiosyncratic error term. A random effects (RE) model is used to estimate equation (2). This model assumes that variation across entities is random (and uncorrelated with variables in the model), such that individual error term is not correlated with the explanatory variables x_{it}.

Given the binary outcome variable, panel logistic regression models are used,replicating the analysis of Chapter 6 and providing a comparison of self-reported versus administrative derived records of Pap test participation.

Given the potential for endogeneity of continuity of care in the model, the same instrumental variable used in the analysis from Chapter 6 is incorporated within the models for 27-month Pap testing. A woman's satisfaction with the manner of her GP is used as an instrument for personal continuity of care in an analysis using a two-stage least squares (2SLS) approach. Given that the IV is taken from survey data, reduced results are provided for every third year.

For the sub-group of women who are considered overdue their smear from administrative data, a variable of 'months overdue' is created to understand if there an association between site or personal continuity and time to retesting. The model estimating months until next Pap test for for women overdue testing is given in equation (3) below, as a function of continuity of care, other personal demographics, and individual patient characteristics

$$y_{it} = \beta_0 + COC_{it}\beta_1 + \boldsymbol{x_{it}\beta_2} + \mu_i + \varepsilon_{it} \quad (3)$$

where y_{it} is a continuous variable representing the number of months overdue Pap testing for woman *i* at a particular time point *t*, $\boldsymbol{x_{it}}$ is a vector of time variant regressors (such as age and marital status) and time invariant regressors (such as country of birth). The availability of a continuous outcome variable expands options for analysis, including fixed effects (FE) panel data estimation, which is challenging for binary outcome variables due to the incidental parameters problem. Equation (3) will be modelled using both FE and RE.

A fixed effect estimator permits controlling for unobserved individual heterogeneity. This is potentially important within this analysis as patient preferences for seeking continuity of care are not measured within the survey and are potentially time invariant. To elaborate, multiple unobserved patient-level attributes (such as preference for seeing a known doctor, trust in a new or known doctor, confidence or understanding of a health condition) may influence patient behaviour in seeking care from one provider or one practice. This individual heterogeneity can be controlled for by estimating a fixed-effects model using the available panel data. This model relaxes the random effects assumption and allows for individual and/or time specific effects to correlate with $\boldsymbol{x_{it}}$. and that some unobserved patient-level characteristic (such as preferences for care) may impact outcome variable.

While there may be some change in these preferences, they are presumed to be (at least relatively) fixed. With the FE model, time invariant characteristics and the individual error term (μ_i) are removed and only the effect of time variant characteristics is assessed.

In order to determine the most appropriate model between FE and RE, a Hausman test is performed. The Hausman test (Hausman 1978) compares the parameters of the fixed-effects and random-effects models, that is testing the null hypothesis that regressors are uncorrelated with the dependent variable. If the random-effects and fixed-effects estimators do not differ significantly, then both estimators are considered unbiased and consistent and the random-effects estimator is traditionally used due to efficiency. If the difference between the fixed-effects and random-effects estimators is statistically significant, this provides evidence against the random-effects assumption, and the fixed-effects is the preferred model if this model is supported in theory (Wooldridge 2010).

7.4.3 Modelling approach

It appears logical that any effect of continuity of care is contingent on ongoing interaction between patients and their health care providers. Within this analysis, all women who do not report any GP visits in a year are excluded from the analysis. A sensitivity analysis setting a threshold of three visits in the previous two years is provided, as this is minimum contact before GPs should assume a patient is a 'regular patient' of a practice according to Royal Australian College of General Practitioners standards (RACGP 2017), and is therefore relevant to the Australian context.

As survey data is provided only every three years, but Medicare statistics are annual, survey data has been assumed to be stable between survey waves. For example, if a woman reported residing in Western Australia in Wave 3 but resided in South Australia in Wave 4, she has been assumed to live in Western Australia until the year before Wave 4 survey. This likely underestimates the variation between surveys but greatly increases sample size and improves precision of estimates.

Women from Victoria are excluded from the analysis as around 50% of Pap test reporting is conducted by the Victorian Cytology Service, a government-funded pathology laboratory whose activity is not included in Medicare statistics (Victorian Cytology Service 2016).

Age and Age squared are included in the model to consider the potential non-linear association between Pap testing and ageing (a positive effect of age and negative effect of age squared would suggest that while on average there is an association between increasing age and the outcome, this association is less significant with increasing age). Robust standard errors are included to correct the possible presence of heteroscedasticity (White 1980).

7.5 Results

The results are reported in three sections. Summary statistics are first reported, before logistic regression results of the full sample, and finally the sub-group analysis of those women who are overdue for Pap testing.

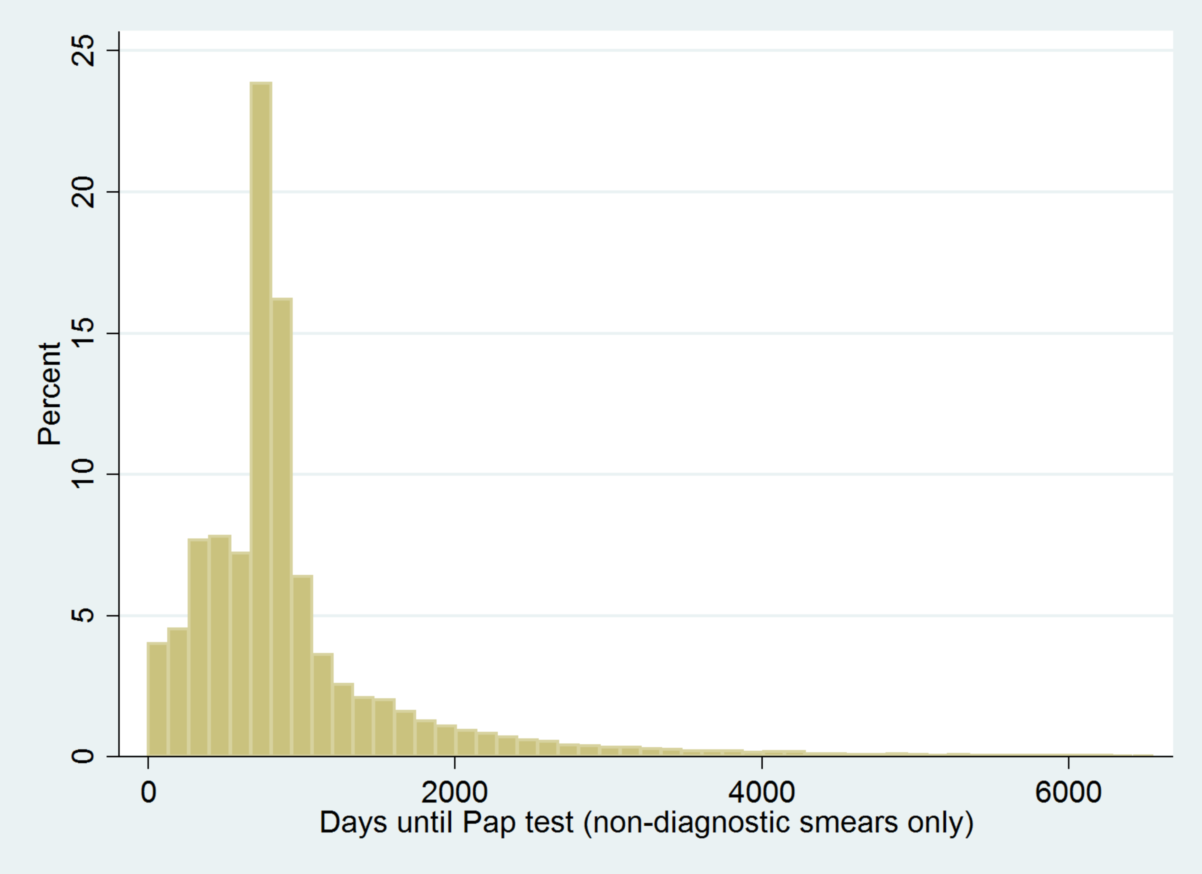
7.5.1 Summary statistics

There are 116,788 Pap tests recorded in Medicare data, including 18,949 diagnostic tests and 97,849 screening tests. Diagnostic tests are not analysed and these are dropped, as are a further 943 duplicate tests (where two pap tests are recorded on same day and by same provider). Women are also removed from the analysis once they report having had a hysterectomy in the survey, or at surgery date if they have a hysterectomy recorded in Medicare statistics. Observations are also omitted if they are prior to the year 2000 (when continuity measures are first available for the full cohort).

Summary statistics for all included variables are provided in Table 52 in the Appendices, but discussion will focus on Pap testing estimates. Full summary statistics for separate mid and young ALSWH cohorts are provided in Table 53 and Table 54 in the Appendices.

An annual variable of days to Pap test is created for women in final sample. The distribution of days to Pap smear for screening Pap tests (MBS item 73053) is shown in Figure 22 below. There is a peak in Pap testing corresponding to around 750-900 days (2-2½ years) and this drops to low levels from 1,300 days (3½ years).

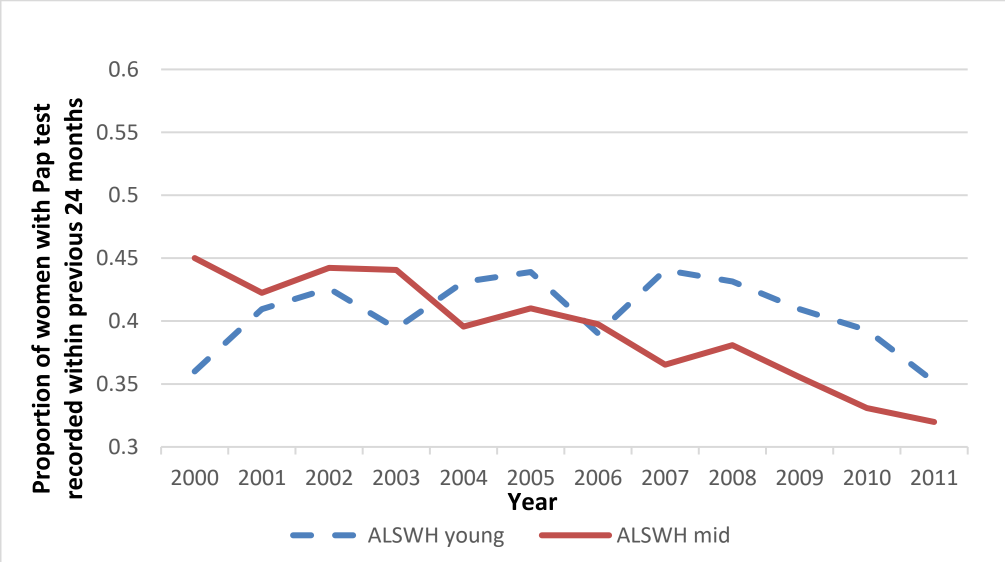
Figure 22 - Distribution of days to Pap test (MBS item 73053- screening Pap test)



7.5.1.1 24-month and 27-month Pap test participation

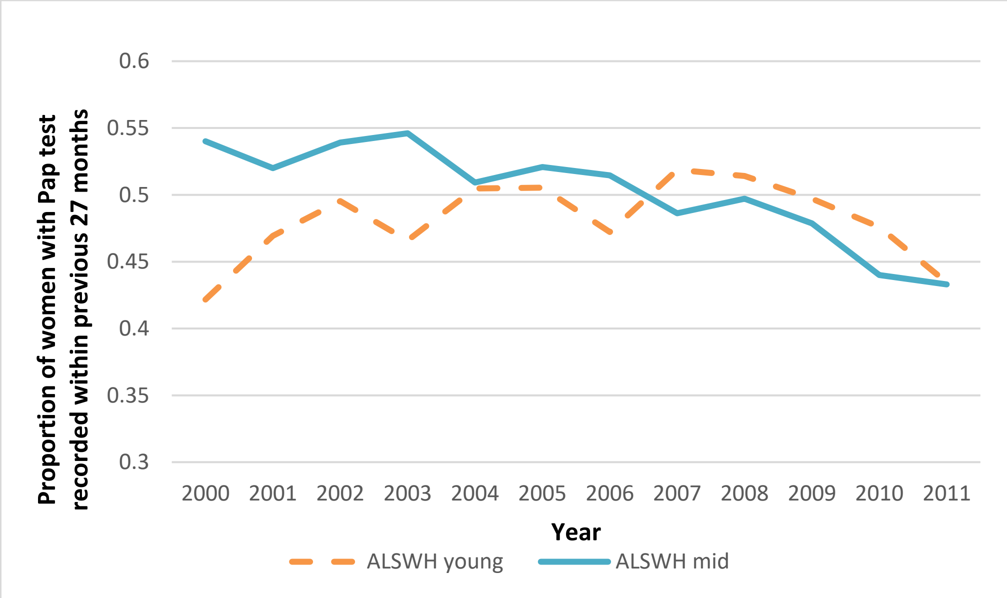
Figure 23 and Figure 24 indicate Pap testing rates for the ALSWH mid and young cohorts between 2000 and 2011. For women in the mid cohort, the 24-month Pap test participation rate gradually drops from 45% in 2000 (when the women are on average 51.5 years of age) to 32% in 2011 (with average age of 62.5). Participation among women in the young cohort is 36% in 2000 (when women in this cohort have an average age of 24.5 years) and increases to a maximum of 44% in 2007, before declining in each subsequent year, to 2011 when 35% of women (with an average age of 35.6 years) have Pap tests recorded in the previous two years.

Figure 23 – 24-month Pap testing rates for women in ALSWH mid and young cohorts



As discussed earlier. a more pragmatic threshold of 27 months between Pap tests is estimated and is reported for the remainder of this analysis. The patterns of participation for women in both cohorts are similar to the 24-month variable (shown in Figure 24 below). This 27-month to Pap test measure is the preferred measured used within regression analysis (with alternative 24-month models showing consistent findings and provided in Appendices).

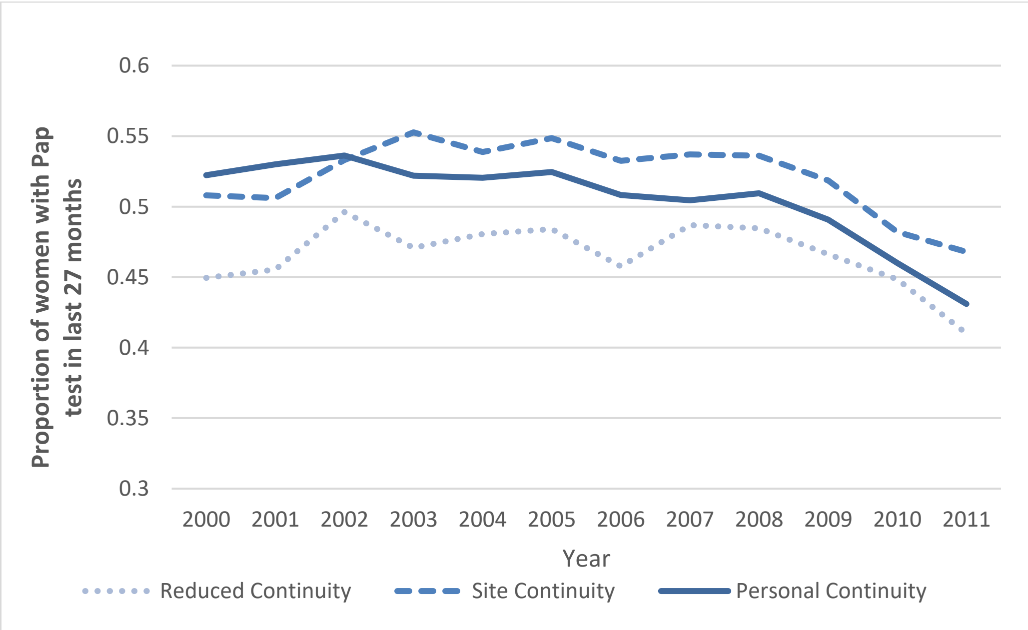
Figure 24 – 27-month Pap test participation rates ALSWH mid and young cohorts



There is an initial rise then decline in Pap testing since 2007 for the young cohort, and a gradual decline since 2000 for the mid cohort, accelerating after 2008. The results of this 27-month threshold indicate participation rates in the ALSWH sample approaching those of national population statistics (AIHW 2016a). Pap test participation and continuity of care.

Pap test participation rates in the previous 27 months were classified according to continuity of care categories and are shown graphically in Figure 25 below. Between 2000 and 2011, women with site continuity of care or personal continuity of care have had increased Pap testing rates than women with reduced continuity of care. Between 2000 and 2002, rates of Pap testing are highest for women with personal continuity of care. From 2001 to 2003 there has been an increase in Pap testing for women with site continuity, and from 2003 onwards, Pap testing rates are highest for women with site continuity of care. There has been a gradual decline in Pap testing rates for women with personal continuity since 2002, and in all continuity categories since 2007. This suggests that the decline in participation at the end of the observation period is not influenced by continuity of care category.

Figure 25 – 27-month Pap testing rates classified according to continuity of care



7.5.2 Regression analysis.

7.5.2.1 Sample

Due to the marked decline in Pap test participation from 2009 (potentially due to combination of age, increasing awareness of HPV vaccination and LBC testing), regression analysis is limited to the nine years between 2000 and 2009 (an expanded analysis including data from 2010-12 provides consistent findings in terms of associations according to continuity of care and is provided in Table 55 in the Appendices). After restricting the sample to the observations between 2000 and 2009, excluding women with no GP visits in any year and excluding women with no Medicare reported Pap test between 1996 and 2012, provides a final sample of 124,113 observations in 14,670 women, with an average 8.5 observations per women for the period between 2000 and 2009.

7.5.3 Analysis of continuity of care and screening participation.

Table 26 provides a series of odds ratio results from logistic regression models similar to Table 5 in Chapter 6. Within the results shown in Table 26 all models include estimates of Pap testing in the previous 27 months derived from Medicare data, while in the previous chapter, self-reported estimates of Pap testing were modelled. Model 1 shows results from panel random effects logistic regression of the full sample (the preferred model). Model 2 limits analysis to women who have had at least three GP consultation items recorded in Medicare data in previous two years, and Model 3 provides analysis of a balanced sample. The results from the three models are broadly consistent and suggest that the results are robust to exclusion of patients with low GP attendance and by attrition within the sample. .

Table 26: Regression analysis of MBS derived measure of Pap test participation

Variable	Model 1 Panel Logistic RE	Model 2 Panel Logistic RE (3+ visits past 2 years)	Model 3 Panel Logistic RE balanced sample	Model 4 Panel Logistic RE mid cohort	Model 5 Panel logistic RE young cohort
Personal continuity of care	1.152*** (0.03)	1.130*** (0.032)	1.164*** (0.038)	1.107* (0.047)	1.167*** (0.038)
Site continuity of care	1.146*** (0.031)	1.138*** (0.033)	1.163*** (0.04)	1.067 (0.05)	1.201*** (0.039)
Age	1.088*** (0.011)	1.099*** (0.011)	1.074*** (0.013)	1.004 (0.189)	1.274** (0.102)
Age squared	0.999*** (0)	0.999*** (0)	0.999*** (0)	1.000 (0.002)	0.996** (0.001)
Year- 2001	0.994 (0.031)	0.989 (0.034)	0.944 (0.034)	0.853** (0.049)	1.119* (0.049)
2002	1.122*** (0.037)	1.092* (0.039)	1.053 (0.042)	0.959 (0.064)	1.243*** (0.068)
2003	1.080* (0.036)	1.059 (0.038)	1.095* (0.044)	0.98 (0.078)	1.06 (0.066)
2004	1.038 (0.037)	1.041 (0.039)	0.992 (0.042)	0.794* (0.078)	1.144 (0.08)
2005	1.049 (0.036)	1.044 (0.038)	1.009 (0.043)	0.82 (0.09)	1.133 (0.088)
2006	0.991 (0.035)	1.007 (0.038)	0.973 (0.042)	0.766* (0.096)	1.02 (0.088)
2007	1.017 (0.036)	1.014 (0.038)	0.997 (0.043)	0.704* (0.100)	1.15 (0.106)
2008	0.992 (0.035)	0.994 (0.037)	0.984 (0.043)	0.682* (0.108)	1.128 (0.113)
2009	0.887*** (0.032)	0.887** (0.033)	0.901* (0.04)	0.591** (0.104)	1.026 (0.112)
Good access to pap smears	1.328*** (0.055)	1.375*** (0.062)	1.317*** (0.07)	1.322** (0.112)	1.317*** (0.06)
Good GP hours	1.017 (0.026)	1.021 (0.028)	1.034 (0.033)	1.067 (0.045)	0.985 (0.031)
Good GP numbers	1.067* (0.029)	1.062* (0.031)	1.052 (0.036)	1.077 (0.047)	1.059 (0.035)
Good bulk-billing access	0.888*** (0.021)	0.880*** (0.022)	0.902*** (0.026)	0.890** (0.034)	0.880*** (0.025)
Good access to female GP	1.219*** (0.032)	1.248** (0.036)	1.242*** (0.042)	1.306*** (0.057)	1.160*** (0.038)
Queensland	1.246*** (0.045)	1.255*** (0.047)	1.245*** (0.056)	1.248*** (0.082)	1.232*** (0.048)

Variable	Model 1 Panel Logistic RE	Model 2 Panel Logistic RE (3+ visits past 2 years)	Model 3 Panel Logistic RE balanced sample	Model 4 Panel Logistic RE mid cohort	Model 5 Panel logistic RE young cohort
SA	1.240*** (0.059)	1.213*** (0.06)	1.267*** (0.074)	1.232* (0.104)	1.263*** (0.068)
WA	1.183*** (0.057)	1.199*** (0.06)	1.071 (0.067)	1.494*** (0.133)	1.023 (0.054)
Tasmania	1.280*** (0.092)	1.307*** (0.096)	1.346** (0.123)	1.434** (0.178)	1.127 (0.092)
NT	1.244 (0.139)	1.369** (0.161)	1.052 (0.152)	1.414 (0.317)	1.128 (0.135)
ACT	0.936 (0.08)	0.969 (0.087)	0.922 (0.105)	0.782 (0.16)	0.99 (0.084)
Australian-born	1.011 (0.047)	1.017 (0.049)	0.994 (0.057)	1.017 (0.068)	1.052 (0.067)
Inner regional	0.926* (0.029)	0.917** (0.031)	0.905* (0.036)	0.927 (0.051)	0.950 (0.036)
Outer regional	0.792*** (0.031)	0.774*** (0.032)	0.754*** (0.037)	0.750*** (0.052)	0.846*** (0.038)
Remote	0.702*** (0.049)	0.680*** (0.05)	0.689*** (0.063)	0.543*** (0.072)	0.829* (0.064)
Married	1.359*** (0.038)	1.374*** (0.042)	1.532*** (0.055)	1.172** (0.068)	1.419*** (0.044)
HSC	0.987 (0.039)	0.961 (0.04)	0.986 (0.048)	0.989 (0.052)	0.93 (0.057)
Trade	1.037 (0.04)	1.006 (0.041)	1.001 (0.048)	0.998 (0.056)	1.012 (0.057)
University	1.061 (0.043)	1.000 (0.043)	1.002 (0.051)	1.140* (0.076)	0.955 (0.054)
Income impossible	0.784** (0.059)	0.755*** (0.062)	0.757** (0.071)	0.701** (0.079)	0.931 (0.091)
Always difficult	0.877** (0.036)	0.859*** (0.038)	0.862** (0.044)	0.829** (0.056)	0.929 (0.046)
Sometimes difficult	0.951 (0.03)	0.925* (0.032)	0.986 (0.038)	0.868** (0.044)	1.041 (0.041)
Not bad income	1.003 (0.028)	0.987 (0.031)	1.023 (0.035)	0.977 (0.041)	1.035 (0.038)
Employed	0.939* (0.028)	0.942 (0.03)	0.926* (0.034)	0.988 (0.044)	0.904** (0.035)
Unemployed	0.803** (0.057)	0.774*** (0.058)	0.695*** (0.065)	0.824 (0.121)	0.781** (0.06)
Private Hospital Insurance	1.327*** (0.035)	1.342*** (0.038)	1.357*** (0.045)	1.218*** (0.06)	1.420*** (0.043)

Variable	Model 1 Panel Logistic RE	Model 2 Panel Logistic RE (3+ visits past 2 years)	Model 3 Panel Logistic RE balanced sample	Model 4 Panel Logistic RE mid cohort	Model 5 Panel logistic RE young cohort
Health care card holder	1.004 (0.026)	0.998 (0.028)	0.978 (0.032)	1.024 (0.037)	0.891** (0.035)
N	124133	99642	77707	59150	64983
n	14670	14560	7884	6616	8054
AIC	148779.6	120527.4	93075.4	65877	82149.5
BIC	149188.3	120926.8	93464.3	66254.5	82531

Note: exponentiated coefficients and standard errors in parentheses. Significance stars legend: *= p<.1; ** = p<.05; *** = p<.001. OR>1 indicates increased odds of having Pap test in previous 27 months. OR<1 indicates decreased odds of having Pap test within 27 months. Reference categories (OR=1) are omitted. Base case is women with reduced continuity of care, from NSW, major city, did not complete HSC, copes easily with available income, is not in workforce, do not have private health insurance or health concession card, poor or fair access to number of GP, choice of GPs, female GP, bulk-billing, access to Pap test, year 2000. Women from Victoria are omitted from this analysis.

Results from Model 1 indicate that compared with women with reduced continuity of care, Pap smear participation within 27 months is significantly increased for women with site continuity of care (OR 1.15; 95% CI 1.09-1.21) or women with personal continuity of care (OR 1.15; 95% CI 1.09-1.21). Women who report good or better access to Pap smear services are significantly more likely to report Pap smear participation than women with fair or poor access (OR 1.33; 95% CI 1.22-1.44). The interaction between the age and age squared variable indicates that although there is an association between increased Pap testing rates as women get older, the strength of this association is decreasing with age. Good or better access to a female GP is significantly associated with increased Pap testing (OR 1.22; 95% CI 1.16-1.28, while good or better access to GP hours is not significant. After excluding women from Victoria, and compared with women in New South Wales, women who live in most of the remaining Australian states (Queensland, South Australia, Western Australia and Tasmania) have significantly increased odds of Pap smear participation in the previous 27 months. Regarding access to bulk-billing, these results suggest that good or better access to bulk-billing is associated with decreased Pap testing according to guidelines (OR 0.89; 95% CI 0.85-0.93). One reason may be that for women having Pap tests, finding a bulk-billing GP is less important than having continuity of care and seeing a female GP. Another potential explanation is that women who attend bulk-billing appointments may be afforded less time and are unable to have Pap tests within these appointments. However, the content of consultation cannot be determined from the administrative data such a supposition requires further research.

Other significant findings in Model 1 are consistent with previous research and with the analyses of Chapter 6 of this thesis. These findings include statistically significantly increased Pap testing for women who report being married or in a de facto relationship (compared with unmarried or widowed women) and for women with private health insurance, and decreased Pap testing for women in rural and outer regional areas (compared with metropolitan areas) and for women with decreased financial means (compared to those women reporting no financial difficulty). There were no significant differences in Pap testing according to educational attainment, being Australian-born, or being in possession of a health care card.

Comparing the separate mid (Model 4) and young (Model 5) cohorts shows that the significant association between increased personal continuity of care and Pap testing is stronger for women in the young cohort, and of marginal significance for women in the mid cohort. Also, the significant association between site continuity of care and Pap testing is similarly restricted to the younger cohort of women. These findings indicate that the association between Pap testing and continuity of care is stronger for women in the younger age cohort and are consistent with the statistically significantly reduced age squared term reported in Model 1. Most other significant findings are consistent across both cohorts. However, there are some exceptions: reduced Pap smear participation associated with being in the work force (either employed or unemployed) is limited to the young cohort of women, an association between lower income and decreased Pap testing is confined to the mid cohort of women, and possession of a concession card is associated with significantly decreased Pap testing is reported for women in the young cohort (and is non- significant at $p<0.05$ level for the total sample). For women in the young cohort, there is potentially reduced job flexibility associated with more junior roles, and being at work may have a greater impact on reducing the ability to see a doctor, and this effect dominates over the effect of reduced income (which is limited to women from the older age cohort).

The results of the IV analysis reported similar findings to Chapter 6 (full output is provided in Table 49 in the Appendices) suggesting that estimates of personal continuity of care are downwardly biased in un-instrumented models.

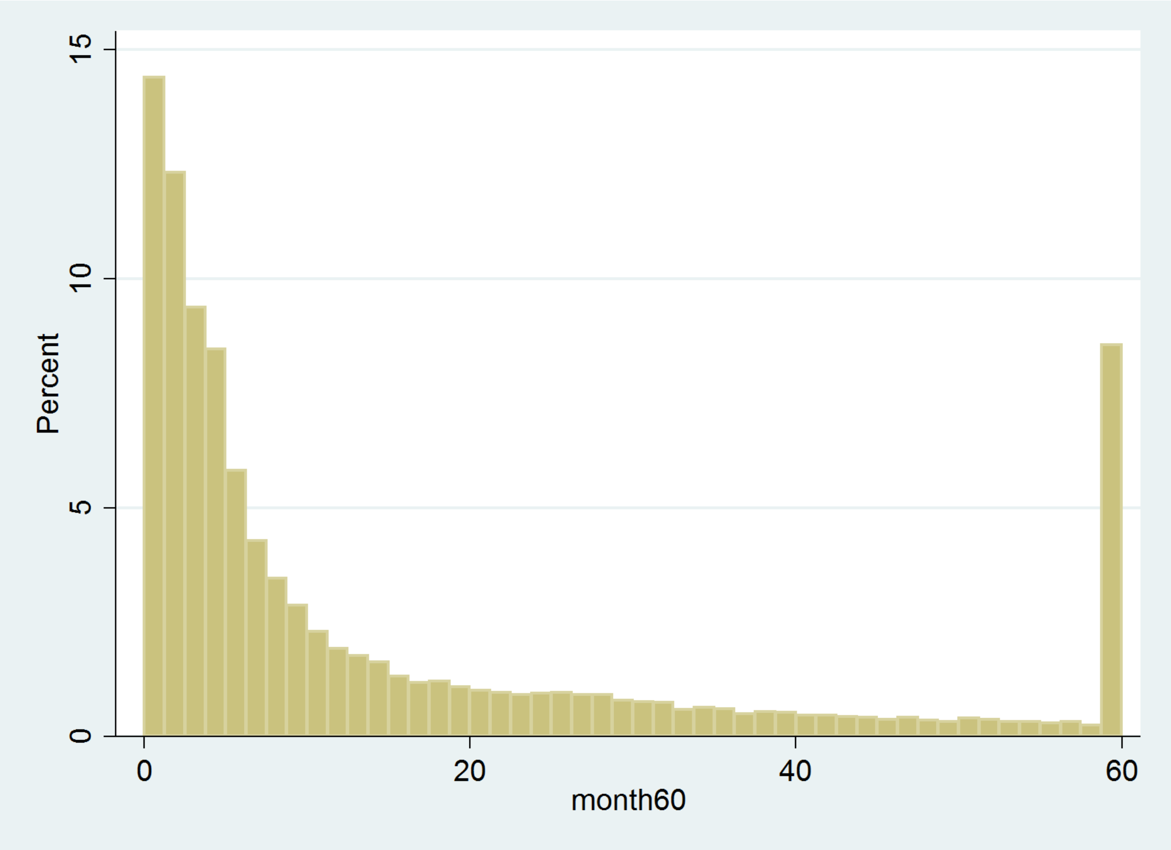
Table 27: IV results, and results of model testing

Variable	Model 1 - Panel regression RE	Model 9 - Panel IV regression	Model 10 - Pooled IV regression RE
Personal continuity of care	0.142***(0.026)	0.177**(0.067)	0.168**(0.071)
Site continuity of care	0.136***(0.027)	0.102***(0.027)	0.096***(0.029)
Breusch Pagan LM test for RE(Comparing OLS and RE)		Chibar=94128.73	Prob>chibar2= .000
Hausman test(Comparing FE and RE)		Chi2 -= 459.97	Prob>chi2 0.000

7.5.4 Regression analysis of time to rescreening for women who are overdue Pap testing

For women in the total sample, there are 61,114 observations when women do not have a Pap test reported within 27 months. For these women, the additional average time to next Pap test was 18 months. Figure 26 illustrates this distribution. Over 50% of the women retest within five months, while nearly 10% of women still have not retested after five years.

Figure 26 - Months until next Pap test for women who are overdue testing (27-month cutoff and truncated at 60 months)



Regression analysis is provided analysing the sub-sample of women who are overdue Pap smears in order to determine whether there is an association between continuity of care and time taken to remedy this overdue status. It is anticipated that if there is a therapeutic value to continuity of care (either through increased response to a practice's recall systems or through increased compliance with a doctor's recommendation) then women with site or personal continuity of care would be anticipated to re-engage with the screening program sooner than women with reduced continuity of care.

The regression results analysing months until next Pap test for women overdue Pap testing are shown in Table 28 below. Pooled regression (Model 6), panel random effects (Model 7) are provided, and the use of a continuous outcome variable expands the options for analysis, permitting individual fixed effects (Model 8) to be provided. A negative coefficient indicates reduced time between Pap tests associated with a variable.

Table 28: Regression results of subgroup of women overdue Pap testing and subsequent months until next Pap test

Model Variable	Model 6 - Pooled regression	Model 7- Panel RE c regression	Model 8 - Panel FE regression
Personal continuity of care	-0.171(0.334)	-1.751***(0.49)	-2.121***(0.592)
Site continuity of care	-1.86***(0.355)	-1.941***(0.5)	-1.629**(0.594)
Age	-3.037***(0.134)	-3.942***(0.203)	-0.76(1.054)
Age squared	0.393***(0.002)	0.0485***(0.003)	0.0531***(0.003)
Year- 2001	6.02***(0.256)	6.907***(0.242)	3.640***(1.085)
2002	11.26***(0.303)	10.81***(0.296)	3.965(2.114)
2003	16.30***(0.362)	14.98***(0.366)	4.368(3.154)
2004	18.98***(0.417)	19.65***(0.42)	5.924(4.19)
2005	22.76***(0.444)	24.03***(0.454)	6.885(5.231)
2006	28.21***(0.517)	29.51***(0.505)	8.652(6.284)
2007	30.66***(0.553)	33.79***(0.542)	9.79(7.327)
2008	33.32***(0.574)	38.56***(0.576)	11.49(8.37)
2009	35.92***(0.606)	43.39***(0.618)	13.13(9.454)
Good access to pap smears	-5.368***(0.506)	-4.754***(0.747)	- 4.150***(0.855)
Good GP hours	-0.210 (0.339)	-0.182(0.451)	0.0716(0.52)
Good GP numbers	0.338 (0.361)	0.45(0.485)	0.581(0.553)

Model Variable	Model 6 - Pooled regression	Model 7- Panel RE c regression	Model 8 - Panel FE regression
Good bulk-billing access	2.116***(0.301)	1.488***(0.441)	0.888(0.531)
Good access to female GP	-2.09***(0.336)	-1.347**(0.483)	-0.767(0.57)
Queensland	-2.471***(0.339)	-2.284***(0.657)	-0.65(1.772)
SA	-1.491***(0.476)	0.429(0.87)	3.163(3.027)
WA	-0.928**(0.451)	-1.007(0.835)	0.143(2.878)
Tasmania	-1.779***(0.678)	-1.458(1.278)	4.455(3.815)
NT	-5.542***(1.225)	-3.402(2.224)	-0.35(3.516)
ACT	0.384 (0.920)	0.246(1.682)	0.366(2.815)
Australian-born	-1.012**(0.414)	0.891(0.776)	-
Inner regional	0.386 (0.346)	1.488*(0.605)	2.299*(0.95)
Outer regional	3.294***(0.397)	2.256**(0.727)	0.106(1.252)
Remote	4.862***(0.711)	4.777***(1.285)	2.823(1.972)
Married	-6.966***(0.318)	-3.995***(0.539)	-1.913**(0.732)
HSC	-1.655**(0.443)	-1.316*(0.542)	-0.241(0.65)
Trade	-1.553***(0.418)	-0.649(0.534)	0.946(0.65)
University	-2.016***(0.429)	-0.37(0.604)	1.437(0.932)
Income Impossible	-2.177*(0.982)	-1.161(1.025)	-1.343(1.11)
Always Difficult	-1.332*(0.526)	-1.011(0.573)	-1.235(0.641)
Sometimes Difficult	-1.313**(0.43)	-0.864(0.451)	-0.739(0.499)
Not bad income	-0.845*(0.403)	-0.499(0.397)	-0.173(0.43)
Employed	0.458 (0.372)	1.275*(0.564)	1.823**(0.706)
Unemployed	2.126**(0.797)	0.227(1.257)	-1.01(1.684)
Private Hospital Insurance	-4.231***(0.299)	-3.923***(0.514)	-3.228***(0.74)
Health Care Card Holder	1.714***(0.357)	0.930**(0.354)	0.497(0.374)
n	61460	61460	61460
N	13334	13334	13334
Breusch Pagan LM test for RE(Comparing OLS and RE)	Chibar=94128.73	Prob>chibar2= 0.000	
Hausman test(Comparing FE and RE)	Chi2 -= 459.97	Prob>chi2 0.000	

Note: Results indicate coefficients, with standard errors in parentheses. A positive coefficient indicates that variable is associated with increased time for women to have next Pap test. A negative coefficient indicates that variable is associated with decreased time to next Pap test. Significance stars legend: *= p<.1; ** = p<.05; *** = p<.001. Reference categories (OR=1) are omitted. Base case is women with reduced continuity of care, from NSW, major city, did not complete HSC, copes easily with available income, is not in workforce, do not have private health insurance or health concession card, poor or fair access to number of GP, choice of GPs, female GP, bulk-billing, access to Pap test, year 2000. Women from Victoria are omitted from this analysis.. No variation of Australian born status and drops out of FE analysis

In both panel data models (models 7 and 8), women who are overdue for testing retest significantly earlier if they report having site continuity of care or personal continuity of care, compared with women in the reduced continuity group. In this analysis, there are potentially important unobserved patient-level characteristics which may be associated with a woman's behaviour in having Pap tests, and her behaviour in attending the same practice or provider. These might include personal preference for seeing the same doctor, likely compliance with recommendations to have preventative care, and also the availability of a preferred doctor to perform a Pap test. This unobserved individual heterogeneity can be controlled for in the fixed effects model and this is the preferred model for this analysis. It is comforting however, that in both the RE and FE models, the time to retest is around two months earlier for patients with personal or site continuity. The difference between the two panel models (models 7 and 8) and the pooled OLS model (Model 6), suggest that the strong assumptions underlying that model are not met. This is further supported by the rejection of the null hypothesis of the Breusch Pagan Lagrange multiplier test (Breusch & Pagan 1980) in comparison models 6 and 7, suggesting the presence of panel random.

The results from the fixed effects model indicate a statistically significant decreased time for retesting of 2.12 months for women with personal continuity of care, and 1.63 months for women with site continuity of care, compared with women in the reduced continuity group. Within the fixed effects model, the significant associations with time, location of residence and age are reduced or drop out completely, and the remaining significant findings suggest increased Pap testing associated with marriage, private health insurance, and good access to Pap tests, and reduced Pap testing associated with being in the workforce. These significant findings are consistent with earlier analysis of the full sample of women shown in Table 26.

The results of the Hausman test comparing models 7 and 8 (Hausman 1978) suggest significant differences in the estimated coefficients between the random and fixed effect analysis, which provides further support to the choice of fixed effects model within this analysis

Separate cohort analyses (included in Table 56 in the Appendices) indicate that personal continuity of care has a stronger association with reduced Pap testing interval for the mid cohort women compared with the young women, while site continuity has a significant association with reduced testing interval for the young cohort. Although the significant reduced time to retest associated with site continuity of care was only found in the young cohort analysis.

7.5.4.1 Sensitivity testing

As discussed throughout this analysis, models were robust to sample considerations (including balanced panel and exclusion according to RACGP visit guidelines), and multiple definitions of timing for being overdue Pap testing. This analysis provides evidence of statistically significant reduction in time to Pap test according to continuity categories. However, the clinical significance of a two-month reduction in Pap testing is questionable.

7.6 Discussion

Both personal and site continuity of care are shown to be associated with increased rates of Pap testing, this time using Medicare derived data in this sample of Australian women, even after controlling for a rich set of covariates obtained from the ALSWH survey.

Pap testing rates were lower than those estimated using self-reported Pap testing (in Chapter 5) and are closer to the Australian population rates. The use of Medicare data for this purpose has potentially improved the accuracy of estimating participation rates but is not without limitations.

Pap testing rates always remain lower that national participation rates and show decreasing participation in since 2009. Firstly, this is potentially due to the absence of women from Victoria from Medicare statistics, as AIHW statistics indicate women from Victoria have rates of Pap testing over two percent higher compared with other Australian states (AIHW 2017a) and the exclusion of these women likely leads to underestimation of Pap test participation within the cohort..

Secondly, MBS data for this timeframe does not record liquid-based cytology (LBC) cervical screening. These tests are the preferred cervical screening test in the US, UK and New Zealand (Gibb & Martens 2011; National Institute for Health and Care Excellence 2003), and have been available privately in Australia since 1996 (at an average cost of $40) but have not been Government-funded until 2017. LBC tests analyse a greater volume of the cervical sample, can test for the presence of HPV, and since December 2017 are the preferred screening test in the Australian national cervical screening program (Cancer Council Australia Cervical Cancer Screening Guidelines Working Party 2016; Commonwealth of Australia 2013). Non-government-funded investigations (including Pap tests) are not recorded in Medicare statistics (unless a standard Pap test was also taken at the same time). So women who had LBC tests alone, would not have their tests recorded during the time of this analysis which may explain some of the decreasing participation

Despite these data limitations, estimates of Pap testing appear more accurate using Medicare date than those estimated using self-report. These findings reinforce the value of having multiple measures of health service utilisation in order to estimate the accuracy or concordance of measures.

Women in the ALSWH sample reported a decline in Pap testing, most marked from 2007. This decline has not been reported in national data and remains unexplained. Data checking has been performed and the results appear accurate. There have been no changes to Medicare coding which may explain this result and although a number of reasons have been suggested, they remain conjecture.

One potential explanation for the more rapid decrease in participation in mid cohort women, and consistent with previous literature indicating reduced screening with age (Byles et al. 2014; Oscarsson, Wijma & Benzein 2008), is that for these older women (with an average age of 59.5 in 2008) Pap testing may seem less relevant. Another factor may be that Pap testing after menopause is known to be potentially more uncomfortable, and may be a barrier to participation. Alternatively, GPs may be less likely to suggest Pap testing in this age group and potentially a joint decision between women and their GPs may be influencing their ongoing participation.

For the young cohort of women, the availability of the human papilloma virus (HPV) vaccine from 2007 may have some influence in reducing participation (Gertig et al. 2013). While the young cohort did not qualify for free HPV vaccination, they may have chosen private HPV vaccination and there is emerging evidence of decreased Pap test participation rates in women who have been vaccinated against HPV (Budd et al. 2014).

In the absence of an explanation for this decline, the analysis was restricted to data from 2000-09. Alternative models until 2012 are also provided in Appendices and provide materially consistent results

The analysis of women who were overdue for Pap testing also provides interesting findings. Women with personal or site continuity are likely to re-test statistically significantly earlier than women with reduced continuity of care. An additional analysis using individual fixed effects found persisting significant differences even after controlling for unobserved individual heterogeneity.

The use of multiple panel data modelling techniques including fixed and random effects adds strength to the earlier findings, and lends further support to a positive association between continuity of care and participation in Pap test screening.

The differences between the ALSWH age cohorts is interesting. The results suggest a stronger association between increased continuity of care (both personal and site) and increased Pap smear participation for women in the younger ALSWH age cohort.

Although a positive association between personal or site continuity and cervical screening exists for women in the mid cohort, this is not significant at the $p<0.05$ level. One reason for this may be that women in the young age group are more responsive to a GP's discussion about the benefits of screening and more responsive to practice-level education and reminders than older women, or because they perceive themselves to be at higher risk of cervical cancer.

For women in the older cohort, participation in screening may be influenced by previous experiences of cervical screening and of GP services. Such experience may be less amenable to the influence of a regular GP or having a usual practice. These findings are consistent with previous research which has found that previous negative experiences may act as barriers to screening. The findings that increased Pap testing by women in the mid cohort is associated with better access to a female GP, and history of a previous abnormal Pap test or a previous abnormal smear are consistent with the previous literature and further supports the interpretation that variables other than continuity of care are also likely to influence participation rates in this group of women**.**

These results suggest significantly increased Pap testing and potentially greater benefits of continuity of care in the younger age group, at least pertaining to preventative screening. Previous authors have suggested that continuity of care is more important to older patients and particularly for those people with chronic and complex health conditions, and attempts to encourage continuity of care have focused on these groups. While younger cohorts may have less morbidity compared with older people, the younger cohort may potentially be more responsive to recommendations about preventive services from a trusted provider. The reduced results of the IV analysis once again suggest that accounting for endogeneity of continuity of care in models provides evidence of a persistent difference in screening rates according to continuity of care.

At the end of 2017, the national cervical cancer screening program converted to five-yearly, rather than two-yearly screening, and now includes LBC and HPV testing routinely (Cancer Institute NSW 2017a). Modelling of this updated program undertaken in preparation for the introduction of five-yearly screening estimated an additional 15-22% reduction in the incidence and mortality of cervical cancer, compared with the current program (Medical Services Advisory Committee 2014). It will be important to monitor compliance with this new regime, particularly as the increasing population coverage through the HPV vaccination program decreases the incidence of cervical cancer and abnormal Pap tests in the community. The impact of a preferred general practice or GP in encouraging participation in a program of this (ir)regularity needs to be determined.

The other findings within the model were as anticipated, and consistent with the findings from Chapter 6 of this thesis.

7.7 Conclusion

The results reported above provide further evidence of a positive relationship between continuity of care and rates of Pap test participation in this sample of Australian women. They also suggest that women with site or personal continuity of care who are overdue for a Pap test will on average re-screen earlier compared to women with reduced continuity of care. The difference of two months is unlikely to be clinically significant but does suggest some therapeutic value of continuity of primary care at both a personal and site level.

