

Reducing High Rates of Unplanned Hospital Readmissions among Aboriginal and Torres Strait Islander People with Chronic Disease

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BSc Sociology (Hons), MSc Demography and Health

A thesis submitted in fulfilment of the requirements for the
degree of Doctor of Philosophy in Behavioural Science

Submitted October 2021

This research was supported by an Australian Government Research Training Program (RTP)
Scholarship

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Acknowledgements

I acknowledge the sovereignty of Aboriginal and Torres Strait Islander Peoples as the original custodians of Australia and acknowledge and pay respect to Elders past, present and future.

I acknowledge the Aboriginal and Torres Strait Islander people who participated in the qualitative study for this thesis. It was a privilege to hear their stories and experiences. I also want to express my deepest gratitude to the Aboriginal and Torres Strait Islander members of the advisory groups for each study for my thesis. I particularly thank the staff of Nunyara Aboriginal Health Unit and Yerin Aboriginal Health Services for your time, ideas, for sharing and commitment to the communities you serve.

Thank you to my supervisors – Laureate Professor Rob Sanson-Fisher, Professor Mariko Carey, Dr Jamie Bryant, and Dr Christopher Oldmeadow. Thank you for your encouragement and support. I particularly express my thanks to Jamie and Mariko for your infinite patience and time providing feedback.

Finally, I would like to say a big thank you to Sujen, Holly, Joseph, Zach and Thomas. Thank you for your patience over the years, your encouragement and love. Thank you to Peter and Beverley Oliver, John Lawrence, and Sharon and Jayakody Vengadaselam for believing in me!

List of Publications Included as Part of This Thesis

Paper one

Jayakody A, Oldmeadow C, Carey M, Bryant J, Evans T, Ella S, Attia J, Towle S, and Sanson-Fisher R. Frequent avoidable admissions amongst Aboriginal and non-Aboriginal people with chronic disease in New South Wales, Australia: a historical cohort study. BMC Health Services Research. (2020) Nov 25;20(1):1082.

Paper two

Jayakody A, Oldmeadow C, Carey M, Bryant J, Evans T, Ella S, Attia J, and Sanson-Fisher R. Unplanned readmission or death after discharge for Aboriginal and non-Aboriginal people with chronic disease in NSW Australia: a retrospective cohort study. BMC Health Services Research (2018) 18:893.

Paper three

Jayakody A, Carey M, Bryant J, Ella S, Hussein P, Warren E, Davidson C, Bacon S, Field B, Sanson-Fisher R. Exploring experiences and perceptions of Aboriginal people readmitted to hospital with chronic disease in NSW, Australia: a qualitative study. Australian Health Review (2021) Aug;45(4):411-417.

Paper four

Jayakody A, Bryant J, Carey M, Hobden B, Dodd N and Sanson-Fisher R. Effectiveness of interventions utilizing telephone follow up in reducing hospital readmission within 30 days for individuals with chronic disease: a systematic review. BMC Health Services Research (2016) 16:403.

Paper five

Jayakody A, Passmore E, Oldmeadow C, Bryant J, Carey M, Simons E, Cashmore A, Maher L, Hennessey K, Bunfield J, Terare M, Milat A, and Sanson-Fisher R. The impact of telephone follow up on adverse events for Aboriginal people with chronic disease in New South Wales, Australia: a retrospective cohort study. *International Journal for Equity in Health* (2018) 17:60.

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Abstract

Aboriginal and Torres Strait Islander people, hereinafter respectfully referred to as Aboriginal people,^a have a rich heritage and diverse cultures. They have a strong connection to their community and country. However, Aboriginal people have suffered long-lasting effects from colonisation, dispossession of land and racism with devastating impacts, particularly for health outcomes. In Australia, Aboriginal people have up to three-fold higher rates of chronic disease compared to non-Aboriginal people. Given the high risk of frequent avoidable admissions and unplanned hospital readmissions for people with chronic diseases, it is not surprising that Aboriginal people also have higher rates of these types of hospitalisations compared to non-Aboriginal people. High rates of avoidable admissions and unplanned readmissions reflect sub-optimal community healthcare and poor hospital care. However, little research has explored these types of potentially unnecessary hospitalisations for Aboriginal people with chronic disease in Australia's most populous state of New South Wales (NSW).

This thesis explores frequent avoidable admissions and unplanned readmissions among Aboriginal people by focusing on three key aims. The first was to examine the prevalence and trends of frequent avoidable admissions and unplanned readmissions of Aboriginal and non-Aboriginal people residing in NSW, utilising linked hospital administrative data. International research examining the factors associated with unplanned readmissions in general populations indicate the importance of factors such as chronic disease management, a regular general practitioner, good health literacy and medication adherence. Therefore, the second aim of this thesis was to identify perceptions of Aboriginal people regarding potential contributors to chronic-disease-related unplanned readmissions. In-depth interviews were conducted with a sample of Aboriginal people who had been readmitted to hospital. Telephone follow-up has been used alongside other intervention components, such as tailored

^a The importance of using correct, respectful, and appropriate terminology for Aboriginal and Torres Strait Islander people is acknowledged. In keeping with NSW Health recommendations and acknowledging that Aboriginal people are the original inhabitants of NSW, where most of the data for this PhD thesis were collected. This thesis will herein use "Aboriginal people".¹

discharge planning and patient education, with the aim of reducing unplanned readmissions in surgical and general medicine patients. The final aim of this thesis was to examine the potential impact of telephone follow-up in reducing unplanned readmissions rates for patients with chronic disease. This involved a systematic review of the research literature on the impact of telephone follow-up, and an evaluation of a program utilising telephone follow-up for Aboriginal people. The implications of the findings of this work are discussed in relation to hospital and community health service practices and state-wide data monitoring. Further explorative research and a community-led multicomponent telephone follow-up enhancement intervention are proposed.

Thesis Overview

This thesis consists of an introduction, a summary of the research governance that guided the work, five papers (which have all been published in peer-reviewed journals), and a discussion.

The **introduction** provides an overview of the health status of Aboriginal people in Australia in the context of colonisation and its ongoing impacts on biomedical, behavioural and psychological risk factors, social and economic disadvantage, and access to health services.¹⁻³ The importance of chronic diseases being managed in the community health setting and through self-management is discussed. Frequent avoidable admissions and unplanned readmissions are considered to be indicators of how successful the health system is in managing chronic diseases.^{4, 5} Avoidable admissions, also known as potentially preventable hospitalisations, are defined as admissions for ambulatory-care-sensitive chronic conditions that are considered to be potentially preventable by quality and well-timed primary and community-based care.⁴ Unplanned readmissions are defined as unplanned admissions to hospital, usually within one month of discharge from the initial admission.^{5, 6} The introduction outlines what is known in the literature regarding the prevalence and burden of frequent avoidable admissions and unplanned readmissions in the Australian general population, and then specifically among Aboriginal people. An adapted conceptual model by Vest *et al.*⁷ is used to provide a framework for understanding environmental-, patient-, encounter- and organisational-level factors that are associated with avoidable admissions and unplanned readmissions. A brief review is then provided of factors which have been shown empirically to be associated with avoidable admissions and unplanned readmissions for general and Aboriginal populations. Lastly, interventions which have been found to be effective in reducing avoidable admissions and unplanned readmissions, particularly telephone follow-up, are discussed.

Given the focus on Aboriginal people, a strong **research governance** structure was implemented for the work conducted in this thesis. Chapter 2 describes key guidelines which should be considered

together when planning and conducting Aboriginal research. The ethical approval processes for each study are outlined, and how the NSW Aboriginal Health and Medical Research Council Ethics Committee five key principles for research on Aboriginal health were addressed for each part of the work.

Paper one describes a retrospective cohort analysis using de-identified linked NSW administrative health datasets. This study aimed to examine trends in avoidable admissions among Aboriginal and non-Aboriginal people with chronic conditions. Eligible patients were adults, admitted to NSW acute facilities between 2005–2006 and 2013–2014 who had one or more ambulatory-care-sensitive chronic conditions: diabetic complications, asthma, angina, hypertension, congestive heart failure and chronic obstructive pulmonary disease. Two primary outcomes were examined: (1) the number of avoidable admissions for an individual in each financial year; and (2) whether an individual had three or more admissions compared to one to two avoidable admissions in each financial year. Aboriginal people in the sample were significantly more likely to have a higher number of avoidable admissions and were almost twice as likely to experience three or more avoidable admissions per financial year, compared to non-Aboriginal people. There was no significant change in these rates over the study period.

Another key indicator of chronic disease management is unplanned readmissions.⁵ **Paper two** examines whether rates of unplanned hospital readmissions, or death, significantly differ between Aboriginal and non-Aboriginal patients over a nine-year period, using the same linked data as for paper one. The primary outcome was unplanned readmissions or death within 28 days of discharge from an index admission. Death within 28 days of discharge alone accounted for only 1.4% of admissions. Aboriginal people had a significantly higher relative risk of 1.34 of unplanned readmissions compared to non-Aboriginal people, and there were no significant changes in proportion of unplanned readmissions over the nine-year period examined.

The significantly higher risk of both frequent avoidable admissions and unplanned readmissions for Aboriginal people in NSW suggests the importance of identifying culturally appropriate interventions

which can reduce such risks. However, to plan effective interventions, it is important to understand the perspectives and experiences of Aboriginal people. **Paper three** describes a qualitative study where in-depth interviews were conducted with 15 Aboriginal people who had been readmitted to hospital with chronic disease. The patients were identified and invited to participate by an Aboriginal Hospital Liaison Officer (AHLO). Interviews were conducted by the PhD student, together with the AHLO, and examined perceptions of avoidable readmissions, experiences of healthcare, medications, and carer support. Key enablers of chronic disease management that emerged from interviews included family support and having a regular general practitioner. Common barriers to chronic disease management discussed by participants included poor communication by health professionals, low levels of health literacy and adherence to chronic disease management, poor access to community services, and health risk behaviours. Results suggest there are barriers to accessing important health and community services for Aboriginal people with chronic disease.

Given the higher risk of frequent avoidable admissions and unplanned admissions for Aboriginal people with chronic disease, reported in papers one and two, it is imperative to identify interventions that can effectively prevent unnecessary hospitalisation. Various interventions targeting unplanned readmissions have been examined in general populations, and many of these have utilised telephone follow-up.^{8,9} **Paper four** describes the findings of a systematic review which aimed to determine the methodological quality and effectiveness of interventions utilising telephone follow-up in reducing readmissions within 30 days among patients with chronic diseases. Ten eligible studies were identified. Although the methodological quality of the studies was poor, five were effective in reducing unplanned readmissions. None of the studies reported findings for Aboriginal people. The evidence was inconclusive for the effectiveness of telephone follow-up in reducing unplanned readmissions for people with chronic diseases. The findings suggest the potential for future intervention research that combines telephone follow-up with pre-discharge components and focuses on developing health professional skills in conducting telephone follow-up.

Given that paper four identified no prior research on the effectiveness of telephone follow-up for Aboriginal people, **paper five** reports the findings of a retrospective cohort study which aimed to assess the effectiveness of a NSW Health telephone follow-up program, 48 Hour Follow Up, in reducing unplanned hospital readmissions, unplanned emergency department presentations and mortality within 28 days of discharge among Aboriginal people with chronic disease. As part of the 48 Hour Follow Up program, recently discharged Aboriginal patients with chronic disease are contacted by phone and asked about accessing medications, attending follow-up appointments, and their general wellbeing.¹⁰ The analysis found there was no significant reduction in unplanned readmissions for Aboriginal patients who received 48 Hour Follow Up compared to Aboriginal patients who did not receive 48 Hour follow Up. However, there were significant reductions in emergency presentations and occurrence of at least one adverse event (i.e., unplanned readmission, emergency department presentation or mortality). Whilst the findings are promising, further research is needed to explore how such a telephone follow-up program can be enhanced to significantly reduce unplanned readmissions.

The thesis finishes with a general **discussion** of the findings from all five thesis papers. Three overarching findings are drawn: the inequity in frequent avoidable admissions and unplanned readmissions between Aboriginal and non-Aboriginal people; the potential environmental-, patient-, encounter- and organisational-level factors which may be contributing to unplanned readmissions for Aboriginal people with chronic disease; and the merit in telephone follow-up being included in multicomponent interventions aimed at reducing unplanned readmissions. Key study limitations are discussed, and recommendations for practice and policy are proposed. Further explorative research and a community-led multicomponent 48 Hour Follow Up enhancement intervention across NSW to effectively reduce the high rates of unplanned readmissions and frequent avoidable admissions are suggested.

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Chapter 1: Introduction

Aboriginal and Torres Strait Islander peoples are the first peoples of Australia and the oldest continuous civilisation in the world.^{1, 2} Aboriginal people are not one group; instead, they represent hundreds of distinct descent groups, languages and cultures.^{3, 4} The latest census data from 2016 reports that there were 649,173 Aboriginal people in Australia, representing approximately 3% of the total population.³ NSW, Australia's most populous state, is home to the largest proportion of Australia's Aboriginal population (33%).⁵ Aboriginal people have a younger age structure, with a median age of 22 compared to 38 in non-Aboriginal Australians.³ Although the majority (79%) live in cities and regional areas, a larger proportion of Aboriginal people live remotely compared to non-Aboriginal people (21% and 2%, respectively).³

Aboriginal communities maintain strong connections to their country, community, culture and language and view the world with a spiritual lens.^{2, 6} These strong connections and identity are also reflected in their holistic view of health: *“Aboriginal health means not just the physical wellbeing of an individual but refers to the social, emotional and cultural wellbeing of the whole community in which each individual is able to achieve their full potential as a human being, thereby bringing about the total wellbeing of their community... It is a whole of life view and includes the cyclical concept of life-death-life.”*⁷

1.1 High chronic disease burden among Aboriginal people

Aboriginal people continue to have poorer health outcomes compared to non-Aboriginal Australians, and compared to other Indigenous peoples around the world.⁸ The Closing the Gap campaign has helped publicise the gap in life expectancy, which is now an average of 8.6 years less than for non-Aboriginal people.^{9, 10} The majority of this gap is due to a high prevalence of chronic diseases among Aboriginal people, which they are more likely to experience at younger ages compared to non-

Aboriginal people.³ Some of the most prevalent chronic diseases for Aboriginal people are cardiovascular disease, chronic respiratory disease, diabetes and renal diseases.¹¹ Compared to non-Aboriginal people, Aboriginal people have double the rate of cardiovascular disease, a 2.5 times higher rate of respiratory disease, and up to a three times higher rate of diabetes.¹² Aboriginal people have an age-standardised incidence rate for treated end-stage kidney disease of 64 per 100,000, compared to 9.2 per 100,000 in non-Aboriginal people.¹² Most chronic diseases have a gradual onset, persist over time and are rarely cured.¹³ Such diseases can quickly become life-threatening and can result in hospitalisation.¹³

1.2 Factors contributing to the disproportionate chronic disease burden among Aboriginal people

The high burden of chronic diseases experienced by Aboriginal people can be partially explained by biomedical, behavioural and psychological risk factors.^{3, 14} Biomedical risk factors such as high blood pressure, obesity and glucose control can be affected by behaviours, genetics and the environment.³ Although high blood pressure is a cardiovascular condition in itself, it is also a risk factor for chronic diseases such as stroke, diabetes and chronic kidney disease.^{3, 12} Aboriginal people are 1.2 times more likely to have high blood pressure compared to non-Aboriginal people.³ Aboriginal people are also 1.6 times more likely, compared to non-Aboriginal people, to be obese, and obesity is a risk factor for heart disease and diabetes.³ Based on fasting glucose results, Aboriginal people were 1.8 times more likely to be at high risk of developing diabetes which, in turn, can be caused by obesity and high blood pressure.³

Behavioural risk factors for chronic diseases are prevalent among Aboriginal people.¹² Although daily smoking rates have declined from 45% in 2008 to 37% in 2018/19 in Aboriginal people aged 15 years and above,¹² there has been no significant decline in Aboriginal people living in remote areas.¹² Smoking can increase the risk of developing heart disease, stroke, cancer and chronic respiratory conditions.³ One in five Aboriginal adults drink above the daily recommended limit for ‘lifetime risk’

of disease, i.e. more than two drinks per day.¹² This has not changed since 2012-13.¹² Risky alcohol consumption is a risk factor for developing liver disease, and some cancers.³ It has also been increasingly recognised that mental health can have a negative impact on physical health; conversely, physical health can negatively impact mental health. Aboriginal people are 2.7 times more likely than non-Aboriginal adults to have high levels of psychological distress compared to non-Aboriginal people.³

In addition to these behavioural, biomedical and psychological risk factors, there are important socioeconomic and environmental factors that contribute to and exacerbate the disproportionate chronic disease burden among Aboriginal people.^{12, 14} It is hypothesised that for Indigenous people worldwide, poverty is linked to poor health outcomes.¹⁵ A lack of adequate housing, education, employment and income can lead to risk factors, like heavy drinking and smoking, which contribute to poor health.¹⁶ People with low income and poor education often live shorter and unhealthier lives and have limited opportunities to improve their health.¹⁶ Australia's history of European colonisation/invasion has had a devastating impact on Aboriginal people, resulting in loss of their land and authority, and disruptions to their culture, language, and social arrangements.^{2, 17} Aboriginal people have endured human rights abuses, trauma and pain through various practices and policies, e.g. the Stolen Generation, Missions and Protection Policy.² The impact of this is still felt today and is reflected in a range of indicators of social disadvantage, also known as social determinants of health.¹⁵ For example, in 2016 Aboriginal and Torres Strait Islander people nationally accounted for 20% of the homeless population, and 70% of homeless Aboriginal people were living in severely crowded dwellings.¹² Severely crowded dwellings can be due to houses being inadequately sized to cater for Aboriginal cultural needs such as housing large Aboriginal families and their visiting relatives, e.g. for "Sorry Business" (mourning the death in the family).¹⁸ Although educational retention, attendance and attainment rates among Aboriginal students are improving, a gap remains between Aboriginal and non-Aboriginal students.¹² In 2017–2019, less than 10% of Aboriginal people had a Bachelor degree or above, compared to 35% of non-Aboriginal people.¹² Similarly, more Aboriginal people are unemployed and have low incomes compared to non-Aboriginal Australians.¹² In 2018–2019, 49% of

Aboriginal people aged 15–64 years were employed compared to 76% of non-Aboriginal people.¹² The unemployment gap is worse for Aboriginal people living in remote areas (80% of non-Aboriginal people compared to 40% of Aboriginal people living in remote or very remote areas).¹²

Besides impacting on lifestyle factors, social disadvantage may contribute to poorer health by reducing access to health services.¹⁹ Barriers to accessing health services have been defined as encapsulating “*problems of availability, affordability, acceptability and appropriateness*”.²⁰ Locational and cultural factors can impede access to appropriate healthcare services for Aboriginal people.^{16, 21} In 2018–2019, 30% of Aboriginal people reported difficulties in accessing health services, and 13% experienced difficulties accessing a doctor.¹² For people who reported difficulties, reasons included being too busy to attend, long waiting times, cost, lack of transport, disliking the service or being afraid.¹² Other research has reported financial barriers, and difficulties understanding and being understood by health professionals.^{16, 21} It has become increasingly recognised that racist beliefs and values within the Australian health system have created a barrier for Aboriginal people in accessing health services and care.^{22, 23} These underlying risk factors and consequences of social disadvantage have enduring effects and contribute significantly to the disproportionate burden of chronic disease among Aboriginal people.¹²

1.3 Healthcare delivery context in Australia

The health system in Australia is complex, with various providers of healthcare services for Aboriginal people with chronic disease.²⁴ The health system consists of both public and private healthcare (see Figure 1.1).^{25, 26} Medicare, Australia’s universal public healthcare system, covers all the cost of public hospital services and some or all of the cost of other health services, such as those provided by general practitioners (GPs) and medical specialists.²⁶ The government subsidises a list of services and provides a safety net through the Medicare Benefits Schedule. Medicare’s Pharmaceutical Benefits Scheme (PBS) provides subsidised access to some medicines.²⁶ This includes the Closing the Gap PBS co-payment scheme which reduces the costs of medicines for Aboriginal

people with chronic diseases.²⁷ At the NSW state level, NSW Health oversees local health districts (LHDs) and speciality health networks (e.g. St Vincent’s Health Network) which operate public hospitals, and community-based and primary health services within geographical catchment areas.²⁴ Also at the community level, Aboriginal Community Controlled Health Services (ACCHSs) operate specifically for Aboriginal people. ACCHSs are owned and operated by Aboriginal communities.²⁴

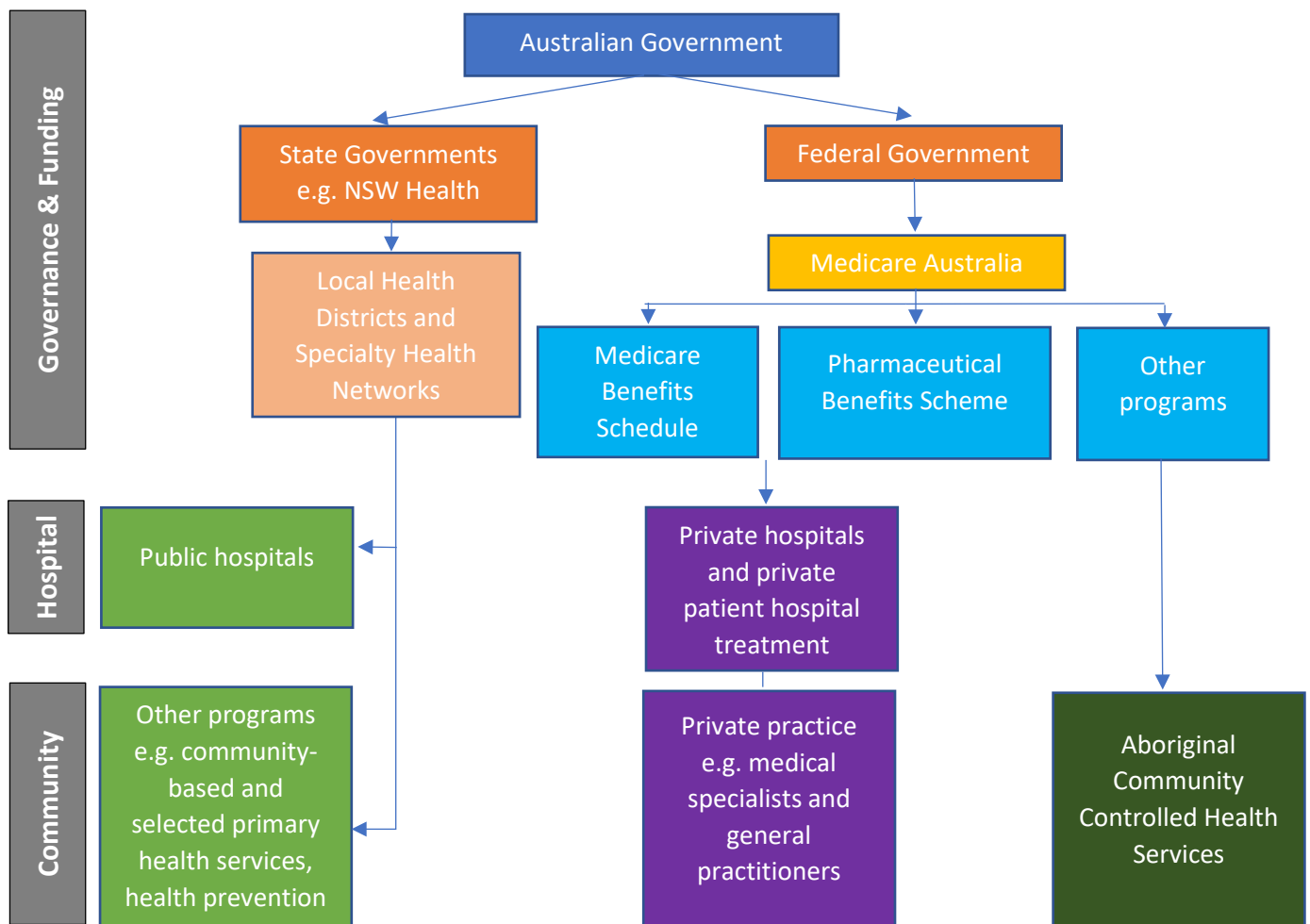


Figure 1.1: Simplified representation of primary sources of funding in the Australian health system²⁴.

1.4 Community management of chronic diseases

The majority of chronic diseases should ideally be managed in the community setting (shown predominantly in the bottom section of Figure 1.1) with the support of regular GPs, resources for self-management, and appropriate specialist input as needed.^{28, 29} The aim of community management is to control chronic disease symptoms effectively, thereby slowing disease progression and helping prevent high-cost hospitalisations.^{12, 30} Adequate primary healthcare and organised chronic disease management are associated with better health outcomes for people with chronic diseases, and also lower healthcare costs.³¹ GPs are well-placed to undertake chronic disease management. They can readily meet the needs of most patients with chronic diseases, can co-ordinate specialist care when needed, are in a position to provide behavioural change and self-management support on a consistent basis, and can refer to allied health professionals (e.g. dieticians) to assist with particular lifestyle issues.²⁹ In Australia, GPs have access to evidence-based guidelines for most chronic diseases and can offer Medicare-rebated Chronic Disease Management GP services, which include a GP Management Plan and a Team Care Arrangement.^{32, 33} A GP Management Plan is a plan of action which identifies the patient's health and care needs, the services required by the GP, and a list of self-management tasks to be undertaken by the patient.³⁴ A Team Care Arrangement facilitates the GP coordinating multidisciplinary care for patients with complex care needs, whereby the GP provides care alongside at least two other health or care providers.³⁴

1.4.1 Aboriginal Community Controlled Health Services

Although there are currently no complete and comparative data on which primary health services Aboriginal people access the most, Medicare data indicate that in 2014–2015, 203 ACCHSs, and related Aboriginal services, provided healthcare to 434,600 clients, with more than 5 million contacts, and that the number of episodes of care in these services had tripled since 1999–2000.³⁵ The National Aboriginal Community Controlled Health Organisation estimates that 50–60% of the Australian Aboriginal population annually visit an Aboriginal primary health service or ACCHS.³⁶ ACCHSs are multifunctional, providing comprehensive and culturally safe clinical healthcare, and other services

such as population health programs, child and maternal health services, screening programs, and access to allied health and specialist services.^{35, 37} ACCHSs are primarily funded by the Australian and State governments,²⁴ and were established to address the barriers experienced by many Aboriginal people in accessing healthcare.²² ACCHSs and mainstream services are strengthened by employing Aboriginal health workers who play an important role in promoting and supporting community management of chronic diseases for Aboriginal people.²² Aboriginal health workers (who identify as Aboriginal and Torres Strait Islander people themselves) enable cultural safety and the development of relationships with patients, and promote access to health services.²² Whilst there are various definitions of cultural safety, it can be summarised in the following definition: “*Cultural safety is the individual and institutional knowledge, skills, attitudes and competencies needed to deliver optimal health care for Aboriginal and Torres Strait Islander Peoples as determined by Aboriginal and Torres Strait Islander individuals, families and communities*”.³⁸ Table 1.1 describes how cultural safety is considered from the healthcare provided and the healthcare experienced by Aboriginal people themselves.³⁹

Table 1.1: Cultural safety in healthcare definition*

How healthcare is <i>provided</i>	<ul style="list-style-type: none"> • Behaviour, attitude and culture of providers: respects and understands Indigenous culture and people • Defined with reference to the provision of care, including governance structures, policies and practices
How healthcare is <i>experienced</i> by Indigenous people	<ul style="list-style-type: none"> • Feeling safe, connected to culture, and cultural identity is respected • Can only be defined by those who receive healthcare

*Source: Cultural safety in health care for Indigenous Australians: monitoring framework. Australian Institute of Health and Welfare 2019³⁹

1.4.2 Chronic disease self-management

As well as community health's role in providing timely and accessible chronic disease management services, the individual with a chronic disease also has a crucial role in optimising disease control.^{40, 41} Barlow *et al.* describe chronic disease self-management as, "*the individual's ability to manage symptoms, treatment, physical and psychosocial consequences and lifestyle changes inherent in living with a chronic condition, to effect the cognitive, behavioural and emotional responses necessary to maintain a satisfactory quality of life, so a dynamic and continuous process of self-regulation is established.*"(p.178,⁴⁰) Self-management emphasises the importance of patient education about their chronic diseases, informed decision-making, care planning, making appropriate changes to diet, exercise, taking medication as prescribed and monitoring vital signs such as blood pressure.^{41, 42} It encompasses regular monitoring and support by community healthcare, with individuals attending their appointments regularly.²⁹

1.5 Frequent avoidable hospital admissions are an indicator of poor chronic disease management

Avoidable admissions, also known as potentially preventable hospitalisations or ambulatory-care-sensitive conditions, refer to hospitalisations for defined conditions that are considered potentially preventable by quality and well-timed primary and community-based care.^{12, 43} Although internationally there are variations in coding and conditions, there are three main types of avoidable admissions: acute, vaccine-preventable and chronic conditions.^{12, 43, 44} Included chronic conditions may be preventable through lifestyle change, but effective chronic disease management in the primary care setting can prevent worsening disease and hospitalisation.^{43, 45} Table 1.2 defines the chronic conditions included in the Australian National Healthcare Agreement potentially preventable hospitalisations indicator.⁴⁶ Within this thesis, all references to avoidable admissions will relate to a selection of these chronic conditions which fit within the specific chronic disease focus of this thesis and are the most common conditions among adult Aboriginal people.