The significant increase in Pap test participation is greater for younger women, who, if they have either personal or site continuity of care, are also significantly more likely to retest. Limiting the promotion of continuity of care to older patients or those with chronic and complex conditions may potentially overlook the benefits in terms of cancer screening.

8 Chapter 8 – What Role for Continuity of Primary Care in Australia?

8.1 Introduction

This thesis has been motivated by the need for improved understanding of the performance of primary care. The value of primary care may be difficult to determine as the value of inputs and outputs can be uncertain. This thesis has attempted to understand the value of prolonged or concentrated care with one health provider, continuity of care, within a framework of the principal agent problem.

This thesis has characterised and explored continuity of primary care in the Australian context, in order to understand whether unrestricted access to general practice services is consistent with high levels of continuity of care at both a provider- and practice-level, and whether an association between increased continuity of care and improved health screening exists in Australia.

The final chapter of this thesis summarises and compares the findings of the empirical research, before discussing the contribution of this research to the existing literature, and its policy implications for stakeholders. This chapter also considers areas for future investigation which have become apparent during this research.

Two important issues were identified early after assessment of the context of Australian primary care. These issues relate to the decision to investigate both personal and site continuity of care, and more specifically, the use of subjective survey data as the predominant estimate of continuity of care.

Regarding the first issue, contextual analysis indicated that Australian primary care is characterised by unrestricted access to GP services, and current demographic and workforce pressures are potentially shifting the focus of care for an individual patient from a GP to care provision within a practice. In this setting, continuity of care appears to exist at a practice as well as an individual-level, and investigation of continuity of care at both levels appeared warranted.

The second important issue relates to the selection of appropriate measures of continuity of care. Both subjective and claims-based measures of continuity of care are used in current research and consensus is lacking about what are the most appropriate measures. In the absence of a universally agreed measure, context guided the decision to estimate continuity of care using subjective measures. This decision was supported by multiple considerations. First, subjective measures of continuity of care have been proposed as better reflecting the doctor-patient relationship than measures derived from administrative claims (Bentler et al. 2014b). Understanding the doctor-patient relationship as a principal-agent relationship was central to the conceptual and economic framework of this thesis. Therefore it was deemed important to choose measures of continuity of care which best reflected this relationship. Second, the focus of this analysis was a general population sample seeking primary care. Claims-based measures used to estimate continuity of care are unstable if visit numbers are low and for low frequency attenders (usually people with less than three annual visits); these should be excluded from any analysis. Using claims-based measures would have greatly reduced the sample under consideration and the conclusions which could be drawn. Finally, as practice-level claims data are not available to researchers in

Australia, claims-based measures of site continuity of care were unable to be calculated for this thesis. Without measures of personal and site continuity, gaining an understanding of continuity of care at two levels (one of the contributions to knowledge made in this thesis) could not be achieved. From a pragmatic perspective, the decision about whether to use subjective or claims-based measures was forced by this final data limitation, but was supported by the other considerations.

These decisions to consider continuity of care at two levels, and the choice of subjective measures of continuity of care, guided the selection of the ALSWH as the main data source for this thesis. As the ALSWH sample is restricted to women, outcome variables related to women's health were extensively investigated, including self-reported mammography, and Pap testing estimated by self-report from ALSWH and Medicare claims data.

This thesis has used multiple data sources and analytical approaches to understand the associations between continuity of care in Australian primary care, patient characteristics and cancer screening. The inclusion of two age cohorts and two different data sources within the analysis has permitted additional analyses to be undertaken about the heterogeneity of women in the ALSWH sample, and the accuracy of data, respectively.

8.2 Summary of findings

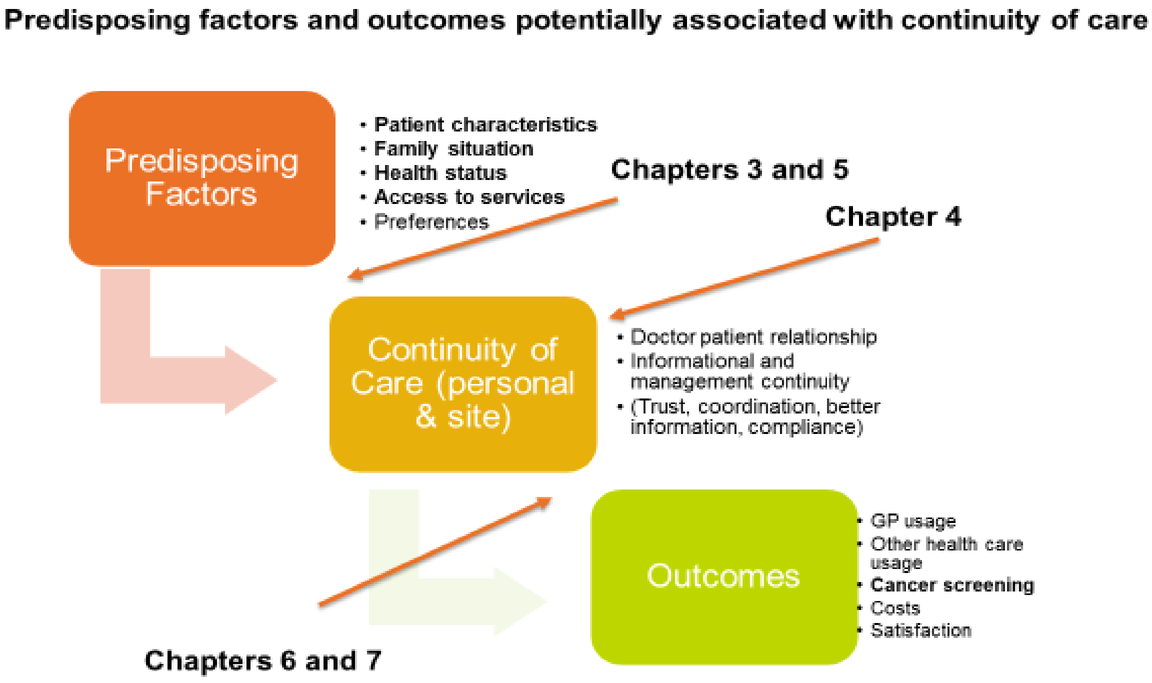
A summary of each of the empirical chapters is shown in Table 29 below, indicating data source, outcome measure and what element of continuity of care was considered.

Table 29: Summary of Empirical Chapters (including data sources, outcome measures, level and source of continuity of care measures and additional methods)

Chapter and Title	Data	Outcome Measure	Level of continuity		Source of measure		Methods
			Personal	Site	Self-report	Claims-data	
Chapter 3 - Multiple practice attendance in Australia	GP Survey	Multiple Practice Attendance		✓	✓		Cross sectional analysis
Chapter 4 - ALSWH and Medicare data and Changing Continuity of Care in Australia	ALSWH/ Medicare	Descriptive statistics	✓	✓	✓	✓	Panel data Concordance of measures of personal continuity
Chapter 5 - Predictors of Continuity of Care in Australia	ALSWH	Personal and Site Continuity of Care	✓	✓	✓		Panel data
Chapter 6 - Continuity of Care and Cancer Screening	ALSWH	Self-reported cancer screening rates	✓	✓	✓		Instrumental variables
Chapter 7 - Continuity of care and Screening Medicare	ALSWH/ Medicare	Administrative data derived Pap testing rates	✓	✓	✓		Individual fixed effects

Chapter 3 investigated the prevalence of multiple general practice attendance and characteristics of multiple practice attenders in a sample of Australian adults. Chapter 4 assessed changes over time in self-reported general practice attendance in order to understand potential changes in continuity of care for Australian women, and also contained a comparison of subjective and claims-based measures of personal continuity of care. Chapter 5 analysed the predictors of personal and site continuity of care in the same longitudinal sample of Australian women while chapters 6 and 7 explored the association between continuity of care and cancer screening. Figure 27 shows graphically how each empirical chapter interrogates a component of the interaction between continuity of primary care, the doctor patient interaction, and health outcomes.

Figure 27 -Summary of empirical chapters within this thesis



8.2.1.1 Multiple practice attendance is common

The analysis of the GP Suryey reported in Chapter 3 indicated that over 25% of adults from an online sample had attended multiple general practices in the previous year, and that multiple practice attendance was not associated with decreased identification of a usual GP. Conclusions from this cross-sectional survey are limited to simple associations, but supported the investigation of personal and site continuity of care.

8.2.1.2 Continuity of care is changing for Australian women

The results of the analysis of ALSWH sample in Chapter 4 suggest that women of all ages are increasingly seeking their care within a practice rather than with a GP. Personal continuity of care as an attendance pattern is decreasing, particularly for younger women, and this trend appears to be increasing over time. This is consistent with women preferring to see a known GP but being prepared to see another provider (preferably within a practice) for the purposes of access or convenience. Older women continue to prefer personal continuity of care, and this potentially reflects the greater utility these women gain from a therapeutic doctor-patient relationship.

8.2.1.3 There are different predictors for personal and site continuity of care

Chapter 5 reported an exploration of the predictors of continuity of care. The aims of this research were to understand the characteristics of women more likely to report continuity of care, and to distinguish between women's characteristics associated with personal and site continuity of care.

There were many differences between women reporting personal and site continuity of care. Women who reported personal continuity of care were significantly more likely to have private health insurance, concession health care cards, and two or more chronic health conditions, while increasing age, living outside of major cities, increasing levels of education, and living with children were significantly associated with site continuity of care. Compared with infrequent GP attenders, women with average attendance of around five visits per year were significantly more likely to report site continuity of care, while the most frequent GP attenders were significantly more likely to report personal continuity of care. The results suggest that there are potential differences between having continuity of care with an individual provider and with a practice, and these are unrecognised if continuity of care is considered at one level only. Differentiating between personal and site continuity is a significant contribution of this thesis, and evaluating both levels of continuity of care is an important contribution to the continuity of care literature.

8.2.1.4 There is a relationship between increased continuity of care and increased cancer screening

In chapters 6 and 7, the results of multiple analyses of the association between continuity of care and cancer screening were reported. These analyses used both ALSWH survey and Medicare administrative data, and incorporated panel data methods (including individual fixed effects estimators) and instrumental variable (IV) analysis in order to add stronger methodological evidence to the large existing continuity of care literature base. The key results of chapters 6 and 7 are summarised in Table 30 below (although comparisons should be interpreted with caution due to differences in the samples within each chapter).

Table 30: Comparison of results from empirical analyses of cancer screening participation

	Chapter 6- Odds of self-reporting Pap test (ALSWH survey data)	Chapter 6 Odds of self-reporting mammogram (ALSWH survey data)	Chapter 7 – Odds of having screening Pap test (Medicare data)
Personal continuity of care	1.234***	1.367*** (0.03)	1.152*** (0.03)
Site continuity of care	1.204***	1.3821*** (0.031)	1.146*** (0.031)
Reduced continuity of care	1	1	1

The results reported in Chapter 6 indicate that compared to women with reduced continuity of care, women who report either site or personal continuity of care have significantly increased rates of recommended cancer screening. Statistically significant differences associated with continuity were shown in multiple cancer screening tests and these results were reinforced by use of an instrumental variable to control for the endogeneity of personal continuity on the probability of Pap testing. Significant findings were reported for Pap testing and mammography in Chapter 6; the associations were of greater magnitude for mammography than for Pap testing. This is consistent with an association between increased continuity of care and increased cancer screening. Further research is needed to see whether this finding extends to other preventive care or screening undertaken in primary care, such as immunisations or cardiovascular checks. Measures of screening have been previously reported as good proxies for the quality of primary health care (Campbell et al. 2001; Carrier et al. 2011), but further research is needed to see whether increased personal or site continuity of care is associated with changes in health service utilisation or improvement in health outcomes.

Significant results were shown using self-reported estimates of Pap testing (Chapter 6) and Pap testing estimated using Medicare data (Chapter 7). The statistically significant differences according to continuity of care persisted when regression analyses were employed using either data source, although the magnitude of coefficients was lower with the use of Medicare data. Women with continuity of care (either site or personal) were less likely to be overdue for Pap testing. The results of models which used individual fixed effects to control for unobserved individual heterogeneity indicated that women with continuity of care who were overdue Pap testing were statistically significantly more likely to retest earlier than were women with reduced continuity of care.

8.2.1.5 Comparisons between personal and site continuity of care

While researchers are increasingly utilising administrative databases to investigate the relationship between continuity of care and health outcomes, it is less common to distinguish between continuity of care at an individual and location level, potentially due to the lack of availability of location level administrative data. This represents a weakness of commonly available administrative data which means the influence of patient characteristics on health service utilisation and/or health outcomes associated with different levels of continuity of care may be overlooked.

Both personal and site continuity of care are associated with significantly increased rates of cancer screening, but the results indicated few significant differences between these levels of continuity. The exception to this was results of the instrumental variable (IV) analysis. The IV analyses showed that after controlling for the endogeneity of continuity of care, the association between increased personal continuity of care and Pap testing is significantly greater than for either site continuity, or reduced continuity of care. Taking into account the endogeneity of continuity of care within the models and conditioning on instrumented personal continuity of care increased the significant positive relationship between personal continuity of care and Pap testing. This suggests that there may be a significant difference between personal and site continuity of care in terms of the probability of Pap testing. Failing to control for the endogeneity of continuity of care results in downwardly biased estimates and potentially underestimates the impact of continuity of care.

8.2.1.6 Comparisons between different measures of continuity of care

Although subjective measures of continuity of care have been the focus of this thesis, the availability of Medicare data has permitted some limited comparisons of personal continuity of care using administratives measures. In Chapter 4, results indicating weak concordance between these different measures of personal continuity of care were reported. These findings are consistent with personal continuity of care alone being an inadequate measure for investigating the performance of Australian general practice, but require further investigation.

8.2.1.7 Comparison of different age cohorts

Previous authors have suggested that most benefits associated with continuity of care will be achieved in older patients and those with chronic diseases, and policy measures have targeted these groups, such as Australia's Health Care Home Initiative (Australian Government Department of Health 2016). The results of the empirical research in this thesis suggest that there may be merit in encouraging continuity of care for women of all ages.

Although significant positive associations between continuity of care and cancer screening were found for women of all ages, these associations were weaker for Pap tests in younger women if the self-reported survey data were used and stronger if Medicare data were used. These differences warrant further exploration and are potentially masked by the declining Pap test participation rates recorded in administrative data for women in the mid ALSWH cohort.

8.3 Implications for policymakers?

These results indicate that Australians receive a high proportion of care from either their preferred GP and/or practice, and that they have strong preferences for seeing a GP and practice. These results also suggest that most Australian women obtain their care from within one practice, and many also have continuity of care with a GP. Furthermore these findings suggest that having either personal or site continuity of care is associated with improved health outcomes, at least pertaining to cancer screening. Comparisons of self-reported estimates of continuity of care with continuity measures derived from administrative data are consistent with previous literature suggesting that subjective measures potentially better reflect the doctor-patient relationship than measures derived from claims data.

The comparison between personal and site continuity of care indicates that both levels of continuity provide a benefit in terms of cancer screening rates, but that they are associated with different patient characteristics. The consistency of the results using different data sources, different screening tests and multiple analytic techniques adds robustness to the findings, and strengthens the likelihood that there is a real relationship between increased continuity of care (personal and site) and increased rates of cancer screening.

The implication of this research is that continuity of care at both a personal and site level may have therapeutic value and there may be potential health benefits associated with encouraging continuity of primary care in Australia. However this does not mean that all patients should be forced to seek care from one GP and one location, as enforcement may not provide the benefits of a therapeutic doctor patient relationship. Enforcing continuity of care may also override other features of the Australian health system, such as rapid access and high levels of patient choice.

Three broad policy options appear available to encourage continuity of care within Australian primary care.

The first approach would be to maintain the current structure of primary care but to increase public awareness about the benefits of continuity of care. This approach would retain the current Australian characteristic of high levels of patient identification with a regular GPs or practices, but without a mechanism for recording this relationship.

A second approach would be to introduce formal registration for patients with a practice (and a GP) and reduce access to non-registered practices (enrolment with restriction), as exists in the English National Health Service.

A third option would be to encourage patients to register with one GP and practice but without restricting attendance at other practices (enrolment without restrictions), as has been trialled in Norwegian primary care.

These three policy options and their potential advantages and disadvantages are discussed in the following section. These options are not mutually exclusive and may be introduced in combination.

8.3.1 Increased public awareness alone

One approach to increasing continuity of care may be community promotion of continuity of care as the preferred pattern of general practice care. Both the Australian Medical Association (AMA) and the RACGP have run campaigns encouraging patients to have a regular GP, or to know their GP (Australian Medical Association 2017; RACGP 2012), and internationally the Royal College of General Practioners (UK) (RCGP) has suggested that practices advertise the benefits of continuity of care, both to patients and to staff (Baker & Jeffers 2016).

An ongoing campaign highlighting the benefits of obtaining all primary care within one practice (and with one GP within that practice) may be appropriate to encourage both personal and site continuity of care. An alternative approach would be to highlight the potential disadvantages of discontinuity of care, or of care fragmentation. This campaign would align with international models of cares such as the Patient Centred Medical home, and nationally with the RACGP Vision for General Practice (RACGP 2015).

Efforts by professional groups to encourage patients to identify a regular GP or practice may be only a partial solution to fragmented care. One disadvantage of the current Australian health system is that although Australians can frequently identify a regular

GP and practice—suggesting some relationship between provider and patient—this is not known by their provider. Currently in Australia, there is no (formal or administrative) mechanism available to identify a patient's regular practice or GP, and providers (practices or GP) may be unaware that they the regular provider. It is unclear whether this current 'one way' relationship is sufficient to provide the 'attitudinal contract' between GP and patient that has been long considered central to the therapeutic benefit of continuity of care (Banahan & Banahan 1981). Put another way, it remains uncertain whether the potential benefits of a principal-agent relationship can be achieved if the agent is unware that the relationship exists.

In Australia's health system which offers unrestricted access to multiple practices, a means of notification of usual provider/practice status may encourage a two-way doctor-patient relationship and potentially be an important step in facilitating continuity without introducing restrictions which might limit either patient choice or competition between practices.

Particularly for young patients, new approaches may be needed to encourage them to link with a practice. For example, after an individual has attended a practice more than once, she or he could be asked, "Do you consider this your regular/home general practice?" If the reply is affirmative, it could be followed up by asking if the patient would like to be provided with preventative care reminders, or sign up for regular correspondence.

One advantage of this option is that costs would be limited to the education campaign and would not require changes to administrative (practice or Medicare) systems. The following two options would create a more formal link between patient and provider.

8.3.2 Enrolment with restrictions

A second option to encourage continuity of care in Australia would be for patients to register with a single general practice and for their access to general practice services to be restricted to that practice. As discussed in Chapter 3 of this thesis, this model is used in other countries, and has the advantage of enforcing site continuity of care and providing control over funding in a capitation system of health funding. The potential disadvantages of enrolment with restriction include reduced patient mobility between practices, potentially reduced access to services, and reduced choice of provider and practice (particularly if geographic limitations are introduced as in the English NHS).

By reducing patient choice (particularly in metropolitan areas), enrolment with restrictions may also lead to decreased competition between practices. Such an approach may undermine the benefits of the current Australian primary care structure and has implications in terms of increasing costs or decreasing quality of primary care. Another disadvantage of practice-level enrolment is that it does not consider the benefits of personal continuity of care. With practice-level registration, no individual health professional is required to take direct responsibility for the patient. The absence of a responsible individual may potentially lead to worse health outcomes, in what previous authors have termed the culture of anonymity or the bystander effect (Balint 1957; Stavert & Lott 2013).

The impact of the restriction of general practice services within one practice is currently being tested within the Australian Health Care Homes trial (Australian Government Department of Health 2016). Results from this trial may be helpful in comparing patient and provider experiences of care under restriction of GP services within one practices, but these experiences may be difficult to disentangle from the multiple interventions of the trial. Enrolment with restriction will probably require legislative changes to Medicare and is likely to be strongly resisted by both patients and health professionals in Australia. Thus, this option is potentially politically unpalatable, particularly in the absence of evidence of significant health improvements or costs savings.

8.3.3 Enrolment without restriction

A third policy option would be to encourage patients to register with a regular GP and a regular practice but to not restrict their access to other practices. One potential option would be for patients to nominate a preferred provider and practice ('preferred GP' in a 'home practice') when attending a practice, but not to restrict access to alternative ('non-home') practices. Patients could be added to a practice and a GP's 'list' of patients. This nomination process has the potential to provide some elements of an agency relationship between the patient and provider without placing limitations on patient choice in attending another practice. This nomination process would have the advantage of informing practices about who are their regular patients, and potentially formalising a two-way link of shared responsibility between patient and their providers.

Patients would be able to attend other practices for convenience, access or cost reasons, while knowing that a 'home' practice would continue to monitor their overall preventative health needs. There is the potential for practices to be paid an incentive for the oversight role. Such an incentive should not be so high enough to encourage gaming (including practices pressuring patients to register), and may be unnecessary if other incentives to encourage continuity (detailed below) are introduced.

Practices would be permitted to see 'non-home' patients, and potentially would prefer these patients in some locations. This may permit differentiation between general practices, with some practices deciding to provide more chronic disease 'home practice' care while others may focus on acute episodic primary care (such as in metropolitan centres catering to commuters) and would cater more for non-home patients..

The features of these three options to encourage continuity of care, their potential advantages and disadvantages are summarised below in Table 31.

Table 31: Potential advantages and disadvantages of potential policy options

	Description	Advantages	Disadvantages
Enrolment with restriction	Patient required to seek all care from one provider	Enforces practice continuity Cost control in capitated primary care system	Limits choice Inefficient use of workforce Switching/transferring problems
Enrolment without restriction	Patient asked to nominate regular GP/practice	Both provider and patient aware of relationship Would permit free transfer of patients to other practices when needed Attitudinal contract encouraging improved care and compliance	May reduce patient mobility or access Potentially decreased satisfaction or competition Ongoing costs if associated with provider or patient incentives
Education + Affiliation (current system)	Patient can identify usual GP or practice	Maximum patient choice Competition between GPs High levels patient satisfaction	Affiliation not recorded by provider No obligation to provide non-urgent care Potential for worse quality of care

There is currently no incentive for patients to have a formal link with a preferred or ‘home’ practice, nor for any practice to identify infrequent attenders and provide preventive health advice, appropriate screening, or behavioural modification which could delay the onset of disease. Registration without restriction may provide the benefits of continuity of care, without the restrictive elements likely to be broadly unpopular and challenging to implement. This may encourage practices to provide preventative care for their home patients (including appropriate screening tests or other routine recalls), and permit recalling patients if they are overdue, and may improve responsiveness of patients to these recalls.

Further to this registration process, there are potential financial incentives which could be introduced to encourage continuity of care within the current Australian funding regime. Remuneration could be directed to patients, providers or practices, and could be provided either through the current MBS structure or through the Practice Incentives Program. Another approach would be to introduce financial penalties, so that patients might receive reduced Medicare subsidies if they attended a non-regular practice. As this thesis suggests that there are benefits associated with both personal and site continuity of care, it is appropriate to consider doctor-level as well as practice-level incentives. Professional organisations have previously advocated for the importance of both provider- and practice-level payments to encourage high quality sustainable general practice (RACGP 2015).

8.4 Suggestions for future research

One of the most urgent needs identified from this research is for data to be collected and made available at the primary care practice-level, to better understand continuity of care, and more broadly, primary care utilisation, in the Australian context. It remains unclear whether patients seeing multiple GPs in a practice benefit from having one GP who provides the majority of care (with the others providing backup care when that doctor is unavailable) or whether care can be spread more evenly across multiple GPs within a practice. This is potentially an important distinction and research into the merits of these different types of care within a practice is needed to determine whether one provides more efficient or higher value care. If the provision of the majority of care by one GP results in more efficient and effective care this suggests that personal continuity of care retains value within a setting of site continuity. Alternatively, if a model of dispersed care within a practice proves superior, this would suggest that personal continuity has limited value within a model of coordinated care, and that the therapeutic value of continuity of care can be obtained through informational continuity and coordination within a practice.

These results of this research show that continuity of care is associated with increased cancer screening, and provides some evidence that continuity of care is associated with better health outcomes. This research has been limited to investigating the relationship between continuity of care and screening in women; the potential that other health outcomes will be improved with increased continuity of care requires further research. Further research is also needed to determine if the relationship between continuity of care and cancer screening is generalisable to men, and in women of ages other than the ALSWH age cohorts investigated in this thesis.

The data sources used within this thesis did not provide information about the clinical content of consultations. The availability of such information is likely to provide greater insights into how continuity of care influences the quality of primary care. Further research is needed to understand how continuity of care effects the behaviour of GPs, practice staff and patients. For instance, do doctors behave differently when they think they are seeing a regular or a non-regular patient, or will patients provide different information to a regular compared to a non-regular GP?

The research in this thesis has focused on one half of the doctor-patient relationship. It has utilised patient data and does not provide insights into how doctor behaviour is influenced by continuity of care. This is potentially an important area of future research but requires clinical data beyond Medicare's health service utilisation statistics. Future research is needed to determine if continuity of care provided by doctors is associated with better outcomes. One possible hypothesis is that doctors who provide continuity of care to a higher proportion of their patient provide improved care. If this is the case, then making the benefits of the therapeutic doctor-patient relationship known to doctors may also be an important policy intervention.

As providers increasingly work part-time, further research is needed to understand whether there is a threshold of care which must be provided by one GP to obtain the benefits of personal continuity of care. Further research is also needed to understand whether seeing the same doctor provides all the benefits of continuity of care, or whether it is the attitude of a GP who feels responsible for the wellbeing of the patient that provides the benefits. If the latter is the case, then shifts to practice-based continuity which lose the doctor-patient link may lead to worse health outcomes unless someone in the practice retains a therapeutic relationship with the patient.

8.5 Conclusion

This thesis has used multiple econometric techniques to consider the biases and limitation of non-experimental data as it pertains to continuity of care in the Australian primary care context.

The results of the research conducted for the thesis are consistent with general practice continuity of care at both a personal- and practice-level increasing patient utility, and being most valued by patients with the most complex health problems. The results provide evidence of a positive association between cancer screening for women, and both personal and site continuity of care. This association exists for multiple cancer screening tests, for women of all ages and is robust to examination using panel data, and econometric techniques to control for the endogeneity of continuity of care.

Thus, the results suggest that benefits are likely to be gained by encouraging continuity of care as the preferred pattern for general practice attendance. Such encouragement must be balanced with the current structure of Australian general practice such as high levels of patient choice, competition between providers and high levels of patient satisfaction. So although we may wish to encourage continuity of care, a more important initiative may be to improve the relationship between patient and doctors. One approach for doing this would be to make doctors aware of who their regular patients are. A focus on continuity of care must not be to the exclusion of these other qualities, as this may reduce the overall performance of the Australian health system.

9 References

ABS 2011a, *2011 Census Quickstats.*, vol. 2016, Australian Bureau of Statistics, Canberra, Australia.
ABS 2011b, *Australian Statistical Geography Standard (ASGS)*, Canberra, viewed 5 January 2017 <http://www.abs.gov.au/ausstats/abs@.nsf/mf/1270.0.55.005?OpenDocument>.
ABS 2012, *Australian Health Survey: First Results, 2011-12* vol. 2016, Australian Bureau of Statistics, Canberra.
ABS 2015, *3101.0- Australian Demographic Statistics, Jun 2015*, Australian Bureau of Statistics, viewed Nov 20, 2017, <http://www.abs.gov.au/ausstats/abs@.nsf/featurearticlesbyCatalogue/7A40A407211F35F4CA257A2200120EAA?OpenDocument>.
ABS 2017a, *MBS Statistics 2016-17*, Australian Bureau of Statistics, Canberra, viewed Feb 25 2018, <http://www.health.gov.au/internet/main/publishing.nsf/content/annual-medicare-statistics>.
ABS 2017b, *Patient Experiences in Australia: Summary of Findings, 2016–17*, Commonwealth of Australia, Canberra, Australia.
ABS 2018, *Australian Demographic Statistics ,September quarter 2017 (cat. no. 3101.0)*, ABS, Canberra.
Adler, R., Vasiliadis, A. & Bickell, N. 2010, 'The relationship between continuity and patient satisfaction: a systematic review', *Fam Pract*, vol. 27, no. 2, pp. 171-8.
AIHW 2011, *Medical labour force 2009. Bulletin no. 89. Cat. no. AUS 138*, AIHW, viewed Feb 18 2018, <https://www.aihw.gov.au/getmedia/d5dff737-09f4-481e-89ca-90179c708f29/13279.pdf.aspx?inline=true>.
AIHW 2014, *Australia's Health 2014*, vol. 14, Canberra, Australia.
AIHW 2015, *1 in 5 Australians affected by multiple chronic diseases*, Australian Institute of Health and Welfare, Canberra, viewed February 22 2016, <http://www.aihw.gov.au/media-release-detail/?id=60129552034>.
AIHW (ed.) 2016a, *Australia's Health 2016*, vol. 15, Canberra, Australia.
AIHW 2016b, *BreastScreen Australian monitoring report 2013-2014.*, Australian Institute of Health and Welfare, <http://www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=60129557141>.
AIHW 2016c, *Life Expectancy*, AIHW, Canberra viewed February 23 2016, <http://www.aihw.gov.au/deaths/life-expectancy/>.
AIHW 2016d, *Medical practitioners workforce 2015*, AIHW viewed November 20 2017, <https://www.aihw.gov.au/reports/workforce/medical-practitioners-workforce-2015/contents/how-many-medical-practitioners-are-there>.
AIHW 2017a, *Cancer screening in Australia: participation data*, AIHW, Canberra, Australia, viewed October 11 2017, <https://www.aihw.gov.au/reports/cancer-screening/cancer-screening-in-australia/data>.
AIHW 2017b, *Cervical screening in Australia 2014–2015. Cancer series no. 105.*, vol. Cat. no. CAN 104, AIHW Canberra.
AIHW 2017c, *Health expenditure Australia 2015–16. Health and welfare expenditure series no.58. Cat no HWE 68*, Australian Institute of Health and Welfare, Canberra.
AIHW 2017d, *Older Australia at a glance*, Canberra.

American Academy of Family Physicians 2010, *Continuity of care, definition of*, viewed February 17 2015, <http://www.aafp.org/about/policies/all/definition-care.html>.
Angrist, J.D., Imbens, G.W. & Rubin, D.B. 1996, 'Identification of Causal Effects Using Instrumental Variables', *J Am Stat Assoc*, vol. 91, no. 434, pp. 444-55.
Arrow, K.J. 1985, *The economics of agency*, Harvard Business School Press, Boston.
Atlas, S.J., Grant, R.W., Ferris, T.G., Chang, Y. & Barry, M.J. 2009, 'Patient-physician connectedness and quality of primary care', *Ann Intern Med*, vol. 150, no. 5, pp. 325-35.
Australian Bureau of Statistics 1996, *1996 National Census*, Australian Government Publishing Service, Canberra, Australia.
Australian Digital Health Agency 2018, *What is My Health Record?*, Canberra, viewed April 24 2018, <https://www.myhealthrecord.gov.au/for-you-your-family/what-is-my-health-record>.
Australian Government Department of Health 2015, *Australian Medicare Statistics - Financial Year 2007-08 to 2014-15*, Commonwealth of Australia, Canberra, viewed February 18 2017, <http://www.health.gov.au/internet/main/publishing.nsf/Content/Annual-Medicare-Statistics>.
Australian Government Department of Health 2016, *Health Care Homes. Patient-Centred. Coordinated. Flexible.*, Australian Government Department of Health, Canberra, viewed December 4 2016, <http://www.health.gov.au/internet/main/publishing.nsf/Content/1D9A22E753DFA9BDCA257FB100033A6A/$File/Health%20Care%20Homes%20info%20book.pdf>.
Australian Health Ministers' Advisory Council 2017, *National Strategic Framework for Chronic Conditions*, Australian Government, Canberra.
Australian Health Practitioner Regulation Agency 2016, *The National Registration and Accrediation Scheme*, Canberra, Australia, viewed October 5 2016, <http://www.ahpra.gov.au/About-AHPRA/What-We-Do.aspx>.
Australian Medical Association 2006, *AMA Code of Ethics - 2004, Editorially Revised 2006*, Australian Medical Association, Canberra, viewed October 5 2016, <https://ama.com.au/position-statement/ama-code-ethics-2004-editorially-revised-2006>.
Australian Medical Association 2017, *Importance of a Trusted Regular GP Emphasised*, Canberra, ACT, viewed December 11 2017, <https://ama.com.au/gp-network-news/importance-trusted-regular-gp-emphasised>.
Australian Medical Workforce Advisory Committee and Australian Institute of Health and Welfare 1998, *Medical Workforce Supply and Demand in Australia: A Discussion Paper AMWAC Report 1998.8 AIHW Cat. No. HWE 12*, Australian Medical Workforce Advisory Committee, Sydney, Australia.
Baker, M. & Jeffers, H. 2016, *Continuity of care in modern day general practice*, Royal College of General Practitioners, London, England.
Baker, R., Mainous, A.G., 3rd, Gray, D.P. & Love, M.M. 2003, 'Exploration of the relationship between continuity, trust in regular doctors and patient satisfaction with consultations with family doctors', *Scand J Prim Health Care*, vol. 21, no. 1, pp. 27-32.
Balint, M. 1957, *The doctor, his patient and the illness.*, Pitman Medical, London.
Baltagi, B.H. 2008, *Econometric analysis of panel data*, John Wiley & Sons, Wiltshire, England.
Banahan, B.F., Jr. & Banahan, B.F., 3rd 1981, 'Continuity as an attitudinal contract', *J Fam Pract*, vol. 12, no. 4, pp. 767-8.
Banfield, M., Gardner, K., McRae, I., Gillespie, J., Wells, R. & Yen, L. 2013, 'Unlocking information for coordination of care in Australia: a qualitative study of information continuity in four primary health care models', *BMC Fam Pract*, vol. 14.

Barker, I., Steventon, A. & Deeny, S.R. 2017, 'Association between continuity of care in general practice and hospital admissions for ambulatory care sensitive conditions: cross sectional study of routinely collected, person level data', *Bmj*, vol. 356, p. j84.

Bayliss, E.A., Ellis, J.L., Shoup, J.A., McQuillan, D.B., Steiner, J.F. & Zeng, C. 2017, 'Association between Continuity of Care and Health-Related Quality of Life', *J Am Board Fam Med*, vol. 30, no. 2, pp. 205-12.

Bentler, S.E., Morgan, R.O., Virnig, B.A. & Wolinsky, F.D. 2014a, 'The Association of Longitudinal and Interpersonal Continuity of Care with Emergency Department Use, Hospitalization, and Mortality among Medicare Beneficiaries', *PLoS ONE*, vol. 9, no. 12, p. e115088.

Bentler, S.E., Morgan, R.O., Virnig, B.A. & Wolinsky, F.D. 2014b, 'Do claims-based continuity of care measures reflect the patient perspective?', *Med Care Res Rev*, vol. 71, no. 2, pp. 156-73.

Bentler, S.E., Morgan, R.O., Virnig, B.A. & Wolinsky, F.D. 2014c, 'Evaluation of a patient-reported continuity of care model for older adults', *Qual Life Res*, vol. 23, no. 1, pp. 185-93.

Berwick, D.M., Nolan, T.W. & Whittington, J. 2008, 'The Triple Aim: Care, Health, And Cost', *Health Affairs*, vol. 27, no. 3, pp. 759-69.

Bhandari, A. & Wagner, T. 2006, 'Self-reported utilization of health care services: improving measurement and accuracy', *Med Care Res Rev*, vol. 63, no. 2, pp. 217-35.

Bice, T.W. & Boxerman, S.B. 1977, 'A quantitative measure of continuity of care', *Med Care*, vol. 15, no. 4, pp. 347-9.

Birch, S., Haas, M., Savage, E. & Van Gool, K. 2007, 'Targeting services to reduce social inequalities in utilisation: an analysis of breast cancer screening in New South Wales', *Aust New Zealand Health Policy*, vol. 4, p. 12.

Blomqvist, A. 1991, 'The doctor as double agent: information asymmetry, health insurance, and medical care', *J Health Econ*, vol. 10, no. 4, pp. 411-32.

Bodenheimer, T. 2014, 'The 10 building blocks of high-performing primary care', *The Annals of Family Medicine*, vol. 12.

Bodenheimer, T., Ghorob, A., Willard-Grace, R. & Grumbach, K. 2014, 'The 10 Building Blocks of High-Performing Primary Care', *Ann Fam Med 2004*, vol. 12, no. 2, pp. 166-71.

Bonney, A. & Farmer, E. 2010, 'Health care reform. Can we maintain personal continuity?', *Aust Fam Physician*, vol. 39, no. 7, pp. 455-6.

Bonney, A., Jones, S.C., Iverson, D. & Magee, C. 2014, 'Trust, continuity and agency: Keys to understanding older patients' attitudes to general practice trainees', *Education for Health*, vol. 27, no. 1, pp. 39-46.

Bonney, A., Magee, C. & Pearson, R. 2014, 'Cross-sectional survey of older patients’ views regarding multidisciplinary care for chronic conditions in general practice', *Aust J Prim Health*, vol. 20, no. 1, pp. 27-33.

Bowman, J.A., Sanson-Fisher, R. & Redman, S. 1997, 'The accuracy of self-reported Pap smear utilisation', *Soc Sci Med*, vol. 44, no. 7, pp. 969-76.

Bowser, D., Marqusee, H., El Koussa, M. & Atun, R. 2017, 'Health system barriers and enablers to early access to breast cancer screening, detection, and diagnosis: a global analysis applied to the MENA region', *Public Health*, vol. 152, no. Supplement C, pp. 58-74.

Bradburn, N., Rips, L. & Shevell, S. 1987, 'Answering autobiographical questions: the impact of memory and inference on surveys', *Science*, vol. 236, no. 4798, pp. 157-61.

BreastScreen Australia Evaluation Advisory Committee 2009, *Evaluation of the BreastScreen Australia Program – Evaluation Final Report – June 2009*, Commonwealth of Australia Department of Health and Ageing, Canberra, Australia.

Breslau, N. & Reeb, K.G. 1975, 'Continuity of care in a university-based practice', *J Med Educ*, vol. 50, no. 10, pp. 965-9.
Breusch, T. & Pagan, A. 1980, 'The Lagrange multiplier test and its applications to model specification in econometrics', *Review of Economic Studies* vol. 47, pp. 239-53.
Britt H, Bayram C, Pan Y, Henderson J & GC., M. 2014, 'Continuity of general practice attendance', *GP 14. RACGP Annual Scientific Conference*, Royal Australian College of General Practitioners, Adelaide, Australia.
Britt H, Miller GC, Henderson J, Bayram C, Valenti L, Harrison C, Pan Y, Wong C, Charles J, Gordon J, Pollack AJ & T, C. 2015, *A decade of Australian general practice activity 2005-06 to 2014-15. General practice series no. 39* vol. 2016, Sydney University Press, Sydney, New South Wales.
Britt H, M.G., Henderson J, Charles J, Valenti L, Harrison C, Bayram C, Chambers T, Zhang C, Pan Y, O'Halloran J, Pollack AJ. 2013, *A decade of Australian general practice activity 2003-04 to 2012-13.* , Sydney University Press, Sydney.
Britt, H., Miller, G., Valenti, L., Henderson, J., Bayram, C. & Gordon, J. 2016, 'The changing face of Australian general practice across the decades', *Aust Fam Physician*, vol. 45, pp. 628-31.
Brookhart, M.A., Patrick, A.R., Schneeweiss, S., Avorn, J., Dormuth, C., Shrank, W., van Wijk, B.L., Cadarette, S.M., Canning, C.F. & Solomon, D.H. 2007, 'Physician follow-up and provider continuity are associated with long-term medication adherence: a study of the dynamics of statin use', *Arch Intern Med*, vol. 167, no. 8, pp. 847-52.
Brown, W.J., Dobson, A.J., Bryson, L. & Byles, J.E. 1999, 'Women's Health Australia: on the progress of the main cohort studies', *J Womens Health Gend Based Med*, vol. 8, no. 5, pp. 681-8.
Budd, A.C., Brotherton, J.M., Gertig, D.M., Chau, T., Drennan, K.T. & Saville, M. 2014, 'Cervical screening rates for women vaccinated against human papillomavirus', *Med J Aust*, vol. 201, no. 5, pp. 279-82.
Byles, J., Leigh, L., Chojenta, C. & Loxton, D. 2014, 'Adherence to recommended health checks by women in mid-life: data from a prospective study of women across Australia', *Australian and New Zealand Journal of Public Health*, vol. 38, no. 1, pp. 39-43.
Byles, J., Mishra, G., Hockey, R., Adane, A., Chan, H.-W., Dolja-Gore, X., Forder, P., Harris, M.L., Majeed, T., Loxton, D. & Tooth, L. 2017, *Use, access to, and impact of Medicare services for Australian women: Findings from the Australian Longitudinal Study on Women's Health. Final report prepared for the Australian Government Department of Health June 2017*, Women's Health Australia, Newcastle.
Cabana, M.D. & Jee, S.H. 2004, 'Does continuity of care improve patient outcomes?', *J Fam Pract*, vol. 53, no. 12, pp. 974-80.
Cairns, J.A. & Shackley, P.M. 1992, 'The Contribution of Economics to Screening in Health Care', *Eur J Pub Health*, vol. 2, no. 2, pp. 105-12.
Calnan, M. 1995, 'The role of the general practitioner in health promotion in the UK: the case of coronary heart disease prevention', *Patient Educ Couns*, vol. 25, no. 3, pp. 301-4.
Cameron, A.C. & Trivedi, P.K. 2009, *Microeconometrics Using Stata*, Stat Press, College Station, USA.
Campbell, S.M., Hann, M., Hacker, J., Burns, C., Oliver, D., Thapar, A., Mead, N., Safran, D.G. & Roland, M.O. 2001, 'Identifying predictors of high quality care in English general practice: observational study', *BMJ*, vol. 323, no. 7316, pp. 784-7.
Cancer Australia 2015, *Early Detection of Breast Cancer*, viewed April 26 201, <https://canceraustralia.gov.au/publications-and-resources/position-statements/early-detection-breast-cancer>.

Cancer Council Australia Cervical Cancer Screening Guidelines Working Party 2016, *National Cervical Screening Program: Guidelines for the management of screen-detected abnormalities, screening in specific populations and investigation of abnormal vaginal bleeding*, Cancer Council Australia, Sydney
Cancer Institute NSW 2015, *Letters from the NSW Pap Test Register*, Sydney viewed June 6 2017, <https://www.csp.nsw.gov.au/information-and-resources-for-health-professionals/general-information/letters-from-the-nsw-pap-test-register/>.
Cancer Institute NSW 2017a, *The National Cancer Screening Register*, NSW Government, Sydney, Australia, viewed December 18 2017, <https://www.cancerinstitute.org.au/cervical-screening-nsw/about-the-program/the-national-cancer-screening-register>.
Cancer Institute NSW 2017b, *Your role as a GP in BreastScreen NSW*, Cancer Institute NSW, viewed May 5 2017, <https://www.breastscreen.nsw.gov.au/media/348167/CANC10019_A4_Fact-Sheets_Combined_R4.pdf>.
Carne, A. 2013, *Summary Report of the 2011-2012 Annual Survey of Divisions of General Practice*, Primary Health Care Research and Information Service, Flinders University and Australian Department of Health and Ageing, viewed Sept 2, 2015, <http://www.phcris.org.au/products/asd/results/11_12.php>.
Carrier, E.R., Schneider, E., Pham, H.H. & Bach, P.B. 2011, 'Association between quality of care and the sociodemographic composition of physicians' patient panels: a repeat cross-sectional analysis', *J Gen Intern Med*, vol. 26, no. 9, pp. 987-94.
Cashin, C. & Chi, Y.-L. 2011, *Major Developments in Results-Based Financing (RBF) in OECD Countries: Australia: The Practice Incentives Program (PIP)*, Washington DC.
Chan, C.L., You, H.J., Huang, H.T. & Ting, H.W. 2012, 'Using an integrated COC index and multilevel measurements to verify the care outcome of patients with multiple chronic conditions', *BMC Health Serv Res*, vol. 12, p. 405.
Charles, J., Valenti, L. & Britt, H. 2003, 'GP visits by health care card holders. A secondary analysis of data from Bettering the Evaluation and Care of Health (BEACH), a national study of general practice activity in Australia', *Aust Fam Physician*, vol. 32, no. 1-2, pp. 85-8, 94.
Chen, C.C. & Cheng, S.H. 2011, 'Better continuity of care reduces costs for diabetic patients', *Am J Manag Care*, vol. 17, no. 6, pp. 420-7.
Chetty, R., Friedman, J.N. & Saez, E. 2013, 'Using Differences in Knowledge across Neighborhoods to Uncover the Impacts of the EITC on Earnings', *Am Econ Rev*, vol. 103, no. 7, pp. 2683-721.
Cho, K.H., Lee, S.G., Jun, B., Jung, B.-Y., Kim, J.-H. & Park, E.-C. 2015, 'Effects of continuity of care on hospital admission in patients with type 2 diabetes: analysis of nationwide insurance data', *BMC Health Serv Res*, vol. 15, p. 107.
Christakis, D.A., Kazak, A.E., Wright, J.A., Zimmerman, F.J., Bassett, A.L. & Connell, F.A. 2004, 'What factors are associated with achieving high continuity of care?', *Fam Med*, vol. 36, no. 1, pp. 55-60.
Christakis, D.A., Mell, L., Koepsell, T.D., Zimmerman, F.J. & Connell, F.A. 2001, 'Association of lower continuity of care with greater risk of emergency department use and hospitalization in children', *Pediatrics*, vol. 107, no. 3, pp. 524-9.
Christakis, D.A., Mell, L., Wright, J.A., Davis, R. & Connell, F.A. 2000, 'The association between greater continuity of care and timely measles-mumps-rubella vaccination', *Am J Public Health*, vol. 90, no. 6, pp. 962-5.