Table 1.2: Conditions included in the Australian National Healthcare Agreement potentially preventable hospitalisations indicator, 2021⁴⁶

Chronic conditions	
<ul style="list-style-type: none"> • Asthma* • Congestive cardiac failure* • Diabetes complications* • Chronic obstructive pulmonary disease* • Bronchiectasis* • Angina* 	<ul style="list-style-type: none"> • Hypertension* • Iron deficiency anaemia • Nutritional deficiencies • Rheumatic heart diseases

*Indicates conditions included in this thesis's focus of avoidable admissions

Rates of avoidable admissions are used internationally as an indicator of how successful primary and community health services are in preventing, managing, and controlling illnesses and conditions.⁴⁴

Avoidable admissions are a health system performance indicator of accessibility and effectiveness in the Australian National Healthcare Agreement.⁴³ Avoidable admission rates are a proxy measure based on specific admission diagnoses reported in hospital administrative data, and hence are likely to include some degree of error (for example, inclusion of admissions for chronic diseases which could not have been avoided).⁴⁷

Frequent avoidable admissions to hospital has been defined in a number of studies as three or more unplanned admissions within either a six-month or 12-month period.⁴⁷⁻⁴⁹ Some studies have also made a distinction between frequent admissions (three admissions within 12 months) and very frequent admissions (four or more admissions within 12 months).^{47, 48} When assessing the quality of community-based chronic disease management, frequent avoidable admissions are of particular importance and also an indicator of poor chronic disease management. Frequent admissions are independently associated with ambulatory-care-sensitive chronic conditions.^{47, 48} Therefore, focusing improvements in community-based chronic disease management on the small group of high-frequency users of hospitals is likely to have the most impact on reducing avoidable admissions.^{47, 50,}

1.5.1 Prevalence and burden of frequent avoidable admissions

In Australia, chronic diseases account for almost half (46%) of all acute, vaccine-preventable and chronic-condition-related avoidable admissions.⁵² The three most prevalent chronic disease avoidable admissions are congestive heart failure, chronic obstructive pulmonary disease (COPD) and type 2 diabetes complications, which accounted for half of all chronic disease avoidable admissions (50%).⁵²

However, these prevalence data do not provide insights into the proportion of patients who experience frequent avoidable admissions for chronic diseases. A number of small Australian studies have examined the risk of frequent admissions associated with chronic diseases.^{47, 48} In a retrospective study of regional NSW hospital emergency departments, people who had chronic disease avoidable admissions were more likely to have three or more admissions in one year compared to patients with one to two admissions (Odds Ratio = 3.3, $P < .002$).⁴⁸ An analysis of 2009–2010 NSW chronic disease admissions reports that the most frequently admitted 2–4% of COPD and chronic heart failure patients accounted for 43–62% of COPD- and chronic heart failure-specific bed days.⁵¹ Whilst the number of patients frequently admitted to hospital is small, this group represents a disproportionate amount of health costs and visits.⁴⁴ Avoidable admissions are also associated with burden to patients and their families and/or caregivers.⁴⁷

1.5.2 Frequent avoidable admissions among Aboriginal people

Australian Aboriginal people have higher rates of avoidable admissions compared to non-Aboriginal people, especially for chronic diseases.^{12, 52} This is also the case for Indigenous people in the United States of America (USA), Canada and New Zealand.⁵³⁻⁵⁵ Recent Australian government data from 2017–2018 indicate that avoidable admission rates for chronic conditions were 3.2 times higher for Aboriginal people compared to non-Aboriginal people.⁵² Of particular importance is the fact that avoidable admissions for chronic diseases among Aboriginal people have been increasing significantly over time, with a 13% increase in rates since 2012–2013.^{52, 56}

Despite Australian government monitoring of avoidable admissions for Aboriginal people,¹² there are no routinely reported data on rates of frequent avoidable admissions for Aboriginal people with chronic disease. The few independent studies examining frequent admissions among Aboriginal people have been of single hospital emergency department presentations only.⁵⁷ However, a South Australian study of avoidable admissions among people with chronic disease in a linked state-wide administrative dataset found that Aboriginal patients were significantly more likely to experience frequent avoidable admissions compared to non-Aboriginal people (2.6 (95% CI 2.4-2.8) compared to 1.9 (95% CI 1.9-1.9) avoidable admissions per person per year).⁴⁴ Given the statistically significant higher rates of frequent admissions in Aboriginal people reported in this South Australian study, it is important to explore frequent admissions among Aboriginal people in NSW to establish whether there is effective access to primary healthcare and community management of chronic diseases for this population.

1.6 Unplanned readmissions as an indicator of poor chronic disease management

Distinct from avoidable admissions, an unplanned readmission is an admission to a hospital (which was not planned), usually within one month of discharge from an initial (i.e. index) admission.^{24, 58, 59} For this thesis, the definition and measurement of unplanned readmissions is restricted to admissions related to both prevalent chronic diseases for Aboriginal people^{3, 11, 12} and chronic diseases known from the research literature to be associated with an increased risk of unplanned readmissions⁶⁰⁻⁶² namely, cardiovascular diseases, chronic respiratory diseases, diabetes and renal diseases.

Unplanned readmissions may often suggest that patients are discharged with unresolved and/or unmanaged complications,⁶³ and are therefore also considered a measure of quality of care.^{60, 64} Globally, unplanned readmissions are commonly utilised by health systems as a measure of quality, safety and performance of the care delivered in hospital and post-discharge.⁶³ In Australia, unplanned readmissions are considered a performance indicator of whether the government is providing

“services that are of a high quality and well-coordinated to ensure continuity of care, specifically in relation to selected surgical procedures” (Page 6, ⁶³). In NSW, unplanned readmissions are used within local health district agreements as key performance indicators.²⁴ Specific targets and thresholds are used to monitor performance at individual hospitals,^{63, 65} with some LHDs receiving reduced funding when their unplanned readmissions rate exceeded set targets.⁶⁵ While avoidable admissions are generally regarded as reflecting sub-optimal community healthcare,⁴³ unplanned readmissions may reflect poor hospital care (e.g. poor discharge planning), poor community care, or poor transition between the two.^{66, 67} The focus at the Australian national level has been on unplanned or unexpected readmissions related to surgical procedures, whilst the states and territories focus on both all-cause and condition-specific readmissions.⁶³

Commonly, unplanned readmissions data are obtained from hospital administrative records, but these data do not differentiate between readmissions that are potentially avoidable and unavoidable.^{63, 64} Administrative data on hospital readmissions will inevitably include some readmissions that were medically necessary and unavoidable.⁵¹ Researchers have argued that only a peer review process by a panel of experts can determine whether a readmission was avoidable.⁶⁴ However, given the resource intensity of expert panels, most quantitative research on unplanned readmissions use administrative records of a selection of readmissions which are considered avoidable.⁶³

Recently, the Australian Government has agreed to focus on avoidable readmissions which are related to certain diagnoses which *“could be avoided through improved clinical management and/or appropriate discharge planning in the index admission”* (page 11,⁶³). The Australian Commission on Safety and Quality in Healthcare has developed a list of 32 common avoidable readmissions coded from patient medical records, including pressure injury, infections, surgical complications, respiratory complications, renal failure, medication complications and cardiac complications.^{a 63} The Australian

^a The new definition and measurement of avoidable readmission and reimbursement changes are relatively new and are still being operationalised. They are new developments that have come about since the design and implementation of this thesis.

Government plans to not reimburse public hospitals for readmissions related to these 32 common avoidable readmissions,⁶⁸ joining other countries such as the USA and the United Kingdom, which also have penalties and reimbursement systems in place for high rates of unplanned readmissions.^{62, 69}

1.6.1 Prevalence and burden of unplanned readmissions

Currently, at a national level unplanned readmissions are reported for selected surgical procedures as an indicator for the National Healthcare Agreements.⁶³ In 2016–2017, the highest unplanned readmissions rates were for paediatric tonsillectomy and adenoidectomy (40 per 1,000 separations) and hysterectomy (33 per 1,000 separations).⁷⁰ In NSW, the government reports an all-cause unplanned readmissions rate of 6% in 2016–2017²⁴ which is a slight decrease from 6.8% in 2012–2014 but is still above the NSW 2021 target of 5.5%.⁶⁵ Despite national-level reporting of surgical unplanned readmissions and NSW state-level all-cause unplanned readmissions, such reports are not informative of trends in chronic disease unplanned readmissions over time. Prevalence and cohort studies indicate that the risk of unplanned hospital readmissions is high for patients with chronic disease.^{60, 71, 72} A recent longitudinal cohort study of Australian elderly women reported an all-cause unplanned readmissions rate of 11%; for these readmissions, cardiovascular disease was the main cause.⁷³ A study of a major Victorian health service reported an all-cause unplanned readmissions rate of 7.4%, with chronic diseases being a significant risk factor (Odds ratio = 1.4).⁶⁰ A chronic-disease-specific analysis was conducted in 2009–2010 by the NSW Government Bureau of Health Information.⁵¹ The Bureau reported that 13% of patients with COPD and 9% of patients with congestive heart failure (CHF) were readmitted within 28 days.⁵¹ However, this study did not look at long-term trends of chronic disease unplanned readmissions and the risk factors which may predict any significant trends.

The burden of unplanned readmissions can be considered from two perspectives. Firstly, from a patient perspective, unplanned readmissions are disruptive and stressful, with patients potentially

having to leave work and family commitments.⁷⁴ Secondly, from a health system perspective, unplanned readmissions are costly and can impact bed availability.^{59, 74}

1.6.2 Unplanned readmissions among Aboriginal people

There are no government-reported data of unplanned readmissions by Aboriginality at a national level in Australia. At the NSW state level, the 2012 Chief Health Officer's report on the health of Aboriginal people of NSW reported that the all-cause readmissions rate within 28 days for Aboriginal people was 8.1% (compared with 6.3% for non-Aboriginal people) in 2010–2011.⁵⁸ A more recent NSW Government (NSW Health) report from 2016–2017 observed no gap between Aboriginal and non-Aboriginal people (6.0%).²⁴ However, the NSW Health monitoring data have several limitations. The NSW measure includes all causes for readmissions, and this may disguise any gap in chronic-disease-specific readmissions. Further, the NSW Health measure of unplanned readmissions only includes readmissions to the same hospital, and does not pick up all potential unplanned readmissions that may occur between hospitals.⁶⁵ Both NSW Health reports do not account for potential age, sex and socioeconomic differences in unplanned readmissions for Aboriginal and non-Aboriginal people. Lastly, for all hospitalisation data, it is likely there is an underrepresentation in unplanned readmission rates due to underreporting of Aboriginality in hospital data, and therefore caution is needed in interpreting all hospital-level data for Aboriginal people.⁷⁵

According to a thorough search of the literature, to date there has not been a research focus on unplanned readmissions among Aboriginal people with chronic disease. Given the high burden of chronic disease and potentially high unplanned readmission rates for Aboriginal people with chronic disease, there is a need for more specific hospital data analyses to identify potential differences and patterns among Aboriginal and non-Aboriginal people over time. Examining these data will provide an indication of the quality of healthcare received over time by Aboriginal people with chronic disease.

1.7 A conceptual model for understanding factors that may affect frequent avoidable admissions and unplanned readmissions

A significant amount of international research has explored the risk factors for unplanned readmissions in general populations,^{59, 60} with researchers, clinicians and policy-makers seeking to understand effective strategies within hospital and community healthcare settings to reduce both unplanned readmissions and avoidable admissions.⁶⁶ It is imperative to understand the factors that contribute to these types of hospitalisations for the general population and high-risk and vulnerable population groups as the first step in planning descriptive research and successful strategies to reduce them.

Conceptual frameworks are useful in organising and understanding the factors that may contribute to a phenomenon of interest.⁵⁹ Based on an existing health services theory,⁷⁶ Vest *et al.* propose that healthcare is a combination of population health and clinical care and explain that, “*the population perspective suggests outcomes are derived in part from individual characteristics as well as the qualities of their environment, whereas the clinical perspective adds the roles of the processes and structure of healthcare encounters*”(p3,⁵⁹). Using this framework, they formulated four determinants of unplanned readmissions: environmental-, patient-, encounter- and organisational-level factors (Figure 1.2).⁵⁹ The environmental level refers to factors such as geographic location and social environment factors such as social support.⁵⁹ Patient-level factors include sociodemographic, socioeconomic, behaviour and disease factors.⁵⁹ There is growing evidence that sociocognitive factors such as health literacy also contribute to readmissions,⁷⁷ and it has therefore been added to the patient-level factors within the model. The encounter level refers to factors related to the healthcare the patient receives for the index admission.⁵⁹ As this model is also used to consider determinants of avoidable admissions, and there is good evidence for the important role of community healthcare in managing chronic diseases and preventing unplanned readmissions and avoidable admissions,^{43, 78} the encounter-level factor has been expanded to include all activities and events related to chronic disease

healthcare in the community and hospital. Lastly, organisational-level factors include factors such as hospital or primary care type and location, and availability of inpatient and outpatient services.⁵⁹

It is recognised that this conceptual model is a simplification of the complex factors that contribute to unplanned readmissions and avoidable admissions for Aboriginal people. Yet, the model provides a useful framework for considering the types of factors found in the literature that could be considered when planning descriptive research aimed at better understanding frequent avoidable admissions and unplanned readmissions for Aboriginal people. If significant predictors of unplanned readmissions and frequent avoidable admissions are identified, they may be modifiable through targeted interventions.

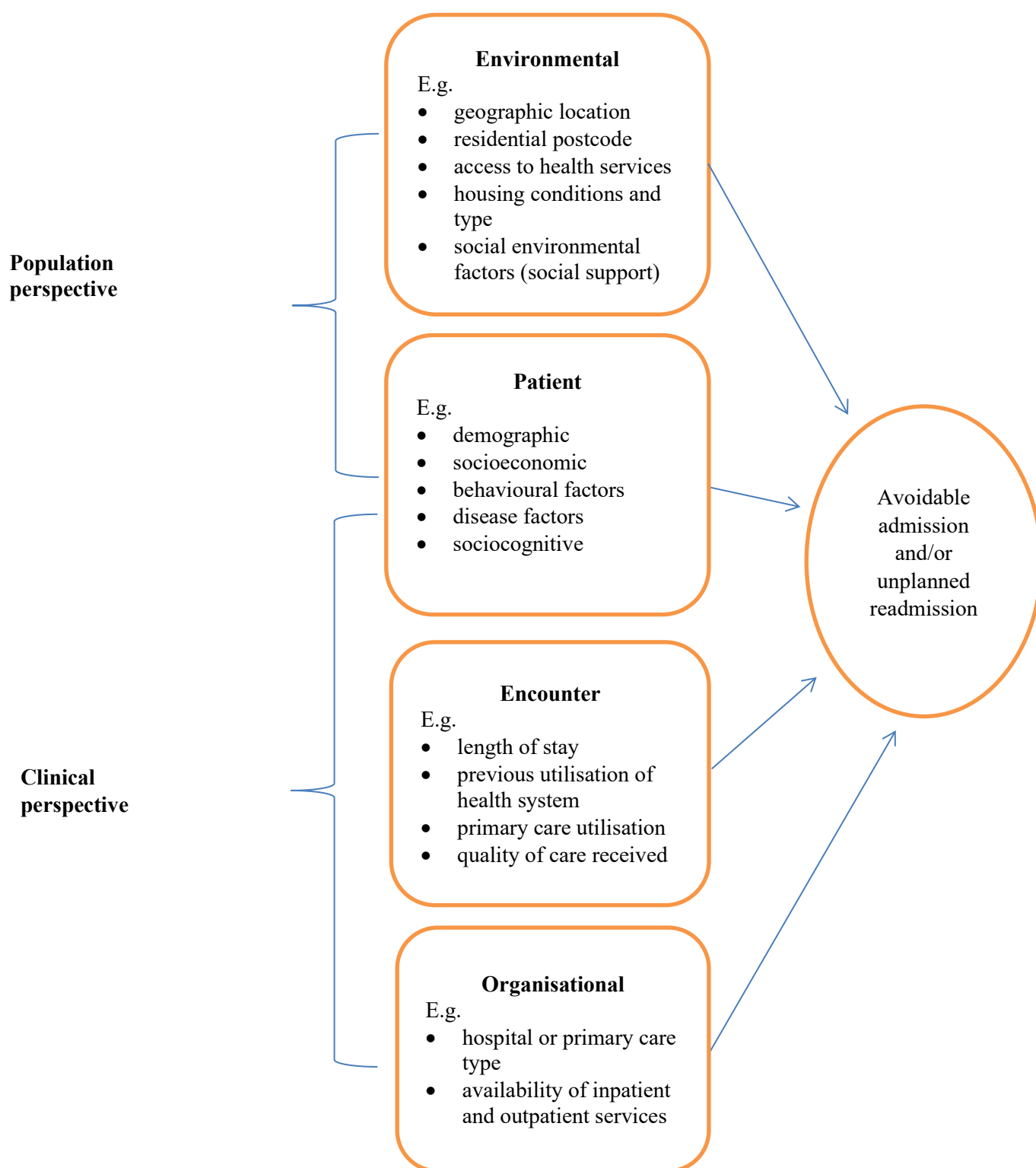


Figure 1.2: Conceptual model of how determinants may influence avoidable admissions and unplanned readmissions (adapted from Vest *et al.*⁵⁹)

1.7.1 Which factors from Vest et al.'s model have been shown empirically to be associated with avoidable admissions?

Environmental-level factors

Internationally and in Australia, research has demonstrated that a range of environmental factors are associated with avoidable admissions.^{79, 80} Australian data show that avoidable admissions vary by location of residence, with patients living in remote and very remote areas having the highest rates of avoidable admissions.⁵² Rates also differ by socioeconomic classification; for example, nationally, the gap between people living in the highest and lowest socioeconomic areas widened between 2012–2013 and 2017–2018, particularly for people with COPD, diabetes complications and CHF.⁴⁵ Living in a socially deprived area was also associated with frequent hospitalisation for COPD and CHF in a 2009–2010 NSW-wide hospitalisation data analysis.⁵¹ A lower ratio of GPs or primary care services to the population has also been found to impact on rates of avoidable admissions. For example, in a large Victorian linked dataset, a lower number of GPs per 10,000 population was associated with higher admissions rates of ambulatory-care-sensitive conditions within rural areas.⁸¹ Social support, and informal and supportive relationships are also significant indicators.^{78, 82} For example, in an Australian elderly cohort, higher social isolation scores were associated with more frequent (four or more) admissions for selected chronic diseases within 12 months.⁴⁷

There is limited evidence that some of the associations between environmental factors and avoidable admissions observed in the general population are also applicable to Aboriginal people. The proportion of people who have an avoidable admission and live in regional or remote areas is almost double for Aboriginal people compared to non-Aboriginal people (64.2% vs 35.6%).⁴⁴ However, rates of avoidable admissions remain higher for Aboriginal people compared to non-Aboriginal people, even after controlling for age, gender and remoteness (of the person hospitalised), suggesting that Aboriginality has a stronger effect on avoidable admissions than remoteness.⁸³

Although the research literature suggests that environmental-level factors are associated with avoidable admissions in non-Aboriginal populations, there is a need to examine the environmental determinants of frequent avoidable admissions, particularly among Aboriginal people in NSW. Further research examining the role of social/carer support and frequent avoidable admissions for Aboriginal people is needed.

Patient-level factors

A variety of patient-level factors have been shown to be associated with avoidable admissions. In a Victorian study of public hospital separations for 2003–2004, males and individuals of older age had increased avoidable admissions, particularly for diabetes complications and COPD.⁷⁹ A systematic review of predictors of preventable hospitalisations for chronic disease by Muenchberger and Kendall, found a strong association between co-morbidity and avoidable admissions, with the risk of readmissions increasing with each additional co-morbid chronic disease.⁸² Higher Charlson scores, an indicator of co-morbidity, were associated with more frequent admissions for chronic diseases in an Australian elderly rural hospital cohort.⁴⁷ Individuals' coping, decision-making ability and mental health were also found to be significantly linked to increased avoidable admissions.^{78, 82}

Several patient-level factors have been shown to be associated with increased frequent avoidable admissions for Aboriginal people. A period prevalence study using linked administrative public hospital records examining avoidable admissions of all South Australian residents between 2005–2006 and 2010–2011 found that Aboriginal patients were significantly more likely to be female and younger compared to non-Aboriginal patients (Median age=48;70, respectively).⁴⁴ Diabetes complications was the most common cause of avoidable admissions, with one-third of Aboriginal patients having avoidable admissions compared to one in five non-Aboriginal patients.⁴⁴ The same study also reported that Aboriginal people aged 35–44 years were more likely than non-Aboriginal people to experience at least one more avoidable admission.⁴⁴ Age differences were also found in a Northern Territory retrospective data analysis of avoidable admissions between 1998–1999 and 2005–

2006.⁸⁴ Although Aboriginal people had higher rates of avoidable admissions compared to non-Aboriginal people, the greatest differences over the study period were seen in the 25–44 and 45–64 years age groups.⁸⁴ The greatest increases over time in hospitalisations for men and women were in the ≥ 45 years age group compared to all other ages, mostly due to diabetes complications.⁸⁴

Existing state-level prevalence studies among Aboriginal people do not consider a wide range of patient-level factors that may be associated with avoidable admissions. These factors include severity of disease and behavioural factors such as medication adherence and health literacy. Further work is needed to understand the patient-level determinants of avoidable admissions, particularly frequent avoidable admissions in Aboriginal people in NSW.

Encounter- and organisational-level factors

Systematic reviews have identified several encounter-level determinants of avoidable admissions.^{78, 82} For example, in a prospective study of 293 hospital patients with moderate or severe asthma in South Australia, patients who were admitted to hospital were more likely to have been admitted to hospital for asthma in the previous year and to not have self-management supports such as an asthma action plan.⁸⁵ These associations were stronger for recurrent admissions (≥ 2 admissions) to hospital compared to no admissions.⁸⁵ The type of encounter is also associated with avoidable admissions, with studies showing that patients who received care from primary health services which used coordination of care or integrated services had lower rates of avoidable admissions.⁸² Reviews give no mention to organisational-level factors such as hospital or primary health service type.^{78, 82}

A limited number of studies have examined the association between encounter-level factors and increased risk of avoidable admissions among Aboriginal people.^{30, 86} High levels of primary care utilisation among Aboriginal people are associated with lower avoidable admission rates.³⁰ In a retrospective cohort study examining annual average number of clinic visits to primary healthcare involving a total of 14,184 remote-living Aboriginal people in the Northern Territory, medium (2–11

visits) and high (>12 visits) levels were significantly associated with decreases in avoidable chronic disease admissions.³⁰ Compared to low users (<2 visits), high primary healthcare users were found to have a reduction in admissions of 82–85% for renal disease and 63–78% for ischaemic heart disease, suggesting the benefits of primary care use in preventing unnecessary hospital admissions.³⁰ In another retrospective cohort study of 49 communities in the Northern Territory, patients who received a diabetes care plan within 60 days of diagnosis were more likely to have better short-term blood glucose control and fewer diabetes-related admissions compared to patients who had a delayed care plan put in place (from 60 days to less than two years; from two years to less than four years; or four years or greater).⁸⁷

Research on the impact of encounter-level factors associated with avoidable admissions among Aboriginal people were conducted in remote areas in the Northern Territory and may not be representative of Aboriginal people with chronic disease in other parts of Australia. Further work is needed to understand any associations of potential organisational and encounter factors, at both the primary care and hospital levels, with avoidable admissions for Aboriginal people in NSW.

1.7.2 Which factors from Vest et al.'s model have been shown empirically to be associated with unplanned readmissions?

Environmental-level factors

A limited number of environmental-level factors have been found in the international and Australian literature to be associated with unplanned readmissions.^{59, 88} In Australia, research has demonstrated an association between patients living in lower socioeconomic areas and a higher risk of unplanned readmissions. In a hospital linked data analysis of 139,043 admissions for asthma between 2000 and 2003 in NSW and Victoria, a significantly higher risk of readmission within 28 days was found for people who lived in areas of greater socioeconomic disadvantage.⁸⁸ However, these findings may not be representative of other chronic diseases. Several USA studies have found that both a lack of social support and difficulty in obtaining caregiver support were associated with an increased risk of

unplanned readmission.^{59, 89} However, few Australian studies have examined these potential indicators. Mudge *et al.* in their prospective cohort study of 142 patients aged 50 years and older found there was high social support, as measured by satisfaction with discharge supports, and this was associated with a decreased risk of readmissions.⁷² There are no current data examining direct associations of environmental factors and unplanned readmissions among Aboriginal people with chronic disease.

Little research in Australia has examined an association between environmental factors and unplanned readmissions, especially across different chronic diseases. Given the significant association between remoteness and avoidable admissions, environmental factors are likely to be important for understanding unplanned readmission patterns for Aboriginal Australians. Further descriptive research is needed to establish whether this is the case, especially for rates over longer time periods.

Patient-level factors

Particular patient factors have been consistently found in the international and Australian literature to be associated with unplanned readmissions.⁵⁹ In Australia, particular patient-level factors have been found to be associated with an increased risk of unplanned readmissions, in particular, increasing age,^{48, 90, 91} increasing Charlson comorbidity scores,⁹⁰ having a moderate to severe disability⁹² and having a major health complication at admission.⁹² An analysis of linked NSW population health data for patients with heart failure for the period 2000–2007 used Cox regression analyses to find that increasing age, increasing Charlson comorbidity score and male gender were significantly associated with readmissions.⁹⁰ Whilst the study examined trends over time for readmissions, this study did not measure unplanned or preventable readmissions.

Although examined in less detail, behavioural and sociocognitive factors such as medication adherence and health literacy have been shown to be associated with readmissions in the US literature.^{59, 77, 93, 94} However, few studies in Australia have examined these behavioural and

sociocognitive factors in relation to unplanned readmissions. A Queensland prospective cohort study of 142 inpatients aged ≥ 50 years found no significant association between poor medication adherence, poor cognition, reduced literacy and subsequent unplanned readmissions.⁷² However, this study used a small sample, examined unplanned readmissions at six months rather than the standard 28 days post-discharge, and did not focus on chronic diseases alone but rather all medical conditions. Therefore, it is hard to make any conclusions from these findings about unplanned readmissions within 28 days for chronic disease for other Australian populations.

There have been no published research examining associations of patient-level factors and unplanned readmissions for Aboriginal people with chronic disease. However, an unpublished NSW Health hospitalisation report examined age differences in unplanned readmissions and found that in all age groups, the rate of readmissions, following a chronic disease admission, was higher for Aboriginal people compared to non-Aboriginal people.⁹⁵ Readmission rates increased with age, with the 45–64 years age group having the greatest difference between Aboriginal and non-Aboriginal people (Rate Ratio = 1.3). No significant gender differences in readmission rates were reported.⁹⁵ The report highlights that co-morbidities may put Aboriginal people at higher risk of readmission at three months than Aboriginal people with a single chronic disease (24% and 18%, respectively).⁹⁵

Patient-level factors such as poor medication adherence and poor health literacy are considered potential barriers to chronic disease management for Aboriginal people.^{96, 97} However, a systematic review of studies of adherence rates and enablers and barriers for Aboriginal people from the perspectives of health professionals and patients found no evidence that adherence rates were lower for Aboriginal people compared to non-Aboriginal people.⁹⁸ The authors, however, argue that given the chronic disease burden for Aboriginal people, there was a need for enhanced medication adherence.⁹⁸ Rheault *et al.* tested a health literacy questionnaire among 200 Aboriginal adults with a diagnosis of chronic disease/s in Queensland and reported that younger age (<55 years), being female and having only one chronic disease were strongly associated with a higher level of health literacy for Aboriginal people.⁹⁹ However, further research is needed to explore whether levels of health literacy

and poor medication adherence are significantly different between Aboriginal and non-Aboriginal people with chronic disease, and whether they are associated with unplanned readmissions.

Although there is early evidence for the association between patient-level factors and unplanned readmissions in Australia, further work is needed to establish this association among Aboriginal people with chronic diseases, and over longer time periods. In particular, further descriptive work is needed to understand the role that behavioural and sociocognitive factors, such as health literacy and medication adherence, play in chronic disease self-management among Aboriginal people.

Encounter-level factors

In Australia there are mixed findings for the association of length of stay and unplanned readmissions. In a comparative cohort study, from one Victorian public health network, of 638 readmitted older patients with chronic heart failure compared with 5622 non-readmitted patients, patients with a length of stay of 10 days or more were significantly more likely to be readmitted than those patients discharged within three days of admission (Odds ratio=1.75; 95% CI 1.30, 2.36).⁹¹ On the other hand, Robertson *et al.*, in their hospital-linked study of patients with heart failure in NSW, found that length of stay was not a major risk factor for readmissions in their final Cox regression model.⁹⁰ Similar to US studies,^{59, 100} high previous utilisation of the health system may be a risk factor for subsequent readmissions in Australia. For example, in a NSW Bureau of Health Information report, frequent admissions for COPD and chronic heart failure in the previous 12 months were significantly associated with subsequent unplanned readmissions.⁵¹ However, again, findings are mixed, as a Queensland prospective cohort study of 142 medical inpatients aged ≥ 50 years found no associations of the number of previous admissions, discharge supports or length of stay with subsequent unplanned readmissions.⁷²

Little is known about the association of encounter-level factors and unplanned readmissions among Aboriginal people with chronic disease. However, qualitative research exploring the experiences of

hospital and community healthcare of Aboriginal people with chronic disease do give an indication of some potential encounter-level risk factors. In-depth interviews with 16 Aboriginal people with diabetes, chronic heart failure or COPD in NSW reported experiences of racism whilst receiving healthcare and poor communication by health professionals.²² Another qualitative study of Aboriginal patients who had been treated in a cardiology unit in Melbourne, Victoria, also reported mixed experiences with hospital staff and racism.¹⁰¹ Another potentially important encounter-level factor is length of stay in hospital, and there is early evidence for Aboriginal people staying longer in hospital than non-Aboriginal people.⁴⁴ However, no research has examined whether this is associated with higher risk of unplanned readmissions among Aboriginal people.

There are mixed findings for encounter-level factors as a determinant for increased risk of unplanned readmissions for chronic diseases in the general Australian population, and little empirical work conducted among Aboriginal people. Further research is needed to establish any encounter-level risk factors among Aboriginal people with chronic disease and their association with unplanned readmission over longer time periods.

Organisational factors

US studies have found that the risk of unplanned readmissions may vary by the admitting hospital.⁵⁹ In Australia little research has examined the association of organisational factors and unplanned readmissions for chronic diseases. One retrospective longitudinal study examining readmissions to 38 intensive care units (ICU) found greater risk of readmissions for tertiary hospital ICUs (Odds ratio 1.21; 95% CI 1.13–1.29; p value <0.001).¹⁰² However, the authors state there was an underrepresentation of rural and private hospitals.¹⁰² Vest *et al.* argue that overall little is known about whether the actual hospital has an effect on unplanned readmissions through structures or policies, or whether it is a variation for which data analysis needs to account.⁵⁹ They suggest, however, that large databases can easily incorporate organisational factors and adjust for random effects or clustering so

as to better understand the role organisational factors may have in increased unplanned readmissions.⁵⁹

There is little research knowledge of the association of organisational factors and unplanned readmissions among Aboriginal people with chronic disease. Research on the experiences of general health service delivery for Aboriginal people have reported that the cultural competence of services may impact upon health outcomes for Aboriginal people.^{22, 58, 103} For a health service to be culturally competent, it needs to value all cultures, educate staff in cultural skills and acceptance, and ensure the dynamics of the organisation are sensitive and empowering to all cultures.¹⁰⁴ Further research is needed to explore the impact of organisational-level factors on unplanned readmission outcomes for Aboriginal people.

Little research has examined the impact of organisational-level factors on unplanned readmissions for chronic diseases in Australia, particularly for Aboriginal people. Large hospital linked datasets have the potential to consider these factors by looking at hospital type variables, such as whether the hospital is an acute facility, and the geographic location of the hospital.

1.8 Which interventions have been found to be effective in reducing avoidable admissions and unplanned readmissions?

Descriptive research has identified factors associated with avoidable admissions and unplanned readmissions in certain population groups. The next step is to consider how any identified modifiable factors associated with frequent avoidable admissions and unplanned readmissions could be targeted by an intervention, with the intention of providing robust evidence of effectiveness in reducing rates for at-risk population groups such as Aboriginal people.