Christakis, D.A., Wright, J.A., Koepsell, T.D., Emerson, S. & Connell, F.A. 1999, 'Is greater continuity of care associated with less emergency department utilization?', *Pediatrics*, vol. 103, no. 4 Pt 1, pp. 738-42.
Christakis, D.A., Wright, J.A., Zimmerman, F.J., Bassett, A.L. & Connell, F.A. 2003, 'Continuity of Care Is Associated With Well-Coordinated Care', *Ambulatory Pediatrics*, vol. 3, no. 2, pp. 82-6.
Clifford, G.M., Smith, J.S., Plummer, M., Munoz, N. & Franceschi, S. 2003, 'Human papillomavirus types in invasive cervical cancer worldwide: a meta-analysis', *Br J Cancer*, vol. 88, no. 1, pp. 63-73.
Cockburn, J., White, V.M., Hirst, S. & Hill, D. 1992, 'Barriers to cervical screening in older women', *Aust Fam Physician*, vol. 21, no. 7, pp. 973-8.
Cohen, J. 1960, 'A Coefficient of Agreement for Nominal Scales', *Educ Psychol Meas*, vol. 20, no. 1, pp. 37-46.
Commonwealth Department of Community Services and Health 1989, *National Women's Health Policy. Advancing Women's Health in Australia*, Australian Governmenet Publishing Service, Canberra.
Commonwealth of Australia 2013, *National Cervical Screening Program Renewal*, Commonwealth of Australia, Canberra, Australia.
Commonwealth of Australia 2015, *Intergenerational report: Australia in 2055*, Commonwealth of Australia,, Canberra.
Coote, W. 2009, 'General practice reforms, 1989-2009', *Med J Aust*, vol. 191, no. 2, pp. 58-61.
Coughlin, S.S. 1990, 'Recall bias in epidemiologic studies', *J Clin Epidemiol*, vol. 43, no. 1, pp. 87-91.
Coughlin, S.S., Breslau, E.S., Thompson, T. & Benard, V.B. 2005, 'Physician recommendation for papanicolaou testing among U.S. women, 2000', *Cancer Epidemiol Biomarkers Prev*, vol. 14, no. 5, pp. 1143-8.
Cronin, K.A., Miglioretti, D.L., Krapcho, M., Yu, B., Geller, B.M., Carney, P.A., Onega, T., Feuer, E.J., Breen, N. & Ballard-Barbash, R. 2009, 'Bias associated with self-report of prior screening mammography', *Cancer Epidemiol Biomarkers Prev*, vol. 18, no. 6, pp. 1699-705.
De Maeseneer, J.M., De Prins, L., Gosset, C. & Heyerick, J. 2003, 'Provider continuity in family medicine: does it make a difference for total health care costs?', *Ann Fam Med*, vol. 1, no. 3, pp. 144-8.
Dennis, S.M., Zwar, N., Griffiths, R., Roland, M., Hasan, I., Powell Davies, G. & Harris, M. 2008, 'Chronic disease management in primary care: from evidence to policy', *Med J Aust*, vol. 188, no. 8 Suppl, pp. S53-6.
Department of Health 2015, *Fraud prevention and compliance – Increased billing assurance for the Medicare Benefits Schedule PN2012:2231*, Department of Health, Canberra.
Department of Health 2017a, *GP Workforce Statistics - Financial Year 2000-01 to 2016-17*, Commonwealth of Australia, Canberra, viewed March 24 2018, <http://health.gov.au/internet/main/publishing.nsf/Content/General+Practice+Statistics-1>.
Department of Health 2017b, *MBS Online. Medicare Benefits Schedule.*, Commonwealth of Australia, Canberra, viewed November 6 2017, <http://www.mbsonline.gov.au/internet/mbsonline/publishing.nsf/Content/Home>.
Department of Health 2018, *Quarterly Medicare Statistics - September Quarter 1984 - March Quarter 2018*, Department of Health, Canberra, viewed May 9 2018, <http://www.health.gov.au/internet/main/publishing.nsf/Content/Quarterly-Medicare-Statistics>.

Dobson, A.J., Hockey, R., Brown, W.J., Byles, J.E., Loxton, D.J., McLaughlin, D., Tooth, L.R. & Mishra, G.D. 2015, 'Cohort Profile Update: Australian Longitudinal Study on Women's Health', *Int J Epidemiol*, vol. 44, no. 5, pp. 1547-f.
Donaldson, M.S. 2001, 'Continuity of Care: A Reconceptualization', *Med Care Res Rev*, vol. 58, no. 3, pp. 255-90.
Dreiher, J., Comaneshter, D.S., Rosenbluth, Y., Battat, E., Bitterman, H. & Cohen, A.D. 2012, 'The association between continuity of care in the community and health outcomes: a population-based study', *Isr J Health Policy Res*, vol. 1, no. 1, p. 21.
DuGoff, E.H., Bandeen-Roche, K. & Anderson, G.F. 2016, 'Relationship between continuity of care and adverse outcomes varies by number of chronic conditions among older adults with diabetes', *J Comorb*, vol. 6, no. 2, pp. 65-72.
Dusheiko, M., Gravelle, H., Martin, S., Rice, N. & Smith, P.C. 2011, 'Does better disease management in primary care reduce hospital costs? Evidence from English primary care', *J Health Econ*, vol. 30, no. 5, pp. 919-32.
Eisenhardt, K.M. 1989, 'Agency Theory: An Assessment and Review', *Acad Manage Rev*, vol. 14, no. 1, pp. 57-74.
Ejlertsson, G. & Berg, S. 1984, 'Continuity-of-care measures. An analytic and empirical comparison', *Med Care*, vol. 22, no. 3, pp. 231-9.
Enlow, E., Passarella, M. & Lorch, S.A. 2017, 'Continuity of Care in Infancy and Early Childhood Health Outcomes', *Pediatrics*, vol. 140, no. 1.
Erny-Albrecht, K. & Bywood, P. 2016, *Corporatisation of general practice—impact and implications*, Primary Health Care Research & Information Service., Adelaide, SA.
Ettner, S.L. 1996, 'The timing of preventive services for women and children: the effect of having a usual source of care', *Am J Public Health*, vol. 86, no. 12, pp. 1748-54.
Evans, R.G. 1984, *Strained mercy: The Economics of Canadian Health Care.*, Butterworths, Toronto, Canada.
Everett, T., Bryant, A., Griffin, M.F., Martin-Hirsch, P.P., Forbes, C.A. & Jepson, R.G. 2011, 'Interventions targeted at women to encourage the uptake of cervical screening', *Cochrane Database Syst Rev*, no. 5, p. CD002834.
Fan, V.S., Burman, M., McDonell, M.B. & Fihn, S.D. 2005, 'Continuity of Care and Other Determinants of Patient Satisfaction with Primary Care', *J Gen Intern Med*, vol. 20, no. 3, pp. 226-33.
Fiebig, D.G., Haas, M., Hossain, I., Street, D.J. & Viney, R. 2009, 'Decisions about Pap tests: what influences women and providers?', *Soc Sci Med*, vol. 68, no. 10, pp. 1766-74.
Fitzgerald, P.D. 2002, 'General practice corporatisation: the half-time score', *Med J Aust*, vol. 177, no. 2, pp. 90-2.
Fortney, J., Sullivan, G., Williams, K., Jackson, C., Morton, S.C. & Koegel, P. 2003, 'Measuring Continuity of Care for Clients of Public Mental Health Systems', *Health Services Research*, vol. 38, no. 4, pp. 1157-76.
Freeman, G. 1984, 'Continuity of care in general practice: a review and critique', *Fam Pract*, vol. 1, no. 4, pp. 245-52.
Freeman, G. & Hjortdahl, P. 1997, 'What future for continuity of care in general practice?', *BMJ*, vol. 314, no. 7098, p. 1870.
Freeman, G. & Hughes, J. 2010, *Continuity of care and the patient experience*, The King's Fund, viewed January 28 2015, <http://www.kingsfund.org.uk/sites/files/kf/field/field_document/continuity-care-patient-experience-gp-inquiry-research-paper-mar11.pdf>.
Freeman, G., Shepperd, S., Robinson, I., Ehrich, K. & Richards, S. 2001, *Continuity of care: report of a scoping exercise for the NCCSDO*, NCCSDO, London.

Freeman, G., Woloshynowych, M., Baker, R., Boulton, M., Guthrie, B., Car, J., Haggerty, J. & Tarrant, C. 2007, *Continuity of Care 2006: what have we learned since 2000 and what are the policy imperatives? Report for the National Co-ordinating Centre for NHS Service Delivery and Organisation R & D (NCCSDO)*, London, UK.

Freeman, G.K., Olesen, F. & Hjortdahl, P. 2003, 'Continuity of care: an essential element of modern general practice?', *Fam Pract*, vol. 20, no. 6, pp. 623-7.

Gannon, M. & Dowling, M. 2008, 'Increasing the uptake of cervical screening programmes', *Br J Nurs*, vol. 17, no. 20, pp. 1280-4.

Gardner, K., Banfield, M., McRae, I., Gillespie, J. & Yen, L. 2014, 'Improving coordination through information continuity: a framework for translational research', *BMC Health Serv Res*, vol. 14, no. 1, pp. 1-5.

Garland, S.M., Kjaer, S.K., Muñoz, N., Block, S.L., Brown, D.R., DiNubile, M.J., Lindsay, B.R., Kuter, B.J., Perez, G., Dominiak-Felden, G., Saah, A.J., Drury, R., Das, R. & Velicer, C. 2016, 'Impact and Effectiveness of the Quadrivalent Human Papillomavirus Vaccine: A Systematic Review of 10 Years of Real-world Experience', *Clin Infect Dis*, vol. 63, no. 4, pp. 519-27.

Garland, S.M., Skinner, S.R. & Brotherton, J.M. 2011, 'Adolescent and young adult HPV vaccination in Australia: achievements and challenges', *Prev Med*, vol. 53 Suppl 1, pp. S29-35.

Geroldinger, A., Sauter, S.K., Heinze, G., Endel, G., Dorda, W. & Duftschmid, G. 2018, 'Mortality and continuity of care-definitions matter! A cohort study in diabetics', *PLoS ONE*, vol. 13, no. 1, p. e0191386.

Gertig, D.M., Brotherton, J.M., Budd, A.C., Drennan, K., Chappell, G. & Saville, A.M. 2013, 'Impact of a population-based HPV vaccination program on cervical abnormalities: a data linkage study', *BMC Med*, vol. 11, p. 227.

Gibb, R.K. & Martens, M.G. 2011, 'The impact of liquid-based cytology in decreasing the incidence of cervical cancer', *Rev Obstet Gynecol*, vol. 4, no. Suppl 1, pp. S2-S11.

Gill, J.M. & Mainous, A.G., 3rd 1998, 'The role of provider continuity in preventing hospitalizations', *Arch Fam Med*, vol. 7, no. 4, pp. 352-7.

Gill, J.M., Mainous, A.G., 3rd & Nsereko, M. 2000, 'The effect of continuity of care on emergency department use', *Arch Fam Med*, vol. 9, no. 4, pp. 333-8.

Gjevjon, E.R., Eika, K.H., Romoren, T.I. & Landmark, B.F. 2014, 'Measuring interpersonal continuity in high-frequency home healthcare services', *J Adv Nurs*, vol. 70, no. 3, pp. 553-63.

Gordon, N.P., Hiatt, R.A. & Lampert, D.I. 1993, 'Concordance of self-reported data and medical record audit for six cancer screening procedures', *J Natl Cancer Inst*, vol. 85, no. 7, pp. 566-70.

Gray, D.J. 1979, 'The key to personal care', *The Journal of the Royal College of General Practitioners*, vol. 29, no. 208, pp. 666-78.

Greene, W. 2002, 'The Bias of the Fixed Effects Estimator in Nonlinear Models. ', Manuscript, Department of Economics, Stern School of Business, New York University.

Greenhalgh, T. & Heath, I. 2010, 'Measuring quality in the therapeutic relationship--part 1: objective approaches', *Qual Saf Health Care*, vol. 19, no. 6, pp. 475-8.

Grumbach, K. & Bodenheimer, T. 2002, 'A primary care home for Americans: putting the house in order', *Jama*, vol. 288, no. 7, pp. 889-93.

Gruneir, A., Bronskill, S.E., Maxwell, C.J., Bai, Y.Q., Kone, A.J., Thavorn, K., Petrosyan, Y., Calzavara, A. & Wodchis, W.P. 2016, 'The association between multimorbidity and hospitalization is modified by individual demographics and physician continuity of care: a retrospective cohort study', *BMC health services research*, vol. 16, p. 154.

Gulliford, M., Naithani, S. & Morgan, M. 2006, 'What is 'continuity of care'?', *J Health Serv Res Policy*, vol. 11, no. 4, pp. 248-50.
Guthrie, B., Saultz, J.W., Freeman, G.K. & Haggerty, J.L. 2008, 'Continuity of care matters', *BMJ*, vol. 337.
Haggerty, J.L., Reid, R.J., Freeman, G.K., Starfield, B.H., Adair, C.E. & McKendry, R. 2003, 'Continuity of care: a multidisciplinary review', *BMJ*, vol. 327, no. 7425, pp. 1219-21.
Haggerty, J.L., Roberge, D., Freeman, G.K., Beaulieu, C. & Bréton, M. 2012, 'Validation of a Generic Measure of Continuity of Care: When Patients Encounter Several Clinicians', *Ann Fam Med*, vol. 10, no. 5, pp. 443-51.
Hall, J. 2015, 'Australian Health Care — The Challenge of Reform in a Fragmented System', *New England Journal of Medicine*, vol. 373, no. 6, pp. 493-7.
Hall, J., Gerard, K., Salkeld, G. & Richardson, J. 1992, 'A cost utility analysis of mammography screening in Australia', *Soc Sci Med*, vol. 34, no. 9, pp. 993-1004.
Hall, M., Dugan, E., Zheng, B. & Mishra, A. 2001, 'Trust in physicians and medical institutions: what is it, can it be measured, and does it matter?', *Milbank Q*, vol. 79, pp. 613 - 39.
Hansen, M.F. 1975, 'Continuity of care in family practice. Part 3: measurement and evaluation of continuity of care', *J Fam Pract*, vol. 2, no. 6, pp. 439-44.
Harris, M.F. & Zwar, N.A. 2007, 'Care of patients with chronic disease: the challenge for general practice', *Med J Aust*, vol. 187, no. 2, pp. 104-7.
Harris, M.F. & Zwar, N.A. 2014, 'Reflections on the history of general practice in Australia', *Med J Aust*, vol. 201, no. 1 Suppl, pp. S37-40.
Hausman, J.A. 1978, 'Specification Tests in Econometrics', *Econometrica*, vol. 46, no. 6, pp. 1251-71.
Health Quality Ontario 2013, 'Continuity of Care to Optimize Chronic Disease Management in the Community Setting: An Evidence-Based Analysis', *Ontario Health Technology Assessment Series*, vol. 13, no. 6, pp. 1-41.
Heckman, J. 1976, 'The Common Structure of Statistical Models of Truncation, Sample Selection and Limited Dependent Variables and a Simple Estimator for Such Models', *Annals of Economic and Social Measurement* vol. 5, no. 4, pp. 475-92.
Hennen, B.K. 1975, 'Continuity of care in family practice. Part 1: dimensions of continuity', *J Fam Pract*, vol. 2, no. 5, pp. 371-2.
Hetlevik, O. & Gjesdal, S. 2012, 'Personal continuity of care in Norwegian general practice: A national cross-sectional study', *Scand J Prim Health Care*, vol. 30, pp. 214-21.
Heywood, A., Firman, D. & Ring, I. 1996, 'Factors associated with Pap smear taking in general practice: focusing public health initiatives', *Aust N Z J Public Health*, vol. 20, no. 3, pp. 260-6.
Hjortdahl, P. 1990, 'Ideology and reality of continuity of care', *Fam Med*, vol. 22, no. 5, pp. 361-4.
Hjortdahl, P. 1992, 'Continuity of care: general practitioners' knowledge about, and sense of responsibility toward their patients', *Fam Pract*, vol. 9, no. 1, pp. 3-8.
Hjortdahl, P. & Laerum, E. 1992, 'Continuity of care in general practice: effect on patient satisfaction', *BMJ : British Medical Journal*, vol. 304, no. 6837, pp. 1287-90.
Homer, C.S. 2016, 'Models of maternity care: evidence for midwifery continuity of care', *Med J Aust*, vol. 205, no. 8, pp. 370-4.
Hsiao, C. 2007, 'Panel data analysis—advantages and challenges', *TEST*, vol. 16, no. 1, pp. 1-22.
Hussey, P.S., Schneider, E.C., Rudin, R.S., Fox, D., Lai, J. & Pollack, C. 2014, 'Continuity and the costs of care for chronic disease', *JAMA Intern Med*, vol. 174, no. 5, pp. 742-8.

Ince-Cushman, D., Correa, J.A., Shuldiner, J. & Segouin, J. 2013, 'Association of primary care physician sex with cervical cancer and mammography screening', *Can Fam Physician*, vol. 59, no. 1, pp. e11-8.
International Agency for Research on Cancer 2014, *Globocan 2012: Estimated Cancer Incidence, Mortality and Prevalence Worldwide in 2012*, IARC, Lyon, France, viewed June 16 2017, <http://www.wcrf.org/int/cancer-facts-figures/worldwide-data>.
Jann, B. 2014, 'Plotting regression coefficients and other estimates', *The Stata Journal* vol. 14, no. 4, pp. 708-37.
Jatrana, S. & Crampton, P. 2009, 'Affiliation with a primary care provider in New Zealand: who is, who isn't', *Health Policy*, vol. 91, no. 3, pp. 286-96.
Jatrana, S., Crampton, P. & Richardson, K. 2011, 'Continuity of care with general practitioners in New Zealand: results from SoFIE-Primary Care', *N Z Med J*, vol. 124, no. 1329, pp. 16-25.
Jee, S.H. & Cabana, M.D. 2006, 'Indices for continuity of care: a systematic review of the literature', *Med Care Res Rev*, vol. 63, no. 2, pp. 158-88.
Jepson, R., Clegg, A., Forbes, C., Lewis, R., Sowden, A. & Kleijnen, J. 2000, 'The determinants of screening uptake and interventions for increasing uptake: a systematic review', *Health Technol Assess*, vol. 4, no. 14, pp. i-vii, 1-133.
Jia, Y., Li, S., Yang, R., Zhou, H., Xiang, Q., Hu, T., Zhang, Q., Chen, Z., Ma, D. & Feng, L. 2013, 'Knowledge about Cervical Cancer and Barriers of Screening Program among Women in Wufeng County, a High-Incidence Region of Cervical Cancer in China', *PLOS ONE*, vol. 8, no. 7, p. e67005.
Jung, H.P., Baerveldt, C., Olesen, F., Grol, R. & Wensing, M. 2003, 'Patient characteristics as predictors of primary health care preferences: a systematic literature analysis', *Health Expect*, vol. 6, no. 2, pp. 160-81.
Kaida, A., Colman, I. & Janssen, P.A. 2008, 'Recent Pap tests among Canadian women: is depression a barrier to cervical cancer screening?', *J Womens Health (Larchmt)*, vol. 17, no. 7, pp. 1175-81.
Kalucy, L., Katterl, R., Jackson-Bowers, E. & Hordacre, A.-L. 2009, *Models of patient enrolment. PHCRIS Policy Issue Review.*, vol. 2017, Primary Health Care Research Information Service, Adelaide, South Australia.
Kao, Y.-H. & Wu, S.-C. 2016, 'STROBE-compliant article: Is continuity of care associated with avoidable hospitalization among older asthmatic patients?', *Medicine*, vol. 95, no. 38, p. e4948.
Kao, Y.-H. & Wu, S.-C. 2017, 'Effect of Continuity of Care on Emergency Department Visits in Elderly Patients with Asthma in Taiwan', *Journal of the American Board of Family Medicine : JABFM*, vol. 30, no. 3, pp. 384-95.
Kenny, P., De Abreu Lourenco, R., Wong, C.Y., Haas, M. & Goodall, S. 2016, 'Community preferences in general practice: important factors for choosing a general practitioner', *Health Expect*, vol. 19, no. 1, pp. 26-38.
Kerse, N., Buetow, S., Mainous, A.G., 3rd, Young, G., Coster, G. & Arroll, B. 2004, 'Physician-patient relationship and medication compliance: a primary care investigation', *Ann Fam Med*, vol. 2, no. 5, pp. 455-61.
Knight, J.C., Dowden, J.J., Worrall, G.J., Gadag, V.G. & Murphy, M.M. 2009, 'Does higher continuity of family physician care reduce hospitalizations in elderly people with diabetes?', *Popul Health Manag*, vol. 12, no. 2, pp. 81-6.
Kohnke, H. & Zielinski, A. 2017, 'Association between continuity of care in Swedish primary care and emergency services utilisation: a population-based cross-sectional study', *Scandinavian journal of primary health care*, vol. 35, no. 2, pp. 113-9.

Kriegsman, D., Penninx, B., van Eijk, J., Boeke, A. & Deeg, D. 1996, 'Self-report and general practitioner information on the presence of chronic diseases in community dwelling elderly. A study on the accuracy of patients' self-reports and on determinants of inaccuracy', *J Clin Epidemiol*, vol. 49.

Labeit, A.M. & Peinemann, F. 2017, 'Determinants of a GP visit and cervical cancer screening examination in Great Britain', *PLOS ONE*, vol. 12, no. 4, p. e0174363.

Lancaster, T. 2000, 'The incidental parameters problem since 1948', *J Econometrics*, vol. 95, pp. 391-413.

Landis, J.R. & Koch, G.G. 1977, 'The measurement of observer agreement for categorical data', *Biometrics*, vol. 33, no. 1, pp. 159-74.

Lauby-Secretan, B., Scoccianti, C., Loomis, D., Benbrahim-Tallaa, L., Bouvard, V., Bianchini, F. & Straif, K. 2015, 'Breast-cancer screening--viewpoint of the IARC Working Group', *N Engl J Med*, vol. 372, no. 24, pp. 2353-8.

Lee, C., Dobson, A.J., Brown, W.J., Bryson, L., Byles, J., Warner-Smith, P. & Young, A.F. 2005, 'Cohort Profile: The Australian Longitudinal Study on Women's Health', *Int J Epidemiol*, vol. 34, no. 5, pp. 987-91.

Leung, J., McKenzie, S., Martin, J., Dobson, A. & McLaughlin, D. 2014, 'Longitudinal patterns of breast cancer screening: mammography, clinical, and breast self-examinations in a rural and urban setting', *Women's Health Issues*, vol. 24, no. 1, pp. e139-46.

Lin, I.P. & Wu, S.C. 2017, 'Effects of long-term high continuity of care on avoidable hospitalizations of chronic obstructive pulmonary disease patients', *Health Policy*, vol. 121, no. 9, pp. 1001-7.

Lin, I.P., Wu, S.C. & Huang, S.T. 2015, 'Continuity of care and avoidable hospitalizations for chronic obstructive pulmonary disease (COPD)', *J Am Board Fam Med*, vol. 28, no. 2, pp. 222-30.

Liss, D.T., Chubak, J., Anderson, M.L., Saunders, K.W., Tuzzio, L. & Reid, R.J. 2011, 'Patient-Reported Care Coordination: Associations With Primary Care Continuity and Specialty Care Use', *Ann Fam Med*, vol. 9, no. 4, pp. 323-9.

Litaker, D., Ritter, C., Ober, S. & Aron, D. 2005, 'Continuity of care and cardiovascular risk factor management: does care by a single clinician add to informational continuity provided by electronic medical records?', *Am J Manag Care*, vol. 11, no. 11, pp. 689-96.

Long, J.S. & Freese, J. 2006, *Regression models for categorical dependent variables using Stata*, Stata press, Texas, USA.

Love, M.M., Mainous, A.G., 3rd, Talbert, J.C. & Hager, G.L. 2000, 'Continuity of care and the physician-patient relationship: the importance of continuity for adult patients with asthma', *J Fam Pract*, vol. 49, no. 11, pp. 998-1004.

Lurie, N., Slater, J., McGovern, P., Ekstrum, J., Quam, L. & Margolis, K. 1993, 'Preventive care for women. Does the sex of the physician matter?', *N Engl J Med*, vol. 329, no. 7, pp. 478-82.

Maarsingh, O.R., Henry, Y., van de Ven, P.M. & Deeg, D.J. 2016, 'Continuity of care in primary care and association with survival in older people: a 17-year prospective cohort study', *Br J Gen Pract*, vol. 66, no. 649, pp. e531-e9.

Macinko, J., Starfield, B. & Shi, L. 2003, 'The contribution of primary care systems to health outcomes within Organization for Economic Cooperation and Development (OECD) countries, 1970-1998', *Health Serv Res*, vol. 38, no. 3, pp. 831-65.

Mainous, A.G., 3rd, Baker, R., Love, M.M., Gray, D.P. & Gill, J.M. 2001, 'Continuity of care and trust in one's physician: evidence from primary care in the United States and the United Kingdom', *Fam Med*, vol. 33, no. 1, pp. 22-7.

Mainous, A.G., 3rd, Koopman, R.J., Gill, J.M., Baker, R. & Pearson, W.S. 2004, 'Relationship between continuity of care and diabetes control: evidence from the Third National Health and Nutrition Examination Survey', *Am J Public Health*, vol. 94, no. 1, pp. 66-70.

Mainous, A.G. & Gill, J.M. 1998, 'The importance of continuity of care in the likelihood of future hospitalization: is site of care equivalent to a primary clinician?', *Am J Public Health*, vol. 88, no. 10, pp. 1539-41.

Martin, S.S., Peter C; Dusheiko, Mark; Gravelle, Hugh; Rice, Nigel 2011, *Do quality improvements in primary care reduce secondary care costs?*, The Health Foundation, London, viewed October 14 2012, <http://www.health.org.uk/publications/QOF-report/>.

McCallum, J. 1995, 'The SF-36 in an Australian sample: validating a new, generic health status measure', *Aust J Public Health*, vol. 19, no. 2, pp. 160-6.

McCusker, J., Tousignant, P., Silva, R. B. D., Ciampi, A., Lévesque, J.-F., Vadeboncoeur, A., & Sanche, S 2012, 'Factors predicting patient use of the emergency department: a retrospective cohort study.', *CMAJ*, vol. 184, no. 6, pp. E307-16.

McGuire, A., Henderson, J. & Mooney, G. 1988, *The economics of health care*, Routledge & Kegan Paul, New York, USA.

McHugh, M.L. 2012, 'Interrater reliability: the kappa statistic', *Biochemia Medica*, vol. 22, no. 3, pp. 276-82.

McRae, I., Yen, L., Gillespie, J. & Douglas, K. 2011, 'Patient affiliation with GPs in Australia-who is and who is not and does it matter?', *Health Policy*, vol. 103, no. 1, pp. 16-23.

McWhinney, I.R. 1975, 'Continuity of care in family practice. Part 2: implications of continuity', *J Fam Pract*, vol. 2, no. 5, pp. 373-4.

Medical Services Advisory Committee 2014, *National Cervical Screening Program renewal: effectiveness modelling and economic evaluation in the Australian setting. Report November 2013. MSAC application 1276.*, Australian Government Department of Health Canberra.

Meissner, H.I., Breen, N., Taubman, M.L., Vernon, S.W. & Graubard, B.I. 2007, 'Which women aren't getting mammograms and why? (United States)', *Cancer Causes Control*, vol. 18, no. 1, pp. 61-70.

Menec, V., Sirski, M. & Attawar, D. 2005, 'Does Continuity of Care Matter in a Universally Insured Population?', *Health Serv Res*, vol. 40, no. 2, pp. 389-400.

Menec, V., Sirski, M., Attawar, D. & Katz, A. 2006, 'Does continuity of care with a family physician reduce hospitalizations among older adults?', *J Health Serv Res Policy*, vol. 11, no. 4, pp. 196-201.

Miller, G.J. 2008, 'Solutions to Principal-Agent Problems in Firms', in C. Ménard & M.M. Shirley (eds), *Handbook of New Institutional Economics*, Springer Berlin Heidelberg, Berlin, Heidelberg, pp. 349-70.

Mishra, G. & Schofield, M.J. 1998, 'Norms for the physical and mental health component summary scores of the SF-36 for young, middle-aged and older Australian women', *Qual Life Res*, vol. 7, no. 3, pp. 215-20.

Mooney, G. 1992, *Economics, Medicine and Health Care, 2nd edition*, Harvester Wheatsheaf, Guildford, England.

Mooney, G. 2009, *Challenging health economics*, Oxford University Press, Oxford.

Mooney, G. & Ryan, M. 1993, 'Agency in health care: getting beyond first principles', *J Health Econ*, vol. 12, no. 2, pp. 125-35.

Moreira, M.J. 2003, 'A Conditional Likelihood Ratio Test for Structural Models', *Econometrica*, vol. 71, no. 4, pp. 1027-48.

Munro, A., Pavicic, H., Leung, Y., Westoby, V., Steel, N., Semmens, J. & O'Leary, P. 2014, 'The role of general practitioners in the continued success of the National Cervical Screening Program', *Aust Fam Physician*, vol. 43, pp. 293-6.

Murphy, B. 2017, *National Cancer Screening Register*, Australian Government Department of Health, Canberra.

Muth, C., van den Akker, M., Blom, J.W., Mallen, C.D., Rochon, J., Schellevis, F.G., Becker, A., Beyer, M., Gensichen, J., Kirchner, H., Perera, R., Prados-Torres, A., Scherer, M., Thiem, U., van den Bussche, H. & Glasziou, P.P. 2014, 'The Ariadne principles: how to handle multimorbidity in primary care consultations', *BMC Medicine*, vol. 12, p. 223.

Nam, Y.S., Cho, K.H., Kang, H.C., Lee, K.S. & Park, E.C. 2016, 'Greater continuity of care reduces hospital admissions in patients with hypertension: An analysis of nationwide health insurance data in Korea, 2011-2013', *Health Policy*, vol. 120, no. 6, pp. 604-11.

Napolitano, F., Napolitano, P., Garofalo, L., Recupito, M. & Angelillo, I.F. 2016, 'Assessment of Continuity of Care among Patients with Multiple Chronic Conditions in Italy', *PLOS ONE*, vol. 11, no. 5, p. e0154940.

National Health and Hospitals Reform Commission 2009 *A Healthier Future for All Australians*, Commonwealth of Australia, Canberra, viewed February 22 2016, <http://www.health.gov.au/internet/nhhrc/publishing.nsf/content/nhhrc-report>.

National Health and Medical Research Council 2001, *Australian Alcohol Guidelines: health risks and benefits*, Commonwealth of Australia, Canberra.

National Health and Medical Research Council 2005, *Screening to Prevent Cervical Cancer: Guidelines for the Management of Asymptomatic Women with Screen Detected Abnormalities*, Commonwealth of Australia, Canberra, Australia.

National Health Performance Authority 2015, *Healthy Communities: Frequent GP attenders and their use of health services in 2012–13.*, vol. 2015, National Health Performance Authority, Sydney, New South Wales.

National Institute for Health and Care Excellence 2003, *Guidance on the use of liquid-based cytology for cervical screening*, NICE London England.

National Preventative Health Taskforce 2009, *Australia: The Healthiest Country by 2020- National Preventative Health Strategy – Overview*, Commonwealth of Australia, Canberra, ACT.

Nguyen, T.T., McPhee, S.J., Nguyen, T., Lam, T. & Mock, J. 2002, 'Predictors of Cervical Pap Smear Screening Awareness, Intention, and Receipt Among Vietnamese-American Women', *Am J Prev Med*, vol. 23, no. 3, pp. 207-14.

Nutting, P.A., Goodwin, M.A., Flocke, S.A., Zyzanski, S.J. & Stange, K.C. 2003, 'Continuity of primary care: to whom does it matter and when?', *Ann Fam Med*, vol. 1, no. 3, pp. 149-55.

Nyweide, D.J. 2014, 'Concordance between continuity of care reported by patients and measured from administrative data', *Med Care Res Rev*, vol. 71, no. 2, pp. 138-55.

O'Malley, A.S. & Forrest, C.B. 1996, 'Continuity of care and delivery of ambulatory services to children in community health clinics', *J Community Health*, vol. 21, no. 3, pp. 159-73.

O'Malley, A.S., Mandelblatt, J., Gold, K., Cagney, K.A. & Kerner, J. 1997, 'Continuity of care and the use of breast and cervical cancer screening services in a multiethnic community', *Arch Intern Med*, vol. 157, no. 13, pp. 1462-70.

OECD 2017, *OECD Health Statistics 2017*, OECD viewed February 25 2018, <http://www.oecd.org/els/health-systems/health-data.htm>.

Olea, J.L.M. & Pflueger, C. 2013, 'A Robust Test for Weak Instruments', *J Bus Econ Stat*, vol. 31, no. 3, pp. 358-69.

Olesen, S.C., Butterworth, P., Jacomb, P. & Tait, R.J. 2012, 'Personal factors influence use of cervical cancer screening services: epidemiological survey and linked administrative data address the limitations of previous research', *BMC Health Serv Res*, vol. 12, no. 1, p. 34.

Osborne, S.L., Tabrizi, S.N., Brotherton, J.M., Cornall, A.M., Wark, J.D., Wrede, C.D., Jayasinghe, Y., Gertig, D.M., Pitts, M.K. & Garland, S.M. 2015, 'Assessing genital human papillomavirus genoprevalence in young Australian women following the introduction of a national vaccination program', *Vaccine*, vol. 33, no. 1, pp. 201-8.

Oscarsson, M.G., Wijma, B.E. & Benzein, E.G. 2008, ''I do not need to… I do not want to… I do not give it priority…'– why women choose not to attend cervical cancer screening', *Health Expect*, vol. 11, no. 1, pp. 26-34.

Overland, J., Yue, D.K. & Mira, M. 2001, 'Continuity of care in diabetes: to whom does it matter?', *Diabetes Res Clin Pract*, vol. 52, no. 1, pp. 55-61.

Peckham, S., Hann, A. & Boyce, T. 2011, 'Health promotion and ill-health prevention: the role of general practice', *Qual Prim Care*, vol. 19, no. 5, pp. 317-23.

Pedersen, L.B., Kjaer, T., Kragstrup, J. & Gyrd-Hansen, D. 2012, 'Do general practitioners know patients' preferences? An empirical study on the agency relationship at an aggregate level using a discrete choice experiment', *Value Health*, vol. 15, no. 3, pp. 514-23.

Petersen, T. 1993, 'The Economics of Organization: The Principal-Agent Relationship', *Acta Sociologica*, vol. 36, no. 3, pp. 277-93.

Peterson, N.B., Murff, H.J., Cui, Y., Hargreaves, M. & Fowke, J.H. 2008, 'Papanicolaou Testing among Women in the Southern United States', *Journal of Women's Health*, vol. 17, no. 6, pp. 939-46.

Pourat, N., Davis, A.C., Chen, X., Vrungos, S. & Kominski, G.F. 2015, 'In California, Primary Care Continuity Was Associated With Reduced Emergency Department Use And Fewer Hospitalizations', *Health Aff (Millwood)*, vol. 34, no. 7, pp. 1113-20.

Powers, J. & Loxton, D. 2010, 'The Impact of Attrition in an 11-Year Prospective Longitudinal Study of Younger Women', *Ann Epidemiol*, vol. 20, no. 4, pp. 318-21.

Powers, J., Tavener, M., Graves, A. & Loxton, D. 2015, 'Loss to follow-up was used to estimate bias in a longitudinal study: a new approach', *J Clin Epidemiol*, vol. 68, no. 8, pp. 870-6.

Primary Health Care Advisory Group 2015, *Better Outcomes for People with Chronic and Complex Health Conditions*, vol. 2016, Commonwealth of Australia, Canberra, Australia.

Productivity Commission 2017, *Report of government services 2015. Chapter 10: Primary and community services.* , Commonwealth of Australia, Canberra: .

Pu, C. & Chou, Y.J. 2016, 'The impact of continuity of care on emergency room use in a health care system without referral management: an instrumental variable approach', *Ann Epidemiol*, vol. 26, no. 3, pp. 183-8.

RACGP 2010, *Standards for general practices (4th edition)*, Royal Australian College of General Practitioners., viewed September 1, 2015, <http://www.racgp.org.au/download/documents/Standards/standards4thedition.pdf>.

RACGP 2012, *College of GPs encourages Australians to have a 'medical home' on World Family Doctor Day*, RACGP, Melbourne, viewed Dec 11 2017, <https://www.racgp.org.au/yourracgp/news/media-releases/college-of-gps-encourages-australians-to-have-a-%E2%80%98medical-home%E2%80%99-on-world-family-doctor-day/>.

RACGP 2015, *Vision for General Practice and a Sustainable Health System.*, RACGP, Melbourne, viewed March 22 2016, <http://www.racgp.org.au/download/Documents/advocacy/racgp-vision-for-general-practice-and-a-sustainable-health-system.pdf>.

RACGP 2016, *Guidelines for preventive activities in general practice. (9th edition)*, Royal Australian College of General Practitioners., viewed April 11, 2017, <http://www.racgp.org.au/download/Documents/Guidelines/Redbook9/17048-Red-Book-9th-Edition.pdf>.

RACGP 2017, *Standards for general practices (5th edition)*, RACGP, East Melbourne, Victoria.

Raddish, M., Horn, S.D. & Sharkey, P.D. 1999, 'Continuity of care: is it cost effective?', *Am J Manag Care*, vol. 5, no. 6, pp. 727-34.

Rauscher, G.H., Johnson, T.P., Cho, Y.I. & Walk, J.A. 2008, 'Accuracy of self-reported cancer-screening histories: a meta-analysis', *Cancer Epidemiol Biomarkers Prev*, vol. 17, no. 4, pp. 748-57.

Reddy, A., Pollack, C.E., Asch, D.A., Canamucio, A. & Werner, R.M. 2015, 'THe effect of primary care provider turnover on patient experience of care and ambulatory quality of care', *JAMA Intern Med*.

Reid, R.J., Haggerty, J. & McKendry, R. 2002, *Defusing the Confusion: Concepts and Measures of Continuity of Healthcare*, Canadian Health Services Research Foundation, Ottawa.

Rice, T. 2012, 'The physician as the patient's agent', in A.M. Jones (ed.), *The Elgar Companion to Health Economics, 2nd edition*, Edward Elgar Publishing, Cheltenham, UK.

Rochaix, L. 1989, 'Information asymmetry and search in the market for physicians' services', *J Health Econ*, vol. 8, no. 1, pp. 53-84.

Rodriguez, H.P., Marshall, R.E., Rogers, W.H. & Safran, D.G. 2008, 'Primary Care Physician Visit Continuity: A Comparison of Patient-reported and Administratively Derived Measures', *J Gen Intern Med*, vol. 23, no. 9, pp. 1499-502.

Rogers, J. & Curtis, P. 1980, 'The concept and measurement of continuity in primary care', *Am J Public Health*, vol. 70, no. 2, pp. 122-7.

Roman, L., Meghea, C., Ford, S., Penner, L., Hamade, H., Estes, T. & Williams, K.P. 2014, 'Individual, Provider, and System Risk Factors for Breast and Cervical Cancer Screening Among Underserved Black, Latina, and Arab Women', *Journal of Women's Health*, vol. 23, no. 1, pp. 57-64.

Romano, M.J., Segal, J.B. & Pollack, C. 2015, 'The association between continuity of care and the overuse of medical procedures', *JAMA Intern Med*.

Sabatino, S.A., Habarta, N., Baron, R.C., Coates, R.J., Rimer, B.K., Kerner, J., Coughlin, S.S., Kalra, G.P. & Chattopadhyay, S. 2008, 'Interventions to increase recommendation and delivery of screening for breast, cervical, and colorectal cancers by healthcare providers systematic reviews of provider assessment and feedback and provider incentives', *Am J Prev Med*, vol. 35, no. 1 Suppl, pp. S67-74.

Sandall, J., Soltani, H., Gates, S., Shennan, A. & Devane, D. 2016, 'Midwife-led continuity models versus other models of care for childbearing women', *Cochrane Database Syst Rev*, vol. 4, p. Cd004667.

Saultz, J.W. 2003, 'Defining and Measuring Interpersonal Continuity of Care', *Ann Fam Med*, vol. 1, no. 3, pp. 134-43.

Saultz, J.W. & Albedaiwi, W. 2004, 'Interpersonal Continuity of Care and Patient Satisfaction: A Critical Review', *Ann Fam Med*, vol. 2, no. 5, pp. 445-51.

Saultz, J.W. & Lochner, J. 2005, 'Interpersonal Continuity of Care and Care Outcomes: A Critical Review', *Ann Fam Med*, vol. 3, no. 2, pp. 159-66.

Schneider, E.C., Sarnak, D., Squires, D., Shah, A. & Doty, M.M. 2017, *Mirror, Mirror 2017: International Comparison Reflects Flaws and Opportunities for Better U.S. Health Care*, The Commonwealth Fund, Washington USA.

Scholl, I., Zill, J.M., Härter, M. & Dirmaier, J. 2014, 'An Integrative Model of Patient-Centeredness – A Systematic Review and Concept Analysis', *PLOS ONE*, vol. 9, no. 9, p. e107828.
Scott, A. 2000, 'Economics of General Practice', in A.J. Culyer & J.P. Newhouse (eds), *Handbook of Health Economics*, Elsevier, Amsterdam.
Scott, A. & Jan, S. 2011, 'Primary Care', in S. Glied & P.C. Smith (eds), *The Oxford handbook of health economics*, Oxford University Press,, New York, pp. 463-85.
Scott, A., Schurer, S., Jensen, P.H. & Sivey, P. 2009, 'The effects of an incentive program on quality of care in diabetes management', *Health Econ*, vol. 18, no. 9, pp. 1091-108.
Scott, A. & Vick, S. 1999, 'Patients, Doctors and Contracts: An Application of Principal-Agent Theory to the Doctor-Patient Relationship', *Scott J Polit Econ*, vol. 46, no. 2, pp. 111-34.
Shapiro, S. 2005, 'Agency Theory', *Annu Rev Sociol*, vol. 31, no. 1, pp. 263-84.
Shin, D.W., Cho, J., Yang, H.K., Park, J.H., Lee, H., Kim, H., Oh, J., Hwang, S., Cho, B. & Guallar, E. 2014, 'Impact of continuity of care on mortality and health care costs: a nationwide cohort study in Korea', *Ann Fam Med*, vol. 12, no. 6, pp. 534-41.
Srinivasan, U., Rao, S., Ramachandran, D. & Jonas, D. 2016, *Flying Blind: Australian Consumers and Digital Health, Volume 1: Australian Health Data Series,*, CMCRC, Sydney.
Standing Council on Health 2013, *National Primary Health Care Strategic Framework*, Commonwealth of Australia, Canberra.
Starfield, B. 1980, 'Continuous confusion? ', *Am J Public Health*, vol. 70, no. 2, pp. 117-9.
Statacorp 2017, *Stata/MP 14.1 for Windows*, Statacorp, College Station, Texas, USA
Stavert , R.R. & Lott , J.P. 2013, 'The Bystander Effect in Medical Care', *New England Journal of Medicine*, vol. 368, no. 1, pp. 8-9.
Steinwachs, D.M. 1979, 'Measuring provider continuity in ambulatory care: an assessment of alternative approaches', *Med Care*, vol. 17, no. 6, pp. 551-65.
Stewart, R. & Thistlethwaite, J. 2010, 'Pap tests: what do women expect?', *Aust Fam Physician*, vol. 39, no. 10, pp. 775-8.
Stock, J. & Staiger, D. 1997, 'Instrumental Variables Regression with Weak Instruments', *Econometrica*, vol. 65, no. 3, pp. 557-86.
Stock, J. & Yogo, M. 2005, 'Testing for Weak Instruments in Linear IV Regression', in D.W.K. Andrews (ed.), *Identification and Inference for Econometric Models: Essays in Honor of Thomas Rothenberg*, Cambridge University Press, New York, pp. 80-108.
Stock, J., Yogo, M. & Wright, J. 2002, 'A Survey of Weak Instruments and Weak Identification in Generalized Method of Moments', *J Bus Econ Stat*, vol. 20, pp. 518 – 29.
Sturmberg, J.P. & Martin, C.M. 2003, '"Only a GP?": is the solution to the general practice crisis intellectual?', *Med J Aust*, vol. 179, no. 9, p. 507; author reply
Sturmberg, J.P. & Schattner, P. 2001, 'Personal doctoring. Its impact on continuity of care as measured by the comprehensiveness of care score', *Aust Fam Physician*, vol. 30, no. 5, pp. 513-8.
Sutton, S. & Rutherford, C. 2005, 'Sociodemographic and attitudinal correlates of cervical screening uptake in a national sample of women in Britain', *Soc Sci Med*, vol. 61, no. 11, pp. 2460-5.
Sweeney, A., Davies, J., McLaren, S., Whittock, M., Lemma, F., Belling, R., Clement, S., Burns, T., Catty, J., Jones, I.R., Rose, D. & Wykes, T. 2016, 'Defining continuity of care from the perspectives of mental health service users and professionals: an exploratory, comparative study', *Health Expect*, vol. 19, no. 4, pp. 973-87.
Swerissen, H., Duckett, S. & Wright, J. 2016, *Chronic failure in medical primary care. Report No. 2016-2*, Grattan Institute, Melbourne, Victoria.

Tammes, P., Morris, R.W., Brangan, E., Checkland, K., England, H., Huntley, A., Lasserson, D., MacKichan, F., Salisbury, C., Wye, L. & Purdy, S. 2017, 'Exploring the relationship between general practice characteristics and attendance at Walk-in Centres, Minor Injuries Units and Emergency Departments in England 2009/10-2012/2013: a longitudinal study', *BMC health services research*, vol. 17, no. 1, p. 546.

The Cancer Council Australia 2007, *National Cancer Prevention Policy 2007−09.*, The Cancer Council Australia, , Sydney, NSW.

Tumiel-Berhalter, L.M., Finney, M.F. & Jaen, C.R. 2004, 'Self-report and primary care medical record documentation of mammography and Pap smear utilization among low-income women', *J Natl Med Assoc*, vol. 96, no. 12, pp. 1632-9.