1.8.1 Frequent avoidable admissions

By definition, avoidable admissions should be reduced by early intervention through community healthcare and resources for self-management and address other environmental, patient, encounter and organisational factors.⁴⁴ Systematic reviews of the effectiveness of interventions in reducing avoidable admissions in general populations¹⁰⁵ and unplanned admissions for heart failure patients¹⁰⁶,¹⁰⁷ have found that education with self-management supports, exercise-based rehabilitation, telemedicine, continuity of care with a GP and integration of primary and secondary care have had good levels of success.

Although there is a substantial amount of research on effective interventions to prevent and treat chronic disease among Aboriginal people in Australia, not all intervention studies examine longer-term outcomes of reductions in avoidable admissions.¹⁰⁸ However, there have been several studies examining the impacts of various interventions aimed at reducing avoidable admissions among Aboriginal people in Australia, with mixed results. A cluster-randomised controlled trial aimed at improving care for Aboriginal people with poorly controlled diabetes by providing intensive chronic disease management delivered by Aboriginal health workers showed a non-significant reduction in diabetes-related hospitalisation in the treatment group ($P = 0.06$).¹⁰⁹ An observational time-trend study assessed the effect of the introduction of the Australian Government's Closing the Gap PBS co-payment incentive, which reduces the cost of prescription medication for Aboriginal people with or at risk of chronic disease, and showed significant reductions in hospitalisations with higher uptake of the incentive 18 months after the co-payment's introduction.¹¹⁰ However, as this study was a descriptive study, causal inferences cannot be made from the findings. A longitudinal study aimed to determine the impact of a home-based case management program for 60 Aboriginal people with chronic disease by providing person-centred and multidisciplinary care, but there was no significant improvement in hospitalisations over the 12-month period.¹¹¹ The lack of a significant reduction in hospitalisations may be due to the fact that the sample size was small and that this was an uncontrolled study design.

Despite good evidence of interventions successfully reducing avoidable admissions in non-Aboriginal populations, there is still a need for robust evidence of effective interventions for Aboriginal people with chronic disease, particularly with regard to frequent avoidable admissions.

1.8.2 Unplanned readmissions

There is a substantial body of literature systematically reviewing the effectiveness of interventions in reducing unplanned readmissions among medical and surgical patients in the general population.^{66, 112-114} Most studies have focused on gaps in the transition between hospital and community healthcare, with three main domains of focus: pre-discharge, bridging interventions and post-discharge.⁶³ Pre-discharge interventions occur in the hospital and can include discharge planning, medication review and patient education.⁶⁶ Bridging interventions are aimed at the transition from hospital to home and can include care coordination, clinician continuity or a transition coach, whilst post-discharge interventions take place once the patient has been discharged and can include a home visit or telephone follow-up (TFU).⁶⁶ Some studies have focused on implementing a single intervention whilst others combine interventions which can include activities from all three domains.⁶³

TFU interventions are used to address discharged patients' needs to help reduce the risk of unplanned readmissions, with some documented success.^{66, 115} TFU typically includes a health professional calling the recently discharged patient or carer with the aim of ensuring the patient understands and is taking their prescribed medications and is attending medical follow-up appointments, and the carer is supporting the patient in health management.¹¹⁵ It is considered easy to implement at a population level and cost-effective.¹¹⁵ However, to date there has not been a research focus on the effectiveness of TFU in reducing unplanned readmissions in patients with chronic diseases in general or in Aboriginal populations.

Recently, there have been two published protocols for interventions aimed at reducing unplanned readmissions, which include TFU with either a focus on or sub-analysis for Aboriginal participants.

Diplock *et al.* describe a protocol for a tailored multidimensional transitional care randomised controlled trial for patients with chronic disease with the aim of preventing readmissions in Aboriginal and non-Aboriginal adults admitted to medical and surgical units in Alice Springs Hospital.¹¹⁶ The intervention will include a case-based transitional care package, which includes pre-discharge, bridging and post-discharge interventions. The TFU component is proposed to take place with the patient and family at day 3 and day 5 post-discharge. The call will include topics such as how the patient is coping, any complications or problems, medication adherence, and any potential barriers to attending medical appointments. The authors hypothesise that compared to usual care, a tailored transitional care intervention will significantly reduce all-cause unplanned readmissions and health care utilisation in the previous 12 months.¹¹⁶ This is a promising intervention with a robust study design, but the authors need to ensure that a more accurate measure of unplanned readmissions is used for analysis. Despite the authors describing their aim of reducing unplanned readmissions, the primary outcome described can be defined as frequent avoidable admissions and not unplanned readmissions.

A second protocol for a stepped-wedge, cluster-randomised trial of a model of structured pharmacist and GP care intervention aims to reduce unplanned readmissions for patients with chronic disease in Southeast Queensland compared to usual care.¹¹⁷ The intervention includes a face-to-face pharmacist consultation 5 days post-discharge, a GP consultation, and either a face-to-face consultation or TFU call from a pharmacist 5 days after the initial consultation. No details of the content of the call are provided. Although the intervention is not specifically focused on Aboriginal people, there is a proposed sub-group analysis of whether the intervention is effective in Aboriginal Community Controlled Health Organisations compared to non-Aboriginal community health organisations.¹¹⁷ The usefulness of this intervention in providing evidence of the effectiveness of TFU in reducing unplanned readmissions for Aboriginal people with chronic disease will be determined by whether the analysis also includes a breakdown of subjects by Aboriginal status.

1.9 Study aims

This thesis aimed to inform the development of future practice and research to reduce frequent avoidable admissions and unplanned readmissions among Aboriginal people with chronic disease. To achieve this, the thesis addresses key gaps in current knowledge about frequent avoidable admissions and unplanned readmissions among Aboriginal people. The thesis adopted a mixed-methods approach to examine prevalence and trends over time; potential indicators of risk for avoidable hospitalisation and chronic disease management; and the effectiveness of TFU programs aimed at reducing unplanned readmissions among Aboriginal patients. Specifically, the aims of this thesis were:

- 1) To examine the prevalence of frequent avoidable admissions and unplanned readmissions among Aboriginal and non-Aboriginal people with chronic disease, and to explore any correlates in trends utilising linked NSW Health administrative health datasets (Papers one and two).
- 2) To explore the perceptions and experiences of unplanned readmissions among Aboriginal people who have been readmitted to hospital with chronic diseases (Paper three).
- 3) To examine the impact of telephone follow-up in reducing unplanned readmission rates for Aboriginal people with chronic disease (Papers four and five).

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Chapter 2: Research Governance Undertaken for This Thesis

Research governance refers to the processes used to ensure research is conducted according to established ethical principles and guidelines for best practice research.¹ In Australia, the National Statement on Ethical Conduct in Human Research guides the research design, ethical review and research conduct for all human research.¹ The statement outlines key values which must be adhered to in all research, namely, respect for human beings, research merit and integrity, justice, and beneficence.¹ However additional considerations are needed for research conducted with Aboriginal people. Historically, Aboriginal people have been the subject of much research that has not always been beneficial to Aboriginal people, has not addressed priorities for Aboriginal communities, has been invasive and unethical, and has been conducted without appropriate consultation and collaboration with Aboriginal communities.²⁻⁴ The 2007 United Nations Declaration of the Rights of Indigenous Peoples,⁵ which was endorsed by Australia in 2009, has led to the advocacy of Australian policies and programs ensuring the right to self-determination for Aboriginal people, so that all research upholds the rights of Aboriginal people and that they are involved in all aspects of research in their communities.⁶ This has led to the development of guidelines and key principles in conducting research with Aboriginal people.

2.1 Key guidelines and principles for research with Aboriginal people

The 2018 National Health Medical and Research Council (NHMRC) guidelines and principles for research studies with Aboriginal people² and its companion document, Keeping Research on Track II,⁶ outline six main values that are important for and should underpin all research conducted with Aboriginal people:

- *Spirit and integrity* – Spirit refers to connection and continuity between Aboriginal people and their past, present, and future generations. Integrity is about honouring and respect.

- *Cultural continuity* – Research should be conducted in a way that respects and protects Aboriginal knowledge, cultures, language and identities.
- *Equity* – This value affirms and recognises Aboriginal people’s right to be different.
- *Reciprocity* – Shared responsibility and obligation are core to kinship networks and involve caring for country and sharing benefits such as food and housing, and redistribution of resources.
- *Respect* – Respecting each other’s dignity and different ways of living is important for the way Aboriginal people live.
- *Responsibility* – There are core responsibilities at the center of all Aboriginal communities such as caring for country and people, and ensuring there is no harm to any person or place.⁶

The guidelines specify how Aboriginal people’s right to self-determination can be applied to the research context; for example, Aboriginal people always have the right to refuse to participate in research, the right for Aboriginal ways of doing things to be respected and the right to have input into the research agenda.⁶ Keeping Research on Track II provides guidance and practical steps to researchers and participants on applying these values and rights to ethical conduct in research from building relationships, creating initial research ideas, study design, implementation, and reporting and dissemination of findings.⁶

The Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS) have developed a Code of Ethics for Aboriginal and Torres Strait Islander Research, and an application guide.^{3, 7} The code of ethics work, which commenced in 1999, “*repositioned Indigenous peoples from subjects of research to partners in research*” (page 2, ⁷). It sets out four core principles for ethical Aboriginal research: Indigenous self-determination, Indigenous leadership, impact and value, and sustainability and accountability.³ Each principle sets out key responsibilities for researchers, such as recognition and respect, engagement and collaboration, and informed consent.³ These guidelines should be considered together when planning and conducting Aboriginal research.

2.2 Ethics approval processes

In Australia, Human Research Ethics Committees (HREC) review research proposals and determine whether they are ethically acceptable and in keeping with laws, regulations and ethics guidelines.⁶ In NSW, research projects with Aboriginal people, or any research that affects Aboriginal people and communities^a, must also receive ethics approval from the Aboriginal Health and Medical Research Council of NSW (AH&MRC) Human Research Ethics Committee. The committee, which consists of predominantly Aboriginal and Torres Strait Islander members, reviews research proposals to ensure the design is meaningful, ethical, culturally appropriate, respectful and beneficial to Aboriginal communities.⁸ They assess all research applications against the above-mentioned guidelines and other HREC guidelines.⁹

This thesis included three main components which required ethical approval: data linkage study (papers one and two), a qualitative study (paper three) and the evaluation of the 48 Hour Follow Up program (paper five). Paper four was a systematic review and did not require ethical approval. Table 2.1 outlines the ethical approval obtained for each of these papers.

^a Aboriginal research is not defined as research that is only focused on Aboriginal people. There are other reasons why a research study may need to obtain approval from the AH&MRC, such as if research study includes Aboriginal people, as a group, being examined in the results. <https://www.ahmrc.org.au/submit-an-ethics-application/>

Table 2.1: Ethical approval by thesis paper

	AH&MRC Human Research Ethics Committee approval reference	HREC name and approval reference
Papers 1 and 2	1090/15	NSW Population and Health Services Research Ethics Committee (HREC/15/CIPHS/18)
Paper 3	1325/17	Hunter New England Human Research Ethics Committees (HREC/17/HNE/473)
Paper 5	967/13	University of Newcastle Human Research Ethics Committee (H-2013-0381)

2.3 Addressing the Aboriginal Health and Medical Research Council's five key principles

Any research which affects Aboriginal people and communities in NSW is required to meet all five AH&MRC Ethics Committee key principles: net benefits for Aboriginal people and communities, Aboriginal community control of research, cultural sensitivity, reimbursement of costs, and enhancing Aboriginal skills and knowledge.⁹ Researchers are required to demonstrate how they plan to embed these principles throughout their research practice through processes and mechanisms.⁹ Table 2.2 provides a description of how this thesis's research studies met each of the five key principles.

Table 2.2: How this thesis’s studies, which required ethical review, addressed the Aboriginal Health and Medical Research Council’s five key principles

1. Net benefits for Aboriginal People and Communities – for Aboriginal health in general or specifically for the health of Aboriginal people and communities participating in the project.⁹	
Papers 1, 2, 3 and 5	<ul style="list-style-type: none"> • Papers 1 and 2 provide important information confirming the health gap which Aboriginal people in Australia experience, namely, that Aboriginal people in our cohort who were admitted to hospital with a chronic disease had a significantly higher risk of unplanned readmissions or death, and frequent avoidable admissions, compared with non-Aboriginal people. It highlights an important area that must be addressed by evidence-based and culturally appropriate interventions. • Paper 3 provides unique data from interviews with Aboriginal people about their perspectives and experiences of unplanned readmissions. The findings highlight the enablers and barriers to chronic disease management for Aboriginal people and the potential challenges of access to disability services, and access to culturally appropriate care. • Paper 5 offers some encouraging data showing the potential effectiveness of a telephone follow-up program in reducing emergency department presentations for Aboriginal people with chronic disease who have recently been discharged from hospital. • The information from papers 1, 2, 3 and 5 may indirectly contribute to the health of Aboriginal and Torres Strait Islander communities by providing important information for the future development of Aboriginal health services, as well as the development of research strategies aimed at reducing unplanned hospital readmissions and frequent avoidable admission rates.

2. Aboriginal Community Control of Research – must be a key focus of all stages of the research study so that Aboriginal people and communities participating in or affected by the research will be fully informed about and agree with the purposes and conduct of the project.⁹

<p>Papers 1 and 2</p>	<ul style="list-style-type: none"> • Papers 1 and 2 used administrative data and involved no primary data collection. • Aboriginal oversight and meaningful engagement were sought at both the design phase and analysis phase for both studies by establishing an advisory group/Aboriginal reference group to ensure a good research partnership.^{7, 9} • Terms of reference for the advisory group were drafted and sent to a representative from AH&MRC, an Aboriginal health worker, a representative from an Aboriginal Medical Service and a leading Aboriginal academic with expertise in Aboriginal health and administrative data^b. Although three Aboriginal people agreed to join the group, two did not participate in the group due to their time constraints. In the end there was one Aboriginal member of the advisory group, an experienced local health district (LHD) Aboriginal health manager. The other members of the advisory group had extensive experience in conducting Aboriginal research. The group included University of Newcastle and James Cook University researchers, including an expert in epidemiology and biostatistics. • The advisory group played a central role in ensuring the project demonstrated excellence in evaluation and research methodology and provided useful information to inform practice and policy, by providing critical feedback and advice at specific stages of the project.
<p>Paper 3</p>	<ul style="list-style-type: none"> • Aboriginal oversight and meaningful engagement in the study described in paper 3 were achieved through establishment of an advisory group. • The advisory group comprised the Chief Executive Officer, Operations Manager and general practitioner from Yerin Aboriginal Health Services, the manager and operations manager from Nunyara Aboriginal Health

^b A Guide to applying: The AIATSIS Code of Ethics for Aboriginal and Torres Strait Islander Research sets out guidelines on how to appropriately engage Aboriginal communities early in a research study, in a way that is appropriate for the type of research being conducted, e.g. state-wide survey or local community qualitative study.⁷ Researchers are advised to engage the appropriate organisations which have authority to make decisions and represent “collective rights and interests and cultural heritage”.⁷ For the AH&MRC, it is also important to identify and engage local organisations and local communities to be actively engaged in the research. A research partnership must be formed, which can be in the form of an advisory group.

	<p>Unit, and University of Newcastle researchers. Both Aboriginal organisations served the local communities in the area and had detailed knowledge of their communities' strengths and needs. Draft terms of reference for the advisory group were sent to all members. Three members of the group identified as Aboriginal and Torres Strait Islander.</p> <ul style="list-style-type: none"> • This research study involved primary data collection, and the advisory group met early in the study to provide expertise in areas such as cultural oversight in the research design and development of interview questions. • The advisory group played a central role in ensuring the project demonstrated excellence in evaluation and research methodology and provided useful information to inform practice and policy, by providing critical feedback and advice at specific stages of the project. The advisory group ensured there was appropriate Aboriginal oversight of the project and ensured cultural appropriateness of the research approaches and interpretation of data. The engagement of Aboriginal members and Aboriginal Medical Service representatives in refining and developing the analysis ensured that this study adhered to the values and priorities of the communities they represented. The advisory group met face-to-face and online and communicated via email.
Paper 5	<ul style="list-style-type: none"> • The 48 Hour Follow Up program was designed in response to the Walgan Tilly Clinical Redesign project which aimed to find practical solutions to health and access issues for Aboriginal people with chronic disease.¹⁰ The Chronic Care for Aboriginal People Program (CCAP) at the NSW Agency for Clinical Innovation played a primary role in: a) identifying aims and priorities for the project; and b) identifying and developing evaluation strategies. The CCAP team was made up of four staff members, of whom two were Aboriginal (male and female) and two non-Aboriginal. The manager, from the Kamilaroi (Moree) nation, was instrumental in the development and implementation of 48 Hour Follow Up. The consultations in rural, remote and metropolitan areas with populations of Aboriginal communities informed CCAP of the need for telephone follow-up.¹⁰ • Paper 5 reports the findings of one part of a larger evaluation of the 48 Hour Follow Up program. • The evaluation was guided by an advisory group. This consisted of CCAP, NSW Ministry of Health, Centre for Aboriginal Health, University

	<p>of Newcastle researchers, AH&MRC, and LHD 48 Hour Follow Up staff. The findings from the evaluation were interpreted in conjunction with information provided by staff members involved in the delivery of 48 Hour Follow Up, including Aboriginal staff members and non-Aboriginal people with substantial experience in Aboriginal health. The advisory group met on a regular basis, and members were involved in the interpretation of the data and the formulation of recommendations arising from the evaluation.</p>
<p>3. Cultural Sensitivity – cultural protocols and community decision-making processes will vary among Aboriginal communities, and researchers should consider this when designing a project.⁹</p>	
Papers 1 and 2	<ul style="list-style-type: none"> • The research proposal for the two studies described in papers 1 and 2 was based on building a strong collaborative relationship between the research team and members of the advisory group. The Aboriginal member of the advisory group ensured there was cultural appropriateness of the research approaches and interpretation of data, that the information produced was of relevance to and respected the experiences and values of Aboriginal and Torres Strait Islander individuals and communities. • There was an ongoing process of consultation with the advisory group to ensure that all study processes and materials were culturally appropriate and sensitive. The advisory group met online at two key points throughout the course of the project (prior to receiving the linked data to review the study design and protocol, and prior to write-up to review results and their interpretation) to ensure the project aligned with Aboriginal people's needs and values.
Paper 3	<ul style="list-style-type: none"> • Aboriginal community engagement, support and consent were sought early in the research study described in paper 3. • The Yerin Aboriginal Health Services and Nunyara Aboriginal Health Unit were both approached to see if they were interested in the research concept. Both organisations were keen to be involved, and a strong relationship was built among partners. • There was an ongoing process of engagement to ensure that all study processes and materials were culturally appropriate and sensitive. The advisory group met early in the research study to design the study methodology and interview questions, thus ensuring there was cultural appropriateness of the research approaches.

	<ul style="list-style-type: none"> The advisory group suggested the interviewer work alongside the Aboriginal Hospital Liaison Officer (AHLO) on her regular ward rounds. The AHLO identified eligible patients, explained the study to them, and sought consent. She was present during the interview if the patient requested. The advisory group met on two main occasions – the planning stage (as mentioned) and then again for interpretation of data – to ensure the themes were culturally sensitive and respected the experiences and values of Aboriginal individuals and communities.
Paper 5	<ul style="list-style-type: none"> The 48 Hour Follow Up advisory group met regularly to ensure there was ongoing engagement with Aboriginal representatives to ensure that all evaluation processes were culturally appropriate and sensitive. The advisory group was always co-chaired by an Aboriginal person and included Aboriginal and non-Aboriginal members.
4. Reimbursement of Costs – there must not be any imposition upon Aboriginal people and communities to be involved in the research project.⁹	
Papers 1 and 2	<ul style="list-style-type: none"> The research studies described in papers 1 and 2 did not collect primary data, but instead analysed a large linked administrative population and hospital dataset. As the researchers did not have access to identifiable data, they did not have any contact with individuals in the dataset, and therefore no extra costs or time were required of participants who had already contributed to the dataset.
Paper 3	<ul style="list-style-type: none"> The research team recognised the importance of ensuring that the costs of research study described in paper 3 were not borne by the participating sites, the AHLO or the participants involved. The AHLO's contribution to recruitment was through her usual working role. The interviews were conducted by a PhD Student from the University of Newcastle, therefore minimising the burden imposed on staff. In order to thank patients for the time taken to participate in the research, participants were offered a \$20 supermarket gift card.
Paper 5	<ul style="list-style-type: none"> Similar to papers 1 and 2, there were no out-of-pocket costs borne by patients or services for the study described in paper 5, as it used data that were routinely collected.

5. Enhancing Aboriginal Skills and Knowledge – build the capacity of Aboriginal people to participate in and lead research projects. Individuals may be from an Aboriginal community organisation, Aboriginal reference group, participants, or researchers on the project team⁹

Papers 1 and 2	<ul style="list-style-type: none"> • The Aboriginal advisory group member, for the research studies described in papers 1 and 2, was from a service delivery rather than a research role. He expressed his desire to be involved in health research. Therefore, by working with a multidisciplinary team, he was able to learn about each stage of the research process. His skills were further advanced by his contribution to the two peer-reviewed journal papers. Thus, the research study did provide capacity-building opportunities.
Paper 3	<ul style="list-style-type: none"> • Similar to papers 1 and 2, the advisory group members for the study described in paper 3 were from health service delivery organisations. Thus, their skills and knowledge in research processes were enhanced through their involvement in the research study. All Aboriginal members of the advisory group became co-authors in the peer-reviewed journal paper arising from the study. • The AHLO was invited to contribute to the paper, but she did not have the time to contribute in this way. She was, instead, acknowledged at the end of the paper for her contribution to data collection.
Paper 5	<ul style="list-style-type: none"> • Aboriginal members of the 48 Hour Follow Up advisory group benefited from discussions regarding interpretation of the data, which considered the experiences of Aboriginal workers and other service deliverers. • The evaluation encouraged a dialogue between partners, thus helping build strong relationships and understanding. • Additionally, advisory group members were invited to contribute to a peer-reviewed journal article.

2.4 Advisory group membership

Below are lists of the members of the three different advisory groups established for the research studies used in this thesis.

Papers 1 and 2:

- Mr Steve Ella, Manager Aboriginal Health, Central Coast Local Health District, of the Yuin nation.
- Laureate Professor John Attia, School of Medicine and Public Health, University of Newcastle.
- Mr Simon Towle, Adjunct Research Fellow, The Cairns Institute, James Cook University
- Laureate Professor Rob Sanson-Fisher, School of Medicine and Public Health (Public Health), University of Newcastle.
- Professor Mariko Carey, NHMRC Boosting Dementia Research Leadership Fellow, School of Medicine and Public Health, University of Newcastle.
- Dr Jamie Bryant, NHMRC–ARC Dementia Research Development Fellow, School of Medicine and Public Health, University of Newcastle.
- Ms Amanda Jayakody, PhD Candidate, School of Medicine and Public Health, University of Newcastle.

Paper 3

- Mr Steve Ella, Manager, Nunyara Aboriginal Health, Central Coast Local Health District, of the Yuin nation.
- Ms Shanell Bacon, Operations Manager, Nunyara Aboriginal Health, Central Coast Local Health District, of the Gamilaroi nation.
- Ms Belinda Field, Chief Executive Officer, Yerin Aboriginal Services, of the Wiradjuri nation.
- Mr Paul Hussein, Operations Manager, Yerin Aboriginal Services.

- Dr Eloise Warren, General Practitioner, Yerin Aboriginal Services.
- Laureate Professor Rob Sanson-Fisher, School of Medicine and Public Health (Public Health), University of Newcastle.
- Professor Mariko Carey, NHMRC Boosting Dementia Research Leadership Fellow, School of Medicine and Public Health, University of Newcastle.
- Dr Jamie Bryant, NHMRC–ARC Dementia Research Development Fellow, School of Medicine and Public Health, University of Newcastle.
- Ms Amanda Jayakody, PhD Candidate, School of Medicine and Public Health, University of Newcastle.

Paper 5

- Mr Kiel Hennessey, Agency for Clinical Innovation, of the Wiradjuri Nation.
- Ms Eunice Simons, Agency for Clinical Innovation.
- Ms Regina Osten, Agency for Clinical Innovation.
- Ms Jacinta Bunfield, Centre for Aboriginal Health, NSW Ministry of Health.
- Mr Maurice Terare, Centre for Aboriginal Health, NSW Ministry of Health, Aboriginal community member (nation unknown at time of writing).
- Dr Andrew Milat, Centre for Epidemiology and Evidence, NSW Ministry of Health.
- Dr Marianne Gale, Office of the Chief Health Officer, NSW Ministry of Health.
- Keri Lucas, Aboriginal Health and Medical Research Council of NSW.
- Ms Marilyn Body, Mid North Coast Local Health District.
- Ms Anau Speizer, South Western Sydney Local Health District.
- Ms Margaret Broadbent, South Eastern Sydney Local Health District, of the Tharawal Nation.
- Ms Leonie Leonard, Central Coast Local Health District.
- Laureate Professor Rob Sanson-Fisher, School of Medicine and Public Health (Public Health), University of Newcastle.

- Professor Mariko Carey, NHMRC Boosting Dementia Research Leadership Fellow, School of Medicine and Public Health, University of Newcastle.
- Dr Jamie Bryant, NHMRC–ARC Dementia Research Development Fellow, School of Medicine and Public Health, University of Newcastle.

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Chapter 3: Paper One

Introduction to paper one

Ambulatory-care-sensitive chronic conditions are considered manageable in community health settings. Therefore, hospital admissions for these conditions are referred to as avoidable admissions. If a person has three or more avoidable admissions within 12 months, these admissions are considered to be frequent avoidable admissions. Aboriginal people have higher rates of avoidable admissions compared to non-Aboriginal people. However, the prevalence of frequent avoidable admissions among Aboriginal people is not known.

Paper one reports on a study that aimed to examine trends in avoidable admissions among Aboriginal and non-Aboriginal people with chronic conditions in NSW between 2005–2006 and 2013–2014. A large, linked dataset spanning a nine-year period that used NSW administrative data from the NSW Admitted Patient Data Collection and the NSW Emergency Department Data Collection was analysed. Data linkage is a method of gathering information about the same person from different data sources, allowing for chronological sequencing of events. Data linkage has several advantages over other study methods: it provides valuable information on the health and wellbeing of a population over time, is less intrusive and costly than collecting the same information by other means such as large-scale surveys, and also allows large or entire populations to be studied across different parts of the health system (e.g. community and hospital healthcare settings), thus reducing the common problems with follow-up encountered in survey-based research designs.

This paper has been published in *BMC Health Services Research*. The statements of contribution from co-authors are shown in Appendix 1.

Citation: Jayakody A, Oldmeadow C, Carey M, Bryant J, Evans T, Ella S, Attia J, Towle S, and Sanson-Fisher R. Frequent avoidable admissions amongst Aboriginal and non-Aboriginal people with


chronic disease in New South Wales, Australia: a historical cohort study. BMC Health Services Research. (2020) Nov 25;20(1):1082.

RESEARCH ARTICLE

Open Access



Frequent avoidable admissions amongst Aboriginal and non-Aboriginal people with chronic conditions in New South Wales, Australia: a historical cohort study

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Abstract

Background: Aboriginal and Torres Strait Islander people have high rates of avoidable hospital admissions for chronic conditions, however little is known about the frequency of avoidable admissions for this population. This study examined trends in avoidable admissions among Aboriginal and non-Aboriginal people with chronic conditions in New South Wales (NSW), Australia.

Methods: A historical cohort analysis using de-identified linked administrative data of Aboriginal patients and an equal number of randomly sampled non-Aboriginal patients between 2005/06 to 2013/14. Eligible patients were admitted to a NSW public hospital and who had one or more of the following ambulatory care sensitive chronic conditions as a principal diagnosis: diabetic complications, asthma, angina, hypertension, congestive heart failure and/or chronic obstructive pulmonary disease. The primary outcomes were the number of avoidable admissions for an individual in each financial year, and whether an individual had three or more admissions compared with one to two avoidable admissions in each financial year. Poisson and logistic regression models and a test for differences in yearly trends were used to assess the frequency of avoidable admissions over time, adjusting for sociodemographic variables and restricted to those aged ≤ 75 years.

(Continued on next page)

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Results: Once eligibility criteria had been applied, there were 27,467 avoidable admissions corresponding to 19,025 patients between 2005/06 to 2013/14 (71.2% Aboriginal; 28.8% non-Aboriginal). Aboriginal patients were 15% more likely than non-Aboriginal patients to have a higher number of avoidable admissions per financial year (IRR = 1.15; 95% CI: 1.11, 1.20). Aboriginal patients were almost twice as likely as non-Aboriginal patients to experience three or more avoidable admissions per financial year (OR = 1.90; 95% CI = 1.60, 2.26). There were no significant differences between Aboriginal and non-Aboriginal people in yearly trends for either the number of avoidable admissions, or whether or not an individual experienced three or more avoidable admissions per financial year ($p = 0.859$; 0.860 respectively).

Conclusion: Aboriginal people were significantly more likely to experience frequent avoidable admissions over a nine-year period compared to non-Aboriginal people. These high rates reflect the need for further research into which interventions are able to successfully reduce avoidable admissions among Aboriginal people, and the importance of culturally appropriate community health care.

Keywords: Aboriginal health, Frequent admissions, Health services research, Data linkage, Chronic disease

Background

The term ‘avoidable admissions’, also known as potentially preventable hospitalisations, refers to hospital admissions for ambulatory care sensitive conditions. Such conditions are considered manageable through timely and effective primary care [1, 2]. Internationally, and in Australia, the concept of avoidable admissions is used as an indicator of health system performance [1, 3, 4]. Chronic conditions which are ambulatory care sensitive include (but are not limited to) chronic obstructive pulmonary disease, diabetic complications and congestive heart failure.

Aboriginal and Torres Strait Islander people (respectfully referred to as Aboriginal people hereinafter) have a higher prevalence of chronic conditions and higher rates of avoidable admissions for chronic conditions compared to non-Aboriginal Australians [3, 5]. Within the Australian state of New South Wales (NSW) avoidable admission rates for chronic diseases are more than three times higher among Aboriginal people compared to non-Aboriginal people [4, 6]. Of particular importance is the fact that these higher rates have remained consistent over the past decade [7].

Among those who experience avoidable hospital admissions, there is a subset of people who are particularly vulnerable due to the frequency of avoidable admissions experienced. Frequent avoidable admissions to hospital are a significant and complex issue facing health services internationally [8–10]. The definition of frequent avoidable admissions varies in the literature, with cut off points at three or four admissions within a 12 months period used [8–11]. However, the most widely reported definition uses three or more admissions within 12 months [8, 11, 12]. Frequent avoidable admissions are associated with a higher risk of an unplanned readmission and are an indication of poor chronic disease management within the community setting [3, 11, 12].