Uijen, A.A., Schers, H.J. & van Weel, C. 2010, 'Continuity of care preferably measured from the patients' perspective', *J Clin Epidemiol*, vol. 63, no. 9, pp. 998-9.

van Walraven, C., Oake, N., Jennings, A. & Forster, A.J. 2010, 'The association between continuity of care and outcomes: a systematic and critical review', *J Eval Clin Pract*, vol. 16, no. 5, pp. 947-56.

Veale, B.M., McCallum, J., Saltman, D.C., Lonergan, J., Wadsworth, Y.J. & Douglas, R.M. 1995, 'Consumer use of multiple general practitioners: an Australian epidemiological study', *Fam Pract*, vol. 12, no. 3, pp. 303-8.

Vick, S. & Scott, A. 1998, 'Agency in health care. Examining patients' preferences for attributes of the doctor–patient relationship', *J Health Econ*, vol. 17, no. 5, pp. 587-605.

Victorian Cytology Service 2016, *Saving Lives. 2015/16 Annual Report*, VCS, viewed 23 Oct 2017, <http://www.vcs.org.au/publications/annual>.

Villani, J. & Mortensen, K. 2013, 'Patient-provider communication and timely receipt of preventive services', *Prev Med*, vol. 57, no. 5, pp. 658-63.

Vogt, V., Koller, D. & Sundmacher, L. 2016, 'Continuity of care in the ambulatory sector and hospital admissions among patients with heart failure in Germany', *European journal of public health*.

Wall, E.M. 1981, 'Continuity of care and family medicine: definition, determinants, and relationship to outcome', *J Fam Pract*, vol. 13, no. 5, pp. 655-64.

Waller, J., Jackowska, M., Marlow, L. & Wardle, J. 2012, 'Exploring age differences in reasons for nonattendance for cervical screening: a qualitative study', *BJOG*, vol. 119, no. 1, pp. 26-32.

Ware, J.E., Jr. & Sherbourne, C.D. 1992, 'The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection', *Med Care*, vol. 30, no. 6, pp. 473-83.

Warren, J.R., Falster, M.O., Tran, B. & Jorm, L. 2015, 'Association of Continuity of Primary Care and Statin Adherence', *PLoS ONE*, vol. 10, no. 10, p. e0140008.

Wasson, J.H., Sauvigne, A.E., Mogielnicki, R.P., Frey, W.G., Sox, C.H., Gaudette, C. & Rockwell, A. 1984, 'Continuity of outpatient medical care in elderly men. A randomized trial', *JAMA*, vol. 252, no. 17, pp. 2413-7.

Wei, X., Barnsley, J., Zakus, D., Cockerill, R., Glazier, R. & Sun, X. 2008a, 'Assessing continuity of care in a community diabetes program: initial questionnaire development and validation', *J Clin Epidemiol*, vol. 61, no. 9, pp. 925-31.

Wei, X., Barnsley, J., Zakus, D., Cockerill, R., Glazier, R. & Sun, X. 2008b, 'Evaluation of a diabetes management program in China demonstrated association of improved continuity of care with clinical outcomes', *J Clin Epidemiol*, vol. 61, no. 9, pp. 932-9.

Weir, D.L., McAlister, F.A., Majumdar, S.R. & Eurich, D.T. 2016, 'The Interplay Between Continuity of Care, Multimorbidity, and Adverse Events in Patients With Diabetes', *Med Care*, vol. 54, no. 4, pp. 386-93.

White, H. 1980, 'A heteroskedasticity-consistent covariance matrix estimator and adirect test for heteroskedasticity. ', *Econometrica*, vol. 48, no. 4, pp. 817–38.

WHO 2000, *The World health report 2000: health systems: improving performance.*, WHO, Geneva.
WHO 2014, *Global status report on noncommunicable diseases 2014*, WHO, Geneva, Switzerland.
Williams, A. 1988, 'Health economics: the end of clinical freedom?', *Bmj*, vol. 297, no. 6657, pp. 1183-6.
Women's Health Australia 2014, 'Randomised parallel control trial of internet and paper surveys for ongoing participants in the 1973-78 cohort', in Women's Health Australia (ed.), *Technical Report 37. The Australian Longitudinal Study on Women's Health*, The University of Queensland Brisbane
Women's Health Australia 2018, *Data Linkage: Medicare Benefits Schedule (MBS)*, viewed February 3 2018, <https://www.alswh.org.au/how-to-access-the-data/external-linked-datasets/medicare-benefits-schedule>.
Wooldridge, J.M. 2000, *Introductory econometrics : a modern approach*, South-Western College, Cincinnati, OH.
Wooldridge, J.M. 2010, *Econometric analysis of cross section and panel data*, 2nd edn, MIT Press, Cambridge, Mass.
World Health Organisation 2014, *WHO position paper on mammography screening*, WHO, Geneva, Switzerland.
World Health Organization 2008, *The World Health Report 2008- Primary Health Care (Now More Than Ever)* World Health Organization, Geneva Switzerland.
Worrall, G. & Knight, J. 2011, 'Continuity of care is good for elderly people with diabetes: Retrospective cohort study of mortality and hospitalization', *Can Fam Physician*, vol. 57, no. 1, pp. e16-e20.
Wright, M., Hall, J., van Gool, K. & Haas, M. 2018, 'How common is multiple general practice attendance?', *Australian Journal of General Practice,*, vol. 47, no. 5, pp. 289-96.
Xu, K.T. 2002, 'Usual Source of Care in Preventive Service Use: A Regular Doctor versus a Regular Site', *Health Serv Res*, vol. 37, no. 6, pp. 1509-29.
Xu, W.Y., Dowd, B. & Abraham, J. 2016, 'Lessons from state mandates of preventive cancer screenings', *Eur J Health Econ* vol. 17, no. 2, pp. 203-15.
Young, A.F., Dobson, A.J. & Byles, J.E. 2001, 'Health services research using linked records: who consents and what is the gain?', *Aust N Z J Public Health*, vol. 25, no. 5, pp. 417-20.
Young, A.F., Powers, J.R. & Bell, S.L. 2006, 'Attrition in longitudinal studies: who do you lose?', *Aust N Z J Public Health*, vol. 30, no. 4, pp. 353-61.

10 Appendices

10.1 Chapter 2 – Literature Review

10.1.1 Search strategy

Based on the previous literature search of van Walrarven et al. (2010), literature investigating the association between continuity of care and health outcomes in the primary care setting was investigated.

Population: Patient in primary care setting

Intervention: Individual patient pattern of health care delivery classified according to continuity of care.

Comparison: Not specified.

Outcome: Patient satisfaction, changes to health service utilisation, health care costs, or the quality of clinical care.

Continuity of care was broadly defined, and measures included increased proportion of care with one provider (either individual provider or at an institutional level), all care from one provider, the effect of loss of a provider.

Search strategy: A literature review was conducted in August 2016 (and updated in March 2018) in the following electronic databases:.

- Medline/Pubmed
- EconLit

Studies were included if they were experimental studies, observational studies, (cohort studies, before and after studies) or cross-sectional studies investigating the association between continuity of care and health outcomes, and were in English. Importantly, studies also needed to include temporality, either by estimating continuity of care at a time period prior to the period of measurement of health outcomes, or by taking into account the endogeneity of continuity of care.

Studies were excluded if they met any of the following exclusion criteria:

- Did not take account of the temporal relationship between continuity of care and health outcomes.
- Published in a language other than English.
- Published prior to 2010.
- Not original research, including reviews, letters, editorials.
- Abstracts from conference proceedings.
- Not investigating continuity of care in a primary care setting.

The search strategy is as below using Medline:

Search conducted 13.03.2018

Search Strategy:

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1 *"Continuity of Patient Care"/ (9347)
2 "continuity of care".mp. (5728)
3 (continuity adj5 provider).mp. (236)
4 (continuity adj5 doctor*).mp. (117)
5 or/1-4 (13614)
6 measure$.mp. (2995469)

7 index.mp. (891512)
8 evaluat$.tw. (2958833)
9 effect?.tw. (4771305)
10 or/6-9 (8917295)
11 5 and 10 (4337)
12 limit 11 to ed=20080701-20171231 (2391)
13 limit 12 to english language (2289)
14 (editorial or letter or note or comment).pt. (1630323)
15 13 not 14 (2270)

Results of search strategy

2,270 citations identified from multiple databases

368 potentially relevant from title screen

After abstract review

104 potentially relevant

85 papers excluded

Reason for exclusion

- cross-sectional or methodology where continuity and outcome measured over same time period eg (Dreiher et al. 2012; Kohnke & Zielinski 2017; Maarsingh et al. 2016)
- investigating practice population continuity rather than individual patient-level continuity e.g. (Tammes et al. 2017)
- continuity of care not included as explanatory variable, e.g. a mediating factor between explanatory and outcome variable, e.g. (Gruneir et al. 2016).

After inclusion and exclusion criteria applied, 19 papers included in the review.

10.1.2 Analysis of empirical literature meeting search criteria

Table 32: Critical analysis of empirical literature

<table>
<tr><th>Study ID</th><th>Study design and population characteristics</th><th>Modelling of continuity of care</th><th>Results</th><th>Conclusion</th></tr>
<tr><td>Bentler 2014</td><td>Study
Retrospective cohort study

Population
Community residing Medicare beneficiaries aged 65 or over

Sample size
N = 1,219 Medicare beneficiaries with complete survey responses

Location
Community setting
Iowa, USA</td><td>Level of continuity of care
Personal - primary care visits

Continuity of Care Measure
Subjective and claims-based continuity of care. Subjective continuity estimated from self-developed 13-item patient questionaire, 17 claims-based measures including COCI, UPC, SeCon.

Categorisation of continuity of care
• Modelled in Tertiles (high medium low) and around median
• 12 month
• Claims-based measures calculated in 2003-04 outcomes calculated 2005-09

Visits for inclusion
Not discussed.
Methods</td><td>Those in the highest tertile for self-reported personal continuity and site continuity had statisically significantly decreased ED visits. those in third of COCI and UPC had significantly increased rates of potentially preventable hospitalisation and increased mortality rates.</td><td>Critique
Initial sample consists of 2,620 Medicare beneficiaries, with over half sample excluded due to different billing reporting requirements- unclear if this exclusion prohibited calculation of claims-based measures. Use of multiple less common claims-based measures does not suggest superiority of one claims-based measure over others. Potentially small sample and use of self-developed subjective meaure limiting generalisability.

Conclusion</td></tr>
</table>

Study ID	Study design and population characteristics	Modelling of continuity of care	Results	Conclusion
		Modelled adjusted hazards ratio of first time to ED use, first hospitalisation or mortality. ED, hospitalisation, mortality. **Covariates included** Age, sex, marital status, race, education, health insurance, income, smoking status, past medical history (cancer, diabetes, heart failure, myocardial infarction, high blood pressure, cerebrovascular disease, and lung disease), hospitalisation in year before survey, number of GP visits.		Different results using subjective and claims-based measures. Use of both subjective and claims-based continuity of care measures advocated.
Chen 2011	**Study** Retrospective cohort study **Population** Adults with diabetes **Sample size** N = 48,107 at baseline **Location** Hospital Outpatient (no GP context in Taiwan) Taiwan	**Level of continuity of care** Personal and site continuity - Measure diabetes-related outpatient visits. **Continuity of Care Measure** COCI of diabetes-related outpatient visits. **Categorisation of continuity of care** • Tertiles • 12 month • Panel data and GEE **Visits for inclusion**	Highest tertile COCI odds ratio (OR) of 0.26 (95% CI 0.25-0.27)for diabetes related hospital admissions, and 0.34 (95% CI 0.33-0.36) for diabetes related ED visits, compared to those in lowest tertile for COCI. There were also assocations for patients with increasing age, low income status, higher disease severity and more frequent physician attendance in previous year to have	**Critique** Only considering diabetes related consultations and costs. All consultations COC also measured (COCI-0.35 versus average of 0.64 for diabetes consultations) but analysis of health outcomes not provided **Conclusion**

Study ID	Study design and population characteristics	Modelling of continuity of care	Results	Conclusion
		Three or more diabetes visits in every year. **Methods** Longitudinal data, GEE used to account for correlated data, likelihood of ED visit modelled using logit link with binomial distribution, costs modelled with a logarithmic link function with Gamma distribution. Odds of diabetes related ED visits, diabetes related hospitalisation and mean predicted diabetes related costs. **Covariates included** Age, number of physician visits , diabetes severity, sex, income status, time dummy.	increased OR of diabetes related hospitalisation and ED attendance. Compared with low tertiled COCI group, patients within highest tertile of COCI had $737 higher healthcare spending.	Better continuity of care was associated with less healthcare use and lower healthcare expenses for diabetic patients. Improving continuity of care might benefit diabetic patients.
DuGoff 2016	**Study** Retrospective cohort **Population** 65+ with diabetes + one other chronic disease **Sample size** N = 1,254 **Location**	**Level of continuity of care** Personal (All GP and specialist). **Continuity of Care Measure** UPC, COCI, Known Provider Continuity (KPC). **Categorisation of continuity of care** • Tertiles • 6 months	In unadjusted models, increased continuity associated with decreased ED and hospitalisation for all measures. In full model, only KPC was significant.	**Critique** Short period of analysis (6 months) of continuity may be inadequate time for doctor patient relationshiop, measured both GP and specialist visits an unclear if separating these visits out may be more relevant for primary care.

Study ID	Study design and population characteristics	Modelling of continuity of care	Results	Conclusion
	GP and specialist visits five states of the USA	• Continuity 6 /12, then outcomes 12 months **Visits for inclusion** Three visits in six months. **Methods** Multivariate logistic regression Any ED or hosptialisation. **Covariates included** Age, race, gender, morbidity , number physician visits. Adverse events, state of residence.		**Conclusion** Different results using different claims-based measures. No positive findings using COCI or UPC in models.
Enlow 2017	**Study** Prospective birth cohort **Population** Birth cohort **Sample size** N = 17,773 **Location** Primary care visits Philadelphia, USA	**Level of continuity of care** Personal Primary care visits - nurse and GP (also calculate measure of well visits only **Continuity of Care Measure** UPC (and COCI) **Categorisation of continuity of care** • Quartiles- compared lowest and highest • 12 month • UPC in year 1, then preventative care and HSU Years 1-3	Children within highest continuity quartiles (either UPC or COCI) had decreased ACSH, and decreased ED utilisation compared with lowest quartile. Also more likely to have infant immunisations up to date in unadjusted model, but not significant in full model.	**Critique** Similar results using COCI and UPC. Initial cohort of 22104 in first year reduced to 17773 at year so potential for bias from attrition. **Conclusion** Higher continuity in infancy associated with lower subsequent hospitalisation.

Study ID	Study design and population characteristics	Modelling of continuity of care	Results	Conclusion
		Visits for inclusion Three well visits and five total visits. **Methods** Mutlivariate logistic regression and propensity scores to balance covariates within continuity quartiles Immunisations, number of sick and well GP visits, ED attendances. **Covariates included** Gestational age, gender, race, insurance status, chronic condition count, SES, location.		
Geroldinger 2018	**Study** Retrospective cohort study **Population** Adults with diabetes drug dipsensing history **Sample size** N = 51,717 **Location** Insurance claims database Austria	**Level of continuity of care** Two analyses with same methods - GP visits only in analysis one, all medical contacts (including specialist visits, pathology and imaging) in Analysis Two **Continuity of Care Measure** COCI (and UPC in sensitivity) **Categorisation of continuity of care** • Continous and modelled in tertiles • One year	In GP visit analysis, 61.9% of patients had COCI of 1, and 10% with COCI less than 0.75. Univariate analysis suggesting decreased mortality with increased GP COCI Compared with patients in lowest tertile of CIC (COCI<0.75) those with COCI=1 had mortality of HR=0.81 (95% CI; 0.75-0.88). Non significant difference in full model. For all medical contacts analysis (less	**Critique** Diabetic patients with very high COCI for all visits are unlikely to be getting appropriate mulitdisciplinary care- leading to worse outcomes. Sample is from 70% of population from Lower Austria. **Conclusion** Non-significant trend for increased GP continuity of

Study ID	Study design and population characteristics	Modelling of continuity of care	Results	Conclusion
		• COCI in frst year following drug dispensing, mortality in subsequent censored observation period of up to 30 months **Visits for inclusion** Three GP visits in first year. **Methods** Univariate and multivariate Cox regression models. (All cause) Mortality. **Covariates included** Age, sex, age/sex interaction, number of doctor contacts, hospitalisation dummy, length of hospital stays, 39 drug dispensing dummies and 4 ICD-10 diagnosis code dummies.	applicable for this thesis) increased COCI of total contacts associated with increased increased mortality.	care for diabetic adults being associated with subsequent mortality reduction.
Kao 2016	**Study** Retrospective cohort study **Population** Patients aged 65 or over with asthma **Sample size** N = 3,356	**Level of continuity of care** Personal **Continuity of Care Measure** COCI **Categorisation of continuity of care** • Tertiles • One year	Risk of asthma related hospitalisation significantly higher in lowest tertlle compared with highest tertile COCI, even after adjustment for confounder (aHR 2.68; 95% CI, 1.55-4.63). Non significant increased HR for middle tertiled compared	**Critique** Taiwanese setting more like hospital than Australian primary care. **Conclusion** In Taiwanese, setting increased risk of asthma related hospitalisation for

Study ID	Study design and population characteristics	Modelling of continuity of care	Results	Conclusion
	Location Taiwan primary care (predominantly in hospital based clinics) Taiwan	• COCI calculated in year 1, outcome in year 2 **Visits for inclusion** Four asthma-related outpatient visits in year **Methods** Multivariate Cox regression models with asthma related hospitalisation as outcome variable. Avoidable asthma-related hospital admission. **Covariates included** Age, sex, insurance premiums, health status and charlson comorbidity index, number of ambulatory visits, ED visit or hospitalisation in previous year.	with high COCI tertile aHR=1.77; 95% CI 0.80-2.75).	asthmatic patients with lower COCI for asthma related outpatient visits.
Kao 2017	**Study** Retrospective cohort study **Population** Patients aged 65 or over with asthma **Sample size**	**Level of continuity of care** Personal **Continuity of Care Measure** COCI **Categorisation of continuity of care** • Three groups based on first and third quartiles of continuity using COCI- low	Overall incidence of asthma-related ED visits of 3.45%. Risk of asthma related hospitalisation significantly higher in low continuity group compared with perfect COCI, even after adjustment for confounders (aHR 2.11; 95% CI, 1.37-3.25). Non-significant	**Critique** Taiwanese setting more like hospital than Australian primary care. Threshold of four asthma-related visits potentially identifies most severe asthmatic patients and may not be relevant to Australian primary cares

Study ID	Study design and population characteristics	Modelling of continuity of care	Results	Conclusion
	N = 3,395 (sample identical to Kao 2016 other than 39 patients with an asthma admission in year of continuity calculation are excluded earlier study but included in this analysis). **Location** Taiwan primary care (predominantly in hospital based clinics) Taiwan	continuity group =bottom quartile (COCI<0.47), moderate continuity group (0.47<COCI<1), perfect continuity (COCI=1) • One year • COCI calculated in year 1, outcome in year 2 **Visits for inclusion** Four asthma-related outpatient visits in year **Methods** Multivariate Cox regression models with asthm- related ED visits as outcome variable. Asthma-related emergency department (ED) visits. **Covariates included** Age, sex, insurance premiums, health status and charlson comorbidity index, history of COPD, number of asthma-related ambulatory visits, ED visit or hospitalisation in previous year.	increased HR for moderate continuity group compared with perfect continuity group (aHR=1.15; 95% CI 0.70-1.87).	setting. Unable to replicate disease specific analysis of visits using Medicare data. Motivation for uincluding three continuity groups based on quartiles unclear. **Conclusion** In Taiwanese setting, increased risk of asthma-related ED use for asthmatic patients with lower COCI.
Lin 2015	**Study** Retrospective cohort study	**Level of continuity of care** Personal continuity (all physicians)	The logistic regression model showed that Compared with	**Critique**

Study ID	Study design and population characteristics	Modelling of continuity of care	Results	Conclusion
	Population Newly diagnosed COPD patients from sample population **Sample size** N = 3,015 **Location** National health insurance sample Taiwan	**Continuity of Care Measure** COCI of COPD visits **Categorisation of continuity of care** • tertiles • 2 year • COC in 2 years, then PPH in year 3 **Visits for inclusion** Three visits in two years. **Methods** Multivariate logistic regression with PPH as outcome variable. COPD related PPH. **Covariates included** Sex, age, low-income, COPD-related ED visits, Charlson index.	high COCI group, low COCI group had increased odds (OR=2.29 (95% CI 1.26–4.15) of COPD-related avoidable hospitalizations after controlling for other covariates. Medium COCI group - OR of hospitalisation.- OR 1.81 (0.97-3.36).	Older sample with high burden of disease, controlled for disease severity by considering COPD -related ED visits. **Conclusion** Suggestions of dose response effect of increased COC on COPD-related hospitalisation.
Lin 2017	**Study** Retrospective cohort **Population**	**Level of continuity of care** Personal continuity - COPD coded physician visits. **Continuity of Care Measure** COCI	Stronger effect of COCI over longer time period. Compared with high tertile of 2 year COCI group, higher rates of PPH for those patients in medium COCI	**Critique** Longer term COPD visit COCI associated with reduced COPD related hospitalisation. **Conclusion**

Study ID	Study design and population characteristics	Modelling of continuity of care	Results	Conclusion
	Newly diagnosed COPD patients from sample population **Sample size** N = 2,199 **Location** National health insurance sample Taiwan	**Categorisation of continuity of care** • tertiles • 12 month and 2 year • COC in year 1 and year 2, then PPH in following year **Visits for inclusion** Three visits in one year. **Methods** Multivariate logistic regression with PPH as outcome variable. Measured disease visit related visits to calculate COCI over 1 and 2 years. COPD related PPH. **Covariates included** Sex, age, low-income, COPD-related ED visits, Charlson index.	(OR: 1.98, 95% CI: 1.0-3.94) low COCI group (OR: 2.03, 95% CI: 1.05-3.94).	Measuring COCI over longer time period aassociated with increased effect.
Liss 2011	**Study** Survey sample **Population** Medicare insurance recipients (ie 65+) with diabetesCAD o	**Level of continuity of care** Personal - GP visits **Continuity of Care Measure** COCI **Categorisation of continuity of care**	Association between increased COCI and increased care coordination. 1 SD in COCI associated with increased care coordination score of 2.21 ($p<0.001$)in multivariate model. No	**Critique** Care coordination only considered. Association between incresaed continuity and increased coordination not found for those patients with high usage of specialists.

Study ID	Study design and population characteristics	Modelling of continuity of care	Results	Conclusion
	Sample size N = 3,224 **Location** GP Washington State, USA	• COCI included as continuous independent variable • 12 month • COCI in year prior to survey completion **Visits for inclusion** Three or more visits. **Methods** Multivariate regression models. Patient experience survey completed, COCI estimated from admin data for year before survey. Subgroup analysis of patients with high usage of medical specialists. Care coordination score of 0-100. **Covariates included** Age, race, gender, chronic disease, self-assessed health, any hospitalisation.	significant association in subgroup analysis considering high specialty users (with 10 or more specialist visits).	**Conclusion** High use of specialiats may attenuate the ability of GPs to coordinate care.
McCusker 2012	**Study** Retrospective cohort study **Population** Population **Sample size** N = 367,315	**Level of continuity of care** Personal (GP visits) **Continuity of Care Measure** UPC **Categorisation of continuity of care** • Tertiles	No significant association between increased UPC (in tertiles) and decreased odds of subsequent ER utilisation (except for patients with more than 24 visits)	**Critique** Non-standard measures of affiliation included. Also sought to differentiate between a family physician (GP)and a specialist as primary care provider which

Study ID	Study design and population characteristics	Modelling of continuity of care	Results	Conclusion
	Location Primary care setting Quebec, Canada	• 2 year • UPC in first 2 years, then ED use in following three **Visits for inclusion** Three visits in two years **Methods** Negative binomical regression models to calculate indicence rate ratios for ED attendance, controlling for other variables ED utilisation. **Covariates included** Age, sex, material deprivation, area of residence, comorbidity score, number GP visits, hospital admissions, ED visits.		may be less relevant to Australia. **Conclusion** No association between continuity of care and ED utilisation in main model.
Nam 2016	**Study** Retrospective cohort study **Population** Adult aged 20 or over with hypertension **Sample size** N = 30,474 **Location**	**Level of continuity of care** Clinic-level continuity (ie site continuity of care) **Continuity of Care Measure** COCI **Categorisation of continuity of care** • Binary measure around 0.75 • 1 year	0.5% of sample had admission recorded due to hypertension. Compared with high continuity group (COCI> 0.75), patients with lower COCI had higher adjusted HR for hospital admission of 1.42 (95% CI, 1.10-1.83). Adjusted HR associated with continuity of care was higher for patients over 70 year of age, and for	**Critique** Outpatient setting rather than GP setting so less relevant, Validity of choosing 0.75 as threshold between high and low continuity uncertain. HT visits based on coding of each visit, and diagnosistic certainty esimated at 70%. HT may be more likely to be a secondary diagnosis rather

Study ID	Study design and population characteristics	Modelling of continuity of care	Results	Conclusion
	Korean outpatient clinics Korea	• COCI in year one, hospital admission in year 2 **Visits for inclusion** Four visits. **Methods** Cox proportional hazards model to estimate time to first hospitalisation Hypertension-related Hospital admission in year following COCI calculation. **Covariates included** Age, sex, insurance status, charlson comorbidity index, number of antihypertensive drugs, type of medical centre (tertiary hospital, clinic, or public health unit), medication possession ratio for hypertensive drugs.	patient with higher Charlson co-morbidity index.	than a primary diagnosis. Unable to estimate provider visits in this data - therefore measure of site continuity of care. **Conclusion** In Korean clinic setting (91% specialists working in solo practice), patients with hypertension with higher personal COCI for visits coded as HT related (or HT meds are precsribed) have significantly lower risk of hospital admission.
Pourat 2015	**Study** Before and after study using administrative data **Population** Adults in insurance program **Sample size**	**Level of continuity of care** Personal, site **Continuity of Care Measure** Proportion of all visits to one location. **Categorisation of continuity of care**	Patient attendance at one practice increased from 31.4 % of sample before the policy was introduced, to 69.6% six month after introduction of incentive. No significant difference in ED utilisation or hospitalisation associated	**Critique** Additional copayments introduced for GP and ED utilisation at same time which may have confounded results. Also classified continuity as exclusive care rather than high, medium and low care

Study ID	Study design and population characteristics	Modelling of continuity of care	Results	Conclusion
	N = 4,191 in pre-intervention period, 5,837 in post-intervention period **Location** Primary care practice California	• All care with one location (100% continuity), sometimes attended same practice (1-99% adherent), never attended recommended practice (0% adherent) • 6 months • Measured pre and post intervention **Visits for inclusion** Two visits. **Methods** Intervention - patients attending non-regular practice no longer funded to receive care at non-home practices. Also copayments introduced for GP visit ($5) and ED ($25). ED visit and hospitalisation in six months subsequent to site continuity estimation. **Covariates included** Sex, age, income, language spoken chronic diease indicators (diabetes, asthma, chronic obstructive pulmonary disease, congestiveheart failure, coronary artery disease, dyslipidemia, and hypertension).	with increased site continuity of care	which may have overlooked differences. **Conclusion** Incentive to encourage site continuity changes patient behaviour. No change in health outcomes in 6 months following change

Study ID	Study design and population characteristics	Modelling of continuity of care	Results	Conclusion
Pu 2016	**Study** Cohort study **Population** Sample of diabetes and HT patients **Sample size** N = 331,506 people with HT, 82,181 with diabetes **Location** disease related HT and diabetes outpatient visits Taiwan	**Level of continuity of care** Personal **Continuity of Care Measure** COCI of HT and diabetesvisits **Categorisation of continuity of care** • Tertiles COCI - continuous in IV • 12 month • IV was COC of family members **Visits for inclusion** 3 disease coded physician visits **Methods** Regression models, two stage least sqaured (2SLS) for IV regression models ED attendance **Covariates included** Charlson comorbidity score, income, gender, age, insurance status, hospital admission in previous year.	Increased annual COCI in year one associated with decreased ED attendance in year 2. Diabetic patients- Marginal effect of increased COCI from 0-1 on decreasing ER attendance increased 12.6% in uninsturmented model to 14.8% in instrumented model. This effect was larger (14.8%) in models controlling for endogeneity. HT patients - ER usage decreasing by 4.4% in the uncorrected model, and by 7.6% in the IV analysis.	**Critique** Both uninstrumented and instrumented COC associated with decreased ED utilisation. **Conclusion** These results suggest the failing to control for endogeneity of continuity of care may underestimate potential impact of continuity care.
Reddy 2015	**Study** Retrospective cohort studey **Population** Veterans affairs population	**Level of continuity of care** Personal (provider could be a doctor, nurse or physician assistant). **Continuity of Care Measure**	Patients who lost their regular provider had lower experience rating in the following year compared with those patients who had not	**Critique** Loss of provider associated with reduced experiences and lower quality care in 1 out of 9 quality measures. Impact of

Study ID	Study design and population characteristics	Modelling of continuity of care	Results	Conclusion
	Sample size N = 510,875- 45,370 with pcp turnover **Location** Primary care attendees Philadelphia, USA - VA system - high use of IT	Loss of provider- also calculated UPC for 13-24 months before loss of provider. **Categorisation of continuity of care** • Not relevant • 12 month • Reported loss of provider first, measured outcomes subsequently **Visits for inclusion** At least one visit in year before doctor stopped work. **Methods** Generaliseed linear models comparing experiences for those patients who had lost provider compared with those who had not Patient experience and 9 measures of primary care quality - retinal eye examination, testing HbA1C and LDL cholesterol, meeting blood pressure, HBA1C and LDL cholesterol targets, breast cancer and colon cancer screening, influenza vaccination. **Covariates included** Age, sex, income, illness severity.	lost their provider. One of nine quality care measures (having controlled blood pressure) was lower for those people who had lost a provider. For patients with high continuity before turnover, decrease in satisfaction was greater, and achievement of LDL cholesterol targets was significantly reduced after provider turnover.	loss is greater for those patients with highest provider continuity before loss of provider. The cause of provider turnover potentially confounds the findings. **Conclusion** Loss of regular provider associated with reduced experience of care.

Study ID	Study design and population characteristics	Modelling of continuity of care	Results	Conclusion
Romano 2015	**Study** Retrospective cohort study **Population** USA Medicaid (65+) **Sample size** N = 1,208,150 potentially avoidable procedures performed in 2008 **Location** Outpatient (GP and specialist) USA - Medicaid population	**Level of continuity of care** Personal - GP and specialist **Continuity of Care Measure** COCI (UPC and SECON in sens) **Categorisation of continuity of care** • Continuous, into tertiles in sensitivity analysis • 6 month • In sens analysis only- 6 month COCI and then procedure overuse **Visits for inclusion** Two or more visits **Methods** Multiple logistic regression for each of 19 procedures Overuse of 19 potentially overused procedures, - 13 Diagnostic tests (Laryngoscopy or Nasal endoscopy for sinusitis, Electroencephalogram for syncope, MRI in mild traumatic brain injury, Stress echocardiogram for acute chest pain, Sinus CT or antibiotics. **Covariates included**	The authors reported significantly different mean continuity scores between patients who had a procedure and those who had not had a procedure for 10 of the 19 procedures. Rates for three of the procedures (laminectomy laryngoscopy, nasal endoscopy and traction for back pain), were significantly lower for people with high continuity, while for six of the procedures, (digoxin monitoring, chest CT imaging, Helicobacter serology testing, PET/CT/bone scan for patients with prostate cancer, preoperative chest radiograph,and coronary artery stenosis) procedure rates were significantly higher for those patients with higher continuity.	**Critique** Overall, an increase in COCI of 0.1, associated with OR 0.93 times odd of having overused procedure. Decreased risk of most procedures but increase in 3 procudures, one of 2 screening tests and one monitoring test. **Conclusion** Increased continuity of care has inconsistent association with potentially unnnecessary procedures For screening and monitoring test, increased continuity associated with increased testing rates.

Study ID	Study design and population characteristics	Modelling of continuity of care	Results	Conclusion
		Age, sex, race, comorbitidy, income, postcode.		
Shin 2014	**Study** Retrospective cohort study **Population** Adults with newly diagnosed hypertension, diabetes mellitus, hypercholesterolemia (or complications) . **Sample size** N = 48,347 patients **Location** Korean adult visits to PCP (most work in solo practice under FFS). Patient able to choose and retain a particular provider.	**Level of continuity of care** Personal **Continuity of Care Measure** COCI (and most frequent provider continuity (MFPC) and modified modified continuity index (MMCI). **Categorisation of continuity of care** • Dichotomous (high and low continuity) at median • 2 year • COCI first two years, **Visits for inclusion** Two or more outpatient visits in a year **Methods** Cox proportional hazards model to estimate survival, and incidence of adverse event Mortality, myocardial infarction, stroke, disease specific health care costs, **Covariates included**	Compared with below median continuity, hazard ratio(HR) for mortality in patients with above median COCI was 1.12 (95% CI 1.04-1.21) , for myocadial infarction HR- 1.57 (95% CI 1.28-1.95) for stroke HR- 1.44(95% CI 1.27-1.63).	**Critique** Large smale size, Results robust to multiple sensitivity analysis,including choise of COC measure. **Conclusion** Association between lower continuity of care and increased risk of myocardial infarction or stroke, and higher mortality rates. Statistically significant reduction in both inpatient and outpatient costs for patients with above median continuity compared to ?????

Study ID	Study design and population characteristics	Modelling of continuity of care	Results	Conclusion
		Age, sex, income Charlson comorbidity index, number of visits, residential area. Smoking drinking status and BMI in sensitivity analyses.		
Vogt 2016	**Study** Retrospective cohort study **Population** Adults with heart failure aged 35 or over **Sample size** N = 382,118 **Location** Insurance claims database Germany	**Level of continuity of care** GP visits only, and also GP and other doctor visits **Continuity of Care Measure** UPC, COCI, SeCon **Categorisation of continuity of care** • Continuous variable from 0-1 • One year • GP/doctor visits in year 1, hospital admission in year 2 **Visits for inclusion** Two GP/doctor visits in year. **Methods** Multivariate logistic regression. Hospital admission for heart failure in year 2 of analysis.	Inverse association between increased continuity (UPC, COC and Secon) and odds of hospital admission for heart failure. Only significant finding was for SeCON for all doctor visits OR 0.75 (95% CI 0.592-0.818).	**Critique** Use of continuous variable limits usefulness of analysis. Including all people with two visits low threshold for inclusion. **Conclusion** Patients with heart failure have high levels of continuity and no significant association between increased GP continuity and heart failure admission.

Study ID	Study design and population characteristics	Modelling of continuity of care	Results	Conclusion
		Covariates included age, sex, Charlson comorbidity index, number of GP visits, prescribed medications, previous heart failure admission.		
Weir 2016	**Study** Retrospective cohort **Population** Newly diagnosed diabetics adults **Sample size** N = 285,231 **Location** Insurance claims database USA	**Level of continuity of care** Personal- All primary care and specialist visits **Continuity of Care Measure** UPC **Categorisation of continuity of care** • Dichotomous at 75% • 2 year • UPC in first two years, then death or hospitalisation in year 3 **Visits for inclusion** Four visits in two years **Methods** Multivariate logistic regression. All cause hospitalisation or death. **Covariates included**	In full adjusted model, high continuity associated with decreased odds of death OR- 0.75 (95% CI 0.61-0.94) or hospitalisiation OR- 0.68 (95% CI 0.67-0.70) compared with low continuity group. Similar findings for patients with comorbidities in addition to diabetes.	**Critique** Large sample 2 year continuity measurement. **Conclusion** Increased continuity of care associated with reduced hospitalisaion and death in a diabetic population.

Study ID	Study design and population characteristics	Modelling of continuity of care	Results	Conclusion
		Age, gender, income, Charlson comorbidity score, hospital admission in previous 2 years, frailty.		

10.1.3 Australian general practice research into continuity of care.

This Section summarises additional Australian literature investigating issues related to continuity of care in Australian general practice. All of the existing Australian research is cross-sectional, did not meet the inclusion criteria of the literature review in Chapter 2, and focuses on relational continuity of care with one provider.

This additional literature which investigates both personal and site continuity of care (relevant to the investigation of continuity of care in the Australian context) was discussed further in Chapter 3.

Veale (Veale et al. 1995) undertook research into the characteristics of patients who attend multiple general practitioners, and found that patients who self-reported attending multiple GPs differed from single GP attenders in sociodemographic terms (multiple GP users were more likely to be younger, female, and have higher education status) and health service usage (multiple GP attenders were more likely to be more frequent GP attenders, and be less satisfied with their previous health status). There was no relationship found between self-reported health status (presence of chronic disease) and incidence of multiple GP usage.

Sturmberg and Schattner (2001) used the modified continuity index (MCI) to analyse the comprehensiveness of care (based on chart audit) of a random sample of general practice patients (n=254) in New South Wales, and found an association between higher MCI (as a measure of provider continuity) and higher comprehensiveness scores (Sturmberg & Schattner 2001).

Overland et al. (2001) analysed diabetic care and complications for a sample of 479 patients attending a hospital clinic and found that over 85% of patients reported attending only one general practitioner. These patients were older and had been diagnosed with diabetes longer than patients attending multiple GPs. The authors found no difference in attainment of any of six diabetes-related, cholesterol or blood pressure targets between patients attending one GP and those attending multiple GPs (location was not considered) (Overland, Yue & Mira 2001).

More recently, McRae and colleagues (McRae et al. 2011) conducted a telephone survey of 1,200 randomly selected Australian adults (and analysed data from 1,146 adults) to investigate patient behaviour (including whether they had attended multiple GPs) and patient affiliation with a GP or practice. Fifty-seven percent of respondents reported *always* attending the same GP (defined as having provider continuity), while 32% reported *usually* going to the same GP. The authors assumed site continuity for patients in both these groups, and considered both groups (89%) as being (practice) affiliated patients. The authors analysed the proportion of patients receiving five forms of preventative health advice (dietary, stop smoking, alcohol reduction, weight management and exercise advice), and found that patients always or usually seeing the same GP were statistically significantly more likely to report receiving dietary advice, compared to other patients. There was no significant difference in advice for the other four preventative measures.

Warren and colleagues used data from the 45 and Up Study, a large cohort study linked to administrative data, to analyse predictors for medication compliance including continuity of primary care measures (UPC and COCI were calculated using administrative data as tertiles). Outcomes and continuity were measured over the same time period. A large list of health characteristics were included to take into account healthy user bias. The authors concluded that, "Greater continuity of care has a positive association with medication adherence for statins which is independent of socio-demographic and health-related factors" (Warren et al. 2015).

Other Australian authors have published some conceptual and early qualitative work about the link between informational continuity and coordination of care (Banfield et al. 2013; Gardner et al. 2014) and written about the potential research gap in personal continuity of care (Bonney & Farmer 2010).

This limited Australian data has found inconsistent results, reporting associations between increased continuity of care and improved care outcomes in two studies (Sturmberg & Schattner 2001; Warren et al. 2015), improvement in one out of five preventative care measures in another (McRae et al. 2011), and no improvement in six chronic disease measures in a fourth study (Overland, Yue & Mira 2001). There is no published Australian literature which measures site continuity of care (although the McRae et al. study uses attendance with one GP as a proxy for site continuity of care). This is another gap within the literature. The absence of administrative data which would permit practice-level analysis is a potential explanation for this gap in the literature.

10.2 Chapter 3 – Multiple General Practice Attendance

10.2.1 Alternative regression models

Model 1 is the model included with the main chapter.

Model 2 omits income variables, the largest source of missing data in the analysis.

Model 3 also includes respondents with less than two visits, excluded from main analysis, as illogical to have attended more than one practice in previous year with less than two visits.

Table 33: Alternative logistic regression models. Odds ratio (SE)

Multiple practice attendance	Model 1(base model)	Model 2	Model 3
Age less than 30	1	1	1
30-39	0.782(0.178)	0.792(0.168)	0.863(0.161)
40-49	0.593*(0.141)	0.582*(0.128)	0.569**(0.111)
50-59	0.378***(0.0977)	0.402***(0.0963)	0.430***(0.0911)
60-69	0.341***(0.0959)	0.335***(0.0879)	0.357***(0.0823)
70+	0.325**(0.119)	0.310***(0.107)	0.314***(0.0995)
Male	1	1	1
Female	1.242(0.18)	1.288+(0.176)	1.17(0.144)
Australian-born	0.954(0.154)	0.852(0.128)	0.906(0.124)
Metropolitan location	1	1	1
Inner regional	0.597*(0.122)	0.569**(0.111)	0.530***(0.0969)
Outer regional	0.478*(0.16)	0.559+(0.174)	0.495*(0.142)
Remote	1.197(0.94)	1.233(0.923)	0.971(0.677)
Less than HSC education	0.975(0.224)	0.835(0.18)	0.757(0.149)
HSC	0.636*(0.136)	0.591**(0.119)	0.562**(0.103)
Trade	0.852(0.15)	0.837(0.136)	0.842(0.121)
University	1	1	1
Excellent Health	0.853(0.27)	0.969(0.284)	1.278(0.311)
Very good health	1.001(0.164)	1.06(0.162)	0.98(0.137)
Good health	1	1	1

Multiple practice attendance	Model 1(base model)	Model 2	Model 3
Fair health	0.789(0.163)	0.803(0.159)	0.816(0.15)
Poor health	1.071(0.34)	1.023(0.307)	0.882(0.257)
Any chronic disease	1.136(0.19)	1.056(0.166)	1.175(0.166)
Low income	0.803(0.182)	-	-
Medium income	0.831(0.152)	-	-
High income	1	-	-
Very high income	1.078(0.26)	-	-
Employed	1.279(0.247)	1.261(0.224)	-
Private health insurance holder	1.045(0.161)	1.024(0.146)	-
Concession card holder	0.817(0.149)	0.721*(0.112)	0.751*(0.1)
Smoker	1.180(0.199)	1.243(0.197)	1.355*(0.191)
1 or 2 GPs in practice	1	1	1
3-5 GPs in practice	0.960(0.1781)	0.988(0.17)	0.953(0.151)
6-10 GPs in practice	0.650*(0.130)	0.75(0.14)	0.827(0.141)
More than 10 GPs	0.552*(0.154)	0.647(0.171)	0.702(0.168)
0 GP visits in last year	-	-	0.0839***(0.0478)
1 GP visit in last year	-	-	0.349***(0.0732)
2-3 GP visits in last year	1	1	1
4-11 GP visits in last year	1.128(0.171)	1.145(0.164)	1.081(0.149)
12 or more GP visits in last year	1.226(0.334)	1.233(0.312)	1.11(0.271)
Practice offers bulk-billing	0.735(0.170)	0.803(0.172)	0.96(0.181)
Have a usual GP	1.149(0.246)	1.256(0.252)	1.269(0.22)
Have a usual practice	0.0580***(0.0198)	0.0655***(0.0201)	0.108***(0.0248)
Attended ED in last 12 months	1.561**(0.263)	1.505**(0.238)	1.620***(0.236)
Home Visit in last 12 months	1.767*(0.423)	1.685*(0.388)	1.621*(0.335)
N	1274	1439	1834
Pseudo R2	0.1526	0.1476	0.1540
LR Chi2	239.76	260.36	330.93
AIC	1403.3	1569.3	1884.0
BIC	1588.7	1743.2	2066.0

Logistic regression results are reported in odds ratios (OR) with an OR >1 indicating an increased odds of multiple practice attendance, and significance stars (* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$) provided for ease of interpretation.

10.3 Chapter 4 – ALSWH Data

10.3.1 ALSWH conceptual categories

Each survey can be identified by a cohort identifier and a survey number (for example, Y4 refers to the fourth survey of the young cohort, which was conducted in 2006). Questions from each survey are classified according to conceptual categories. Most conceptual categorises appear in every survey for all cohorts, with a small number being cohort specific (for example, questions about Activities of Daily Living were limited to the old cohort; and Recreational Drug Use questions were limited to the young cohort), or limited to a single survey (for example, incontinence questions were limited to M4, the fourth survey of the mid cohort). The conceptual categories and their presence in surveys and cohorts are listed in Table 34 below.

Table 34: ALSWH survey conceptual categories, their presence in different surveys and cohorts, and whether included in this thesis.

Category Name	Cohort and Waves	Included
Activities of Daily Living Scale	O	N
Alcohol Status	Y,M,O	Y
Aspirations	Y	N
CES-D scale	Y2, M2	Y
Cognition	O	N
Continence	M4	N
Common Problems	Y,M,O	Y
Demographics	Y,M,O	Y
Drug Use	Y	?Y
Eating Habits	Y,M,O	N
Employment and Education	Y,M,O	Y
Exercise Status	Y,M,O	N
Family and Friends	Y,M,O	Y
Food Frequency Questionnaire (CCV)	M3-M6, Y3-Y7	N
Goldberg Anxiety and Depression Scale	Y,M,O	Y

Category Name	Cohort and Waves	Included
Health Related Hardiness Scale	O2	N
Health Service Utilisation	Y,M,O	Y
Identification	Y,M,O	Y
Inventory of Psychosocial Balance	Y2, M2	N
K10	only in NY cohort	N
Life Control Scale	M3 -M6	y
Life Events	Y,M,O	Y
Lifestyle	O2-O6 M5-M6	N
Life Orientation Test Revised	O2 Y2-Y6,M3-M7	Y
Medical History	Y, M, O	Y
Neighbourhood	O2, M3, M4	N
Physical Health	O3 O4 M4 M5	N
Psychological Wellbeing	Y2-Y6, M3-M7, O6	Y
Reproductive Health	Y,M,O	Y
Retirement	M4-M7	N
Satisfaction	Y, M, O1	Y
SF-36 Scale	Y, M, O	Y
Smoking Status	Y, M, O	Y
Stress	Y, M, O1-O2	Y
Time Use	Y, M, O1	N
Weight and Shape	Y,M,O	Y

Note- Y = young ALSWH cohort- born 1973-1978; M = mid ALSWH cohort – born 1945-1951; O = old ALSWH cohort – born 1921-1926. No number next to cohort indicates all surveys within this cohort have questions from this category.