Frequent avoidable admissions are a costly burden on the health system and are a significant cause of bed shortages in hospitals [8, 10]. People who experience frequent avoidable admissions may experience poor quality of life, high out of pocket expenses, psychological distress; and for those most vulnerable patients, frequent admissions can put them at risk of hospital acquired infection [13–15].

The very few research studies that have examined frequent admissions show that Aboriginal people are significantly more likely to experience frequent emergency department presentations and frequent admissions to hospital compared with non-Aboriginal people [9, 16, 17]. A South Australian prevalence study from 2005 to 2011 examining avoidable admissions using linked administrative public hospital record data found that Aboriginal people hospitalised with a chronic condition went on to experience on average 2.6 avoidable admissions in the next 12 months compared to 1.9 avoidable admissions among non-Aboriginal people [18]. Another study examined all inpatient episodes, rather than just avoidable chronic condition admissions, in Northern Territory public hospitals between 2005 and 2013 [9]. Springer and colleagues found that frequent admissions were more common among Aboriginal people (crude odds ratio = 2.50 (95% CI. 2.41–2.59)) compared to non-Aboriginal people, and mostly due to respiratory diseases, injury and poisoning [9]. It is not clear how generalizable the results from these studies are to other Australian states such as NSW which has the largest population of Aboriginal and Torres Strait Islander people in Australia [19]. Relatively little is known about frequent avoidable admissions for Aboriginal people with chronic conditions in NSW.

Examining trends over time in frequent avoidable admissions among Aboriginal people with ambulatory care sensitive chronic conditions has the potential to inform

strategies aimed at improving community based chronic disease management. This study examined trends in avoidable admissions among Aboriginal and non-Aboriginal people with ambulatory care sensitive chronic conditions admitted to NSW hospitals between 2005/6 and 2013/14.

Methods

Study design

A historical cohort with de-identified linked hospital and administrative data.

Data sets

The study used data from the NSW Admitted Patient Data Collection (APDC) which was provided by the Centre for Health Record Linkage (CHEREL) [20]. The data collection includes all hospital separations in public and private hospitals in NSW and includes discharges, transfers and deaths. Fact of death was provided by the NSW Registry of Births, Deaths and Marriages (RBDM).

Study cohort

The study cohort comprised patients who: were aged 18 years and older at the time of index admission; were admitted to a NSW public hospital between 2005/6 and 2013/14; discharged from hospital to the community (reflecting the focus on potentially avoidable admissions which are considered manageable through timely and effective community health care); and had one or more of the following selected ICD-10 defined ambulatory care sensitive (ACS) chronic conditions as a principle diagnosis: diabetic complications, asthma, angina, hypertension, congestive heart failure (CHF) and/or chronic obstructive pulmonary disease (COPD; including Bronchiectasis) (Additional File 1). These chronic conditions were selected as they are highly prevalent among Aboriginal people and an admission to hospital relating to these chronic conditions is considered potentially avoidable through health promotion, preventative measures, or timely access to non-hospital care such as through community health care [3, 4].

Sampling

The data provided by CHEREL was for the purpose of an overarching analysis project exploring unplanned readmissions [21] and frequent avoidable admissions amongst Aboriginal and non-Aboriginal people (this study). The data provided was restricted to age 18 years and older, and to a selection of chronic conditions (cardiovascular disease, chronic respiratory disease, diabetes and renal disease). The Aboriginal sample included all APDC patients who met this age and chronic disease criteria, had at least one record during the study period, and were documented as Aboriginal and/or Torres Strait

Islander on any APDC record. This method was considered the most accurate method available for retrieving Aboriginal status. The level of correct reporting of Aboriginal status in the APDC has been reported to be 90.7% (95% CI 84.6–94.2) [22]. A non-Aboriginal comparison sample was selected by using an equal number of randomly sampled patients who met the age and chronic disease criteria and were not documented as Aboriginal and/or Torres Strait Islander on any records. RBDM fact of death pertaining to the sample were included in the final dataset.

Data preparation

The APDC and RBDM data were provided in a de-identified format by CHEREL. This study's cohort eligibility criteria (as described above in the Study Cohort section) were applied to the data. Duplicate records were excluded. Periods of care were defined as overlapping episodes of care and sequential transfers were considered in order to define the start and end dates for the period of continuous hospital care. A period of care ended with discharge from hospital. If a patient was discharged and then readmitted the same day, this represented the next period of care. Periods of care in the year of an individual's death were included in the analysis. Periods of care are referred to as admissions for the remainder of this paper. Two datasets were prepared for analysis: an un-aggregated database of admissions with a defined ACS ICD code ($n = 31,836$) and an aggregated dataset of counts of the number of avoidable admissions for each patient by financial year, and whether they were planned or unplanned admissions ($n = 22,802$).

Exclusions

Private hospital admissions were excluded from the cohort. It was a priori acknowledged that most private hospital admissions are planned as very few private hospitals have emergency departments, [23] and the majority of hospital admissions for Aboriginal people are in public hospitals (90%) [24]. Planned admissions were excluded from the analysis.

Analysis variables

For each individual the following outcomes were used: 1) the number of avoidable admissions (defined as an unplanned admission with a principal diagnosis of an ACS chronic condition) for an individual in each financial year (the Australian financial year runs from 1 July to 30 June of the following year); 2) whether or not an individual experienced three or more avoidable admissions in each financial year they were observed over the study period (compared with one to two avoidable admissions). Unplanned admissions were coded as an "emergency status recode" in the APDC.

Patient demographics included in the final dataset were sex, age, Aboriginal status and marital status. The Accessibility/Remoteness Index of Australia (ARIA) and the Index of Relative Socio-economic Disadvantage (IRSD) quintile were calculated. ARIA is an Australian Bureau of Statistics measure of remoteness [25] and the IRSD is a measure of socio-economic status derived from the economic and social conditions within geographic areas [26]. The Charlson Co-morbidity Index (CCI) was calculated [27] which provided a measure of the risk of mortality from comorbidity during the next 12 months. Length of stay was also included.

Statistical analysis

The denominator for the analysis was all avoidable admissions which met the eligibility criteria. At the admission level (unaggregated data), chi-square and t-tests were used to examine crude associations between Aboriginal status and sociodemographic, disease and admission factors. Then at the patient level (aggregated data), the yearly means of avoidable admissions were calculated by Aboriginal status and financial year. Chi-square tests were then used to examine associations of the proportion of individuals with three or more avoidable admissions compared with one to two avoidable admissions by Aboriginal status and financial year. Multivariable analyses were conducted using the aggregated data. Firstly, a Poisson regression model was used to examine the association of the number of avoidable admissions and Aboriginal status controlling for age, sex, marital status, financial year, IRSD, ARIA and restricted to patients aged ≤ 75 to account for the younger age structure of the Aboriginal patients. Secondly, a logistic regression model was used to assess the association of three or more avoidable admissions compared with one to two per financial year and Aboriginal status, controlling for age, sex, marital status, financial year, IRSD, ARIA and restricted to patients aged ≤ 75 . To examine any differences in yearly trend between Aboriginal and non-Aboriginal people, an interaction term for Aboriginal status and financial year (as a categorical variable) was included in both final models, followed by a post estimation Wald test of the interaction term. The model was also fit without the interaction term and a post estimation Wald test was used to test the significance of the financial year term. A sensitivity analysis was used to determine any potential differences in results when index admissions ending in death were excluded. The level of type I error was set at 5% for the analysis. Stata software was used for all analyses [28].

Ethics approval and governance

The Aboriginal Health and Medical Research Council of NSW (AH&MRC) Ethics Committee (1090/15) and the

NSW Population & Health Services Research Ethics Committee (HREC/15/CIPHS/18) provided ethical approval for the study. The study complied with ethical guidelines in research, data management and reporting, [29] and core values in research in Aboriginal health: spirit and integrity, cultural continuity, equity, reciprocity, respect, and responsibility [30]. The study advisory committee, which had Aboriginal representation, ensured there was appropriate Aboriginal oversight, and guidance of the study design, methods, analysis and reporting.

Results

Once all the eligibility criteria had been applied to the linked dataset (Fig. 1), there was a total of 27,467 avoidable admissions ($n = 20,306$ Aboriginal; $n = 7161$ non-Aboriginal) between the study period 2005/06 to 2013/14.

Characteristics of people with avoidable admissions

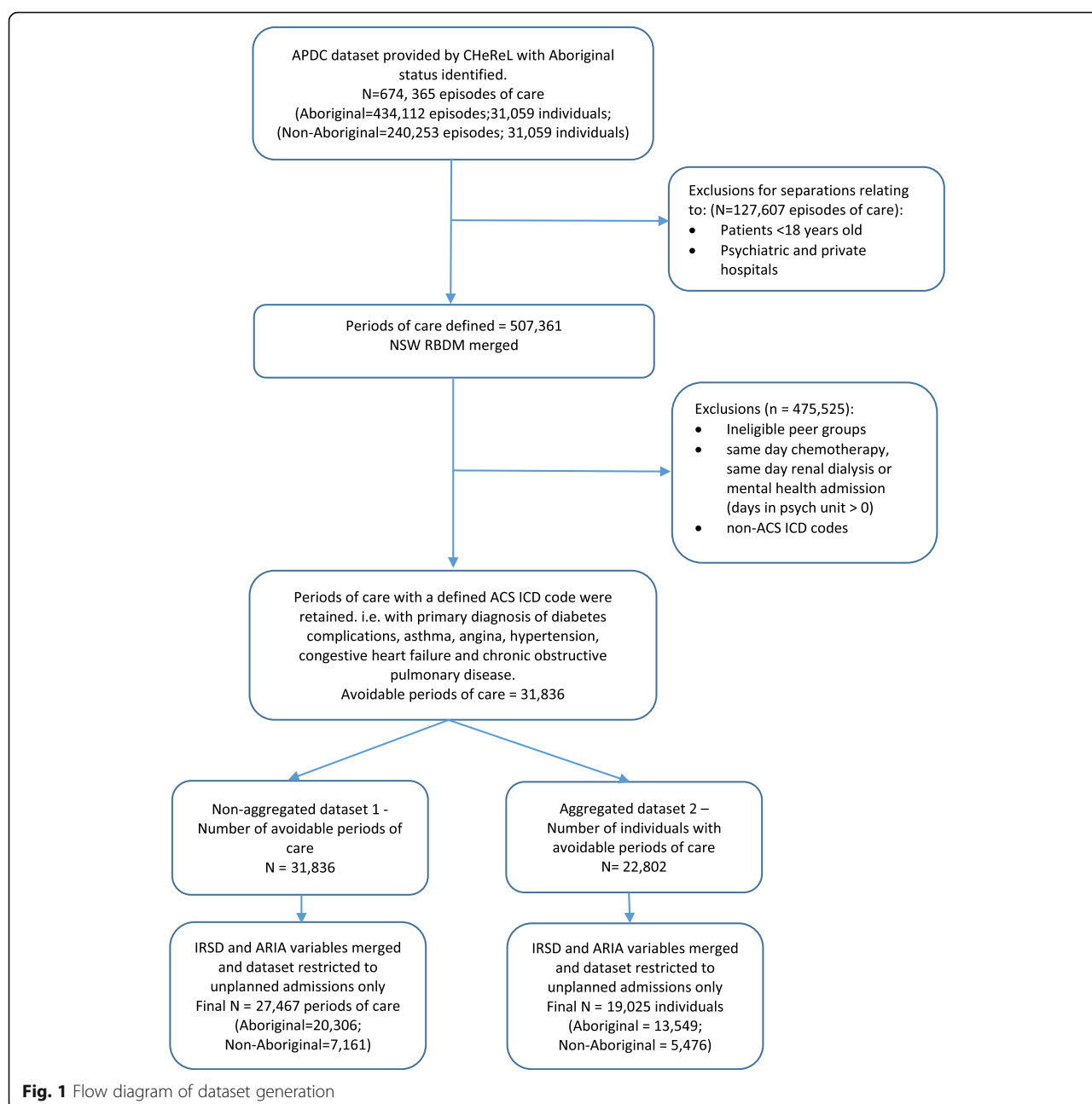
Table 1 describes the characteristics of people with avoidable admissions by Aboriginal status at the admission level between 2005/06 to 2013/14. There were statistically significant differences between Aboriginal and non-Aboriginal patients who experienced avoidable admissions. Aboriginal patients were significantly younger, with an average age of 57 years compared with 70 years in non-Aboriginal people. Aboriginal patients were more likely to be female compared with non-Aboriginal patients, and more likely to be single and divorced. Aboriginal patients had a significantly higher proportion of diabetic complications, asthma and COPD, while non-Aboriginal patients had a significantly higher proportions of angina, hypertension and CHF. Aboriginal patients were also more likely to be socially disadvantaged and live remotely. Lastly, non-Aboriginal patients had a significantly higher median length of stay in hospital compared to Aboriginal patients.

The number of avoidable admissions by Aboriginal status and financial year

At the patient level, the dataset contained a total of 19,025 patients who had experienced avoidable admissions, of which 71.2% were Aboriginal ($n = 13,549$) and 28.8% were non-Aboriginal ($n = 5476$). Averaged across the whole nine-year period, Aboriginal patients had a higher mean of avoidable admissions (Mean = 1.50, Standard deviation = 1.26) compared with non-Aboriginal patients (Mean = 1.30, Standard deviation = 0.84), and this difference remained stable over the study period (Fig. 2).

Three or more avoidable admissions per financial year

Table 2 demonstrates the proportion of patients with three or more compared to one to two avoidable



admissions each financial year by Aboriginal status. Aboriginal people had a consistently and significantly higher proportion of frequent avoidable admissions over the study period compared with non-Aboriginal people.

Regression analyses

At the patient level, unadjusted Poisson regression models were calculated for the number of avoidable admissions for each financial year of the study period (Table 3). Once adjusted for financial year, sex, age, marital status, IRSD and ARIA, Aboriginal patients were 16% more likely than non-Aboriginal patients to have a

higher number of avoidable admissions per financial year (IRR = 1.16; 95% CI: 1.13, 1.20). As the age structure of Aboriginal patients was significantly younger, the model was then restricted to patients aged 75 years or less; however Aboriginal patients remained significantly more likely to have more avoidable admissions per financial year (IRR = 1.15; 95% CI: 1.11, 1.20). An interaction term between Aboriginal status and financial year was added to the model which demonstrated no significant difference between Aboriginal and non-Aboriginal people in yearly trends in the number of avoidable admissions each year over the study period (Post estimation Wald

Table 1 Characteristics of avoidable admissions by Aboriginal status (admission level) ($n = 27,467$)

		Aboriginal % (n) (n = 20,306)	Non-Aboriginal % (n) (n = 7161)	χ^2 p-value
Sex	% Male	43.9 (8921)	51.5 (3691)	< 0.001
Age	Mean (SD)	57.0 (14.9)	69.8 (16.1)	< 0.001
Marital status				< 0.001
	Married/de facto	37.1 (7540)	49.7 (3556)	
	Single	29.7 (6023)	11.4 (815)	
	Widowed	15.5 (3148)	26.5 (1898)	
	Divorced/separated	16.0 (3255)	11.4 (813)	
	Not known	1.6 (327)	1.1 (75)	
Ambulatory care sensitive chronic diseases	Diabetic complications	18.4 (3746)	13.0 (930)	< 0.001
	Asthma	11.4 (2309)	8.7 (626)	< 0.01
	Angina	17.1 (3466)	20.3 (1452)	< 0.001
	Hypertension	2.4 (493)	3.5 (252)	< 0.001
	CHF	11.2 (2274)	22.5 (1609)	< 0.001
	COPD	39.5 (8018)	32.0 (2292)	< 0.001
Charlson co-morbidity Index	0	21.8 (4427)	22.6 (1622)	< 0.001
	1–2	64.9 (13,170)	61.7 (4420)	
	3+	13.3 (2709)	15.6 (1119)	
Index of relative socio-economic disadvantage (IRSD)				< 0.001
	1st quintile - most disadvantaged	29.2 (5939)	13.0 (933)	
	2nd quintile	29.9 (6080)	25.4 (1821)	
	3rd quintile	20.7 (4195)	23.0 (1645)	
	4th quintile	16.4 (3329)	21.4 (1535)	
	5th quintile - least disadvantaged	3.8 (763)	17.1 (1227)	
Accessibility/remoteness index of Australia (ARIA)				< 0.001
	Highly Accessible	33.5 (6811)	64.9 (4647)	
	Accessible	37.5 (7616)	26.6 (1902)	
	Moderately Accessible	19.2 (3897)	7.3 (525)	
	Remote / Very Remote	9.8 (1982)	1.2 (87)	
Length of stay	Median (Interquartile range)	3 (5)	4 (5)	< 0.001

test, $p = 0.860$). As the interaction was not significant it was removed from the final model (Table 3). A final post estimation Wald test was conducted on the final model to provide a test of the estimated average yearly trend in both groups however this was not significant ($p = 0.397$).