Within each survey, questions are coded in the format of xn_1qn_2y where x is the cohort indicator (Y, M, O), n_1 represents the survey number, qn_2 indicates specific question number of each survey, and y represents a response category to question 1. For example, variable m3q87e represents information from the third survey of the m (mid) cohort of women (in 2001), question 87, and the fifth response category. For derived variables (discussed further below), coding is $xn_1varname$, where *varname* is a descriptive variable name following cohort and survey indicators.

10.3.2 Coding issues within ALSWH.

Changes in content between surveys are more frequent in the first three waves. Some changes to questions and response options make variable mapping complex, but is well documented within the ALSWH Data Dictionary.

A classification of survey changes and decisions relevant for this thesis are provided below.

10.3.2.1 Introduction of new questions and omission of others

New conceptual categories and questions have been added since the first survey wave. For example, questions asking women about whether they usually attend the same general practice and see the same person (central to this thesis) were added in the second survey wave, and only for the 1973-78 (young) and 1946-51 (mid) cohorts.

Other conceptual categories have been dropped after featuring prominently in earlier surveys (such as the Physical Health Questionnaire). Some questions are omitted intermittently from ALSWH surveys and these have been considered and recoded (where appropriate) for this research. For example, labour force participation was not asked of the young cohort in first two waves. For this cohort it is assumed that women who were not in labour force in Wave 3 were also not in labour force in Wave 2.

Women were first asked if they were in possession of a Health Care Card (HCC) from the Wave 3 surveys. HCC possession entitles holders to discounts and assistance with medical expenses, and has been used by previous authors as a proxy for socioeconomic status (Charles, Valenti & Britt 2003). Missing values for HCC status for Wave 2 are coded as per responses in Wave 3. This permitted data from an additional wave to be available for the regression analysis but presumes stable HCC status for women.

10.3.2.2 New ordering of questions.

The appearance of new questions and removal of others has led to surveys of differing length, and there is little consistency in question numbers between surveys. For instance, question 5 in Y1 asks about emotional problems in the previous four weeks, while question 5 in Y2 asks about behaviour in relation to attending the same GP and practice, and question 5 in Y6 asks about presence of painful disorders (such as migraine or back pain) in the previous 12 months. Furthermore, there is little consistency in question location between cohorts.

10.3.2.3 Changes to question structure.

Some questions have changed in structure from categorical response questions to binary variables (and back again). Questions about mammography provide an example. In M1, women in the middle cohort were asked, 'When did you last have a mammogram?' with five response options (I have never had a mammogram, 2 years ago or less, More than 2 but less than 5 years ago, 5 or more years ago, Not sure). In M2, the survey question was altered to 'In the last two years, have you had a mammogram?' with binary response options (Yes or No). In M3, the original question was reintroduced, however with slightly altered wording and different ordering of the five response categories (In the last 2 years, 2-5 years ago, More than 5 years ago, Never, Don't Know). All responses were recoded as a binary variable indicating whether a woman reported having a mammogram in the last two years, or not.

10.3.2.4 Alteration to number of response categories.

In some categories, the number of response options has expanded through the survey waves. For example, in the Medical History category for the 1946-51 cohort, the number of recorded medical conditions has expanded from eight medical conditions in M1, to 25 conditions in M3 and, 28 conditions in M7. This has had a particular impact in coding past medical history. For instance arthritis was provided as a past history response in Survey waves 1 and 2. A more precise description of Osteoarthritis and Rheumatoid Arthritis are provided from Wave 3 onward, with a decrease in the proportion of women reporting having these conditions, compared with the earlier term.

There is some inconsistency of the coding of the individual diseases which makes specific coding difficult. For example diabetes (high blood sugar) was coded in Wave 1, non-insulin-dependent diabetes mellitus and insulin-dependent diabetes mellitus were coded separately in Wave 2, a separate marker for impaired glucose tolerance was added in Wave 3, and descriptor reverted to diabetes (high blood sugar) from Wave 4 onwards. Furthermore, coding for arthritis did not begin until Wave 3.

(For instance, a survey question about private health insurance was asked as a yes/no binary variable in Wave 1 (Do you have private hospital health insurance?). In Wave 2 surveys, the question was expanded to include reasons for not having insurance. In the second survey for the middle cohort the question, 'Do you have private health insurance for hospital cover?' included six categorical responses: Yes, No - because I am Veterans Affairs, No - because I can't afford the cost, No - because I don't think you get value for money, No - because I don't think I need it, and No - other reason. For the young cohort, the option for Veterans Affairs was removed.

A decision was made to recode responses to these questions (and the questions about having private health insurance for ancillary services) as a binary variable for all survey waves because the reasons for not having private health insurance are not considered of relevance to this research. This permits analysis of these health insurance variables across multiple waves and cohorts despite changes in question and categorical responses.

10.3.2.5 Alteration to ordering of response categories

For some questions, the content and order of response options has changed. The frequency of Pap tests (for cervical screening) for the young cohort provides an example. In Y1, Y2 and Y3, women were asked, 'When did you have your last Pap test?' with five possible response options (I have never had a Pap test, Less than 2 years ago, 2-5 years ago, More than 5 years ago, Not sure). In Y4, women were asked, 'When did you last have a Pap test?' with six possible response options (I have never had a Pap test, Less than 2 years ago, 2 to less than 3 years ago, 3-5 years ago, More than 5 years ago, Not sure). Then in Y5, six response categories were maintained, but they were presented in a different order. While this change of ordering does not alter the data obtained from the question, it requires particular caution when mapping questions and responses between survey waves.

These changes have resulted in multiple questions being present for some variables of interest. Where this has occurred, variables for this thesis were preferred if they were coded consistently in all waves and both young and mid cohorts, in order to maximise the use of available data and the statistical power of the analysis.

10.3.3 ALSWH Survey Summary Statistics

Table 35: Summary statistics of pooled data for ALSWH 1946-51 (middle) and 1973-78 (young) cohorts, and for separate middle and young cohorts

	Pooled			Mid cohort			Young cohort		
Variable	**n**	**Mean**	**SD**	**n**	**Mean**	**SD**	**n**	**Mean**	**SD**
Demographics									
Age	135,614	43.473	14.613	77,892	54.992	5.986	57,722	27.937	5.736
Australian-born	135,620	0.839	0.368	77,898	0.773	0.419	57,722	0.927	0.261
Married	134,691	0.695	0.46	77,287	0.8	0.4	57,404	0.554	0.497
Australian remoteness classification									
Major city	135,419	0.441	0.497	77,751	0.364	0.481	57,668	0.546	0.498
Inner Reg	135,419	0.347	0.476	77,751	0.395	0.489	57,668	0.282	0.45
Outer Reg	135,419	0.175	0.38	77,751	0.2	0.4	57,668	0.141	0.348
Remote	135,419	0.028	0.166	77,751	0.033	0.177	57,668	0.023	0.15
V Remote	135,419	0.008	0.092	77,751	0.009	0.093	57,668	0.008	0.089
State of residence									
New South Wales	134,843	0.281	0.45	77,613	0.288	0.453	57,230	0.273	0.445
Victoria	134,843	0.248	0.432	77,613	0.236	0.425	57,230	0.265	0.441
Queensland	134,843	0.222	0.416	77,613	0.224	0.417	57,230	0.22	0.414
South Australia	134,843	0.085	0.279	77,613	0.089	0.285	57,230	0.079	0.27
Western Australia	134,843	0.095	0.293	77,613	0.093	0.291	57,230	0.096	0.295
Tasmania	134,843	0.039	0.195	77,613	0.043	0.202	57,230	0.035	0.185
Northern Territory	134,843	0.013	0.111	77,613	0.014	0.119	57,230	0.01	0.099
Australian Capital Territory	134,843	0.016	0.127	77,613	0.012	0.11	57,230	0.022	0.146
Highest educational attainment									
Higher School Certificate not completed	135,620	0.314	0.464	77,898	0.464	0.499	57,722	0.112	0.316
Higher School Certificate	135,620	0.214	0.41	77,898	0.175	0.38	57,722	0.266	0.442

	Pooled			Mid cohort			Young cohort		
Variable	**n**	**Mean**	**SD**	**n**	**Mean**	**SD**	**n**	**Mean**	**SD**
Trade Certificate/ Graduate Diploma	135,620	0.221	0.415	77,898	0.202	0.402	57,722	0.246	0.431
University	135,620	0.251	0.434	77,898	0.159	0.366	57,722	0.375	0.484
Aboriginal or Torres Strait Islander	135,620	0.01	0.1	77,898	0.008	0.087	57,722	0.013	0.115
How do you manage on the income you have available?									
Impossible	124,281	0.02	0.14	76,476	0.02	0.14	47,805	0.02	0.14
All difficult	124,281	0.115	0.319	76,476	0.11	0.313	47,805	0.123	0.329
Some difficulty	124,281	0.279	0.449	76,476	0.262	0.44	47,805	0.308	0.462
Not too bad	124,281	0.412	0.492	76,476	0.435	0.496	47,805	0.375	0.484
Easy	124,281	0.173	0.379	76,476	0.173	0.378	47,805	0.174	0.379
Insurance Status									
Health Care Card holder	85,312	1.762	0.426	51,609	1.705	0.456	33,703	1.849	0.358
Has hospital private health insurance	134,028	0.539	0.499	76,756	0.603	0.489	57,242	0.453	0.498
In labour force	110,756	0.723	0.447	77,099	0.685	0.464	33,657	0.811	0.391
Health status variables									
Smoking									
Never smoked	133,379	0.58	0.494	76,507	0.588	0.492	56,872	0.57	0.495
Ex- smoker	133,379	0.244	0.43	76,507	0.278	0.448	56,872	0.199	0.399
Smoker	133,379	0.176	0.381	76,507	0.134	0.341	56,872	0.232	0.422
Risky drinker	122,653	0.052	0.223	65,307	0.06	0.237	57,722	0.044	0.205
WHO BMI group									
Underweight	127,145	0.031	0.172	73,556	0.014	0.117	53,589	0.054	0.226
Ideal	127,145	0.486	0.5	73,556	0.417	0.493	53,589	0.58	0.493
Overweight	127,145	0.279	0.449	73,556	0.324	0.468	53,589	0.217	0.412
Obese or greater	127,145	0.205	0.404	73,556	0.245	0.43	53,589	0.149	0.356
Self-assessed health									
Excellent	134,952	0.123	0.328	77,388	0.113	0.316	57,564	0.137	0.344
Very good	134,952	0.388	0.487	77,388	0.367	0.482	57,564	0.415	0.493
Good	134,952	0.369	0.483	77,388	0.388	0.487	57,564	0.344	0.475
Fair	134,952	0.105	0.307	77,388	0.117	0.321	57,564	0.09	0.286
Poor	134,952	0.015	0.12	77,388	0.016	0.124	57,564	0.013	0.114
Number of chronic health conditions									
0	133,319	0.371	0.483	77,185	0.284	0.451	56,134	0.491	0.5
1	133,319	0.285	0.452	77,185	0.271	0.444	56,134	0.305	0.46
2	133,319	0.344	0.475	77,185	0.445	0.497	56,134	0.204	0.403

	Pooled			Mid cohort			Young cohort		
Variable	n	Mean	SD	n	Mean	SD	n	Mean	SD
Previous cancer diagnosis	133,177	0.095	0.293	77,152	0.15	0.357	56,025	0.019	0.137
Short form 36 (SF-36) score									
SF-36 Physical health summary score	131,773	48.703	10.632	74,970	48.01	10.722	56,803	49.617	10.441
SF-36 Mental health summary score	131,773	51.79	9.618	74,970	52.058	9.599	56,803	51.436	9.631
Health service utilisation variables									
GP visits last 12 months									
0	134,451	0.061	0.24	76,876	0.07	0.255	57,575	0.05	0.217
1 or 2	134,451	0.319	0.466	76,876	0.347	0.476	57,575	0.283	0.451
3 or 4	134,451	0.305	0.461	76,876	0.286	0.452	57,575	0.331	0.47
5 or 6	134,451	0.17	0.375	76,876	0.155	0.362	57,575	0.189	0.391
7 or more	134,451	0.144	0.351	76,876	0.142	0.349	57,575	0.148	0.355
Seen specialist last 12 months	132,898	0.436	0.496	76,453	0.48	0.5	56,445	0.377	0.485
Seen hospital Dr last 12 months	133,354	0.204	0.403	76,053	0.172	0.377	57,301	0.245	0.43
Access Variables (Good or better)									
Number of GPs	107,335	0.748	0.434	63,854	0.762	0.426	43,440	0.605	.489
Choice of GPs	107,294	0.678	0.468	64,028	0.727	0.445	43,435	0.726	.446
Bulk-billing	104,890	0.740	0.439	62,904	0.757	0.429	43,077	0.536	.499
Female GP	106,167	0.584	0.493	61,813	0.619	0.486	43,263	0.716	.451
Mammogram	63,611	0.927	0.260	63,611	0.927	0.260	NA	NA	NA
Pap tests	105,853	0.935	0.246	62,712	0.954	.209	43,141	.907	.290
Living arrangements									
Live alone	124,869	0.099	0.299	76,713	0.117	0.321	48,156	0.071	0.257
Live with partner	123,428	0.705	0.456	76,161	0.786	0.41	47,267	0.573	0.495
Live with children	123,507	0.294	0.455	76,407	0.238	0.426	47,100	0.384	0.486
idproj	135,650	700001	814100	77,898	800001	814100	57,752	700001	714779
year	135,650	1996	2013	77,898	1996	2013	57,752	1996	2012
wave	135,650	1	7	77,898	1	7	57,752	1	6

Table 36: Response rates and reasons for attrition within ALSWH middle and young cohorts

Survey wave	1	2	3	4	5	6	7
Mid cohort							
Survey Year	1996	1998	2001	2004	2007	2010	2013
Age Range in years)	45-50	47-52	50-55	53-58	56-61	59-64	62-67
Reason for attrition							
Deceased	0	50	119	216	328	474	673
Frailty (e.g. dementia, stroke)	0	7	23	34	51	70	100
Withdrawn	0	209	424	622	870	1,108	1,651
Total ineligible	0	266	566	872	1,249	1,652	2,424
Contacted but survey not return	0	254	997	886	995	1,148	1,052
Unable to contact participant	0	857	926	1,052	833	904	1,088
Total non-respondents	0	1,111	1,923	1,938	1,828	2,052	2,140
Respondents completed survey	13,714	12,338	11,226	10,905	10,638	10,011	9,151
Eligible at current survey	13,714	13,449	13,149	12,843	12,466	12,063	11,291
Retention rate (% of eligible)	100	91.7	85.4	84.9	85.3	83	81
Retention rate (% of original sample)	100	89.9	81.9	79.5	77.6	73	66.7
Young cohort							
Year	1996	2000	2003	2006	2009	2012	-
Age in years	18-23	22-27	25-30	28-33	31-36	34-39	-
Reason for attrition							
Deceased	0	22	33	50	58	77	-
Frailty (e.g. dementia, stroke)	0	3	9	12	15	16	-
Withdrawn	0	230	518	800	951	1,157	-
Total ineligible	0	255	560	862	1,024	1,250	-
Contacted but survey not return	0	1,332	653	1,371	1,994	1,454	-
Unable to contact participant	0	2,972	3,953	2,869	3,029	3,533	-
Total non-respondents	0	4,304	4,606	4,240	5,023	4,987	-
Respondents completed survey	14,247	9,688	9,081	9,145	8,200	8,010	-
Eligible at current survey	14,247	13,992	13,687	13,385	13,223	12,997	-
Response rate (% of eligible)	100%	69.20%	66.30%	68.30%	62.00%	61.60%	-
Retention rate (% of original sample)	100	68	63.7	64.2	57.6	56.2	-

Response rate described as %, number of completed surveys, as proportion of those eligible to respond (and excludes women who have died, become too frail and have withdrawn from survey in previous wave).

Table 37: Summary statistics for ALSWH mid cohort

ALSWH survey wave and year	M1-1996	M2-1998	M3-2001	M4-2004	M5-2007	M6-2010	M7-2013
Age (years)	47.578 (1.463)	49.523 (1.461)	52.511 (1.459)	55.471 (1.462)	58.482 (1.46)	61.533 (1.462)	64.78 (1.465)
Australian-born	0.762 (0.426)	0.769 (0.422)	0.776 (0.417)	0.777 (0.416)	0.774 (0.418)	0.778 (0.415)	0.781 (0.414)
Married	0.829 (0.377)	0.826 (0.379)	0.815 (0.388)	0.805 (0.396)	0.785 (0.411)	0.769 (0.422)	0.748 (0.434)
State of residence							
New South Wales	0.292 (0.455)	0.29 (0.454)	0.288 (0.453)	0.287 (0.452)	0.285 (0.451)	0.287 (0.452)	0.287 (0.453)
Victoria	0.235 (0.424)	0.24 (0.427)	0.24 (0.427)	0.235 (0.424)	0.233 (0.423)	0.233 (0.423)	0.235 (0.424)
Queensland	0.222 (0.415)	0.221 (0.415)	0.221 (0.415)	0.225 (0.418)	0.23 (0.421)	0.227 (0.419)	0.225 (0.417)
South Australia	0.085 (0.279)	0.087 (0.281)	0.09 (0.286)	0.09 (0.287)	0.092 (0.289)	0.092 (0.289)	0.091 (0.288)
Western Australia	0.093 (0.291)	0.091 (0.288)	0.092 (0.289)	0.094 (0.292)	0.094 (0.292)	0.095 (0.294)	0.095 (0.293)
Tasmania	0.042 (0.20)	0.042 (0.20)	0.042 (0.201)	0.043 (0.203)	0.042 (0.201)	0.043 (0.203)	0.044 (0.206)
Northern Territory	0.019 (0.136)	0.018 (0.132)	0.015 (0.121)	0.014 (0.116)	0.012 (0.107)	0.012 (0.107)	0.009 (0.096)
Australian Capital Territory	0.012 (0.11)	0.012 (0.109)	0.012 (0.111)	0.012 (0.108)	0.012 (0.111)	0.012 (0.108)	0.013 (0.113)
Urban/rural location							
Major city	0.365 (0.481)	0.333 (0.471)	0.341 (0.474)	0.377 (0.485)	0.376 (0.484)	0.378 (0.485)	0.385 (0.487)
Inner regional	0.38 (0.485)	0.404 (0.491)	0.407 (0.491)	0.391 (0.488)	0.391 (0.488)	0.40 (0.49)	0.398 (0.489)
Outer regional	0.204 (0.403)	0.213 (0.409)	0.208 (0.406)	0.195 (0.396)	0.195 (0.396)	0.188 (0.391)	0.189 (0.392)
Remote or very remote	0.051 (0.22)	0.051 (0.219)	0.043 (0.204)	0.037 (0.19)	0.038 (0.19)	0.034 (0.181)	0.029 (0.167)
Highest education attainment							
Did not complete HSC	0.501 (0.50)	0.489 (0.50)	0.486 (0.50)	0.483 (0.50)	0.48 (0.50)	0.391 (0.488)	0.383 (0.486)
HSC completed	0.169 (0.374)	0.17 (0.375)	0.168 (0.374)	0.167 (0.373)	0.168 (0.374)	0.196 (0.397)	0.194 (0.395)
Trade or diploma	0.191 (0.393)	0.196 (0.397)	0.199 (0.399)	0.20 (0.40)	0.201 (0.401)	0.218 (0.413)	0.22 (0.414)
University graduate	0.14 (0.347)	0.145 (0.352)	0.148 (0.355)	0.15 (0.357)	0.151 (0.358)	0.195 (0.397)	0.203 (0.403)
Ability to cope with available income							

ALSWH survey wave and year	M1-1996	M2-1998	M3-2001	M4-2004	M5-2007	M6-2010	M7-2013
Impossible	0.025 (0.157)	0.022 (0.146)	0.015 (0.123)	0.02 (0.138)	0.018 (0.132)	0.023 (0.15)	0.016 (0.126)
Always difficult	0.124 (0.329)	0.131 (0.338)	0.098 (0.297)	0.108 (0.311)	0.105 (0.307)	0.109 (0.312)	0.087 (0.282)
Sometimes difficult	0.287 (0.452)	0.293 (0.455)	0.274 (0.446)	0.263 (0.44)	0.239 (0.426)	0.239 (0.427)	0.22 (0.414)
Not bad	0.415 (0.493)	0.404 (0.491)	0.434 (0.496)	0.442 (0.497)	0.44 (0.496)	0.451 (0.498)	0.479 (0.5)
Easy	0.149 (0.356)	0.15 (0.357)	0.179 (0.384)	0.167 (0.373)	0.199 (0.399)	0.177 (0.382)	0.198 (0.399)
Not in workforce	0.248 (0.432)	0.203 (0.402)	0.218 (0.413)	0.271 (0.444)	0.318 (0.466)	0.41 (0.492)	0.542 (0.498)
Employed	0.733 (0.442)	0.782 (0.413)	0.769 (0.421)	0.717 (0.451)	0.672 (0.47)	0.585 (0.493)	0.452 (0.498)
Unemployed	0.019 (0.135)	0.015 (0.122)	0.013 (0.114)	0.013 (0.111)	0.01 (0.10)	0.005 (0.073)	0.006 (0.077)
Private health insurance	0.477 (0.499)	0.472 (0.499)	0.674 (0.469)	0.656 (0.475)	0.654 (0.476)	0.667 (0.471)	0.678 (0.467)
Health Care Card holder	NA	NA	0.203 (0.402)	0.239 (0.427)	0.265 (0.441)	0.327 (0.469)	0.483 (0.5)
Smoking							
Never smoked	0.531 (0.499)	0.563 (0.496)	0.613 (0.487)	0.593 (0.491)	0.603 (0.489)	0.612 (0.487)	0.622 (0.485)
Ex-smoker	0.285 (0.451)	0.266 (0.442)	0.242 (0.429)	0.272 (0.445)	0.287 (0.453)	0.299 (0.458)	0.298 (0.457)
Smoker	0.184 (0.388)	0.172 (0.377)	0.145 (0.352)	0.135 (0.342)	0.11 (0.313)	0.089 (0.285)	0.08 (0.271)
Risky drinker	0.053 (0.224)	0.056 (0.23)	0.056 (0.23)	0.066 (0.248)	0.063 (0.243)	0.066 (0.249)	0.058 (0.234)
Weight (Body Mass Index)							
Underweight	0.018 (0.132)	0.016 (0.125)	0.014 (0.119)	0.011 (0.104)	0.011 (0.106)	0.013 (0.115)	0.012 (0.109)
Ideal weight	0.505 (0.5)	0.462 (0.499)	0.42 (0.494)	0.387 (0.487)	0.375 (0.484)	0.35 (0.479)	0.35 (0.478)
Overweight	0.288 (0.453)	0.316 (0.465)	0.326 (0.469)	0.337 (0.473)	0.34 (0.474)	0.343 (0.475)	0.338 (0.473)
Obese	0.189 (0.392)	0.207 (0.405)	0.24 (0.427)	0.265 (0.441)	0.274 (0.446)	0.286 (0.452)	0.298 (0.458)
Access							
GP opening hours	NA	0.766 (0.423)	0.729 (0.444)	0.717 (0.451)	0.718 (0.45)	0.735 (0.441)	0.815 (0.388)
GPs number to choose from	NA	0.802 (0.399)	0.764 (0.425)	0.743 (0.437)	0.712 (0.453)	0.725 (0.446)	0.826 (0.379)

ALSWH survey wave and year	M1-1996	M2-1998	M3-2001	M4-2004	M5-2007	M6-2010	M7-2013
GP bulk-billing	NA	0.656 (0.475)	0.598 (0.49)	0.47 (0.499)	0.594 (0.491)	0.651 (0.477)	0.762 (0.426)
Female GP	NA	0.733 (0.442)	0.73 (0.444)	0.734 (0.442)	0.74 (0.439)	0.772 (0.419)	0.852 (0.355)
Living arrangements							
Lives alone	0.079 (0.269)	0.062 (0.241)	0.093 (0.291)	0.117 (0.322)	0.145 (0.352)	0.169 (0.375)	0.184 (0.387)
Lives with partner	0.814 (0.389)	0.782 (0.413)	0.81 (0.392)	0.797 (0.402)	0.777 (0.416)	0.761 (0.426)	0.737 (0.44)
Lives with children	0.587 (0.492)	0.549 (0.498)	0.173 (0.378)	0.091 (0.288)	0.047 (0.212)	0.032 (0.176)	0.026 (0.158)
Health variables							
Self- assessed health- Excellent	0.13 (0.336)	0.128 (0.334)	0.105 (0.306)	0.107 (0.309)	0.113 (0.316)	0.102 (0.303)	0.095 (0.293)
Self- assessed health -Very good	0.358 (0.48)	0.376 (0.484)	0.366 (0.482)	0.362 (0.481)	0.375 (0.484)	0.361 (0.48)	0.373 (0.484)
Self- assessed health -Good	0.397 (0.489)	0.373 (0.484)	0.39 (0.488)	0.388 (0.487)	0.375 (0.484)	0.398 (0.49)	0.395 (0.489)
Self- assessed health -Fair	0.098 (0.297)	0.109 (0.311)	0.124 (0.329)	0.128 (0.334)	0.121 (0.327)	0.124 (0.329)	0.121 (0.326)
Self- assessed health- Poor	0.017 (0.13)	0.015 (0.12)	0.016 (0.124)	0.015 (0.121)	0.016 (0.124)	0.015 (0.123)	0.016 (0.126)
No chronic diseases	0.296 (0.457)	0.326 (0.469)	0.419 (0.493)	0.325 (0.468)	0.294 (0.456)	0.268 (0.443)	0.190 (0.392)
1 chronic disease	0.322 (0.467)	0.297 (0.457)	0.312 (0.463)	0.317 (0.466)	0.299 (0.458)	0.29 (0.454)	0.269 (0.444)
Multimorbidity	0.381 (0.486)	0.377 (0.485)	0.269 (0.444)	0.357 (0.479)	0.407 (0.491)	0.442 (0.497)	0.541 (0.498)
Cancer diagnosis	0.158 (0.364)	0.149 (0.356)	0.034 (0.182)	0.129 (0.336)	0.162 (0.369)	0.175 (0.38)	0.261 (0.439)
Mental health summary score	50.42 (9.823)	50.898 (9.955)	51.473 (9.709)	52.092 (9.604)	52.886 (9.204)	53.426 (9.207)	54.226 (8.76)
Physical health summary score	50.079 (9.897)	49.425 (10.278)	48.273 (10.468)	47.607 (10.736)	47.262 (10.996)	46.333 (11.161)	45.94 (11.134)
Health service utilisation							
GP visits in last year							
0 GP visits	0.089 (0.285)	0.094 (0.292)	0.075 (0.263)	0.07 (0.256)	0.062 (0.24)	0.049 (0.216)	0.039 (0.193)
1-2 GP visits	0.373 (0.484)	0.387 (0.487)	0.356 (0.479)	0.339 (0.473)	0.338 (0.473)	0.313 (0.464)	0.301 (0.459)
3-4 GP visits	0.259 (0.438)	0.262 (0.44)	0.28 (0.449)	0.293 (0.455)	0.296 (0.456)	0.311 (0.463)	0.319 (0.466)
5-6 GP visits	0.141 (0.348)	0.132 (0.338)	0.147 (0.354)	0.158 (0.365)	0.162 (0.369)	0.174 (0.379)	0.186 (0.389)

ALSWH survey wave and year	M1-1996	M2-1998	M3-2001	M4-2004	M5-2007	M6-2010	M7-2013
7 or more GP visits	0.138 (0.345)	0.126 (0.332)	0.142 (0.349)	0.139 (0.346)	0.143 (0.35)	0.153 (0.36)	0.155 (0.362)
Specialist doctor in last year	0.408 (0.491)	0.567 (0.496)	0.438 (0.496)	0.455 (0.498)	0.472 (0.499)	0.50 (0.5	0.545 (0.498)
Hospital doctor in last year	0.158 (0.365)	0.151 (0.358)	0.156 (0.363)	0.156 (0.363)	0.185 (0.388)	0.195 (0.396)	0.216 (0.412)
Number of observations	13711	12331	11221	10900	10616	9995	9123

All figures represent proportion of sample in each category (standard deviation in brackets), except for age (years) and SF-36 Mental Health and SF-36 Physical Health summary scores. HSC - higher school certificate. NA - Question not asked in survey.

Table 38: Summary statistics for ALSWH young cohort

ALSWH survey wave and year	Y1- 1996	Y2- 2000	Y3-2003	Y4-2006	Y5-2009	Y6 2012
Age (years)	20.744 (1.459	24.585 (1.468	27.581 (1.458	30.585 (1.459	33.699 (1.469	36.746 (1.48)
Australian born	0.914 (0.28)	0.928 (0.258)	0.93 (0.256)	0.931 (0.254)	0.932 (0.252)	0.934 (0.249)
Married	0.225 (0.418)	0.452 (0.498)	0.614 (0.487)	0.726 (0.446)	0.775 (0.418)	0.789 (0.408)
State of residence						
New South Wales	0.289 (0.453)	0.279 (0.449)	0.27 (0.444)	0.266 (0.442)	0.26 (0.439)	0.257 (0.437)
Victoria	0.256 (0.437)	0.265 (0.441)	0.267 (0.443)	0.268 (0.443)	0.269 (0.444)	0.27 (0.444)
Queensland	0.215 (0.411)	0.214 (0.41)	0.219 (0.413)	0.224 (0.417)	0.226 (0.418)	0.23 (0.421)
South Australia	0.081 (0.273)	0.08 (0.271)	0.081 (0.272)	0.079 (0.27)	0.078 (0.268)	0.076 (0.265)
Western Australia	0.095 (0.293)	0.096 (0.294)	0.097 (0.296)	0.096 (0.294)	0.099 (0.299)	0.096 (0.295)
Tasmania	0.037 (0.188)	0.037 (0.189)	0.033 (0.179)	0.035 (0.183)	0.034 (0.182)	0.035 (0.183)
Northern Territory	0.008 (0.092)	0.01 (0.097)	0.01 (0.102)	0.011 (0.104)	0.01 (0.101)	0.011 (0.105)
Australian Capital Territory	0.019 (0.137)	0.02 (0.141)	0.023 (0.15)	0.023 (0.148)	0.023 (0.151)	0.025 (0.156)
Urban/rural location						
Major city	0.518 (0.5)	0.513 (0.5)	0.559 (0.497)	0.569 (0.495)	0.57 (0.495)	0.576 (0.494)
Inner regional	0.303 (0.459)	0.307 (0.461)	0.27 (0.444)	0.259 (0.438)	0.266 (0.442)	0.267 (0.442)
Outer regional	0.147 (0.354)	0.15 (0.357)	0.141 (0.348)	0.138 (0.345)	0.134 (0.341)	0.13 (0.336)
Remote or very remote	0.033 (0.178)	0.03 (0.171)	0.03 (0.17)	0.034 (0.18)	0.03 (0.17)	0.028 (0.166)
Highest Education attainment						
Did not complete HSC	0.171 (0.376)	0.118 (0.322)	0.108 (0.31)	0.089 (0.285)	0.079 (0.27)	0.066 (0.248)
HSC completed	0.535 (0.499)	0.247 (0.431)	0.197 (0.397)	0.166 (0.372)	0.143 (0.35)	0.123 (0.329)
Trade or diploma	0.182 (0.386)	0.246 (0.43)	0.261 (0.439)	0.278 (0.448)	0.274 (0.446)	0.283 (0.45)
University graduate	0.113 (0.316)	0.39 (0.488)	0.435 (0.496)	0.466 (0.499)	0.504 (0.5)	0.528 (0.499)
Ability to cope with available income						

ALSWH survey wave and year	Y1- 1996	Y2- 2000	Y3-2003	Y4-2006	Y5-2009	Y6 2012
Impossible	0.035 (0.184)	0.031 (0.173)	0.012 (0.11)	0.014 (0.119)	0.015 (0.12)	0.014 (0.117)
Always difficult	0.15 (0.357)	0.137 (0.344)	0.108 (0.31)	0.113 (0.316)	0.11 (0.313)	0.12 (0.325)
Sometimes difficult	0.331 (0.471)	0.322 (0.467)	0.302 (0.459)	0.293 (0.455)	0.285 (0.451)	0.313 (0.464)
Not bad	0.357 (0.479)	0.374 (0.484)	0.384 (0.486)	0.379 (0.485)	0.391 (0.488)	0.375 (0.484)
Easy	0.126 (0.332)	0.136 (0.343)	0.194 (0.396)	0.201 (0.401)	0.2 (0.4)	0.177 (0.382)
Not employed	0.136 (0.343)	0.132 (0.339)	0.131 (0.337)	0.158 (0.364)	0.165 (0.372)	0.145 (0.353)
Employed	0.815 (0.389)	0.823 (0.382)	0.821 (0.383)	0.811 (0.392)	0.795 (0.404)	0.817 (0.387)
Unemployed	0.049 (0.216)	0.045 (0.208)	0.048 (0.214)	0.032 (0.176)	0.04 (0.195)	0.038 (0.19)
Private health insurance	0.307 (0.461)	0.305 (0.461)	0.423 (0.494)	0.519 (0.5)	0.634 (0.482)	0.67 (0.47)
Health Care Card holder	NA	0.159 (0.366)	0.177 (0.382)	0.149 (0.356)	0.149 (0.357)	0.125 (0.33)
Smoking						
Never smoked	0.523 (0.5)	0.574 (0.494)	0.571 (0.495)	0.58 (0.494)	0.594 (0.491)	0.608 (0.488)
Ex-smoker	0.153 (0.36)	0.145 (0.352)	0.185 (0.389)	0.223 (0.416)	0.259 (0.438)	0.274 (0.446)
Smoker	0.324 (0.468)	0.281 (0.45)	0.244 (0.429)	0.197 (0.398)	0.147 (0.355)	0.118 (0.323)
Risky drinker	0.056 (0.229)	0.038 (0.192)	0.037 (0.188)	0.037 (0.189)	0.045 (0.207)	0.046 (0.21)
Weight (Body Mass Index)						
Underweight	0.096 (0.295)	0.064 (0.245)	0.044 (0.206)	0.036 (0.187)	0.027 (0.162)	0.026 (0.159)
Ideal weight	0.665 (0.472)	0.618 (0.486)	0.576 (0.494)	0.542 (0.498)	0.511 (0.5)	0.484 (0.5)
Overweight	0.163 (0.37)	0.201 (0.401)	0.224 (0.417)	0.241 (0.428)	0.256 (0.436)	0.26 (0.439)
Obese	0.075 (0.264)	0.116 (0.32)	0.156 (0.363)	0.18 (0.384)	0.206 (0.404)	0.231 (0.421)
Access						
GP opening hours	NA	0.718 (0.45)	0.675 (0.468)	0.671 (0.47)	0.686 (0.464)	0.723 (0.447)
GPs number to choose from	NA	0.771 (0.42)	0.732 (0.443)	0.698 (0.459)	0.693 (0.461)	0.731 (0.444)
GP bulk-billing	NA	0.696 (0.46)	0.436 (0.496)	0.475 (0.499)	0.514 (0.5)	0.542 (0.498)
Female GP	NA	0.715 (0.451)	0.68 (0.467)	0.7 (0.458)	0.721 (0.448)	0.771 (0.42)
Lives alone	0.061 (0.239)	0.063 (0.242)	0.064 (0.244)	0.084 (0.277)	0.083 (0.275)	0.075 (0.263)
Lives with partner	0.285 (0.452)	0.498 (0.5)	0.483 (0.5)	0.735 (0.441)	0.779 (0.415)	0.801 (0.4)
Lives with children	0.138 (0.345)	0.183 (0.386)	0.169 (0.375)	0.483 (0.5)	0.638 (0.481)	0.731 (0.444)
Self-assessed health						
Excellent	0.125 (0.331)	0.127 (0.333)	0.133 (0.34)	0.158 (0.364)	0.147 (0.354)	0.143 (0.35)
Very good	0.386 (0.487)	0.394 (0.489)	0.42 (0.494)	0.436 (0.496)	0.439 (0.496)	0.445 (0.497)
Good	0.368 (0.482)	0.36 (0.48)	0.351 (0.477)	0.323 (0.468)	0.324 (0.468)	0.32 (0.467)
Fair	0.108 (0.311)	0.108 (0.31)	0.083 (0.275)	0.073 (0.26)	0.077 (0.267)	0.076 (0.266)
Poor	0.013 (0.112)	0.012 (0.107)	0.013 (0.114)	0.011 (0.103)	0.014 (0.117)	0.016 (0.124)
No chronic diseases	0.503 (0.5)	0.452 (0.498)	0.577 (0.494)	0.499 (0.5)	0.443 (0.497)	0.456 (0.498)
1 chronic disease	0.341 (0.474)	0.317 (0.465)	0.277 (0.448)	0.3 (0.458)	0.296 (0.457)	0.268 (0.443)

ALSWH survey wave and year	Y1- 1996	Y2- 2000	Y3-2003	Y4-2006	Y5-2009	Y6 2012
Multimorbidity	0.155 (0.362)	0.231 (0.422)	0.146 (0.353)	0.2 (0.4)	0.261 (0.439)	0.276 (0.447)
Cancer diagnosis	0.016 (0.126)	0.009 (0.095)	0.012 (0.107)	0.013 (0.112)	0.033 (0.179)	0.04 (0.197)
Mental health summary score	50.162 (9.953)	50.465 (9.736)	51.436 (9.592)	52.305 (9.342)	52.54 (9.341)	52.777 (9.154)
Physical health summary score	49.976 (9.956)	49.911 (10.103)	49.768 (10.342)	49.594 (10.451)	49.298 (10.82)	48.992 (10.872)
Health service utilisation						
GP visits in last year						
0 GP visits	0.059 (0.236)	0.036 (0.185)	0.049 (0.216)	0.048 (0.213)	0.05 (0.219)	0.051 (0.221)
1-2 GP visits	0.319 (0.466)	0.157 (0.364)	0.196 (0.397)	0.344 (0.475)	0.34 (0.474)	0.35 (0.477)
3-4 GP visits	0.28 (0.449)	0.461 (0.498)	0.347 (0.476)	0.298 (0.458)	0.309 (0.462)	0.302 (0.459)
5-6 GP visits	0.175 (0.38)	0.205 (0.404)	0.287 (0.452)	0.156 (0.363)	0.153 (0.36)	0.154 (0.361)
7 or more GP visits	0.167 (0.373)	0.141 (0.348)	0.12 (0.325)	0.154 (0.361)	0.147 (0.354)	0.143 (0.35)
Specialist doctor in last year	0.299 (0.458)	0.303 (0.46)	0.291 (0.454)	0.461 (0.499)	0.487 (0.5)	0.488 (0.5)
Hospital doctor in last year	0.261 (0.439)	0.233 (0.423)	0.232 (0.422)	0.245 (0.43)	0.256 (0.436)	0.235 (0.424)
Number of observations	14241	9677	9065	9012	7996	7731

All figures represent proportion of sample in each category (standard deviation in brackets), except for age (years) and SF-36 Mental Health and SF-36 Physical Health summary scores. HSC - higher school certificate. NA - Question not asked in survey.

10.4 Chapter 5 – Predictors of Continuity of Care

10.4.1 Sample summary statistics

Table 39: Proportion of ALSWH respondents with personal and site continuity of care

ALSWH Survey Wave	1	2	3	4	5	6	7
Mid cohort site continuity	NA	0.28	0.29	0.29	0.30	0.32	0.34
Mid cohort personal continuity	NA	0.45	0.45	0.46	0.48	0.47	0.48
Young cohort personal continuity	NA	0.25	0.25	0.26	0.24	0.21	NA
Young cohort site continuity	NA	0.22	0.25	0.29	0.33	0.37	NA

NA - not available. Questions about GP attendance were not asked in Wave 1 ALSWH survey. Data not available for ALSWH Y7 survey.

Table 40: Summary Statistics for Women included within Regression Analysis One of Predictors of continuity of care.

Variable	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6	Wave 7 (mid only)	Total
Age (years)	37.835 (12.535)	41.035 (12.51)	43.654 (12.519)	47.698 (12.381)	50.569 (12.41)	64.773 (1.467)	43.654 (12.519)
Australian-born	0.847 (0.36)	0.848 (0.359)	0.854 (0.354)	0.846 (0.361)	0.849 (0.358)	0.785 (0.411)	0.854 (0.354)
Married	0.648 (0.478)	0.728 (0.445)	0.772 (0.419)	0.781 (0.414)	0.779 (0.415)	0.753 (0.432)	0.772 (0.419)
State of residence							
New South Wales	0.281 (0.449)	0.279 (0.448)	0.279 (0.449)	0.274 (0.446)	0.276 (0.447)	0.289 (0.453)	0.279 (0.449)
Victoria	0.253 (0.435)	0.251 (0.434)	0.251 (0.433)	0.25 (0.433)	0.249 (0.433)	0.236 (0.425)	0.251 (0.433)
Queensland	0.22 (0.414)	0.223 (0.416)	0.226 (0.418)	0.23 (0.421)	0.229 (0.42)	0.226 (0.418)	0.226 (0.418)
South Australia	0.085 (0.279)	0.087 (0.282)	0.085 (0.279)	0.085 (0.278)	0.085 (0.279)	0.092 (0.289)	0.085 (0.279)
Western Australia	0.091 (0.288)	0.092 (0.29)	0.093 (0.29)	0.096 (0.295)	0.093 (0.291)	0.093 (0.29)	0.093 (0.29)
Tasmania	0.039 (0.194)	0.038 (0.191)	0.039 (0.193)	0.038 (0.192)	0.039 (0.193)	0.043 (0.202)	0.039 (0.193)
Northern Territory	0.014 (0.116)	0.013 (0.111)	0.012 (0.107)	0.01 (0.101)	0.01 (0.101)	0.008 (0.091)	0.012 (0.107)
Australian Capital Territory	0.016 (0.127)	0.017 (0.13)	0.016 (0.127)	0.017 (0.128)	0.019 (0.135)	0.013 (0.112)	0.016 (0.127)
Urban/rural location							
Major city	0.425 (0.494)	0.45 (0.498)	0.472 (0.499)	0.466 (0.499)	0.47 (0.499)	0.387 (0.487)	0.472 (0.499)
Inner regional	0.355 (0.478)	0.34 (0.474)	0.328 (0.47)	0.335 (0.472)	0.34 (0.474)	0.396 (0.489)	0.328 (0.47)
Outer regional	0.179 (0.383)	0.172 (0.377)	0.164 (0.37)	0.165 (0.372)	0.161 (0.367)	0.187 (0.39)	0.164 (0.37)
Remote or very remote	0.041 (0.199)	0.038 (0.191)	0.036 (0.187)	0.034 (0.18)	0.03 (0.171)	0.029 (0.168)	0.036 (0.187)
Highest education attainment							
Did not complete HSC	0.306 (0.461)	0.308 (0.462)	0.294 (0.456)	0.302 (0.459)	0.243 (0.429)	0.38 (0.485)	0.294 (0.456)
HSC completed	0.205 (0.404)	0.18 (0.385)	0.165 (0.372)	0.157 (0.364)	0.164 (0.37)	0.193 (0.395)	0.165 (0.372)
Trade or diploma	0.217 (0.412)	0.23 (0.421)	0.239 (0.427)	0.234 (0.423)	0.25 (0.433)	0.219 (0.414)	0.239 (0.427)
University graduate	0.272 (0.445)	0.282 (0.45)	0.302 (0.459)	0.307 (0.461)	0.344 (0.475)	0.207 (0.405)	0.302 (0.459)
Ability to cope with available income							
Impossible	0.024 (0.153)	0.013 (0.111)	0.017 (0.128)	0.016 (0.126)	0.019 (0.136)	0.016 (0.124)	0.017 (0.128)

Variable	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6	Wave 7 (mid only)	Total
Always difficult	0.135 (0.341)	0.102 (0.302)	0.111 (0.315)	0.108 (0.31)	0.114 (0.317)	0.086 (0.28)	0.111 (0.315)
Sometimes difficult	0.307 (0.461)	0.291 (0.454)	0.284 (0.451)	0.261 (0.439)	0.273 (0.445)	0.22 (0.414)	0.284 (0.451)
Not bad	0.39 (0.488)	0.411 (0.492)	0.411 (0.492)	0.415 (0.493)	0.42 (0.494)	0.482 (0.5)	0.411 (0.492)
Easy	0.144 (0.351)	0.184 (0.387)	0.177 (0.382)	0.199 (0.399)	0.175 (0.38)	0.196 (0.397)	0.177 (0.382)
Not in workforce	0.166 (0.372)	0.178 (0.382)	0.221 (0.415)	0.253 (0.435)	0.297 (0.457)	0.547 (0.498)	0.221 (0.415)
In workforce/employed	0.806 (0.395)	0.795 (0.404)	0.758 (0.428)	0.726 (0.446)	0.684 (0.465)	0.446 (0.497)	0.758 (0.428)
Unemployed	0.028 (0.164)	0.028 (0.164)	0.021 (0.144)	0.022 (0.145)	0.02 (0.138)	0.006 (0.08)	0.021 (0.144)
Private health insurance	0.401 (0.49)	0.567 (0.496)	0.598 (0.49)	0.652 (0.476)	0.674 (0.469)	0.684 (0.465)	0.598 (0.49)
Health Care Card holder	NA	NA	0.198 (0.398)	0.215 (0.411)	0.241 (0.428)	0.488 (0.5)	0.198 (0.398)
Smoking							
Never smoked	0.571 (0.495)	0.595 (0.491)	0.585 (0.493)	0.6 (0.49)	0.612 (0.487)	0.627 (0.484)	0.585 (0.493)
Ex-smoker	0.212 (0.408)	0.218 (0.413)	0.253 (0.435)	0.276 (0.447)	0.289 (0.453)	0.302 (0.459)	0.253 (0.435)
Smoker	0.217 (0.412)	0.186 (0.389)	0.162 (0.368)	0.123 (0.329)	0.099 (0.298)	0.072 (0.258)	0.162 (0.368)
Risky drinker	0.571 (0.495)	0.595 (0.491)	0.585 (0.493)	0.6 (0.49)	0.612 (0.487)	0.627 (0.484)	0.585 (0.493)
Weight (Body Mass Index)							
Underweight	0.038 (0.191)	0.028 (0.165)	0.022 (0.148)	0.018 (0.132)	0.018 (0.134)	0.011 (0.106)	0.022 (0.148)
Ideal weight	0.533 (0.499)	0.488 (0.5)	0.452 (0.498)	0.428 (0.495)	0.408 (0.491)	0.351 (0.477)	0.452 (0.498)
Overweight	0.261 (0.439)	0.278 (0.448)	0.292 (0.455)	0.305 (0.46)	0.31 (0.462)	0.336 (0.472)	0.292 (0.455)
Obese	0.169 (0.374)	0.206 (0.404)	0.233 (0.423)	0.249 (0.433)	0.264 (0.441)	0.302 (0.459)	0.233 (0.423)
Access							
GP opening hours	0.749 (0.434)	0.707 (0.455)	0.698 (0.459)	0.708 (0.455)	0.732 (0.443)	0.817 (0.386)	0.698 (0.459)
GPs number to choose from	0.791 (0.406)	0.753 (0.432)	0.725 (0.446)	0.707 (0.455)	0.731 (0.443)	0.831 (0.375)	0.725 (0.446)
GP bulk-billing	0.676 (0.468)	0.516 (0.5)	0.468 (0.499)	0.556 (0.497)	0.599 (0.49)	0.762 (0.426)	0.468 (0.499)
Female GP	0.73 (0.444)	0.709 (0.454)	0.72 (0.449)	0.734 (0.442)	0.775 (0.417)	0.854 (0.354)	0.72 (0.449)
Lives alone	0.063 (0.244)	0.079 (0.27)	0.1 (0.3)	0.117 (0.322)	0.128 (0.334)	0.181 (0.385)	0.1 (0.3)

Variable	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6	Wave 7 (mid only)	Total
Lives with partner	0.648 (0.478)	0.666 (0.472)	0.773 (0.419)	0.779 (0.415)	0.781 (0.413)	0.744 (0.436)	0.773 (0.419)
Lives with children	0.363 (0.481)	0.169 (0.375)	0.282 (0.45)	0.3 (0.458)	0.338 (0.473)	0.025 (0.155)	0.282 (0.45)
Self-assessed health							
Excellent	0.122 (0.327)	0.109 (0.311)	0.122 (0.327)	0.119 (0.324)	0.114 (0.317)	0.089 (0.285)	0.122 (0.327)
Very good	0.389 (0.488)	0.39 (0.488)	0.392 (0.488)	0.398 (0.49)	0.394 (0.489)	0.374 (0.484)	0.392 (0.488)
Good	0.367 (0.482)	0.379 (0.485)	0.364 (0.481)	0.36 (0.48)	0.37 (0.483)	0.399 (0.49)	0.364 (0.481)
Fair	0.109 (0.311)	0.107 (0.309)	0.108 (0.31)	0.107 (0.309)	0.106 (0.308)	0.123 (0.328)	0.108 (0.31)
Poor	0.013 (0.113)	0.015 (0.122)	0.014 (0.116)	0.015 (0.123)	0.016 (0.126)	0.016 (0.124)	0.014 (0.116)
No chronic diseases	0.373 (0.484)	0.473 (0.499)	0.386 (0.487)	0.338 (0.473)	0.331 (0.47)	0 190 (0.392)	0.386 (0.487)
1 chronic disease	0.311 (0.463)	0.304 (0.46)	0.317 (0.466)	0.304 (0.46)	0.284 (0.451)	0.269 (0.444)	0.317 (0.466)
Multimorbidity	0.315 (0.465)	0.224 (0.417)	0.297 (0.457)	0.358 (0.479)	0.386 (0.487)	0.541 (0.498)	0.297 (0.457)
Cancer diagnosis	0.088 (0.284)	0.024 (0.154)	0.078 (0.269)	0.111 (0.314)	0.12 (0.325)	0.265 (0.441)	0.078 (0.269)
Mental health summary score	50.53 (9.889)	51.299 (9.737)	52.043 (9.558)	52.552 (9.412)	53.053 (9.292)	54.186 (8.764)	52.043 (9.558)
Physical health summary score	49.48 (10.224)	48.66 (10.537)	48.115 (10.795)	47.776 (11.108)	47.18 (11.229)	45.719 (11.13)	48.115 (10.795)
Health service utilisation							
GP visits in last year							
1-2 GP visits	0.3 (0.458)	0.296 (0.456)	0.355 (0.479)	0.356 (0.479)	0.343 (0.475)	0.313 (0.464)	0.355 (0.479)
3-4 GP visits	0.383 (0.486)	0.333 (0.471)	0.316 (0.465)	0.321 (0.467)	0.325 (0.468)	0.334 (0.472)	0.316 (0.465)
5-6 GP visits	0.179 (0.384)	0.229 (0.42)	0.17 (0.375)	0.168 (0.374)	0.174 (0.38)	0.196 (0.397)	0.17 (0.375)
7 or more GP visits	0.137 (0.344)	0.142 (0.349)	0.159 (0.365)	0.155 (0.362)	0.157 (0.364)	0.158 (0.365)	0.159 (0.365)
Specialist doctor in last year	0.453 (0.498)	0.389 (0.488)	0.488 (0.5)	0.505 (0.5)	0.517 (0.5)	0.565 (0.496)	0.488 (0.5)
Hospital doctor in last year	0.192 (0.394)	0.199 (0.399)	0.208 (0.406)	0.223 (0.416)	0.219 (0.414)	0.22 (0.415)	0.208 (0.406)
n	16321	16527	16045	15488	15459	8053	87983

All figures represent proportion of sample in each category (standard deviation in brackets), except for age (years) and SF-36 Mental Health and SF-36 Physical Health summary scores. HSC - higher school certificate. NA - Question not asked in survey.

10.4.2 Full regression model outputs and alternative models

Table 41: Additional panel logistic regression models for Analysis One of predictors of continuity of care considering attrition within each wave

	Panel random effects	Wave 2 attriters	Wave 3 attriters	Wave 4 attriters	Wave 5 attriters	Wave 6 attriters	Wave 7 attriters
Age	1.022*	1.003	1.022*	1.020*	1.020*	1.032***	1.026**
	(0.009)	(0.010)	(0.009)	(0.009)	(0.009)	(0.01)	(0.01)
Age squared	1.000^{+}	1.000**	1.000^{+}	1.000^{+}	1.000^{+}	1.000	1.000
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Marker for older cohort	1.010***	1.020***	1.009**	1.010***	1.011***	1.004	1.011***
	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Victoria	1.010	1.010	1.010	1.010	1.009	1.009	1.010
	(0.037)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)
Queensland	0.890**	0.889**	0.890**	0.890**	0.890**	0.890**	0.890**
	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)
South Australia	1.264***	1.264***	1.264***	1.265***	1.264***	1.264***	1.264***
	(0.068)	(0.069)	(0.069)	(0.069)	(0.069)	(0.069)	(0.069)
Western Australia	1.098^{+}	1.099^{+}	1.098^{+}	1.099^{+}	1.098^{+}	1.099^{+}	1.098^{+}
	(0.056)	(0.057)	(0.057)	(0.057)	(0.057)	(0.057)	(0.057)
Tasmania	1.805***	1.803***	1.806***	1.803***	1.805***	1.805***	1.806***
	(0.14)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)
Northern Territory	0.639***	0.640***	0.639***	0.639***	0.639***	0.640***	0.639***
	(0.074)	(0.078)	(0.078)	(0.078)	(0.078)	(0.078)	(0.078)
Australian Capital Territory	1.188^{+}	1.192^{+}	1.188^{+}	1.191^{+}	1.188^{+}	1.191^{+}	1.188^{+}
	(0.11)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
Australian-born	1.243***	1.242***	1.243***	1.243***	1.243***	1.244***	1.243***
	(0.050)	(0.051)	(0.051)	(0.051)	(0.051)	(0.051)	(0.051)
Inner regional	1.533***	1.538***	1.533***	1.537***	1.533***	1.536***	1.532***
	(0.046)	(0.048)	(0.048)	(0.048)	(0.048)	(0.048)	(0.048)
Outer regional	1.276***	1.281***	1.276***	1.280***	1.277***	1.278***	1.276***
	(0.049)	(0.051)	(0.051)	(0.051)	(0.051)	(0.051)	(0.051)
Remote Australia	0.957	0.963	0.957	0.960	0.958	0.959	0.956
	(0.068)	(0.070)	(0.069)	(0.069)	(0.069)	(0.069)	(0.069)
Married	1.208***	1.192***	1.202***	1.208***	1.209***	1.203***	1.207***
	(0.048)	(0.049)	(0.049)	(0.049)	(0.049)	(0.049)	(0.049)

	Panel random effects	Wave 2 attriters	Wave 3 attriters	Wave 4 attriters	Wave 5 attriters	Wave 6 attriters	Wave 7 attriters
Education - HSC completion	0.882**	0.885**	0.883**	0.884**	0.883**	0.887**	0.882**
	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)
Education - Trade/Diploma	0.813***	0.814***	0.813***	0.814***	0.814***	0.816***	0.813***
	(0.031)	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)
Education – University Grad	0.514***	0.517***	0.514***	0.515***	0.514***	0.516***	0.513***
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
Income impossible	0.907	0.912	0.909	0.906	0.907	0.914	0.909
	(0.075)	(0.076)	(0.076)	(0.075)	(0.075)	(0.076)	(0.076)
Income always difficult	0.964	0.965	0.964	0.963	0.964	0.969	0.965
	(0.042)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)
Income some difficulty	0.909**	0.909**	0.909**	0.909**	0.910**	0.912**	0.910**
	(0.031)	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)
Income not too bad	0.963	0.964	0.963	0.963	0.964	0.965	0.963
	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)
In workforce	0.828***	0.830***	0.828***	0.829***	0.827***	0.830***	0.828***
	(0.024)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
Unemployed	0.760***	0.757***	0.759***	0.762***	0.759***	0.761***	0.760***
	(0.054)	(0.056)	(0.056)	(0.056)	(0.056)	(0.056)	(0.056)
Hospital insurance	1.173***	1.165***	1.171***	1.172***	1.172***	1.171***	1.173***
	(0.031)	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)
Health care card holder	1.082**	1.092**	1.083**	1.084**	1.083**	1.080**	1.079**
	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)
Ex-smoker	0.893***	0.893***	0.893***	0.893***	0.893***	0.893***	0.893***
	(0.027)	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)
Smoker	0.942	0.940+	0.942	0.941+	0.942	0.941+	0.942
	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)
Risky drinker	0.844***	0.845**	0.844**	0.844**	0.844**	0.845**	0.844**
	(0.044)	(0.044)	(0.044)	(0.044)	(0.044)	(0.044)	(0.044)
Underweight	1.015	1.017	1.015	1.016	1.016	1.018	1.016
	(0.073)	(0.074)	(0.074)	(0.074)	(0.074)	(0.074)	(0.074)
Overweight	1.126***	1.124***	1.126***	1.125***	1.126***	1.126***	1.127***
	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)	(0.032)
Obese	1.312***	1.306***	1.311***	1.310***	1.311***	1.311***	1.312***
	(0.045)	(0.045)	(0.045)	(0.045)	(0.045)	(0.045)	(0.045)

	Panel random effects	Wave 2 attriters	Wave 3 attriters	Wave 4 attriters	Wave 5 attriters	Wave 6 attriters	Wave 7 attriters
1 chronic disease	1.093***	1.099***	1.096***	1.092***	1.092***	1.093***	1.093***
	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)
Multimorbidity	1.099**	1.117***	1.102**	1.101**	1.100**	1.088**	1.092**
	(0.033)	(0.034)	(0.033)	(0.033)	(0.033)	(0.033)	(0.034)
Cancer diagnosis	0.942	0.950	0.945	0.942	0.941	0.944	0.943
	(0.037)	(0.039)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)
GP visits - 3 or 4	1.152***	1.152***	1.151***	1.155***	1.152***	1.155***	1.153***
	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)
GP visits - 5 or 6	1.258***	1.248***	1.253***	1.262***	1.258***	1.262***	1.259***
	(0.040)	(0.040)	(0.040)	(0.041)	(0.040)	(0.041)	(0.041)
GP visits - 7 or more	1.575***	1.564***	1.572***	1.576***	1.575***	1.581***	1.579***
	(0.060)	(0.061)	(0.061)	(0.062)	(0.062)	(0.062)	(0.062)
Seen specialist in last year	1.068**	1.073**	1.070**	1.066**	1.067**	1.067**	1.067**
	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)
Seen hospital doctor in last	0.856***	0.854***	0.855***	0.856***	0.855***	0.855***	0.856***
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)
SF36 physical health	0.952	0.954	0.953	0.952	0.952	0.951	0.951
second lowest quintile	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)
SF36 physical health	0.957	0.960	0.957	0.958	0.957	0.956	0.956
middle quintile	(0.033)	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)
SF36 physical health	1.000	1.004	1.001	1.000	1.000	0.998	0.999
second highest quintile	(0.036)	(0.037)	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)
SF36 physical health	1.095*	1.099*	1.096*	1.095*	1.094*	1.092*	1.093*
highest quintile	(0.041)	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)
SF36 mental health	1.052	1.053	1.053	1.052	1.052	1.052	1.052
second lowest quintile	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)
SF36 mental health	1.131***	1.132***	1.132***	1.131***	1.131***	1.130***	1.131***
middle quintile	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)
SF36 mental health	1.227***	1.229***	1.228***	1.227***	1.227***	1.225***	1.227***
second highest quintile	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)
SF36 mental health	1.396***	1.397***	1.396***	1.395***	1.396***	1.393***	1.395***
highest quintile	(0.051)	(0.051)	(0.051)	(0.051)	(0.051)	(0.051)	(0.051)
GP hours	1.407***	1.408***	1.407***	1.408***	1.408***	1.407***	1.407***
	(0.036)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)

	Panel random effects	Wave 2 attriters	Wave 3 attriters	Wave 4 attriters	Wave 5 attriters	Wave 6 attriters	Wave 7 attriters
GP numbers	1.374***	1.377***	1.374***	1.376***	1.376***	1.374***	1.373***
	(0.037)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)
Bulk-billing	0.901***	0.912***	0.903***	0.906***	0.901***	0.904***	0.901***
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
Female GP	1.267***	1.268***	1.267***	1.266***	1.267***	1.267***	1.266***
	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)
Lives alone	1.049	1.053	1.052	1.045	1.049	1.046	1.049
	(0.046)	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)
Live with partner	1.075+	1.090*	1.082*	1.070+	1.074+	1.074+	1.075+
	(0.041)	(0.042)	(0.042)	(0.041)	(0.042)	(0.041)	(0.042)
Live with children	1.314***	1.356***	1.324***	1.320***	1.315***	1.318***	1.309***
	(0.038)	(0.042)	(0.040)	(0.039)	(0.039)	(0.039)	(0.039)
Wave 2		0.862***					
		(0.030)					
Wave 3			1.037				
			(0.026)				
Wave 4				1.075**			
				(0.026)			
Wave 5					1.034		
					(0.026)		
Wave 6						0.897***	
						(0.026)	
Wave 7							1.060
							(0.058)
n observation	87893	87893	87893	87893	87893	87893	87893
N women							
AIC	91485.1	91468.7	91485.1	91478.4	91485.4	91474.0	91486.0
BIC	92020.0	92013.0	92029.4	92022.6	92029.7	92018.2	92030.2

Notes Exponentiated coefficients; Standard errors in parentheses Significance: $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. OR>1 indicates increased odds of having any continuity of care (personal or site). OR<1 indicates decreased odds of any continuity of care. Reference categories (OR=1) are omitted. Base case is women from NSW, major city, did not complete HSC, copes easily with available income, is not in workforce, non-smoker of normal weight, with no chronic diseases, and sees GP 1-2 times a year, no visits to specialist or hospital, is in the lowest quintile for SF-36 physical and mental health scores, reports poor/fair access to number of GPs, choice of GPs, bulk-billing, and female GP and does not live alone, or with partner or children.

Table 42: Full output of regression models for Analysis Two – Logistic regression models estimating probability of women having personal continuity (OR>1) versus women having site continuity (OR<1)

Variable	Model 6 Pooled logistic	Model 7 Panel logistic RE	Model 8 Panel RE balanced	Model 9 Panel RE mid cohort	Model 10 Panel RE yng cohort
Age	0.963^{***}	0.915^{***}	0.931^{***}	1.127^{*}	1.206^{**}
	(0.010)	(0.010)	(0.014)	(0.068)	(0.072)
Age squared	1.001^{***}	1.001^{***}	1.000^{**}	0.999^{*}	0.996^{***}
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Marker for older cohort	1.007	1.068^{***}	1.060^{***}		
	(0.006)	(0.004)	(0.005)		
Wave 3	0.921^{*}				
	(0.032)				
Wave 4	0.882^{**}				
	(0.040)				
Wave 5	0.767^{***}				
	(0.046)				
Wave 6	0.616^{***}				
	(0.047)				
Wave 7	0.504^{***}				
	(0.049)				
Victoria	0.704^{***}	0.609^{***}	0.637^{***}	0.633^{***}	0.572^{***}
	(0.016)	(0.026)	(0.038)	(0.035)	(0.038)
Queensland	0.951^{*}	0.929^{+}	0.954	0.923	0.923
	(0.023)	(0.041)	(0.058)	(0.053)	(0.063)
South Australia	0.530^{***}	0.411^{***}	0.425^{***}	0.414^{***}	0.412^{***}
	(0.017)	(0.025)	(0.035)	(0.032)	(0.040)
Western Australia	0.763^{***}	0.667^{***}	0.658^{***}	0.667^{***}	0.661^{***}
	(0.025)	(0.039)	(0.055)	(0.052)	(0.060)
Tasmania	0.760^{***}	0.685^{***}	0.851	0.864	0.456^{***}
	(0.033)	(0.055)	(0.094)	(0.088)	(0.059)
Northern Territory	0.563^{***}	0.437^{***}	0.375^{***}	0.559^{**}	0.269^{***}
	(0.052)	(0.066)	(0.078)	(0.105)	(0.072)
Australian Capital Territory	0.948	0.885	1.116	0.982	0.807
	(0.067)	(0.106)	(0.183)	(0.174)	(0.130)
Australian-born	0.947^{*}	0.898^{*}	0.997	0.900^{*}	0.905
	(0.023)	(0.041)	(0.064)	(0.046)	(0.094)

Variable	Model 6 Pooled logistic	Model 7 Panel logistic RE	Model 8 Panel RE balanced	Model 9 Panel RE mid cohort	Model 10 Panel RE yng cohort
Inner regional	0.761***	0.709***	0.701***	0.702***	0.747***
	(0.016)	(0.025)	(0.033)	(0.031)	(0.041)
Outer regional	0.848***	0.816***	0.790***	0.801***	0.877^{+}
	(0.022)	(0.036)	(0.048)	(0.045)	(0.064)
Remote Australia	0.717***	0.643***	0.765*	0.575***	0.793
	(0.038)	(0.056)	(0.091)	(0.063)	(0.114)
Married	0.952	0.969	0.988	0.895	1.054
	(0.035)	(0.049)	(0.070)	(0.064)	(0.080)
Education - HSC completion	0.915***	0.877**	0.855**	0.902*	0.865
	(0.023)	(0.038)	(0.050)	(0.046)	(0.077)
Education - Trade/Diploma	0.818***	0.761***	0.715***	0.691***	0.868^{+}
	(0.020)	(0.031)	(0.040)	(0.034)	(0.073)
Education - University Graduate	0.732***	0.632***	0.627***	0.664***	0.615***
	(0.019)	(0.029)	(0.039)	(0.039)	(0.054)
Income impossible	1.212**	1.283**	1.325*	1.334*	1.207
	(0.086)	(0.123)	(0.174)	(0.159)	(0.198)
Income always difficult	1.118**	1.149**	1.225**	1.171*	1.138
	(0.039)	(0.058)	(0.084)	(0.076)	(0.093)
Income some difficulty	1.019	1.051	1.088	1.044	1.085
	(0.028)	(0.042)	(0.057)	(0.053)	(0.069)
Income not too bad	1.014	1.025	1.077^{+}	1.010	1.065
	(0.024)	(0.035)	(0.048)	(0.043)	(0.062)
In workforce	0.892***	0.871***	0.882**	0.847***	0.955
	(0.019)	(0.027)	(0.035)	(0.031)	(0.055)
Unemployed	0.954	0.952	0.749*	0.672**	1.237^{+}
	(0.061)	(0.084)	(0.097)	(0.098)	(0.143)
Hospital insurance	1.077***	1.087**	1.102*	1.046	1.130*
	(0.021)	(0.034)	(0.047)	(0.042)	(0.055)
Health care card holder	1.097***	1.101**	1.093*	1.097**	1.132*
	(0.024)	(0.033)	(0.043)	(0.038)	(0.068)
Ex-smoker	1.048*	1.078*	1.053	1.116*	1.013
	(0.021)	(0.037)	(0.049)	(0.048)	(0.059)
Smoker	1.109***	1.131**	1.152*	1.252***	0.993
	(0.029)	(0.049)	(0.074)	(0.075)	(0.063)
Risky drinker	1.003	0.975	1.083	0.988	0.935

Variable	Model 6 Pooled logistic	Model 7 Panel logistic RE	Model 8 Panel RE balanced	Model 9 Panel RE mid cohort	Model 10 Panel RE yng cohort
	(0.039)	(0.058)	(0.087)	(0.070)	(0.106)
Underweight	1.166*	1.275**	1.346*	1.342^{+}	1.235^{+}
	(0.071)	(0.116)	(0.176)	(0.204)	(0.139)
Overweight	1.030	1.041	1.072^{+}	1.058	1.017
	(0.021)	(0.033)	(0.045)	(0.042)	(0.053)
Obese	1.101***	1.088*	1.148**	1.121*	1.016
	(0.025)	(0.041)	(0.059)	(0.053)	(0.064)
1 chronic disease	1.028	1.047	0.995	1.023	1.074
	(0.023)	(0.032)	(0.041)	(0.042)	(0.051)
Multimorbidity	1.096***	1.075*	1.047	1.050	1.166**
	(0.027)	(0.037)	(0.047)	(0.046)	(0.068)
Cancer diagnosis	0.969	0.978	0.995	1.008	0.865
	(0.028)	(0.039)	(0.050)	(0.043)	(0.117)
GP visits - 3 or 4	0.940**	0.924**	0.920*	0.948	0.879*
	(0.020)	(0.027)	(0.036)	(0.035)	(0.045)
GP visits - 5 or 6	0.919**	0.903**	0.904*	0.923^{+}	0.840**
	(0.024)	(0.033)	(0.043)	(0.043)	(0.051)
GP visits - 7 or more	1.085**	1.123**	1.078	1.047	1.196**
	(0.033)	(0.048)	(0.060)	(0.057)	(0.082)
Seen specialist in last year	1.052**	1.090***	1.121***	1.033	1.237***
	(0.019)	(0.027)	(0.036)	(0.031)	(0.054)
Seen hospital doctor in last year	1.022	1.019	1.003	0.983	1.070
	(0.023)	(0.031)	(0.040)	(0.038)	(0.051)
SF36 physical health	0.950^{+}	0.946	0.969	0.924^{+}	1.013
second lowest quintile	(0.025)	(0.034)	(0.045)	(0.041)	(0.066)
SF36 physical health	0.979	0.966	0.944	0.946	1.034
middle quintile	(0.027)	(0.038)	(0.048)	(0.046)	(0.068)
SF36 physical health	0.982	0.972	1.028	0.959	1.021
second highest quintile	(0.028)	(0.040)	(0.055)	(0.050)	(0.068)
SF36 physical health	1.199***	1.163***	1.190**	1.127*	1.254***
highest quintile	(0.036)	(0.051)	(0.070)	(0.065)	(0.085)
SF36 mental health	1.020	1.029	1.041	1.015	1.057
second lowest quintile	(0.029)	(0.040)	(0.053)	(0.049)	(0.067)
SF36 mental health	0.996	1.014	1.006	1.030	0.993
middle quintile	(0.028)	(0.040)	(0.052)	(0.051)	(0.065)

Variable	Model 6 Pooled logistic	Model 7 Panel logistic RE	Model 8 Panel RE balanced	Model 9 Panel RE mid cohort	Model 10 Panel RE yng cohort
SF36 mental health	0.993	1.005	1.003	1.022	0.972
second highest quintile	(0.028)	(0.040)	(0.053)	(0.051)	(0.067)
SF36 mental health	1.071*	1.083^{+}	1.045	1.055	1.141^{+}
highest quintile	(0.030)	(0.044)	(0.057)	(0.055)	(0.077)
GP hours	1.077***	1.106**	1.133**	1.068^{+}	1.178**
	(0.024)	(0.034)	(0.046)	(0.042)	(0.060)
GP numbers	0.829***	0.825***	0.848***	0.884**	0.741***
	(0.019)	(0.027)	(0.036)	(0.036)	(0.040)
Bulk-billing	1.413***	1.402***	1.414***	1.437***	1.379***
	(0.026)	(0.036)	(0.048)	(0.047)	(0.059)
Female GP	0.918***	0.919**	0.907*	0.912*	0.946
	(0.020)	(0.028)	(0.037)	(0.035)	(0.049)
Lives alone	1.030	1.092^{+}	1.105	1.119	0.990
	(0.038)	(0.058)	(0.079)	(0.079)	(0.092)
Live with partner	0.984	0.984	0.938	1.064	0.915
	(0.034)	(0.046)	(0.060)	(0.064)	(0.070)
Live with children	0.796***	0.722***	0.668***	0.845***	0.648***
	(0.019)	(0.024)	(0.030)	(0.041)	(0.034)
N	61049	61049	35477	40587	20462
AIC	80341.0	74848.0	43153.3	48738.9	26053.8
BIC	80891.2	75362.1	43636.5	49221.1	26497.7

Notes Exponentiated coefficients; Standard errors in parentheses Significance: $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ Note OR>1 indicates increased odds of having personal continuity (and decreased odds of having site continuity), OR<1 indicates decreased odds of having personal continuity/increased odds of having site continuity. Selected results only. Full model provided in Table 42 in the Appendix. Reference categories (OR=1) are omitted. Base case is women from NSW, major city, did not complete HSC, copes easily with available income, is not in workforce, non-smoker of normal weight, with no chronic diseases, and sees GP 1-2 times a year, and is in the lowest quintile for SF-36 mental and physical health.

10.5 Chapter 6 – Continuity and Cancer Screening – Survey Data

10.5.1 Sample summary statistics

Table 43: Observations excluded samples for Pap testing and mammogram analyses

Pap testing	Obs
Full sample	101,478
Excluded with hysterectomy	21,322
Excluded Self-reported cervical cancer	926
Excluded Self-reported no sexual activity	2,531
Final sample	76669
Regression sample with no missing data	63117
Mammography Sample	
Full sample	101478
Aged between 50 and 70	51292
Excluded with history mastectomy or breast cancer	3216
Remaining sample	48527
Regression sample with no missing data	35478

Table 44: Summary statistics for all covariates for women responding to Pap test questions.

ALSWH Survey Wave	2	3	4	5	6	Total
Pap test in last 2 years	0.797 (0.402)	0.818 (0.386)	0.788 (0.409)	0.787 (0.41)	0.773 (0.419)	0.793 (0.405)
Personal continuity	0.338 (0.473)	0.337 (0.473)	0.346 (0.476)	0.349 (0.477)	0.325 (0.468)	0.339 (0.473)
Site continuity	0.255 (0.436)	0.278 (0.448)	0.296 (0.456)	0.321 (0.467)	0.354 (0.478)	0.299 (0.458)
Reduced continuity	0.406 (0.491)	0.385 (0.487)	0.358 (0.48)	0.33 (0.47)	0.321 (0.467)	0.362 (0.481)
Abnormal Pap	0.242 (0.428)	0.259 (0.438)	0.289 (0.454)	0.23 (0.421)	0.219 (0.413)	0.249 (0.432)
Good access to Pap tests	0.936 (0.244)	0.932 (0.251)	0.932 (0.253)	0.93 (0.255)	0.936 (0.245)	0.933 (0.249)
Age- 20-29.9	0.51	0.52	0.20	0.00	0.00	0.26
30-39.9	0.00	0.01	0.34	0.52	0.52	0.26

ALSWH Survey Wave	2	3	4	5	6	Total
40-49.9	0.29	0.00	0.00	0.00	0.00	0.07
50-59.9	0.20	0.46	0.46	0.38	0.09	0.32
60-69.9	0.00	0.00	0.00	0.10	0.39	0.09
NSW	0.281 (0.449)	0.276 (0.447)	0.274 (0.446)	0.273 (0.446)	0.275 (0.447)	0.276 (0.447)
Victoria	0.257 (0.437)	0.259 (0.438)	0.259 (0.438)	0.257 (0.437)	0.257 (0.437)	0.257 (0.437)
Queensland	0.218 (0.413)	0.219 (0.413)	0.221 (0.415)	0.224 (0.417)	0.224 (0.417)	0.221 (0.415)
South Australia	0.085 (0.278)	0.085 (0.279)	0.085 (0.278)	0.084 (0.277)	0.083 (0.276)	0.084 (0.278)
Western Australia	0.092 (0.289)	0.094 (0.291)	0.094 (0.291)	0.096 (0.294)	0.093 (0.291)	0.094 (0.291)
Tasmania	0.038 (0.191)	0.037 (0.188)	0.038 (0.191)	0.037 (0.189)	0.038 (0.192)	0.038 (0.19)
Northern Terrritory	0.014 (0.116)	0.013 (0.113)	0.012 (0.109)	0.011 (0.104)	0.011 (0.106)	0.012 (0.11)
Australian Capital Territory	0.017 (0.128)	0.018 (0.135)	0.018 (0.131)	0.018 (0.131)	0.019 (0.135)	0.018 (0.132)
Australian-born	0.851 (0.356)	0.86 (0.347)	0.863 (0.344)	0.855 (0.352)	0.858 (0.35)	0.857 (0.35)
Metropolitan area	0.431 (0.495)	0.465 (0.499)	0.486 (0.5)	0.483 (0.5)	0.488 (0.5)	0.469 (0.499)
Inner regional	0.352 (0.478)	0.331 (0.471)	0.318 (0.466)	0.325 (0.468)	0.329 (0.47)	0.332 (0.471)
Outer regional	0.178 (0.382)	0.168 (0.374)	0.161 (0.368)	0.16 (0.366)	0.155 (0.362)	0.165 (0.371)
Remote	0.039 (0.194)	0.036 (0.187)	0.035 (0.183)	0.033 (0.178)	0.028 (0.166)	0.034 (0.182)
Married	0.658 (0.474)	0.727 (0.446)	0.771 (0.42)	0.784 (0.412)	0.781 (0.413)	0.74 (0.438)
Educational attained-less than HSC	0.289 (0.453)	0.268 (0.443)	0.257 (0.437)	0.256 (0.436)	0.205 (0.403)	0.257 (0.437)
HSC completion	0.213 (0.409)	0.187 (0.39)	0.167 (0.373)	0.158 (0.365)	0.162 (0.368)	0.179 (0.383)
Trade/Diploma	0.224 (0.417)	0.237 (0.425)	0.247 (0.431)	0.243 (0.429)	0.255 (0.436)	0.24 (0.427)
University Graduate	0.274 (0.446)	0.308 (0.462)	0.33 (0.47)	0.343 (0.475)	0.379 (0.485)	0.324 (0.468)
Income impossible	0.026 (0.159)	0.013 (0.111)	0.015 (0.123)	0.016 (0.124)	0.016 (0.127)	0.017 (0.131)
Always difficult	0.134 (0.341)	0.1 (0.299)	0.107 (0.309)	0.103 (0.304)	0.111 (0.314)	0.112 (0.315)

ALSWH Survey Wave	2	3	4	5	6	Total
Sometimes difficult	0.309 (0.462)	0.286 (0.452)	0.278 (0.448)	0.26 (0.439)	0.27 (0.444)	0.282 (0.45)
Not bad income	0.389 (0.488)	0.41 (0.492)	0.41 (0.492)	0.419 (0.493)	0.42 (0.494)	0.409 (0.492)
Income easy	0.142 (0.349)	0.192 (0.394)	0.189 (0.392)	0.203 (0.402)	0.183 (0.386)	0.18 (0.385)
Not in labour force	0.161 (0.367)	0.163 (0.369)	0.2 (0.4)	0.228 (0.419)	0.26 (0.438)	0.2 (0.4)
Employed	0.811 (0.392)	0.807 (0.395)	0.778 (0.415)	0.747 (0.435)	0.719 (0.45)	0.775 (0.418)
Unemployed	0.029 (0.167)	0.03 (0.17)	0.022 (0.146)	0.025 (0.157)	0.022 (0.146)	0.026 (0.158)
Private hospital insurance	0.384 (0.486)	0.547 (0.498)	0.59 (0.492)	0.652 (0.476)	0.675 (0.468)	0.563 (0.496)
Health care card holder	0.303 (0.46)	0.178 (0.383)	0.179 (0.383)	0.193 (0.395)	0.21 (0.407)	0.215 (0.411)
Satisfied with manner of GP	0.884 (0.32)	0.901 (0.299)	0.901 (0.299)	0.912 (0.283)	0.928 (0.258)	0.904 (0.294)
Satisfied GP hours	0.744 (0.436)	0.704 (0.456)	0.697 (0.46)	0.706 (0.456)	0.736 (0.441)	0.718 (0.45)
Satisfied GP numbers	0.793 (0.405)	0.751 (0.432)	0.725 (0.447)	0.705 (0.456)	0.733 (0.442)	0.744 (0.437)
Satisfied GP bulkbilling	0.676 (0.468)	0.497 (0.5)	0.467 (0.499)	0.542 (0.498)	0.589 (0.492)	0.556 (0.497)
Satisfied Female GP	0.732 (0.443)	0.708 (0.454)	0.723 (0.448)	0.738 (0.44)	0.781 (0.414)	0.735 (0.441)
Never smoked	0.559 (0.496)	0.589 (0.492)	0.582 (0.493)	0.594 (0.491)	0.606 (0.489)	0.585 (0.493)
Ex-smoker	0.211 (0.408)	0.216 (0.411)	0.252 (0.434)	0.279 (0.449)	0.291 (0.454)	0.247 (0.432)
Smoker	0.23 (0.421)	0.195 (0.397)	0.166 (0.372)	0.127 (0.333)	0.102 (0.303)	0.167 (0.373)
Risky drinker	0.049 (0.217)	0.048 (0.215)	0.053 (0.224)	0.056 (0.229)	0.057 (0.232)	0.053 (0.223)
Underweight	0.04 (0.195)	0.029 (0.169)	0.025 (0.156)	0.019 (0.135)	0.02 (0.138)	0.027 (0.162)
Ideal weight	0.555 (0.497)	0.515 (0.5)	0.481 (0.5)	0.459 (0.498)	0.436 (0.496)	0.492 (0.5)
Overweight	0.256 (0.436)	0.271 (0.444)	0.285 (0.451)	0.295 (0.456)	0.301 (0.459)	0.28 (0.449)
Obese	0.149 (0.356)	0.185 (0.388)	0.209 (0.407)	0.227 (0.419)	0.244 (0.429)	0.20 (0.4)
Excellent health	0.127 (0.333)	0.122 (0.327)	0.135 (0.342)	0.132 (0.339)	0.127 (0.333)	0.128 (0.335)

ALSWH Survey Wave	2	3	4	5	6	Total
Very good health	0.395 (0.489)	0.403 (0.491)	0.412 (0.492)	0.419 (0.493)	0.415 (0.493)	0.408 (0.492)
Good health	0.364 (0.481)	0.369 (0.482)	0.351 (0.477)	0.345 (0.475)	0.355 (0.478)	0.357 (0.479)
Fair health	0.102 (0.303)	0.094 (0.292)	0.091 (0.288)	0.091 (0.288)	0.09 (0.286)	0.094 (0.292)
Poor health	0.012 (0.107)	0.012 (0.108)	0.011 (0.102)	0.013 (0.113)	0.014 (0.116)	0.012 (0.109)
No chronic diseases	0.39 (0.488)	0.504 (0.5)	0.415 (0.493)	0.365 (0.481)	0.363 (0.481)	0.409 (0.492)
One chronic disease	0.315 (0.465)	0.301 (0.459)	0.317 (0.465)	0.318 (0.466)	0.302 (0.459)	0.311 (0.463)
Multimorbidity	0.295 (0.456)	0.196 (0.397)	0.268 (0.443)	0.317 (0.465)	0.335 (0.472)	0.28 (0.449)
Cancer diagnosis	0.066 (0.248)	0.021 (0.142)	0.067 (0.25)	0.096 (0.294)	0.103 (0.304)	0.069 (0.253)
n	16162	15224	15079	13856	13169	73490

Figures indicate proportion of sample with standard deviation in parentheses.

Table 45: Mammography sample summary statistics - women aged between 50 and 69 and potentially eligible for inclusion in mammography analysis

ALSWH Survey	1	2	3	4	5	6	7	Total
Mammogram in last 2 years	0.659 (0.475)	0.729 (0.444)	0.805 (0.397)	0.824 (0.381)	0.841 (0.366)	0.841 (0.365)	0.859 (0.348)	0.823 (0.382)
Personal continuity	M	0.448 (0.497)	0.452 (0.498)	0.461 (0.498)	0.478 (0.5)	0.469 (0.499)	0.478 (0.5)	0.463 (0.499)
Site continuity	M	0.285 (0.451)	0.29 (0.454)	0.293 (0.455)	0.296 (0.457)	0.319 (0.466)	0.342 (0.474)	0.303 (0.459)
No continuity	M	0.268 (0.443)	0.258 (0.438)	0.247 (0.431)	0.226 (0.418)	0.212 (0.409)	0.18 (0.384)	0.234 (0.423)
Age (years)	50.09	51.02	52.54	55.48	58.49	61.54	64.78	57.56
New South Wales	0.288 (0.453)	0.288 (0.453)	0.288 (0.453)	0.287 (0.452)	0.285 (0.451)	0.287 (0.452)	0.287 (0.452)	0.287 (0.452)
Victoria	0.228 (0.42)	0.242 (0.428)	0.238 (0.426)	0.234 (0.424)	0.232 (0.422)	0.233 (0.422)	0.234 (0.424)	0.235 (0.424)
Queensland	0.242 (0.429)	0.218 (0.413)	0.223 (0.416)	0.226 (0.418)	0.23 (0.421)	0.226 (0.418)	0.225 (0.418)	0.225 (0.418)
South Australia	0.079 (0.27)	0.089 (0.285)	0.089 (0.285)	0.091 (0.288)	0.092 (0.29)	0.092 (0.29)	0.091 (0.288)	0.091 (0.287)
Western Australia	0.108 (0.311)	0.088 (0.284)	0.092 (0.289)	0.094 (0.292)	0.093 (0.291)	0.095 (0.293)	0.094 (0.291)	0.093 (0.291)
Tasmania	0.026 (0.16)	0.043 (0.202)	0.042 (0.202)	0.042 (0.2)	0.042 (0.201)	0.043 (0.203)	0.044 (0.205)	0.043 (0.202)

ALSWH Survey	1	2	3	4	5	6	7	Total
Northern Territory	0.024 (0.153)	0.019 (0.135)	0.015 (0.121)	0.014 (0.116)	0.012 (0.108)	0.011 (0.106)	0.009 (0.094)	0.013 (0.113)
Australian Capital Territory	0.005 (0.069)	0.012 (0.111)	0.013 (0.112)	0.012 (0.107)	0.012 (0.11)	0.012 (0.108)	0.013 (0.112)	0.012 (0.11)
Australian-born	0.717 (0.451)	0.749 (0.434)	0.778 (0.415)	0.778 (0.415)	0.775 (0.418)	0.779 (0.415)	0.783 (0.412)	0.775 (0.417)
City	0.405 (0.492)	0.344 (0.475)	0.341 (0.474)	0.376 (0.484)	0.375 (0.484)	0.377 (0.485)	0.382 (0.486)	0.368 (0.482)
Inner regional	0.343 (0.475)	0.39 (0.488)	0.406 (0.491)	0.391 (0.488)	0.39 (0.488)	0.4 (0.49)	0.397 (0.489)	0.396 (0.489)
Outer regional	0.187 (0.39)	0.212 (0.409)	0.209 (0.406)	0.195 (0.396)	0.195 (0.396)	0.188 (0.391)	0.189 (0.391)	0.197 (0.398)
Remote	0.062 (0.242)	0.053 (0.224)	0.044 (0.204)	0.038 (0.19)	0.038 (0.191)	0.034 (0.18)	0.029 (0.168)	0.038 (0.192)
Married	0.811 (0.392)	0.823 (0.382)	0.817 (0.387)	0.806 (0.395)	0.786 (0.41)	0.769 (0.421)	0.751 (0.433)	0.791 (0.407)
No HSC	0.561 (0.497)	0.513 (0.5)	0.486 (0.5)	0.483 (0.5)	0.48 (0.5)	0.391 (0.488)	0.383 (0.486)	0.454 (0.498)
HSC	0.129 (0.336)	0.165 (0.372)	0.168 (0.374)	0.167 (0.373)	0.168 (0.374)	0.196 (0.397)	0.195 (0.396)	0.176 (0.381)
Trade/Diploma	0.187 (0.39)	0.192 (0.394)	0.199 (0.399)	0.2 (0.4)	0.201 (0.401)	0.218 (0.413)	0.218 (0.413)	0.205 (0.404)
University	0.122 (0.328)	0.129 (0.336)	0.147 (0.354)	0.15 (0.357)	0.151 (0.358)	0.196 (0.397)	0.204 (0.403)	0.164 (0.37)
Income worst	0.038 (0.192)	0.021 (0.145)	0.015 (0.123)	0.019 (0.136)	0.018 (0.132)	0.023 (0.15)	0.016 (0.125)	0.019 (0.135)
Income very hard	0.118 (0.322)	0.134 (0.34)	0.098 (0.297)	0.108 (0.311)	0.104 (0.306)	0.108 (0.311)	0.086 (0.28)	0.104 (0.306)
Income middle	0.29 (0.454)	0.282 (0.45)	0.273 (0.446)	0.262 (0.44)	0.239 (0.426)	0.238 (0.426)	0.219 (0.414)	0.251 (0.434)
Income not hard	0.398 (0.49)	0.406 (0.491)	0.433 (0.495)	0.443 (0.497)	0.439 (0.496)	0.453 (0.498)	0.481 (0.5)	0.444 (0.497)
Income best	0.156 (0.363)	0.156 (0.363)	0.181 (0.385)	0.168 (0.374)	0.20 (0.40)	0.178 (0.382)	0.198 (0.399)	0.182 (0.386)
Not working	0.279 (0.449)	0.228 (0.42)	0.217 (0.412)	0.27 (0.444)	0.315 (0.465)	0.408 (0.491)	0.547 (0.498)	0.332 (0.471)
Employed	0.699 (0.459)	0.755 (0.43)	0.77 (0.421)	0.717 (0.45)	0.675 (0.469)	0.587 (0.492)	0.447 (0.497)	0.657 (0.475)
Unemployed	0.022 (0.147)	0.016 (0.126)	0.013 (0.115)	0.013 (0.112)	0.01 (0.1)	0.005 (0.072)	0.006 (0.075)	0.01 (0.101)
Private health ins	1.534 (0.499)	1.517 (0.5)	1.322 (0.467)	1.342 (0.474)	1.344 (0.475)	1.332 (0.471)	1.319 (0.466)	1.349 (0.477)
Health care card holder	NA	0.455 (0.498)	0.201 (0.401)	0.238 (0.426)	0.264 (0.441)	0.327 (0.469)	0.483 (0.5)	0.311 (0.463)

ALSWH Survey	1	2	3	4	5	6	7	Total
Never smoker	0.501 (0.501)	0.572 (0.495)	0.616 (0.486)	0.594 (0.491)	0.603 (0.489)	0.612 (0.487)	0.626 (0.484)	0.606 (0.489)
Ex-smoker	0.331 (0.471)	0.266 (0.442)	0.242 (0.428)	0.272 (0.445)	0.287 (0.452)	0.299 (0.458)	0.297 (0.457)	0.278 (0.448)
Smoker	0.168 (0.374)	0.162 (0.369)	0.142 (0.349)	0.134 (0.34)	0.109 (0.312)	0.088 (0.284)	0.077 (0.266)	0.116 (0.321)
Risky drinker	0.06 (0.238)	0.049 (0.217)	0.056 (0.23)	0.067 (0.249)	0.062 (0.242)	0.066 (0.249)	0.059 (0.235)	0.061 (0.239)
Underweight	0.015 (0.121)	0.013 (0.112)	0.014 (0.117)	0.011 (0.103)	0.011 (0.104)	0.013 (0.113)	0.011 (0.103)	0.012 (0.109)
Ideal weight	0.491 (0.501)	0.442 (0.497)	0.42 (0.494)	0.386 (0.487)	0.375 (0.484)	0.357 (0.479)	0.348 (0.476)	0.385 (0.487)
Overweight	0.298 (0.458)	0.324 (0.468)	0.327 (0.469)	0.338 (0.473)	0.339 (0.474)	0.343 (0.475)	0.34 (0.474)	0.336 (0.472)
Obese	0.196 (0.397)	0.222 (0.415)	0.239 (0.427)	0.265 (0.441)	0.275 (0.447)	0.287 (0.453)	0.301 (0.459)	0.267 (0.442)
Good GP Hours	NA	0.771 (0.42)	0.732 (0.443)	0.719 (0.45)	0.718 (0.45)	0.736 (0.441)	0.817 (0.386)	0.745 (0.436)
Good GP number	NA	0.803 (0.398)	0.764 (0.425)	0.745 (0.436)	0.713 (0.452)	0.728 (0.445)	0.828 (0.378)	0.758 (0.428)
Good bulk-billing	NA	0.661 (0.473)	0.595 (0.491)	0.465 (0.499)	0.593 (0.491)	0.653 (0.476)	0.762 (0.426)	0.615 (0.487)
Good Female GP	NA	0.733 (0.442)	0.73 (0.444)	0.732 (0.443)	0.74 (0.439)	0.773 (0.419)	0.852 (0.355)	0.76 (0.427)
Health – excellent	0.131 (0.337)	0.127 (0.333)	0.106 (0.308)	0.107 (0.309)	0.113 (0.317)	0.103 (0.303)	0.095 (0.293)	0.113 (0.317)
Health – very good	0.358 (0.48)	0.38 (0.485)	0.365 (0.481)	0.364 (0.481)	0.378 (0.485)	0.363 (0.481)	0.376 (0.484)	0.369 (0.482)
Health – good	0.397 (0.489)	0.374 (0.484)	0.39 (0.488)	0.389 (0.488)	0.374 (0.484)	0.398 (0.49)	0.397 (0.489)	0.388 (0.487)
Health – fair	0.097 (0.296)	0.107 (0.309)	0.123 (0.329)	0.126 (0.331)	0.119 (0.324)	0.122 (0.327)	0.117 (0.322)	0.115 (0.319)
Health – poor	0.017 (0.129)	0.013 (0.114)	0.015 (0.122)	0.014 (0.119)	0.015 (0.123)	0.015 (0.12)	0.016 (0.124)	0.015 (0.122)
No chronic disease	0.296 (0.456)	0.331 (0.471)	0.417 (0.493)	0.325 (0.468)	0.292 (0.455)	0.268 (0.443)	0.189 (0.392)	0.306 (0.461)
1 chronic disease	0.323 (0.468)	0.303 (0.459)	0.312 (0.463)	0.318 (0.466)	0.3 (0.458)	0.289 (0.453)	0.269 (0.443)	0.304 (0.46)
Multimorbidity	0.381 (0.486)	0.366 (0.482)	0.272 (0.445)	0.358 (0.479)	0.408 (0.491)	0.443 (0.497)	0.542 (0.498)	0.391 (0.488)
Cancer diagnosis	0.158 (0.365)	0.151 (0.359)	0.035 (0.183)	0.131 (0.337)	0.163 (0.37)	0.176 (0.381)	0.185 (0.388)	0.142 (0.349)
0 GP visits	0.092 (0.289)	0.082 (0.275)	0.071 (0.256)	0.069 (0.253)	0.06 (0.237)	0.049 (0.215)	0.037 (0.188)	0.06 (0.238)

ALSWH Survey	1	2	3	4	5	6	7	Total
1-2 GP visits	0.34 (0.474)	0.372 (0.483)	0.353 (0.478)	0.339 (0.473)	0.338 (0.473)	0.313 (0.464)	0.302 (0.459)	0.334 (0.472)
3-4 GP visits	0.253 (0.435)	0.272 (0.445)	0.283 (0.451)	0.295 (0.456)	0.296 (0.457)	0.311 (0.463)	0.322 (0.467)	0.298 (0.457)
5-6 GP visits	0.135 (0.342)	0.139 (0.346)	0.15 (0.357)	0.159 (0.366)	0.163 (0.369)	0.174 (0.379)	0.185 (0.389)	0.163 (0.369)
7 or more GP visits	0.181 (0.385)	0.135 (0.342)	0.143 (0.35)	0.138 (0.345)	0.142 (0.349)	0.154 (0.361)	0.155 (0.362)	0.145 (0.353)
Abnormal mammogram	0.202 (0.402)	0.192 (0.394)	0.194 (0.395)	0.221 (0.415)	0.23 (0.421)	0.231 (0.422)	0.275 (0.447)	0.226 (0.418)
Good mammo access	NA	0.908 (0.289)	0.924 (0.264)	0.928 (0.258)	0.933 (0.249)	0.939 (0.238)	0.964 (0.186)	0.934 (0.247)
Breast cancer	0.029 (0.168)	0.031 (0.172)	0.037 (0.188)	0.044 (0.206)	0.055 (0.229)	0.069 (0.253)	0.083 (0.275)	0.053 (0.225)
Breast biopsy	0.146 (0.354)	0.108 (0.31)	0.134 (0.341)	0.15 (0.357)	0.172 (0.377)	0.19 (0.392)	0.211 (0.408)	0.163 (0.369)
Mastectomy	0.024 (0.154)	0.016 (0.126)	0.019 (0.137)	0.021 (0.144)	0.026 (0.159)	0.03 (0.171)	0.035 (0.185)	0.025 (0.156)
Lumpectomy	0.111 (0.315)	0.098 (0.298)	0.109 (0.312)	0.115 (0.318)	0.123 (0.329)	0.136 (0.343)	0.148 (0.355)	0.122 (0.328)
Women between 50 and 69.99 years of age	413	4716	10680	10497	10343	9739	8731	55119

Figures indicate proportion of sample with standard deviation in parentheses. Notes- Regression analyses include data from waves 2-7 only as continuity variables are not asked in Wave 1. NA – indicates data missing from a survey wave (question not asked).

Table 46: Summary statistics of sample for instrumental variable (IV) analysis of Pap testing. Women from young ALSWH cohort only.

ALSWH Survey wave	2	3	4	5	6	Total
Pap test in last 2 years	0.752 (0.431)	0.774 (0.417)	0.747 (0.434)	0.747 (0.434)	0.732 (0.442)	0.751 (0.432)
Personal continuity	0.528 (0.499)	0.490 (0.499)	0.448 (0.497)	0.421 (0.493)	0.413 (0.492)	0.463 (0.498)
Site continuity	0.222 (0.415)	0.257 (0.437)	0.293 (0.455)	0.335 (0.472)	0.377 (0.484)	0.293 (0.455)
Reduced continuity	0.249 (0.432)	0.251 (0.433)	0.258 (0.437)	0.243 (0.429)	0.208 (0.406)	0.243 (0.428)
Abnormal Pap	0.244 (0.429)	0.271 (0.444)	0.324 (0.468)	0.222 (0.416)	0.220 (0.414)	0.258 (0.437)
Good access to Pap tests	0.914 (0.281)	0.908 (0.288)	0.9072 (0.290)	0.905 (0.293)	0.916 (0.276)	0.910 (0.28)
Age-Twenties	1.00	0.972 (0.164)	0.371 (0.483)	0.0001 (0.011)	-	0.499 (0.500)
Age- Thirties	-	0.027 (0.164)	0.628 (0.483)	0.999 (0.011)	0.9959 (0.063)	0.499 (0.500)
Age- Forties	-	-	-	-	0.004 (0.063)	0.001 (0.0267)
New South Wales	0.276 (0.447)	0.269 (0.443)	0.262 (0.439)	0.260 (0.439)	0.260 (0.438)	0.266 (0.441)
Victoria	0.262 (0.440)	0.267 (0.442)	0.269 (0.443)	0.269 (0.443)	0.271 (0.444)	0.267 (0.442)
Queensland	0.216 (0.411)	0.218 (0.413)	0.223 (0.416)	0.225 (0.418)	0.227 (0.419)	0.222 (0.415)
South Australia	0.082 (0.274)	0.081 (0.273)	0.081 (0.272)	0.077 (0.268)	0.076 (0.265)	0.079 (0.271)
Western Australia	0.095 (0.294)	0.097 (0.295)	0.096 (0.295)	0.099 (0.299)	0.094 (0.295)	0.096 (0.295)
Tasmania	0.036 (0.186)	0.0325 (0.177)	0.035 (0.185)	0.033 (0.180)	0.034 (0.181)	0.034 (0.182)
Northern Territory	0.010 (0.100)	0.010 (0.104)	0.010 (0.101)	0.010 (0.102)	0.011 (0.105)	0.011 (0.102)
Australian Capital Territory	0.020 (0.141)	0.023 (0.150)	0.022 (0.149)	0.022 (0.148)	0.025 (0.155)	0.022 (0.148)
Australian-born	0.934 (0.248)	0.934 (0.248)	0.934 (0.248)	0.934 (0.249)	0.935 (0.247)	0.934 (0.247)
Metropolitan area	0.508 (0.499)	0.559 (0.496)	0.570 (0.495)	0.570 (0.495)	0.578 (0.493)	0.555 (0.497)
Inner regional	0.308 (0.462)	0.271 (0.445)	0.258 (0.437)	0.265 (0.441)	0.266 (0.442)	0.274 (0.446)

ALSWH Survey wave	2	3	4	5	6	Total
Outer regional	0.152 (0.359)	0.139 (0.346)	0.138 (0.345)	0.134 (0.342)	0.129 (0.335)	0.139 (0.346)
Remote	0.031 (0.175)	0.0309 (0.173)	0.039 (0.180)	0.030 (0.171)	0.027 (0.164)	0.031 (0.173)
Married	0.497 (0.500)	0.650 (0.477)	0.745 (0.436)	0.789 (0.408)	0.800 (0.399)	0.689 (0.463)
Educational attainment- less than HSC	0.120 (0.324)	0.105 (0.307)	0.088 (0.284)	0.076 (0.265)	0.063 (0.243)	0.092 (0.289)
HSC completion	0.250 (0.433)	0.199 (0.399)	0.165 (0.371)	0.145 (0.352)	0.126 (0.332)	0.181 (0.384)
Trade/Diploma	0.250 (0.433)	0.264 (0.441)	0.282 (0.450)	0.276 (0.448)	0.285 (0.451)	0.271 (0.444)
University Graduate	0.379 (0.485)	0.430 (0.495)	0.463 (0.498)	0.501 (0.500)	0.526 (0.499)	0.456 (0.498)
Income impossible	0.031 (0.174)	0.011 (0.105)	0.014 (0.117)	0.014 (0.119)	0.014 (0.118)	0.0173 (0.130)
Always difficult	0.142 (0.349)	0.108 (0.312)	0.112 (0.316)	0.111 (0.314)	0.123 (0.329)	0.119 (0.324)
Sometimes difficult	0.326 (0.469)	0.304 (0.460)	0.296 (0.456)	0.290 (0.454)	0.312 (0.463)	0.306 (0.461)
Not bad income	0.369 (0.483)	0.385 (0.487)	0.379 (0.485)	0.392 (0.488)	0.376 (0.484)	0.380 (0.485)
Income easy	0.131 (0.337)	0.191 (0.393)	0.199 (0.399)	0.192 (0.394)	0.175 (0.380)	0.177 (0.382)
Not in labour force	0.133 (0.339)	0.133 (0.340)	0.161 (0.367)	0.167 (0.373)	0.147 (0.354)	0.148 (0.355)
Employed	0.823 (0.381)	0.821 (0.382)	0.804 (0.392)	0.793 (0.404)	0.816 (0.387)	0.813 (0.389)
Unemployed	0.043 (0.204)	0.044 (0.207)	0.029 (0.170)	0.039 (0.194)	0.036 (0.188)	0.038 (0.193)
Private hospital insurance	0.301 (0.459)	0.427 (0.494)	0.524 (0.499)	0.637 (0.480)	0.672 (0.469)	0.503 (0.499)
Health care card holder	0.159 (0.366)	0.172 (0.378)	0.145 (0.353)	0.146 (0.353)	0.123 (0.329)	0.150 (0.357)
Good GP hours	0.719 (0.449)	0.678 (0.467)	0.673 (0.468)	0.689 (0.462)	0.730 (0.444)	0.697 (0.459)
Good GP numbers	0.777 (0.416)	0.734 (0.442)	0.701 (0.457)	0.694 (0.460)	0.734 (0.442)	0.729 (0.444)
Good bulk-billing access	0.688 (0.463)	0.423 (0.494)	0.471 (0.499)	0.510 (0.499)	0.541 (0.498)	0.528 (0.499)
Good access to female GP	0.715 (0.451)	0.682 (0.466)	0.704 (0.456)	0.724 (0.446)	0.776 (0.416)	0.718 (0.449)

Mean and standard deviation

10.5.2 Full Regression Model Outputs and Alternative Models

Table 47: Alternative models for Pap testing including expanded model including additional health and usage variables, excluding women with history of abnormal Pap test (and cohort comparisons) and excluding women from Victoria

	Model with extended health variables	Excluding abnomal Pap	Excluding abnormal pap – mid cohort	Excluding abnormal pap – young cohort	Excluding women from Victoria
Personal continuity	1.234***	1.229***	1.197*	1.240***	1.231***
	(0.043)	(0.047)	(0.084)	(0.057)	(0.048)
Site continuity	1.177***	1.201***	1.140+	1.220***	1.202***
	(0.04)	(0.045)	(0.084)	(0.052)	(0.046)
Wave 3	0.935	0.807***	0.857	0.808***	0.905*
	(0.042)	(0.04)	(0.089)	(0.044)	(0.045)
Wave 4	0.738***	0.612***	0.681***	0.594***	0.678***
	(0.038)	(0.034)	(0.072)	(0.042)	(0.038)
Wave 5	0.718***	0.666***	0.668***	0.684***	0.662***
	(0.042)	(0.043)	(0.074)	(0.063)	(0.043)
Wave 6	0.659***	0.603***	0.620***	0.610***	0.601***
	(0.043)	(0.043)	(0.085)	(0.057)	(0.044)
Age- Thirties	0.904+	0.965	-	0.989	0.861**
	(0.047)	(0.055)		(0.073)	(0.05)
Forties	1.392***	1.359***	0.985	0.312+	1.124
	(0.102)	(0.108)	(0.152)	(0.207)	(0.09)
Fifties	1.676***	1.561***	1.054		1.500***
	(0.086)	(0.085)	(0.105)	-	(0.084)
Sixties	1.604***	1.466***	1.0		1.529***
	(0.123)	(0.122)		-	(0.13)
Victoria	1.236***	1.229***	1.305**	1.195***	-
	(0.053)	(0.057)	(0.117)	(0.062)	
Queensland	1.005	1.031	0.971	1.056	1.014
	(0.044)	(0.049)	(0.088)	(0.057)	(0.044)
South Australia	1.244***	1.233**	1.274+	1.228**	1.256***
	(0.079)	(0.083)	(0.161)	(0.093)	(0.078)
Western Australia	0.956	1	1.326*	0.877+	0.975
	(0.057)	(0.066)	(0.179)	(0.064)	(0.058)
Tasmania	1.084	1.136	1.520*	0.982	1.141
	(0.097)	(0.109)	(0.274)	(0.109)	(0.101)
Northern Territory	1.152	1.115	1.365	0.964	1.118

	Model with extended health variables	Excluding abnomal Pap	Excluding abnormal pap – mid cohort	Excluding abnormal pap – young cohort	Excluding women from Victoria
	(0.173)	(0.19)	(0.461)	(0.184)	(0.167)
ACT	1.061	1.154	1.459	1.078	1.1
	(0.124)	(0.146)	(0.452)	(0.141)	(0.127)
Australian-born	0.974	0.897*	0.907	0.878+	0.979
	(0.049)	(0.049)	(0.074)	(0.068)	(0.056)
Inner regional location	1.131***	1.110**	1.169*	1.094+	1.064
	(0.041)	(0.044)	(0.088)	(0.05)	(0.045)
Outer regional location	1.180***	1.114*	1.062	1.165*	1.119*
	(0.056)	(0.057)	(0.1)	(0.071)	(0.057)
Remote/very remote	1.258*	1.261*	1.3	1.278*	1.220*
	(0.116)	(0.129)	(0.266)	(0.144)	(0.112)
Married	1.429***	1.516***	1.788***	1.383***	1.553***
	(0.049)	(0.057)	(0.134)	(0.058)	(0.06)
High School Certificate	0.996	0.981	0.971	1.069	0.997
	(0.05)	(0.053)	(0.085)	(0.081)	(0.056)
Trade Diploma	0.972	0.967	0.904	1.092	1.008
	(0.046)	(0.05)	(0.077)	(0.079)	(0.053)
University	0.997	1.046	0.848+	1.225**	1.067
	(0.05)	(0.057)	(0.08)	(0.089)	(0.059)
Income impossible	0.819+	0.770*	0.644*	0.846	0.819+
	(0.085)	(0.088)	(0.133)	(0.116)	(0.092)
Always difficult	0.832***	0.794***	0.583***	0.942	0.766***
	(0.046)	(0.047)	(0.065)	(0.064)	(0.046)
Sometimes difficult	0.941	0.913+	0.847+	0.961	0.899*
	(0.041)	(0.043)	(0.077)	(0.053)	(0.044)
Not too bad	0.996	0.989	0.91	1.037	0.993
	(0.04)	(0.043)	(0.072)	(0.053)	(0.045)
Employed	0.975	0.961	1.069	0.889*	0.954
	(0.037)	(0.039)	(0.072)	(0.047)	(0.04)
Unemployed	0.931	0.887	0.914	0.845+	0.874
	(0.08)	(0.084)	(0.224)	(0.084)	(0.083)
Private hospital insurance	1.480***	1.514***	1.533***	1.458***	1.487***
	(0.049)	(0.054)	(0.104)	(0.06)	(0.055)
Concession card holder	1.055	1.003	1.049	0.966	1.051
	(0.039)	(0.04)	(0.068)	(0.05)	(0.043)
Good GP hours	0.939+	0.972	0.915	0.996	0.934+

	Model with extended health variables	Excluding abnomal Pap	Excluding abnormal pap – mid cohort	Excluding abnormal pap – young cohort	Excluding women from Victoria
	(0.033)	(0.037)	(0.064)	(0.044)	(0.036)
Good GP numbers	0.884**	0.887**	0.911	0.879**	0.887**
	(0.033)	(0.036)	(0.068)	(0.042)	(0.037)
Good bulk(billing access	0.798***	0.762***	0.769***	0.764***	0.831***
	(0.024)	(0.025)	(0.047)	(0.029)	(0.028)
Good female GP access	1.375***	1.404***	1.514***	1.339***	1.356***
	(0.047)	(0.053)	(0.103)	(0.059)	(0.052)
Good Pap test access	3.471***	3.547***	5.436***	2.942***	3.336***
	(0.179)	(0.199)	(0.626)	(0.181)	(0.187)
Previous abnormal Pap test	1.646***				1.633***
	(0.055)				(0.062)
Ex-smoker	1.062				
	(0.039)				
Smoker	0.805***				
	(0.034)				
Risky drinker	0.905				
	(0.057)				
Underweight	0.655***				
	(0.056)				
Overweight	0.768***				
	(0.027)				
Obese	0.516***				
	(0.021)				
Chronic disease	0.971				
	(0.031)				
Multimorbidity	0.895**				
	(0.034)				
Cancer diagnosis	1.188**				
	(0.071)				
GP visits 3-4	1.550***				
	(0.052)				
GP visits 5-6	1.654***				
	(0.069)				
GP visits (7+)	1.579***				
	(0.074)				

	Model with extended health variables	Excluding abnomal Pap	Excluding abnormal pap – mid cohort	Excluding abnormal pap – young cohort	Excluding women from Victoria
N	60040	47574	22497	25077	47028
AIC	51899.0	43960.7	17431.5	26287.5	41836.6
BIC	52376.2	44311.5	17736.3	26596.4	42187.0

Notes: Exponentiated coefficients; Standard errors in parentheses; Significance: $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Note: OR>1 indicates increased odds of having screening test within last two years, OR<1 indicates decreased odds of screening in last two years. Reference categories (OR=1) are omitted. Base case is women from NSW, major city, did not complete HSC, copes easily with available income, is not in workforce, non-smoker of normal weight, with no chronic diseases, and sees GP 1-2 times a year, and has excellent self-reported health.

Table 48: Alternative regression models for mammogram analysis

	Pooled logistic regression	Panel RE logistic regression	Panel RE expanded model	Panel RE balanced panel	Panel RE women without abnormal mammo-gram.
Personal continuity	1.266***	1.367***	1.277***	1.349***	1.542***
	(0.0522)	(0.0823)	(0.0541)	(0.102)	(0.120)
Site continuity	1.316***	1.382***	1.270***	1.442***	1.465***
	(0.0590)	(0.0887)	(0.0568)	(0.114)	(0.107)
Wave 2	0.837*	0.919	0.925	1.011	0.810+
	(0.0583)	(0.0864)	(0.0605)	(0.118)	(0.102)
Wave 3	0.855+	1.042	0.983	1.158	0.877
	(0.0704)	(0.118)	(0.0777)	(0.162)	(0.130)
Wave 4	0.810*	1.122	1.019	1.265	0.983
	(0.0836)	(0.159)	(0.100)	(0.222)	(0.179)
Wave 5	0.768*	1.148	1.002	1.187	0.867
	(0.0905)	(0.189)	(0.116)	(0.244)	(0.180)
Wave 6	0.760*	1.214	1.015	1.091	0.903
	(0.100)	(0.232)	(0.136)	(0.257)	(0.216)
Age – 55-59.99	1.248**	1.115	1.088	1.255+	1.133
	(0.0908)	(0.106)	(0.0729)	(0.150)	(0.136)
60- 64.99	1.381**	1.043	1.073	1.318	1.177

	Pooled logistic regression	Panel RE logistic regression	Panel RE expanded model	Panel RE balanced panel	Panel RE women without abnormal mammo-gram.
	(0.140)	(0.147)	(0.106)	(0.233)	(0.204)
65-69.99	1.484**	0.920	1.016	1.264	1.090
	(0.201)	(0.178)	(0.137)	(0.298)	(0.260)
Victoria	0.956	0.948	0.936	0.939	0.910
	(0.0426)	(0.0776)	(0.0538)	(0.0948)	(0.0900)
Queensland	1.208***	1.348***	1.220**	1.344**	1.296*
	(0.0576)	(0.116)	(0.0753)	(0.147)	(0.134)
South Australia	1.199**	1.202	1.131	1.360*	1.228
	(0.0776)	(0.139)	(0.0922)	(0.193)	(0.168)
Western Australia	1.096	1.067	1.022	1.090	1.176
	(0.0718)	(0.123)	(0.0835)	(0.158)	(0.169)
Tasmania	0.930	0.937	0.948	1.024	0.811
	(0.0836)	(0.151)	(0.110)	(0.203)	(0.159)
Northern Territory	0.642**	0.462**	0.637*	0.587	0.690
	(0.109)	(0.129)	(0.128)	(0.210)	(0.247)
ACT	0.742*	0.718	0.801	0.641	0.899
	(0.104)	(0.187)	(0.142)	(0.197)	(0.302)
Australian born	1.090*	1.126	1.089+	1.156	1.180+
	(0.0438)	(0.0827)	(0.0566)	(0.107)	(0.103)
Inner regional location	1.075+	1.083	1.069	1.103	1.096
	(0.0427)	(0.0737)	(0.0514)	(0.0928)	(0.0910)
Outer regional location	1.328***	1.466***	1.366***	1.410**	1.602***
	(0.0682)	(0.129)	(0.0855)	(0.153)	(0.172)
Remote/very remote	2.236***	3.060***	2.197***	2.489***	3.036***
	(0.255)	(0.586)	(0.301)	(0.609)	(0.683)
Married	1.268***	1.359***	1.171***	1.279**	1.262**
	(0.0501)	(0.0911)	(0.0555)	(0.107)	(0.103)
Education- HSC	0.957	0.981	0.966	0.938	0.865
	(0.0464)	(0.0786)	(0.0555)	(0.0944)	(0.0832)
Trade Diploma	0.829***	0.813**	0.837**	0.728***	0.739**
	(0.0370)	(0.0615)	(0.0455)	(0.0678)	(0.0691)
University	0.754***	0.669***	0.706***	0.679***	0.575***
	(0.0369)	(0.0577)	(0.0427)	(0.0706)	(0.0595)
Income- impossible	0.569***	0.509***	0.732*	0.615*	0.513**
	(0.0680)	(0.0880)	(0.0897)	(0.136)	(0.108)

	Pooled logistic regression	Panel RE logistic regression	Panel RE expanded model	Panel RE balanced panel	Panel RE women without abnormal mammo-gram.
Always difficult	0.652***	0.627***	0.802**	0.698**	0.655***
	(0.0426)	(0.0619)	(0.0572)	(0.0866)	(0.0809)
Sometimes difficult	0.821***	0.772**	0.897+	0.803*	0.753**
	(0.0443)	(0.0614)	(0.0509)	(0.0770)	(0.0758)
Not too bad	0.966	0.952	0.992	1.008	0.936
	(0.0471)	(0.0653)	(0.0480)	(0.0822)	(0.0811)
Employed	0.912*	0.885*	0.884**	0.892	0.879+
	(0.0360)	(0.0518)	(0.0368)	(0.0654)	(0.0648)
Unemployed	0.884	0.883	0.832	0.828	0.577*
	(0.132)	(0.181)	(0.121)	(0.215)	(0.148)
Private hospital insurance	1.563***	1.749***	1.415***	1.644***	1.723***
	(0.0584)	(0.112)	(0.0644)	(0.132)	(0.134)
Concession card holder	1.108*	1.124+	1.104*	1.093	1.145+
	(0.0468)	(0.0687)	(0.0474)	(0.0835)	(0.0873)
Previous abnormal mammogram	1.824***	2.022***	1.675***	1.883***	-
	(0.0919)	(0.153)	(0.0902)	(0.173)	
Good mammography access	4.640***	7.986***	4.183***	8.154***	8.746***
	(0.258)	(0.712)	(0.243)	(0.894)	(0.974)
Previous breast biopsy or lumpectomy	0.992	1.101	1.078	1.060	1.152
	(0.0462)	(0.0909)	(0.0643)	(0.107)	(0.190)
Good GP hours	0.940	0.919	0.892**	0.928	0.887
	(0.0416)	(0.0562)	(0.0387)	(0.0694)	(0.0677)
Good GP numbers	0.870**	0.850*	0.887**	0.822*	0.837*
	(0.0409)	(0.0539)	(0.0394)	(0.0653)	(0.0676)
Good bulk billing access	0.873***	0.863**	0.905**	0.914	0.874+
	(0.0330)	(0.0461)	(0.0338)	(0.0598)	(0.0611)
Good female GP access	1.150**	1.197**	1.113*	1.230**	1.186*
	(0.0494)	(0.0720)	(0.0466)	(0.0919)	(0.0909)
Ex-smoker			0.883**		
			(0.0404)		
Smoker			0.589***		
			(0.0351)		
Risky drinker			0.867+		
			(0.0640)		

	Pooled logistic regression	Panel RE logistic regression	Panel RE expanded model	Panel RE balanced panel	Panel RE women without abnormal mammo-gram.
Underweight			0.997		
			(0.181)		
Overweight			0.961		
			(0.0422)		
Obese			0.879*		
			(0.0449)		
1 chronic disease			1.033		
			(0.0444)		
Multimorbidity			0.979		
			(0.0468)		
Very good health			0.983		
			(0.0611)		
Good health			0.878+		
			(0.0592)		
Fair health			0.661***		
			(0.0548)		
Poor health			0.447***		
			(0.0615)		
GP visits- 3 or 4			1.237***		
			(0.0495)		
GP visits- 5 or 6			1.205***		
			(0.0619)		
GP visits- 7 or more			1.279***		
			(0.0759)		
N	35478	35478	34164	25469	22426
AIC	25400.8	23467.0	22916.8	14837.1	15744.4
BIC	25748.3	23823.0	23389.4	15179.2	16177.4

Notes: Exponentiated coefficients; Standard errors in parentheses; Significance: $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: OR>1 indicates increased odds of having screening test within last two years, OR<1 indicates decreased odds of screening in last two years. Reference categories (OR=1) are omitted. Base case is women from NSW, major city, did not complete HSC, copes easily with available income, is not in workforce, non-smoker of normal weight, with no chronic diseases, and sees GP 1-2 times a year, and has excellent self-reported health.

Table 49: Results of 2 stage least square (2SLS) IV analysis using satisfaction with GP manner as IV for personal continuity – pooled IV regression

	1st stage regression	2nd stage regression with instrumented personal continuity (Model 8)	
Satisfied with GP manner	0.179(0.008)	0.23(0.045)	Instrumented personal continuity
Site continuity	-0.37(0.005)	0.098(0.017)	Site continuity
Wave 3	0.014(0.007)	-0.025(0.007)	Wave 3
Wave 4	0.024(0.009)	-0.071(0.009)	Wave 4
Wave 5	0.017(0.011)	-0.068(0.012)	Wave 5
Wave 6	-0.009(0.011)	-0.083(0.012)	Wave 6
Age- thirties	0.007(0.009)	-0.011(0.01)	Age-thirties
Age-forties	-0.069(0.094)	-0.171(0.101)	Age-forties
History abnormal Pap	-0.002(0.005)	0.074(0.005)	History abnormal Pap
Good access to pap smears	0.065(0.008)	0.175(0.009)	Good access to pap smears
Good GP hours	0.047(0.005)	-0.018(0.006)	Good GP hours
Good GP numbers	0.002(0.006)	-0.02(0.006)	Good GP numbers
Good bulk-billing access	0.011(0.005)	-0.037(0.005)	Good bulk-billing access
Good access to female GP	0.016(0.005)	0.039(0.006)	Good access to female GP
Victoria	-0.037(0.006)	0.035(0.006)	Victoria
Queensland	-0.013(0.006)	0.009(0.007)	Queensland
South Australia	-0.031(0.009)	0.037(0.009)	South Australia
Western Australia	-0.006(0.008)	-0.017(0.009)	Western Australia
Tasmania	0.019(0.012)	0.004(0.013)	Tasmania
Northern Territory	-0.117(0.022)	0.025(0.024)	Northern Territory
Australian Capital Territory	-0.004(0.015)	0.005(0.016)	Australian Capital Territory
Australian-born	0.029(0.009)	-0.02(0.009)	Australian-born
Inner regional	0.067(0.005)	0(0.006)	Inner regional
Outer regional	0.055(0.007)	0.011(0.008)	Outer regional
Remote	0.009(0.013)	0.035(0.014)	Remote
Married	0.044(0.005)	0.038(0.006)	Married
High School Certificate	-0.023(0.009)	0.02(0.009)	High School Certificate
Trade	-0.022(0.008)	0.026(0.009)	Trade
University	-0.097(0.008)	0.055(0.01)	University
Income impossible	0.034(0.018)	-0.039(0.019)	Income impossible
Always difficult	0.008(0.008)	-0.019(0.009)	Always difficult
Sometimes difficult	0.001(0.006)	-0.009(0.007)	Sometimes difficult
Not bad income	0.008(0.006)	-0.001(0.007)	Not bad income
Employed	-0.037(0.006)	-0.006(0.007)	Employed

Unemployed	-0.007(0.012)	-0.025(0.013)	**Unemployed**
Private hospital insurance	0.024(0.005)	0.05(0.005)	**Private hospital insurance**
Health care card holder	0.019(0.006)	-0.006(0.007)	**Health care card holder**

First stage F = 567.44
Anderson-Rubin Wald test Chi-sq(1) = 27.01 P-val = 0.0000
Notes: Results show coefficients with standard errors in parentheses. Reference categories are omitted. Base case is women aged between 20 and 29.99, from NSW, living in major city, did not complete high school certificate, copes easily with available income, and is not in workforce.

Table 50: Results of 2 stage least square (2SLS) IV analysis using satisfaction with GP manner as IV for personal continuity- panel IV regression

	1st stage regression	2nd stage regression with instrumented personal continuity (Model 9)	
Satisfied with GP manner	0.164(0.006)	0.218(0.052)	**Instrumented personal continuity**
Site continuity	-0.375(0.003)	0.095(0.02)	**Site continuity**
Wave 3	0.012(0.006)	-0.02(0.007)	**Wave 3**
Wave 4	0.025(0.008)	-0.063(0.009)	**Wave 4**
Wave 5	0.021(0.011)	-0.061(0.012)	**Wave 5**
Wave 6	-0.004(0.011)	-0.075(0.012)	**Wave 6**
Age-thirties	0.004(0.009)	-0.016(0.009)	**Age-thirties**
Age-forties	-0.077(0.083)	-0.169(0.116)	**Age-forties**
History abnormal Pap	-0.002(0.005)	0.063(0.005)	**History abnormal Pap**
Good access to pap smears	0.061(0.007)	0.171(0.011)	**Good access to pap smears**
Good GP hours	0.045(0.005)	-0.016(0.006)	**Good GP hours**
Good GP numbers	0.002(0.006)	-0.02(0.006)	**Good GP numbers**
Good bulk-billing access	0.008(0.005)	-0.03(0.005)	**Good bulk-billing access**
Good access to female GP	0.018(0.005)	0.036(0.006)	**Good access to female GP**
Victoria	-0.035(0.007)	0.03(0.007)	**Victoria**
Queensland	-0.01(0.007)	0.006(0.008)	**Queensland**
South Australia	-0.027(0.01)	0.036(0.01)	**South Australia**
Western Australia	-0.004(0.009)	-0.019(0.01)	**Western Australia**
Tasmania	0.028(0.014)	0.001(0.015)	**Tasmania**
Northern Territory	-0.108(0.02)	0.022(0.025)	**Northern Territory**
Australian Capital Territory	0.006(0.016)	0.003(0.017)	**Australian Capital Territory**
Australian-born	0.033(0.01)	-0.017(0.011)	**Australian-born**
Inner regional	0.059(0.006)	0(0.007)	**Inner regional**
Outer regional	0.048(0.008)	0.013(0.008)	**Outer regional**
Remote	0.005(0.014)	0.031(0.015)	**Remote**
Married	0.042(0.005)	0.035(0.006)	**Married**

	1st stage regression	2nd stage regression with instrumented personal continuity (Model 9)	
High School Certificate	-0.025(0.01)	0.021(0.011)	**High School Certificate**
Trade	-0.024(0.009)	0.024(0.01)	**Trade**
University	-0.098(0.009)	0.056(0.011)	**University**
Income impossible	0.019(0.018)	-0.028(0.019)	**Income impossible**
Always difficult	0.009(0.008)	-0.013(0.009)	**Always difficult**
Sometimes difficult	0.002(0.006)	-0.007(0.007)	**Sometimes difficult**
Not bad income	0.008(0.006)	0(0.006)	**Not bad income**
Employed	-0.038(0.006)	-0.01(0.007)	**Employed**
Unemployed	-0.01(0.013)	-0.02(0.014)	**Unemployed**
Private hospitalInsurance	0.023(0.005)	0.048(0.006)	**Private hospitalInsurance**
Health care card holder	0.015(0.006)	-0.004(0.007)	**Health care card holder**

First stage F = 470.09
Anderson-Rubin Wald test Chi-sq(1) = 6.79 P-val = 0.0092
: Results show coefficients with standard errors in parentheses.

Reference categories are omitted. Base case is women aged between 20 and 29.99, from NSW, living in major city, did not complete high school certificate, copes easily with available income, and is not in workforce.

10.6 Chapter 7 – Continuity of care and Pap testing

10.6.1 MBS item number descriptors for Pap testing

Item 73053. Cytology of a smear from cervix where the smear is prepared by direct application of the specimen to a slide, excluding the use of liquid-based slide preparation techniques, and the stained smear is microscopically examined by or on behalf of a pathologist— each examination:

(a) for the detection of precancerous or cancerous changes in women with no symptoms, signs or recent history suggestive of cervical neoplasia; or

(b) if a further specimen is taken due to an unsatisfactory smear taken for the purposes of paragraph (a); or

(c) if there is inadequate information provided to use item 73055.

Item 7305. Cytology of a smear from cervix, not associated with item 73053, where the smear is prepared by direct application of the specimen to a slide, excluding the use of liquid-based slide preparation techniques, and the stained smear is microscopically examined by or on behalf of a pathologist— each test:

(a) for the management of previously detected abnormalities including precancerous or cancerous conditions; or

(b) for the investigation of women with symptoms, signs or recent history suggestive of cervical neoplasia.

(Item number 73069 added to MBS from 1 May 2017.)

Item 73069. Cytology of a specimen obtained from cervix or vagina, not associated with item 73053, 73055 or 73057, where the slide is prepared by liquid-based preparation techniques, and the slide is microscopically examined by or on behalf of a pathologist using manual or semi-automated image analysis methods.

10.6.2 Variable list and summary statistics

Table 51: Variables Used within Chapter 7 analyses - description and categories

Variable name	Description	Variable description and categories
Continuity of care	Pattern of care categorised according to self-reported GP and practice continuity	2 = personal continuity of care (all care provided by one GP); 1 = site continuity of care (all care from one practice but different GPs); 0 = neither site nor personal continuity*
Pap smear in last 2 years	Pap smear within past 24 months	1 = Yes; 0 = No
Pap smear in last 27 months	Pap smear within past 27 months	Pragmatic threshold for being overdue Pap test 1 = Yes; 0 = No
Months overdue	Number of months over 27 months since last Pap test	Continuous variable
Age	Age in years	
Age^2	Age in years	
Year	Year of data	Years from 2000-09
Access to Pap smear	Access to Pap smear	Pap smear access considered Good or better 1 = Yes*; 0 = No
Access to female GP	Access to female GP	Female GP access considered Good or better 1 = Yes*; 0 = No
Access to bulk-billing	Access to Pap smear	Pap smear access considered Good or better 1 = Yes*; 0 = No
Number of GPs	Self-rated access to quantity of GPs	Access to number of GPs considered Good or better 1 = Yes*; 0 = No
GP hours	Self-rating of hours of GP	GP hours considered Good or better 1 = Yes*; 0 = No
State	State or territory of residence in Australia	1 = NSW*; 2 = Qld; 3 = SA; 4 = WA; 5 = Tas; 6 = ACT; 7 = NT (note Victoria excluded)
Australian-born	Country of birth	1 = Australia*; 0 = other country of birth

Variable name	Description	Variable description and categories
ARIA group	Residence coded according to Accessibility/remoteness index of Australia (ARIA)	1 = major city*; 2 = inner regional, 3 = outer regional; 4 = Remote or very remote
Married	Marital status	1 = Married or living with de facto*; 0 = otherwise
Education	Highest educational attainment	1 = did not complete Higher School Certificate (HSC)*; 2 = HSC completion; 3 = Trade/Diploma; 4 = University Graduate
Income	Ability to cope with available income	1 = impossible; 2 = difficult all the time; 3 = difficult some of the time; 4 = not too bad; 5 = easy*
Employed	Labour force participation	1 = labour force (full time, casual or part-time) *; 0 = not in labour force
HCC	Possession of concessional health care card	1 = health care card (HCC) holder; 0 = without HCC *
GP numbers	Number of GPs	Availability of Number of GPs Good or better = 1*; Fair or Poor = 0
GP hours	Hours of access to GP	Hours of GP access Good or better = 1*; Fair or Poor = 0
Female GP	Access to a female GP	Access to female GP Good or better = 1*; Fair or Poor = 0
Bulk-billing access	Availability of bulk-billing	Good or better = 1*; Fair or Poor = 0
Personal manner of GP	Patient rating of personal manner of last GP seen	Good or better = 1; Fair or Poor = 0 (asked only of women in the young cohort)
Living with children	Whether women report living with children	Living with own children = 1; Not living with own children = 0 (women in young cohort only

*Indicates reference category in logistic regression

Table 52: Summary statistics for full sample of women for Pap test analysis using Medicare data

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Pap test													
In last 2 years	0.41 (0.492)	0.415 (0.493)	0.434 (0.496)	0.419 (0.493)	0.416 (0.493)	0.425 (0.494)	0.396 (0.489)	0.412 (0.492)	0.409 (0.492)	0.387 (0.487)	0.371 (0.483)	0.34 (0.474)	0.402 (0.49)
In previous 27 months	0.488 (0.5)	0.492 (0.5)	0.518 (0.5)	0.509 (0.5)	0.507 (0.5)	0.513 (0.5)	0.497 (0.5)	0.508 (0.5)	0.509 (0.5)	0.492 (0.5)	0.466 (0.499)	0.437 (0.496)	0.494 (0.5)
Months Overdue	20.098 (11.853)	25.026 (16.92)	28.891 (21.977)	32.73 (26.74)	34.522 (30.93)	38.166 (34.913)	42.54 (39.572)	44.214 (43.003)	47.112 (46.98)	49.501 (50.805)	53.668 (54.243)	56.959 (57.942)	40.533 (41.83)
Continuity of care													
Personal continuity	0.378 (0.485)	0.367 (0.482)	0.377 (0.485)	0.382 (0.486)	0.364 (0.481)	0.374 (0.484)	0.388 (0.487)	0.376 (0.485)	0.382 (0.486)	0.381 (0.486)	0.376 (0.484)	0.382 (0.486)	0.378 (0.485)
Site continuity	0.251 (0.434)	0.243 (0.429)	0.249 (0.433)	0.259 (0.438)	0.253 (0.435)	0.259 (0.438)	0.273 (0.445)	0.27 (0.444)	0.274 (0.446)	0.287 (0.452)	0.293 (0.455)	0.294 (0.456)	0.268 (0.443)
Age (years)	41.293 (13.177)	39.437 (13.544)	42.099 (13.384)	43.747 (13.298)	41.858 (13.558)	44.392 (13.471)	46.865 (13.252)	44.83 (13.548)	47.159 (13.493)	48.105 (13.463)	47.994 (13.536)	50.113 (13.483)	45.011 (13.792)
Age*Age	1878.743 (1003.85)	1738.713 (1058.90)	1951.449 (1073.52)	2090.619 (1092.47)	1935.884 (1140.889)	2152.102 (1160.54)	2371.963 (1168.29)	2193.26 (1221.25)	2405.997 (1243.35)	2495.321 (1268.46)	2486.581 (1303.04)	2693.142 (1324.91)	2216.206 (1213.89)
Access to services													
Pap access (good or better)	0.934 (0.249)	0.927 (0.26)	0.93 (0.256)	0.926 (0.261)	0.921 (0.27)	0.924 (0.265)	0.925 (0.263)	0.916 (0.278)	0.918 (0.274)	0.917 (0.276)	0.914 (0.281)	0.916 (0.277)	0.922 (0.268)
Good GP hours	0.742 (0.438)	0.722 (0.448)	0.719 (0.449)	0.708 (0.455)	0.69 (0.462)	0.691 (0.462)	0.691 (0.462)	0.685 (0.465)	0.685 (0.465)	0.689 (0.463)	0.697 (0.459)	0.696 (0.46)	0.7 (0.458)
Good GP numbers	0.782 (0.413)	0.76 (0.427)	0.759 (0.428)	0.746 (0.436)	0.734 (0.442)	0.731 (0.444)	0.721 (0.448)	0.703 (0.457)	0.702 (0.458)	0.696 (0.46)	0.703 (0.457)	0.702 (0.457)	0.727 (0.446)

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Good bulk-billing access	0.671 (0.47)	0.643 (0.479)	0.634 (0.482)	0.568 (0.495)	0.507 (0.50)	0.502 (0.50)	0.514 (0.50)	0.54 (0.498)	0.539 (0.498)	0.55 (0.498)	0.571 (0.495)	0.571 (0.495)	0.566 (0.496)
Good access to female GP	0.731 (0.444)	0.719 (0.449)	0.719 (0.449)	0.709 (0.454)	0.703 (0.457)	0.703 (0.457)	0.709 (0.454)	0.707 (0.455)	0.708 (0.455)	0.713 (0.452)	0.721 (0.449)	0.722 (0.448)	0.713 (0.452)
State/territory													
Qld	0.29 (0.454)	0.293 (0.455)	0.292 (0.455)	0.294 (0.456)	0.297 (0.457)	0.297 (0.457)	0.30 (0.458)	0.302 (0.459)	0.303 (0.459)	0.306 (0.461)	0.306 (0.461)	0.306 (0.461)	0.299 (0.458)
SA	0.114 (0.318)	0.111 (0.314)	0.111 (0.315)	0.112 (0.315)	0.112 (0.315)	0.111 (0.314)	0.113 (0.317)	0.112 (0.315)	0.111 (0.314)	0.11 (0.313)	0.11 (0.313)	0.11 (0.313)	0.111 (0.315)
WA	0.12 (0.325)	0.125 (0.331)	0.126 (0.332)	0.124 (0.329)	0.127 (0.333)	0.128 (0.334)	0.124 (0.329)	0.127 (0.332)	0.127 (0.333)	0.127 (0.333)	0.127 (0.333)	0.127 (0.333)	0.126 (0.331)
Tas	0.054 (0.226)	0.054 (0.225)	0.053 (0.224)	0.052 (0.222)	0.052 (0.222)	0.051 (0.22)	0.052 (0.222)	0.053 (0.223)	0.052 (0.221)	0.051 (0.221)	0.053 (0.223)	0.052 (0.222)	0.052 (0.223)
NT	0.019 (0.137)	0.017 (0.13)	0.018 (0.133)	0.018 (0.134)	0.016 (0.125)	0.017 (0.128)	0.017 (0.13)	0.015 (0.123)	0.016 (0.126)	0.016 (0.124)	0.014 (0.118)	0.015 (0.12)	0.016 (0.127)
ACT	0.02 (0.14)	0.021 (0.143)	0.021 (0.144)	0.022 (0.147)	0.023 (0.15)	0.023 (0.149)	0.021 (0.144)	0.022 (0.148)	0.022 (0.147)	0.022 (0.147)	0.022 (0.145)	0.021 (0.145)	0.022 (0.146)
Australian-born	0.829 (0.376)	0.845 (0.362)	0.837 (0.37)	0.831 (0.375)	0.848 (0.359)	0.84 (0.366)	0.829 (0.377)	0.849 (0.358)	0.842 (0.365)	0.843 (0.364)	0.848 (0.359)	0.843 (0.364)	0.84 (0.366)
Region													
Inner regional	0.347 (0.476)	0.338 (0.473)	0.343 (0.475)	0.331 (0.471)	0.308 (0.462)	0.313 (0.464)	0.314 (0.464)	0.307 (0.461)	0.311 (0.463)	0.315 (0.465)	0.314 (0.464)	0.319 (0.466)	0.321 (0.467)
Outer regional	0.212 (0.409)	0.204 (0.403)	0.206 (0.405)	0.202 (0.402)	0.191 (0.393)	0.194 (0.395)	0.194 (0.395)	0.191 (0.393)	0.191 (0.393)	0.19 (0.392)	0.186 (0.389)	0.187 (0.39)	0.195 (0.396)

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Remote	0.056 (0.23)	0.051 (0.22)	0.052 (0.221)	0.051 (0.221)	0.046 (0.209)	0.046 (0.21)	0.048 (0.215)	0.047 (0.212)	0.048 (0.213)	0.046 (0.21)	0.044 (0.205)	0.044 (0.205)	0.048 (0.214)
Married	0.688 (0.463)	0.649 (0.477)	0.67 (0.47)	0.717 (0.45)	0.694 (0.461)	0.705 (0.456)	0.748 (0.434)	0.736 (0.441)	0.739 (0.439)	0.755 (0.43)	0.745 (0.436)	0.744 (0.436)	0.717 (0.45)
Education													
HSC	0.212 (0.409)	0.16 (0.366)	0.159 (0.366)	0.192 (0.394)	0.161 (0.367)	0.16 (0.367)	0.186 (0.389)	0.161 (0.367)	0.16 (0.367)	0.18 (0.385)	0.176 (0.381)	0.176 (0.38)	0.173 (0.378)
Trade	0.224 (0.417)	0.242 (0.428)	0.238 (0.426)	0.229 (0.42)	0.247 (0.431)	0.242 (0.428)	0.237 (0.425)	0.246 (0.431)	0.243 (0.429)	0.243 (0.429)	0.249 (0.432)	0.248 (0.432)	0.241 (0.428)
University	0.25 (0.433)	0.293 (0.455)	0.273 (0.445)	0.268 (0.443)	0.291 (0.454)	0.275 (0.447)	0.267 (0.442)	0.288 (0.453)	0.276 (0.447)	0.289 (0.453)	0.299 (0.458)	0.291 (0.454)	0.28 (0.449)
Financial													
Income Impossible	0.026 (0.159)	0.019 (0.135)	0.019 (0.137)	0.018 (0.135)	0.02 (0.139)	0.02 (0.139)	0.019 (0.138)	0.021 (0.142)	0.02 (0.141)	0.02 (0.138)	0.021 (0.145)	0.022 (0.147)	0.02 (0.141)
Always Difficult	0.114 (0.318)	0.121 (0.326)	0.118 (0.323)	0.113 (0.316)	0.129 (0.335)	0.127 (0.333)	0.118 (0.322)	0.129 (0.336)	0.128 (0.334)	0.121 (0.326)	0.133 (0.34)	0.131 (0.338)	0.124 (0.329)
Sometimes Difficult	0.27 (0.444)	0.296 (0.457)	0.294 (0.456)	0.269 (0.444)	0.298 (0.457)	0.295 (0.456)	0.265 (0.442)	0.288 (0.453)	0.283 (0.451)	0.271 (0.445)	0.292 (0.455)	0.289 (0.453)	0.284 (0.451)
Not bad income	0.427 (0.495)	0.397 (0.489)	0.399 (0.49)	0.42 (0.494)	0.395 (0.489)	0.398 (0.49)	0.42 (0.494)	0.393 (0.488)	0.397 (0.489)	0.414 (0.493)	0.394 (0.489)	0.398 (0.489)	0.404 (0.491)
Employment status													
Employed	0.788 (0.409)	0.787 (0.409)	0.784 (0.411)	0.782 (0.413)	0.758 (0.429)	0.756 (0.43)	0.743 (0.437)	0.733 (0.443)	0.729 (0.445)	0.724 (0.447)	0.691 (0.462)	0.685 (0.465)	0.745 (0.436)

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Unemployed	0.029 (0.167)	0.031 (0.175)	0.029 (0.167)	0.028 (0.166)	0.033 (0.178)	0.031 (0.173)	0.026 (0.159)	0.027 (0.163)	0.025 (0.157)	0.028 (0.165)	0.028 (0.164)	0.026 (0.159)	0.028 (0.166)
Insurance													
Private Hospital Insurance	0.424 (0.494)	0.483 (0.5)	0.506 (0.50)	0.547 (0.498)	0.519 (0.50)	0.535 (0.499)	0.571 (0.495)	0.555 (0.497)	0.563 (0.496)	0.595 (0.491)	0.592 (0.491)	0.598 (0.49)	0.543 (0.498)
Health Care Card Holder	0.34 (0.474)	0.2 (0.4)	0.2 (0.4)	0.343 (0.475)	0.222 (0.415)	0.223 (0.416)	0.341 (0.474)	0.232 (0.422)	0.234 (0.423)	0.324 (0.468)	0.258 (0.438)	0.261 (0.439)	0.265 (0.441)
Number of observations	11253	11140	12818	12141	12176	13759	12240	12683	14098	14218	13007	14272	153807

Figures indicate proportion of sample with standard deviation in parentheses.

Table 53: Summary stats for women in the ALSWH middle cohort

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Pap test													
In last 2 years	0.45 (0.498)	0.422 (0.494)	0.442 (0.497)	0.441 (0.497)	0.396 (0.489)	0.41 (0.492)	0.397 (0.489)	0.365 (0.482)	0.381 (0.486)	0.355 (0.479)	0.331 (0.471)	0.32 (0.466)	0.393 (0.488)
In previous 27 months	0.54 (0.498)	0.52 (0.5)	0.539 (0.499)	0.546 (0.498)	0.509 (0.5)	0.521 (0.5)	0.515 (0.5)	0.486 (0.5)	0.497 (0.5)	0.479 (0.5)	0.44 (0.496)	0.433 (0.496)	0.502 (0.5)
Months overdue	18.445 (12.074)	23.327 (17.174)	27.727 (22.052)	31.408 (26.825)	34.772 (31.739)	39.763 (35.96)	43.877 (40.597)	49.961 (45.346)	53.439 (49.684)	57.34 (54.296)	64.986 (58.88)	67.463 (62.863)	44.051 (45.345)
Continuity of care													
Personal continuity	0.452 (0.498)	0.467 (0.499)	0.462 (0.499)	0.461 (0.499)	0.47 (0.499)	0.466 (0.499)	0.465 (0.499)	0.49 (0.5)	0.48 (0.5)	0.48 (0.5)	0.489 (0.5)	0.482 (0.5)	0.472 (0.499)
Site continuity	0.275 (0.447)	0.268 (0.443)	0.274 (0.446)	0.274 (0.446)	0.27 (0.444)	0.276 (0.447)	0.276 (0.447)	0.269 (0.443)	0.277 (0.448)	0.277 (0.448)	0.286 (0.452)	0.29 (0.454)	0.276 (0.447)

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Age (years)	51.52 (1.463)	52.529 (1.47)	53.512 (1.465)	54.512 (1.465)	55.531 (1.468)	56.493 (1.467)	57.493 (1.467)	58.518 (1.471)	59.497 (1.469)	60.497 (1.469)	61.568 (1.471)	62.539 (1.468)	57.098 (3.752)
Age*Age	2656.42 (150.797)	2761.486 (154.467)	2865.717 (156.942)	2973.72 (159.866)	3085.842 (163.08)	3193.587 (165.864)	3307.577 (168.807)	3426.562 (172.213)	3542.043 (174.85)	3662.037 (177.787)	3792.801 (181.243)	3913.243 (183.718)	3274.225 (428.578)
Good Access to services													
Pap testing	0.952 (0.215)	0.946 (0.227)	0.946 (0.227)	0.946 (0.227)	0.942 (0.234)	0.943 (0.232)	0.943 (0.232)	0.936 (0.244)	0.938 (0.242)	0.938 (0.242)	0.936 (0.245)	0.937 (0.243)	0.942 (0.234)
GP hours	0.76 (0.427)	0.736 (0.441)	0.727 (0.445)	0.727 (0.445)	0.711 (0.453)	0.708 (0.455)	0.708 (0.455)	0.709 (0.454)	0.705 (0.456)	0.705 (0.456)	0.727 (0.446)	0.719 (0.449)	0.72 (0.449)
GP numbers	0.793 (0.405)	0.759 (0.428)	0.757 (0.429)	0.757 (0.429)	0.743 (0.437)	0.736 (0.441)	0.736 (0.441)	0.715 (0.451)	0.71 (0.454)	0.71 (0.454)	0.729 (0.445)	0.724 (0.447)	0.739 (0.439)
Bulk-billing GP	0.67 (0.47)	0.622 (0.485)	0.611 (0.488)	0.611 (0.488)	0.536 (0.499)	0.521 (0.5)	0.521 (0.5)	0.593 (0.491)	0.583 (0.493)	0.583 (0.493)	0.631 (0.483)	0.622 (0.485)	0.592 (0.492)
Female GP	0.741 (0.438)	0.726 (0.446)	0.725 (0.447)	0.725 (0.447)	0.724 (0.447)	0.72 (0.449)	0.72 (0.449)	0.726 (0.446)	0.725 (0.447)	0.725 (0.447)	0.743 (0.437)	0.742 (0.438)	0.728 (0.445)
State													
Queensland	0.29 (0.454)	0.295 (0.456)	0.293 (0.455)	0.293 (0.455)	0.297 (0.457)	0.297 (0.457)	0.297 (0.457)	0.3 (0.458)	0.301 (0.459)	0.301 (0.459)	0.302 (0.459)	0.302 (0.459)	0.297 (0.457)
South Australia	0.114 (0.318)	0.113 (0.317)	0.114 (0.317)	0.114 (0.317)	0.117 (0.322)	0.115 (0.319)	0.115 (0.319)	0.119 (0.324)	0.116 (0.32)	0.116 (0.32)	0.119 (0.323)	0.116 (0.321)	0.116 (0.32)
Western Australia	0.12 (0.325)	0.12 (0.326)	0.123 (0.328)	0.123 (0.328)	0.12 (0.325)	0.123 (0.329)	0.123 (0.329)	0.12 (0.325)	0.122 (0.327)	0.122 (0.327)	0.12 (0.325)	0.122 (0.327)	0.122 (0.327)
Tasmania	0.055 (0.228)	0.057 (0.231)	0.054 (0.227)	0.054 (0.227)	0.058 (0.234)	0.055 (0.228)	0.055 (0.228)	0.058 (0.234)	0.056 (0.229)	0.056 (0.229)	0.059 (0.235)	0.056 (0.231)	0.056 (0.23)
Northern Territory	0.023 (0.151)	0.021 (0.144)	0.022 (0.145)	0.022 (0.145)	0.018 (0.132)	0.019 (0.136)	0.019 (0.136)	0.016 (0.126)	0.017 (0.129)	0.017 (0.129)	0.014 (0.119)	0.015 (0.122)	0.019 (0.135)
ACT	0.016 (0.125)	0.015 (0.12)	0.017 (0.128)	0.017 (0.128)	0.015 (0.121)	0.016 (0.126)	0.016 (0.126)	0.015 (0.121)	0.016 (0.125)	0.016 (0.125)	0.014 (0.117)	0.015 (0.121)	0.016 (0.124)
Australian-born	0.771 (0.42)	0.768 (0.422)	0.77 (0.421)	0.77 (0.421)	0.766 (0.423)	0.769 (0.422)	0.769 (0.421)	0.769 (0.422)	0.77 (0.421)	0.77 (0.421)	0.767 (0.423)	0.769 (0.421)	0.769 (0.421)
Region													
Inner regional	0.381 (0.486)	0.38 (0.485)	0.38 (0.485)	0.38 (0.485)	0.361 (0.48)	0.358 (0.479)	0.358 (0.479)	0.363 (0.481)	0.362 (0.481)	0.362 (0.481)	0.366 (0.482)	0.367 (0.482)	0.368 (0.482)

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Outer regional	0.235 (0.424)	0.231 (0.421)	0.229 (0.421)	0.229 (0.42)	0.217 (0.412)	0.217 (0.412)	0.217 (0.412)	0.219 (0.414)	0.216 (0.411)	0.216 (0.411)	0.213 (0.409)	0.211 (0.408)	0.221 (0.415)
Remote	0.066 (0.248)	0.06 (0.238)	0.059 (0.236)	0.059 (0.236)	0.051 (0.22)	0.051 (0.22)	0.051 (0.22)	0.051 (0.22)	0.051 (0.22)	0.051 (0.22)	0.047 (0.211)	0.047 (0.211)	0.054 (0.225)
Married	0.828 (0.378)	0.812 (0.391)	0.812 (0.391)	0.812 (0.391)	0.798 (0.402)	0.796 (0.403)	0.796 (0.403)	0.785 (0.411)	0.781 (0.414)	0.781 (0.414)	0.766 (0.423)	0.762 (0.426)	0.794 (0.405)
Education													
High School Certificate	0.19 (0.392)	0.162 (0.369)	0.161 (0.367)	0.19 (0.392)	0.165 (0.371)	0.163 (0.369)	0.19 (0.392)	0.162 (0.369)	0.161 (0.367)	0.19 (0.392)	0.193 (0.395)	0.19 (0.392)	0.177 (0.381)
Trade	0.207 (0.405)	0.195 (0.396)	0.199 (0.399)	0.205 (0.404)	0.197 (0.397)	0.199 (0.399)	0.206 (0.405)	0.196 (0.397)	0.198 (0.399)	0.206 (0.404)	0.199 (0.399)	0.206 (0.404)	0.201 (0.401)
University	0.172 (0.377)	0.141 (0.348)	0.14 (0.348)	0.17 (0.376)	0.133 (0.34)	0.138 (0.345)	0.169 (0.375)	0.133 (0.34)	0.138 (0.344)	0.168 (0.374)	0.161 (0.368)	0.168 (0.374)	0.153 (0.36)
Financial													
Income impossible	0.022 (0.147)	0.019 (0.136)	0.019 (0.138)	0.021 (0.144)	0.022 (0.148)	0.021 (0.145)	0.022 (0.145)	0.023 (0.15)	0.022 (0.147)	0.022 (0.145)	0.024 (0.154)	0.025 (0.157)	0.022 (0.146)
Always difficult	0.107 (0.31)	0.111 (0.315)	0.108 (0.311)	0.11 (0.313)	0.123 (0.328)	0.12 (0.325)	0.111 (0.314)	0.121 (0.326)	0.12 (0.325)	0.111 (0.315)	0.127 (0.333)	0.125 (0.33)	0.116 (0.32)
Sometimes difficult	0.24 (0.427)	0.27 (0.444)	0.273 (0.445)	0.243 (0.429)	0.267 (0.442)	0.268 (0.443)	0.243 (0.429)	0.248 (0.432)	0.247 (0.431)	0.244 (0.429)	0.257 (0.437)	0.256 (0.437)	0.254 (0.435)
Not bad income	0.455 (0.498)	0.432 (0.495)	0.428 (0.495)	0.451 (0.498)	0.431 (0.495)	0.429 (0.495)	0.45 (0.498)	0.427 (0.495)	0.428 (0.495)	0.45 (0.497)	0.429 (0.495)	0.43 (0.495)	0.437 (0.496)
Employment status													
Employed	0.77 (0.421)	0.761 (0.426)	0.762 (0.426)	0.762 (0.426)	0.703 (0.457)	0.71 (0.454)	0.71 (0.454)	0.666 (0.472)	0.671 (0.47)	0.671 (0.47)	0.593 (0.491)	0.597 (0.491)	0.698 (0.459)
Unemployed	0.018 (0.132)	0.016 (0.127)	0.015 (0.122)	0.015 (0.122)	0.016 (0.124)	0.015 (0.122)	0.015 (0.122)	0.013 (0.113)	0.012 (0.108)	0.012 (0.108)	0.008 (0.089)	0.008 (0.089)	0.014 (0.115)
Insurance													
Private hospital insurance	0.482 (0.5)	0.632 (0.482)	0.639 (0.48)	0.639 (0.48)	0.624 (0.484)	0.632 (0.482)	0.632 (0.482)	0.624 (0.485)	0.627 (0.484)	0.627 (0.484)	0.627 (0.484)	0.633 (0.482)	0.618 (0.486)

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Health care card holder	0.452 (0.498)	0.252 (0.434)	0.241 (0.428)	0.454 (0.498)	0.291 (0.454)	0.279 (0.449)	0.456 (0.498)	0.308 (0.462)	0.297 (0.457)	0.455 (0.498)	0.355 (0.479)	0.346 (0.476)	0.352 (0.478)

Figures indicate proportion of sample with standard deviation in parentheses.

Table 54: Summary statistics for women in the ALSWH young cohort

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Pap test													
In last 2 years	0.36 (0.48)	0.409 (0.492)	0.426 (0.495)	0.394 (0.489)	0.431 (0.495)	0.439 (0.496)	0.39 (0.488)	0.441 (0.496)	0.431 (0.495)	0.409 (0.492)	0.393 (0.488)	0.352 (0.478)	0.408 (0.491)
In previous 27 months	0.422 (0.494)	0.469 (0.499)	0.495 (0.5)	0.466 (0.499)	0.505 (0.5)	0.505 (0.5)	0.472 (0.499)	0.519 (0.5)	0.514 (0.5)	0.497 (0.5)	0.476 (0.499)	0.434 (0.496)	0.483 (0.5)
Months overdue	21.904 (11.332)	26.314 (16.612)	30.077 (21.841)	34.20 (26.593)	34.398 (30.337)	36.658 (33.828)	41.295 (38.312)	40.083 (40.547)	41.566 (43.475)	42.955 (46.317)	45.867 (48.892)	48.572 (51.679)	37.832 (38.407)
Continuity of care													
Personal continuity	0.263 (0.44)	0.263 (0.441)	0.263 (0.441)	0.264 (0.441)	0.263 (0.44)	0.263 (0.44)	0.268 (0.443)	0.266 (0.442)	0.266 (0.442)	0.265 (0.441)	0.265 (0.441)	0.265 (0.441)	0.265 (0.441)
Site continuity	0.214 (0.41)	0.216 (0.412)	0.216 (0.412)	0.236 (0.425)	0.238 (0.426)	0.238 (0.426)	0.27 (0.444)	0.274 (0.446)	0.274 (0.446)	0.299 (0.458)	0.3 (0.458)	0.3 (0.458)	0.259 (0.438)
Age (years)	24.524 (1.468)	25.593 (1.467)	26.593 (1.467)	27.521 (1.462)	28.574 (1.462)	29.574 (1.462)	30.546 (1.457)	31.583 (1.463)	32.583 (1.463)	33.654 (1.471)	34.657 (1.472)	35.657 (1.472)	30.467 (3.746)
Age*Age	603.586 (72.158)	657.131 (75.106)	709.316 (78.038)	759.538 (80.594)	818.622 (83.575)	876.77 (86.498)	935.197 (89.157)	999.647 (92.51)	1063.814 (95.436)	1134.729 (99.144)	1203.286 (102.138)	1273.59 (105.079)	942.253 (227.54)

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Access to services													
Pap access (good or better)	0.904 (0.294)	0.908 (0.289)	0.908 (0.289)	0.897 (0.304)	0.9 (0.3)	0.9 (0.3)	0.897 (0.303)	0.895 (0.306)	0.895 (0.306)	0.892 (0.311)	0.892 (0.311)	0.892 (0.311)	0.898 (0.303)
Good GP hours	0.711 (0.453)	0.708 (0.455)	0.708 (0.455)	0.677 (0.468)	0.67 (0.47)	0.67 (0.47)	0.664 (0.472)	0.659 (0.474)	0.659 (0.474)	0.667 (0.471)	0.667 (0.471)	0.667 (0.471)	0.676 (0.468)
Good GP numbers	0.763 (0.425)	0.761 (0.426)	0.761 (0.426)	0.728 (0.445)	0.725 (0.447)	0.725 (0.447)	0.697 (0.46)	0.69 (0.463)	0.69 (0.463)	0.678 (0.467)	0.677 (0.468)	0.677 (0.468)	0.711 (0.453)
Good bulk-billing access	0.674 (0.469)	0.665 (0.472)	0.665 (0.472)	0.504 (0.5)	0.479 (0.5)	0.479 (0.5)	0.505 (0.5)	0.49 (0.5)	0.49 (0.5)	0.515 (0.5)	0.515 (0.5)	0.515 (0.5)	0.535 (0.499)
Good access to female GP	0.713 (0.452)	0.712 (0.453)	0.712 (0.453)	0.685 (0.465)	0.683 (0.466)	0.683 (0.466)	0.692 (0.462)	0.688 (0.463)	0.688 (0.463)	0.701 (0.458)	0.701 (0.458)	0.701 (0.458)	0.696 (0.46)
State													
Queensland	0.29 (0.454)	0.29 (0.454)	0.29 (0.454)	0.295 (0.456)	0.297 (0.457)	0.297 (0.457)	0.299 (0.458)	0.299 (0.458)	0.299 (0.458)	0.302 (0.459)	0.303 (0.46)	0.303 (0.46)	0.297 (0.457)
South Australia	0.114 (0.317)	0.108 (0.311)	0.108 (0.311)	0.109 (0.312)	0.106 (0.308)	0.106 (0.308)	0.109 (0.311)	0.104 (0.305)	0.104 (0.305)	0.1 (0.3)	0.1 (0.3)	0.1 (0.3)	0.105 (0.307)
Western Australia	0.121 (0.326)	0.13 (0.336)	0.13 (0.336)	0.124 (0.33)	0.133 (0.339)	0.133 (0.339)	0.123 (0.328)	0.131 (0.337)	0.131 (0.337)	0.13 (0.336)	0.129 (0.336)	0.129 (0.336)	0.129 (0.335)
Tasmania	0.052 (0.222)	0.051 (0.219)	0.051 (0.219)	0.048 (0.215)	0.046 (0.21)	0.046 (0.21)	0.046 (0.21)	0.046 (0.21)	0.046 (0.21)	0.045 (0.208)	0.045 (0.208)	0.045 (0.208)	0.047 (0.212)
Northern Territory	0.012 (0.109)	0.013 (0.114)	0.013 (0.114)	0.013 (0.114)	0.014 (0.117)	0.014 (0.117)	0.014 (0.118)	0.015 (0.12)	0.015 (0.12)	0.014 (0.116)	0.014 (0.116)	0.014 (0.116)	0.014 (0.116)
Australian Capital Territory	0.027 (0.162)	0.028 (0.164)	0.028 (0.164)	0.03 (0.171)	0.031 (0.173)	0.031 (0.173)	0.028 (0.165)	0.029 (0.168)	0.029 (0.168)	0.029 (0.167)	0.028 (0.166)	0.028 (0.166)	0.029 (0.168)

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Australian born	0.923 (0.266)	0.927 (0.26)	0.927 (0.26)	0.922 (0.269)	0.927 (0.26)	0.927 (0.26)	0.919 (0.273)	0.926 (0.262)	0.926 (0.262)	0.926 (0.262)	0.926 (0.261)	0.926 (0.261)	0.925 (0.263)
Region													
Inner regional	0.29 (0.454)	0.292 (0.455)	0.292 (0.455)	0.258 (0.438)	0.257 (0.437)	0.257 (0.437)	0.244 (0.429)	0.247 (0.432)	0.247 (0.432)	0.254 (0.435)	0.256 (0.436)	0.256 (0.436)	0.261 (0.439)
Outer regional	0.174 (0.379)	0.174 (0.38)	0.174 (0.38)	0.161 (0.368)	0.165 (0.371)	0.165 (0.371)	0.156 (0.363)	0.16 (0.367)	0.16 (0.367)	0.156 (0.363)	0.156 (0.363)	0.156 (0.363)	0.163 (0.369)
Remote	0.039 (0.193)	0.041 (0.198)	0.041 (0.198)	0.039 (0.195)	0.04 (0.197)	0.04 (0.197)	0.044 (0.205)	0.043 (0.203)	0.043 (0.203)	0.04 (0.196)	0.04 (0.196)	0.04 (0.196)	0.041 (0.198)
Married	0.459 (0.498)	0.477 (0.499)	0.477 (0.499)	0.574 (0.494)	0.592 (0.491)	0.592 (0.491)	0.673 (0.469)	0.687 (0.464)	0.687 (0.464)	0.723 (0.447)	0.723 (0.447)	0.723 (0.447)	0.625 (0.484)
Education													
High School Certificate	0.249 (0.432)	0.157 (0.363)	0.157 (0.363)	0.196 (0.397)	0.157 (0.364)	0.157 (0.364)	0.179 (0.383)	0.157 (0.364)	0.157 (0.364)	0.167 (0.373)	0.156 (0.363)	0.156 (0.363)	0.168 (0.374)
Trade	0.252 (0.434)	0.291 (0.454)	0.291 (0.454)	0.265 (0.441)	0.295 (0.456)	0.295 (0.456)	0.282 (0.45)	0.293 (0.455)	0.293 (0.455)	0.282 (0.45)	0.294 (0.455)	0.294 (0.455)	0.287 (0.452)
University	0.378 (0.485)	0.453 (0.498)	0.453 (0.498)	0.416 (0.493)	0.444 (0.497)	0.444 (0.497)	0.422 (0.494)	0.444 (0.497)	0.444 (0.497)	0.44 (0.496)	0.444 (0.497)	0.444 (0.497)	0.438 (0.496)
Financial													
Income impossible	0.032 (0.176)	0.019 (0.135)	0.019 (0.135)	0.014 (0.118)	0.017 (0.131)	0.017 (0.131)	0.016 (0.126)	0.018 (0.132)	0.018 (0.132)	0.017 (0.129)	0.018 (0.134)	0.018 (0.134)	0.018 (0.134)
Always difficult	0.125 (0.33)	0.131 (0.337)	0.131 (0.337)	0.117 (0.321)	0.135 (0.342)	0.135 (0.342)	0.127 (0.333)	0.136 (0.343)	0.136 (0.343)	0.129 (0.336)	0.137 (0.344)	0.137 (0.344)	0.132 (0.339)

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Sometimes difficult	0.317 (0.465)	0.324 (0.468)	0.324 (0.468)	0.31 (0.462)	0.327 (0.469)	0.327 (0.469)	0.298 (0.458)	0.326 (0.469)	0.326 (0.469)	0.299 (0.458)	0.322 (0.467)	0.322 (0.467)	0.319 (0.466)
Not bad income	0.381 (0.486)	0.36 (0.48)	0.36 (0.48)	0.374 (0.484)	0.36 (0.48)	0.36 (0.48)	0.372 (0.484)	0.36 (0.48)	0.36 (0.48)	0.372 (0.483)	0.362 (0.48)	0.362 (0.48)	0.365 (0.481)
Employment status													
Employed	0.818 (0.386)	0.814 (0.389)	0.814 (0.389)	0.812 (0.391)	0.812 (0.391)	0.812 (0.391)	0.796 (0.403)	0.799 (0.401)	0.799 (0.401)	0.787 (0.409)	0.787 (0.409)	0.787 (0.409)	0.802 (0.399)
Unemployed	0.047 (0.211)	0.047 (0.212)	0.047 (0.212)	0.048 (0.214)	0.05 (0.218)	0.05 (0.218)	0.042 (0.201)	0.041 (0.198)	0.041 (0.198)	0.046 (0.21)	0.046 (0.21)	0.046 (0.21)	0.046 (0.209)
Insurance													
Private hospital insurance	0.329 (0.47)	0.325 (0.468)	0.325 (0.468)	0.41 (0.492)	0.417 (0.493)	0.417 (0.493)	0.477 (0.5)	0.489 (0.5)	0.489 (0.5)	0.557 (0.497)	0.557 (0.497)	0.557 (0.497)	0.454 (0.498)
Health care card holder	0.157 (0.364)	0.145 (0.352)	0.145 (0.352)	0.174 (0.379)	0.154 (0.361)	0.154 (0.361)	0.163 (0.369)	0.158 (0.365)	0.158 (0.365)	0.168 (0.374)	0.159 (0.366)	0.159 (0.366)	0.158 (0.365)

Figures indicate proportion of sample with standard deviation in parentheses.

10.6.3 Regression output and alternative regression models

Table 55: Alternative logistic regression models estimating Pap testing within 27 months using 12 years of data

	Pooled logistic regression	Panel logistic RE	Panel logistic RE balanced	Panel logistic RE -ALSWH young	Panel logistic RE-ALSWH mid
Personal continuity of care	1.087 (0.014)	1.137 (0.028)	1.145 (0.035)	1.16 (0.036)	1.085 (0.042)
Site continuity of care	1.148 (0.015)	1.121 (0.028)	1.144 (0.036)	1.163 (0.035)	1.054 (0.045)
Age	1.038 (0.005)	1.071 (0.009)	1.069 (0.011)	1.274 (0.084)	1.002 (0.156)
Age squared	1 (0)	0.999 (0)	0.999 (0)	0.996 (0.001)	1 (0.001)
Year - 2001	1.019 (0.028)	0.991 (0.031)	0.944 (0.034)	1.12 (0.049)	0.861 (0.049)
2002	1.108 (0.03)	1.122 (0.037)	1.055 (0.042)	1.249 (0.068)	0.976 (0.065)
2003	1.019 (0.028)	1.081 (0.036)	1.097 (0.044)	1.076 (0.067)	0.998 (0.08)
2004	1.024 (0.028)	1.04 (0.037)	0.994 (0.042)	1.163 (0.081)	0.81 (0.08)
2005	1.038 (0.027)	1.048 (0.036)	1.01 (0.043)	1.154 (0.089)	0.843 (0.094)
2006	0.935 (0.025)	0.984 (0.035)	0.971 (0.042)	1.039 (0.09)	0.789 (0.1)
2007	0.987 (0.026)	1.011 (0.036)	0.995 (0.043)	1.166 (0.109)	0.731 (0.105)
2008	0.992 (0.026)	0.983 (0.035)	0.98 (0.043)	1.153 (0.116)	0.709 (0.113)
2009	0.909 (0.024)	0.869 (0.031)	0.89 (0.039)	1.038 (0.113)	0.615 (0.108)
2010	0.812 (0.022)	0.763 (0.028)	0.793 (0.036)	0.958 (0.113)	0.515 (0.1)
2011	0.732 (0.019)	0.636 (0.023)	0.635 (0.029)	0.798 (0.101)	0.445 (0.095)
Good access to pap smears	1.356 (0.029)	1.336 (0.052)	1.31 (0.066)	1.325 (0.057)	1.333 (0.102)
Good GP hours	1.018 (0.013)	1.031 (0.024)	1.054 (0.032)	1.004 (0.029)	1.071 (0.041)
Good GP numbers	1.037 (0.014)	1.048 (0.026)	1.038 (0.033)	1.028 (0.032)	1.081 (0.044)
Good bulk-billing access	0.853 (0.01)	0.891 (0.019)	0.895 (0.024)	0.883 (0.024)	0.894 (0.032)
Good access to female GP	1.231 (0.016)	1.202 (0.03)	1.222 (0.038)	1.144 (0.035)	1.287 (0.052)
Queensland	1.17 (0.015)	1.269 (0.045)	1.246 (0.056)	1.29 (0.05)	1.201 (0.079)
South Australia	1.243 (0.023)	1.334 (0.063)	1.344 (0.078)	1.38 (0.072)	1.275 (0.109)
Western Australia	1.146 (0.02)	1.232 (0.058)	1.08 (0.067)	1.114 (0.058)	1.426 (0.126)
Tasmania	1.193 (0.03)	1.261 (0.088)	1.311 (0.116)	1.157 (0.091)	1.344 (0.166)
Northern Territory	1.207 (0.061)	1.265 (0.137)	1.093 (0.151)	1.206 (0.141)	1.267 (0.276)
Australian Capital Territory	0.919 (0.033)	1.006 (0.085)	0.958 (0.109)	1.087 (0.092)	0.792 (0.157)
Australian-born	1.003 (0.016)	1.022 (0.047)	0.989 (0.056)	1.057 (0.065)	1.024 (0.068)
Inner regional	0.941 (0.012)	0.931 (0.029)	0.901 (0.035)	0.95 (0.034)	0.938 (0.05)
Outer regional	0.816 (0.013)	0.81 (0.031)	0.758 (0.037)	0.847 (0.037)	0.796 (0.054)
Remote	0.716 (0.021)	0.738 (0.05)	0.719 (0.065)	0.835 (0.063)	0.619 (0.081)
Married	1.313 (0.016)	1.308 (0.035)	1.445 (0.05)	1.355 (0.04)	1.131 (0.061)
High School Certificate	0.988 (0.016)	1 (0.038)	0.967 (0.045)	0.961 (0.058)	0.992 (0.051)
Trade	1.002 (0.016)	1.053 (0.039)	0.99 (0.046)	1.043 (0.057)	1.017 (0.056)
University	0.992 (0.016)	1.098 (0.044)	1.007 (0.05)	0.993 (0.055)	1.177 (0.077)

Income impossible	0.86 (0.035)	0.815 (0.058)	0.796 (0.073)	0.956 (0.088)	0.751 (0.081)
Always difficult	0.877 (0.018)	0.888 (0.035)	0.866 (0.043)	0.917 (0.044)	0.871 (0.055)
Sometimes difficult	0.994 (0.016)	0.964 (0.029)	0.979 (0.036)	1.047 (0.04)	0.892 (0.043)
Not bad income	1.022 (0.015)	1.01 (0.027)	1.029 (0.033)	1.029 (0.036)	0.995 (0.039)
Employed	0.968 (0.013)	0.924 (0.025)	0.908 (0.031)	0.909 (0.032)	0.962 (0.038)
Unemployed	0.83 (0.028)	0.821 (0.056)	0.699 (0.063)	0.811 (0.06)	0.832 (0.116)
Private hospital insurance	1.328 (0.015)	1.351 (0.035)	1.376 (0.044)	1.456 (0.042)	1.202 (0.057)
Health care card holder	1.014 (0.014)	1.007 (0.025)	0.995 (0.031)	0.888 (0.035)	1.035 (0.036)

Note: exponentiated coefficients and standard errors in parentheses. OR>1 indicates increased odds of having Pap test in previous 27 months. OR<1 indicates decreased odds of having Pap test within 27 months. Reference categories (OR=1) are omitted. Base case is women with reduced continuity of care, from NSW, major city, did not complete HSC, copes easily with available income, is not in workforce, do not have private health insurance or health concession card, poor or fair access to number of GP, choice of GPs, female GP, bulk-billing, access to Pap test, year 2000. Women from Victoria are omitted from this analysis.

Table 56: Regression models analysing time to retest for women overdue Pap testing – FE and RE for separate ALSWH age cohorts

Variable	Young cohort RE	Young cohort FE	Mid cohort RE	Mid cohort FE
Personal continuity of care	-1.350* (0.677)	-1.874* (0.866)	-1.810* (0.708)	-2.210** (0.814)
Site continuity of care	-2.697*** (0.656)	-2.091* (0.819)	-1.084 (0.759)	-1.082 (0.863)
Age	-0.732 (1.728)	2.409 (2.348)	-6.547 (3.655)	-3.584 (4.531)
Age squared	0.00704 (0.031)	0.00765 (0.034)	0.0593 (0.034)	0.0705* (0.035)
Year- 2001	5.985*** (0.374)	2.994* (1.278)	8.266*** (0.51)	4.407 (2.278)
2002	10.44*** (0.588)	4.384 (2.484)	11.42*** (0.647)	3.243 (4.431)
2003	14.55*** (0.791)	4.605 (3.674)	16.68*** (0.829)	4.41 (6.612)
2004	17.75*** (0.934)	5.104 (4.852)	22.97*** (1.043)	6.985 (8.766)
2005	21.07*** (1.081)	5.531 (6.025)	29.28*** (1.243)	9.078 (10.93)
2006	26.58*** (1.263)	7.101 (7.214)	36.08*** (1.477)	11.85 (13.09)
2007	28.71*** (1.437)	6.909 (8.376)	43.07*** (1.79)	14.8 (15.27)
2008	32.58*** (1.682)	8.112 (9.545)	49.41*** (2.121)	17.41 (17.43)
2009	36.88*** (2.008)	9.623 (10.8)	55.76*** (2.547)	19.87 (19.61)
Good access to pap smears	-3.589*** (0.906)	-3.337** (1.089)	-6.674*** (1.262)	-5.593*** (1.374)
Good GP hours	-0.159 (0.606)	-0.00849 (0.736)	-0.198 (0.654)	0.165 (0.719)
Good GP numbers	0.242 (0.64)	0.607 (0.767)	0.67 (0.721)	0.538 (0.79)
Good bulk-billing access	1.639** (0.576)	0.843 (0.719)	1.446* (0.673)	1.073 (0.788)
Good access to female GP	-1.229 (0.643)	-0.554 (0.802)	-1.388 (0.713)	-0.875 (0.8)
Queensland	-2.201** (0.814)	0.938 (2.131)	-2.615* (1.029)	-5.138 (3.024)
South Australia	-0.361 (1.074)	4.328 (3.538)	0.811 (1.379)	-1.938 (5.898)
Western Australia	0.0304 (0.997)	2.527 (3.335)	-2.772 (1.427)	-6.269 (5.509)
Tasmania	0.73 (1.623)	5.03 (4.851)	-3.976* (1.949)	2.896 (5.996)
Northern Territory	0.0173 (2.559)	4.13 (3.9)	-10.36** (3.897)	-16.87* (7.641)
Australian Capital Territory	-0.387 (1.893)	0.864 (3.182)	1.514 (3.268)	-3.291 (5.83)
Australian-born	-1.09 (1.202)	-	-1.39 (0.992)	-
Inner regional	0.284 (0.759)	2.285 (1.221)	3.211*** (0.966)	2.524 (1.505)

Variable	Young cohort RE	Young cohort FE	Mid cohort RE	Mid cohort FE
Outer regional	0.0919 (0.907)	-0.814 (1.582)	4.991*** (1.163)	1.14 (2.018)
Remote	0.956 (1.57)	0.698 (2.406)	10.53*** (2.129)	6.891* (3.381)
Married	-6.343*** (0.632)	-3.538*** (0.851)	0.989 (1.002)	3.042* (1.446)
High School Certificate	-0.114 (1.019)	-0.997 (1.635)	-1.433* (0.633)	-0.000624 (0.69)
Trade	-0.817 (0.964)	-0.0889 (1.495)	0.352 (0.64)	1.266 (0.721)
University	0.225 (0.991)	0.141 (1.808)	-1.129 (0.875)	1.287 (1.212)
Income impossible	-3.671* (1.507)	-3.272 (1.735)	1.978 (1.389)	1.266 (1.449)
Always difficult	-2.792*** (0.766)	-2.453** (0.862)	1.806* (0.866)	0.807 (0.957)
Sometimes difficult	-2.429*** (0.615)	-1.911** (0.691)	1.475* (0.656)	1.004 (0.717)
Not bad income	-1.029 (0.572)	-0.469 (0.626)	0.396 (0.55)	0.484 (0.591)
Employed	4.425*** (0.799)	5.303*** (1.161)	-1.131 (0.763)	-0.346 (0.877)
Unemployed	3.141* (1.511)	1.024 (2.289)	-2.188 (2.126)	-2.255 (2.325)
Private hospital insurance	-4.940*** (0.643)	-3.990***(0.932)	-1.792* (0.843)	-0.306 (1.241)
Health care card holder	1.838** (0.606)	0.896 (0.651)	0.456 (0.441)	0.122 (0.467)
n	32995	32995	28465	28465

Note: Results indicate coefficients with standard error in parentheses. A positive coefficient indicates that variable is associated with increased time for women to have next Pap test once overdue. A negative coefficient indicates that variable is associated with decreased time to next Pap test. Significance stars legend: *= p<.1; ** = p<.05; *** = p<.001. Reference categories (OR=1) are omitted. Base case is women with reduced continuity of care, from NSW, major city, did not complete HSC, copes easily with available income, is not in workforce, do not have private health insurance or health concession card, poor or fair access to number of GP, choice of GPs, female GP, bulk-billing, access to Pap test, year 2000. Women from Victoria are omitted from this analysis.. No variation of Australian born status and drops out of FE analysis

Table 57- Results of 2 stage least square (2SLS) IV analysis using satisfaction with GP manner as IV for personal continuity- panel IV

Variables in first stage regression	1st stage regression	2nd stage regression with instrumented personal continuity	Variables in instrumented regression
Satisfied with GP manner	0.185(0.01)	0.177(0.067)	Instrumented personal continuity
Site continuity	-0.387(0.007)	0.102(0.027)	Site continuity
Age	0.013(0.017)	0.055(0.021)	Age
Age Squared	0(0)	-0.001(0)	Age Squared
Year - 2003	0.005(0.012)	-0.013(0.015)	2003- Year
2006	0.008(0.016)	-0.035(0.02)	2006
2009	-0.01(0.02)	0.007(0.025)	2009
Good access to pap tests	0.069(0.011)	0.105(0.015)	Good access to pap tests
Good GP hours	0.055(0.007)	-0.008(0.01)	Good GP hours
Good GP numbers	0(0.008)	-0.001(0.01)	Good GP numbers
Good bulk-billing access	0.01(0.006)	-0.039(0.008)	Good bulk-billing access
Good access to female GP	0.008(1.91)	0.009(3.95)	Good access to female GP
Queensland	-0.016(0.007)	0.056(0.009)	Queensland
South Australia	-0.024(0.01)	0.031(0.013)	South Australia
Western Australia	0.001(0.01)	-0.007(0.012)	Western Australia
Tasmania	0.032(0.015)	0(0.019)	Tasmania
Northern Territory	-0.1(0.027)	0.024(0.034)	Northern Territory
Australian Capital Territory	-0.015(0.018)	0.021(0.022)	ACT
Australian-born	0.046(0.012)	-0.023(0.015)	Australian-born
Inner regional	0.061(0.008)	0.013(0.011)	Inner regional
Outer regional	0.03(0.009)	-0.025(0.012)	Outer regional
Remote	-0.005(0.016)	-0.02(0.02)	Remote
Married	0.041(0.007)	0.091(0.009)	Married
Education- HSC	-0.029(0.012)	-0.001(0.015)	Education -HSC
Trade	-0.031(0.011)	0.002(0.014)	Trade
University	-0.116(0.011)	0(0.016)	University
Income impossible	0.039(0.024)	-0.004(0.03)	Income impossible
Always difficult	0.014(0.012)	-0.01(0.014)	Always difficult
Sometimes difficult	0.006(0.009)	0.006(0.011)	Sometimes difficult
Not bad income	0.008(0.008)	0.014(0.01)	Not bad income
Employed	-0.038(0.008)	-0.008(0.011)	Employed
Unemployed	-0.04(0.017)	-0.054(0.021)	Unemployed
Private hospital insurance	0.032(0.006)	0.074(0.008)	Private Hospital Insurance
Health care card holder	0.02(0.009)	-0.027(0.011)	Health Care Card Holder
IV model testing			

Under id (Anderson canonical correlation LM stat	337.001	Chi2 p<0.0001
Cragg- Donald Wald F statistic	342.826	

Note:. Notes: Results show coefficients with standard errors in parentheses. Reference categories are omitted. Base case is women from NSW in 2000, living in major city, did not complete high school certificate, copes easily with available income, is not in workforce.

Table 58- Comparison of Regression results from Instrumental Variable using Manner of GP as instrument for personal continuity (Young Cohort Only) - with panel regression RE (Model 1)

Variable	Model 1 - Panel Regression RE	Model 9 – Panel IV Regression
Personal continuity of care	0.142***(0.026)	0.177**(0.067)
Site continuity of care	0.136***(0.027)	0.102***(0.027)
Age	0.084***(0.01)	0.055**(0.021)
Age squared	-0.001***(0)	-0.001**(0)
Year - 2001	-0.006(0.032)	-
2002	0.115***(0.033)	-
2003	0.077(0.034)	-0.013(0.015)
2004	0.038(0.035)	-
2005	0.048(0.034)	-
2006	-0.009(0.036)	-0.035(0.02)
2007	0.017(0.036)	-
2008	-0.008(0.036)	-
2009	-0.12***(0.036)	0.007(0.025)
Good access to pap smears	0.276***(0.041)	0.105***(0.015)
Good GP hours	0.033(0.025)	-0.008(0.01)
Good GP numbers	0.051*(0.027)	-0.001(0.01)
Good bulk-billing access	-0.103***(0.023)	-0.039***(0.008)
Good access to female GP	0.217***(0.027)	0.037***(0.009)
Queensland	0.22***(0.036)	0.056***(0.009)
South Australia	0.215***(0.048)	0.031**(0.013)
Western Australia	0.168***(0.048)	-0.007(0.012)
Tasmania	0.247***(0.072)	0(0.019)
Northern Territory	0.218(0.111)	0.024(0.034)
Australian Capital Territory	-0.066(0.085)	0.021(0.022)
Australian-born	0.011(0.047)	-0.023(0.015)
Inner regional	-0.077*(0.032)	0.013(0.011)
Outer regional	-0.234***(0.039)	-0.025**(0.012)
Remote	-0.354***(0.069)	-0.02(0.02)
Married	0.307***(0.028)	0.091***(0.009)
High School Certificate	-0.013(0.039)	-0.001(0.015)
Trade	0.036(0.038)	0.002(0.014)
University	0.059(0.04)	0(0.016)

Variable	Model 1 - Panel Regression RE	Model 9 – Panel IV Regression
Income impossible	-0.243**(0.075)	-0.004(0.03)
Always difficult	-0.131**(0.041)	-0.01(0.014)
Sometimes difficult	-0.05(0.032)	0.006(0.011)
Not bad income	0.003(0.028)	0.014(0.01)
Employed	-0.063*(0.029)	-0.008(0.011)
Unemployed	-0.219**(0.071)	-0.054**(0.021)
Private hospital insurance	0.283***(0.027)	0.074***(0.008)
Health care card holder	0.004(0.026)	-0.027**(0.011)
N	33859	17810
IV diagnostics		
First stage F statistic	F = 128.43 P=<0.0001	
Anderson-Rubin Wald test	F= 7.00 P<0.0001	

Notes: Results show coefficients with standard errors in parentheses. Reference categories are omitted. Base case is women aged between 20 and 29.99, from NSW, living in major city, did not complete high school certificate, copes easily with available income, and is not in workforce, in year 2000.

Table 59- Panel data Summary statistics for variables of interest.

Variable	Mean	Standard Deviation
Pap test in last two years	0.756	0.429
between variation		0.336
within variation		0.307
Personal continuity of care	0.339	0.473
between variation		0.358
within variation		0.337
Site continuity of care	0.299	0.458
between variation		0.358
within variation		0.337
Reduced continuity of Care	0.357	0.479
between variation		0.366
within variation		0.335
Abnormal Pap test previously	0.228	0.419
between variation		0.305
within variation		0.311
Good access to Pap tests	0.933	0.249
between variation		0.191
within variation		0.187
Satisfied with manner of GP	0.901	0.299
between variation		0.205
within variation		0.237