When looking at whether or not an individual experienced three or more avoidable admissions each financial year, once adjusted for explanatory variables and restricted to ages 75 year or less, Aboriginal patients were almost two times more likely than non-Aboriginal patients to have frequent avoidable admissions per financial year (OR = 1.90; 95% CI = 1.60, 2.26; Table 4). An interaction term between Aboriginal status and financial year demonstrated there were no significant differences

between Aboriginal and non-Aboriginal people in yearly trends in the proportion of frequent avoidable admissions over the study period (Post estimation Wald test, $p = 0.859$). As this interaction was not significant, it was removed from the final model (Table 4). There was also no statistically significant average yearly trend in both groups (Post estimation Wald test, $p = 0.397$).

Sensitivity analysis

A sensitivity analysis was conducted to examine any potential differences in results when avoidable admissions ending in death were excluded. The regression analyses results were largely similar.

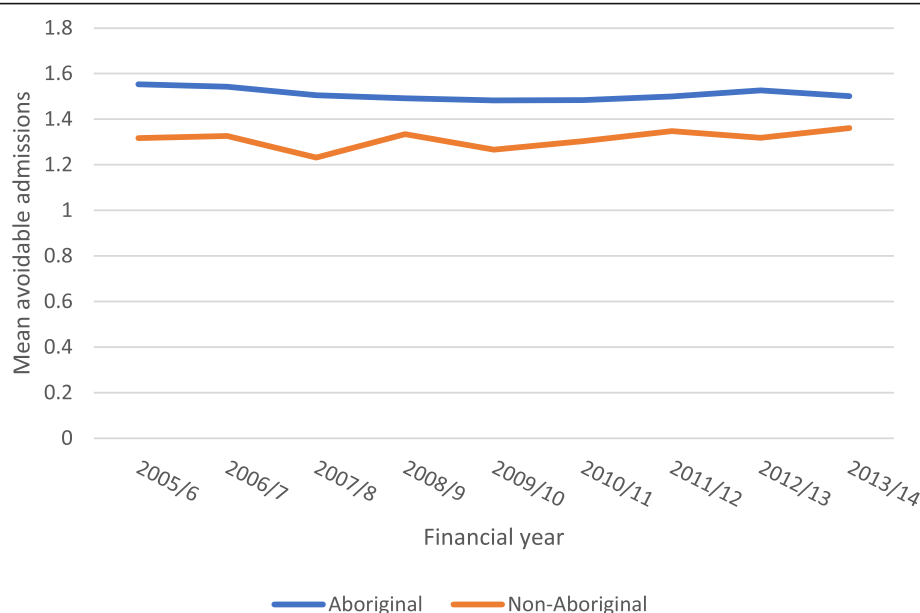


Fig. 2 Mean number of avoidable admissions by Aboriginal status and financial year ($n = 19,025$)

Discussion

This study has demonstrated that Aboriginal people in NSW are significantly more likely to experience frequent avoidable admissions for ambulatory care sensitive chronic conditions compared with non-Aboriginal people. Aboriginal patients were 15% more likely to have a higher number of avoidable admissions for each financial year over the study period and were almost two times as likely to experience three or more avoidable admissions for each financial year compared to non-Aboriginal people. These findings remained significant after being adjusted for sociodemographic variables.

In our study the rates of both the number of avoidable admissions and whether or not an individual

experienced three or more avoidable admissions per financial year remained consistently higher than non-Aboriginal people over the nine-year study period however there were no significant differences in yearly trends between Aboriginal and non-Aboriginal people. This finding demonstrates that Aboriginal people with chronic conditions are at a consistently higher risk of experiencing frequent avoidable admissions compared with non-Aboriginal people. Despite the “Closing the Gap” government strategy to reduce disadvantage among Aboriginal people in health, education and employment being in place since 2008, [31] there is no evidence of the gap being closed in the area of frequent avoidable admissions.

Our findings show that the heightened risk of frequent avoidable admissions is relevant to a small proportion of those Aboriginal people experiencing avoidable admissions. Over the study period an average of 11 % of Aboriginal people experienced three or more avoidable admissions compared to just 6 % in non-Aboriginal people. This is consistent with other research in the area of frequent admissions which reiterates the fact that a small proportion of patients account for a disproportionate share of avoidable admissions [10, 16].

Research in the area of frequent avoidable admissions commonly aims to develop risk profiles or risk prediction tools to help identify those patients most at risk [8, 10, 16]. Our study showed that Aboriginal people experiencing avoidable admissions were more likely to be female, younger, single, have diabetes complications, asthma and COPD, live in moderately accessible to very remote locations, and to be more disadvantaged

Table 2 Proportion of patients with three or more compared to one to two avoidable admissions by Aboriginal status and financial year ($n = 19,025$)

Financial year of admission	Aboriginal ($n = 13,549$) % (n)		Non-Aboriginal ($n = 5476$) % (n)		p-value
	1–2	3+	1–2	3+	
2005/06	88.4 (1102)	11.6 (145)	93.6 (496)	6.4 (34)	0.001
2006/07	89.4 (1139)	10.6 (135)	93.2 (549)	6.8 (40)	0.009
2007/08	89.0 (1234)	11.0 (152)	95.4 (585)	4.6 (28)	< 0.001
2008/09	90.5 (1279)	9.5 (134)	92.6 (525)	7.4 (42)	0.142
2009/10	88.9 (1317)	11.1 (165)	93.8 (515)	6.2 (34)	0.001
2010/11	88.9 (1247)	11.1 (156)	94.3 (525)	5.7 (32)	< 0.001
2011/12	88.8 (1400)	11.2 (177)	93.5 (560)	6.5 (39)	0.001
2012/13	89.5 (1343)	10.5 (157)	93.9 (543)	6.1 (35)	0.002
2013/14	88.9 (1431)	11.1 (179)	92.4 (561)	7.6 (46)	< 0.05

Table 3 Unadjusted and adjusted Poisson regression models for the number of avoidable admissions calculated for each financial year of the study period (2005/06–2013/14) by Aboriginal status and explanatory factors ($n = 19,025$)

	Number of avoidable admissions Incidence rate ratios (IRR) (95% CI)			P-value
	Unadjusted IRR	Adjusted IRR	Adjusted IRR & restricted to < 75 years	
Aboriginal status				< 0.0001
Non-Aboriginal	ref.	ref.	ref.	
Aboriginal	1.15 (1.12, 1.18)	1.16 (1.13, 1.20)	1.15 (1.11, 1.20)	
Financial year				0.397*
2005–06	ref.	ref.	ref.	
2006–07	1.00 (0.94, 1.05)	1.00 (0.94, 1.05)	1.00 (0.93, 1.05)	
2007–08	0.96 (0.91, 1.01)	0.96 (0.91, 1.01)	0.94 (0.89, 1.00)	
2008–09	0.97 (0.92, 1.03)	0.97 (0.92, 1.02)	0.95 (0.90, 1.01)	
2009–10	0.96 (0.91, 1.01)	0.97 (0.92, 1.02)	0.94 (0.88, 0.99)	
2010–11	0.96 (0.91, 1.02)	0.96 (0.91, 1.01)	0.95 (0.89, 1.00)	
2011–12	0.98 (0.93, 1.03)	0.97 (0.92, 1.02)	0.96 (0.91, 1.02)	
2012–13	0.99 (0.94, 1.04)	0.98 (0.93, 1.03)	0.97 (0.92, 1.03)	
2013–14	0.98 (0.93, 1.04)	0.97 (0.93, 1.03)	0.96 (0.90, 1.01)	
Sex				
Male	–	ref.	ref.	
Female	–	1.00 (0.97, 1.02)	1.02 (0.99, 1.04)	0.270
Age	–	1.00 (1.00, 1.00)	1.00 (1.00, 1.01)	< 0.0001
Marital status				
Married	–	ref.	ref.	
Single	–	1.06 (1.03, 1.10)	1.09 (1.05, 1.12)	< 0.0001
Widowed	–	1.04 (1.00, 1.08)	1.09 (1.04, 1.14)	0.001
Divorced/separated	–	1.09 (1.05, 1.13)	1.09 (1.04, 1.13)	< 0.0001
Not known	–	0.98 (0.89, 1.09)	0.99 (0.88, 1.11)	0.833
Index of relative socio-economic disadvantage (IRSD)				
1st quintile – most disadvantaged	–	ref.	ref.	
2nd quintile	–	0.98 (0.95, 1.02)	0.99 (0.96, 1.03)	0.787
3rd quintile	–	0.99 (0.95, 1.03)	0.99 (0.95, 1.04)	0.744
4th quintile	–	0.97 (0.93, 1.01)	0.99 (0.94, 1.04)	0.563
5th quintile – least disadvantaged	–	0.92 (0.87, 0.97)	0.88 (0.82, 0.95)	0.001
Accessibility/remoteness index of Australia (ARIA)				
Highly Accessible	–	ref.	ref.	
Accessible	–	0.97 (0.94, 1.00)	0.96 (0.93, 0.99)	< 0.05
Moderately Accessible	–	0.98 (0.94, 1.02)	0.95 (0.91, 0.99)	< 0.05
Remote / Very Remote	–	1.02 (0.97, 1.08)	1.00 (0.95, 1.06)	0.924

*Post estimation Wald test for financial year term

compared with non-Aboriginal people. Further research in identifying a risk profile for this vulnerable group of people would be helpful in creating appropriate community medical and prevention care.

The high risk of frequent avoidable admissions for Aboriginal people in part reflects the higher rate of chronic conditions in the Aboriginal population which

accounts for most of the gap in life expectancy compared with non-Aboriginal people [5]. However it also highlights the health inequities and barriers that remain for Aboriginal people in terms of access to community health services. Cultural and locational factors can impede access to appropriate primary and community health care services for Aboriginal people [32]. National

Table 4 Logistic regression model for three or more compared with one to two avoidable admissions: for each financial year of the study period (2005/06–2013/14) by Aboriginal status and explanatory factors ($n = 19,025$)

	≥3 avoidable admissions compared to 1 to 2 per financial year			
	Odds ratios (OR) (95% CI)			
	Unadjusted OR	Adjusted OR	Adjusted OR & restricted to < 75 years	P-value
Aboriginal status				< 0.0001
Non-Aboriginal	ref.	ref.	ref.	
Aboriginal	1.79 (1.58, 2.03)	1.97 (1.71, 2.27)	1.90 (1.60, 2.26)	
Financial year				0.6760 ^a
2005–06	ref.	ref.	ref.	
2006–07	0.93 (0.75, 1.16)	0.94 (0.75, 1.17)	0.91 (0.71, 1.16)	
2007–08	0.89 (0.71, 1.10)	0.88 (0.71, 1.10)	0.84 (0.66, 1.07)	
2008–09	0.86 (0.69, 1.08)	0.85 (0.68, 1.06)	0.78 (0.61, 0.99)	
2009–10	0.96 (0.77, 1.18)	0.93 (0.75, 1.16)	0.88 (0.69, 1.11)	
2010–11	0.94 (0.76, 1.17)	0.91 (0.73, 1.13)	0.92 (0.72, 1.17)	
2011–12	0.97 (0.79, 1.20)	0.93 (0.76, 1.15)	0.93 (0.74, 1.17)	
2012–13	0.90 (0.73, 1.11)	0.86 (0.69, 1.07)	0.85 (0.67, 1.08)	
2013–14	0.99 (0.81, 1.23)	0.96 (0.78, 1.18)	0.94 (0.74, 1.18)	
Sex				
Male	–	ref.	ref.	
Female	–	0.96 (0.86, 1.06)	1.01 (0.90, 1.13)	0.864
Age	–	1.01 (1.01, 1.02)	1.02 (1.01, 1.02)	< 0.0001
Marital status				
Married	–	ref.	ref.	
Single	–	1.27 (1.11, 1.45)	1.37 (1.19, 1.59)	< 0.0001
Widowed	–	1.12 (0.96, 1.30)	1.31 (1.09, 1.58)	0.004
Divorced/separated	–	1.33 (1.14, 1.54)	1.34 (1.14, 1.57)	< 0.0001
Not known	–	0.92 (0.59, 1.45)	0.90 (0.54, 1.50)	0.694
Index of relative socio-economic disadvantage (IRSD)				
1st quintile – most disadvantaged	–	ref.	ref.	
2nd quintile	–	0.86 (0.75, 0.99)	0.89 (0.76, 1.04)	0.146
3rd quintile	–	1.01 (0.86, 1.18)	1.00 (0.84, 1.20)	0.970
4th quintile	–	0.91 (0.76, 1.10)	1.00 (0.82, 1.23)	0.979
5th quintile – least disadvantaged	–	0.80 (0.63, 1.03)	0.69 (0.50, 0.95)	< 0.05
Accessibility/remoteness index of Australia (ARIA)				
Highly Accessible	–	ref.	ref.	
Accessible	–	0.89 (0.78, 1.01)	0.85 (0.73, 0.98)	< 0.05
Moderately Accessible	–	0.98 (0.82, 1.16)	0.89 (0.74, 1.08)	0.245
Remote / Very Remote	–	1.11 (0.90, 1.38)	1.07 (0.85, 1.35)	0.549

^a Post estimation Wald test for financial year term

survey data shows that Aboriginal people report difficulties in accessing health services and experience discrimination and services not being culturally appropriate [33]. As our findings demonstrated, compared to non-Aboriginal people, Aboriginal people with avoidable admissions were more likely to live remotely. Aboriginal people who live in remote areas can face practical,

logistical and financial barriers which impact on the timeliness and effectiveness of health care [34]. For some Aboriginal people there are also high rates of homelessness, food insecurity, lack of transport, complex comorbidities and alcohol misuse [17, 35]. These underlying risk factors and consequences of social disadvantage have enduring effects and may contribute significantly to

the disproportionate burden of frequent avoidable admissions among Aboriginal people.

Our study highlights the need to strengthen services that intervene before a patient needs to be admitted to hospital. Effective management of chronic disease in the primary care setting can delay the progression of disease, improve quality of life, increase life expectancy, and decrease the need to be admitted to hospital [3, 36]. However there is little intervention research in the area of frequent avoidable admissions for Aboriginal people with chronic conditions. A Northern Territory cohort study of a community-led case management program using a culturally competent framework to support frequent attenders aimed to address causes of recurrent emergency department presentations among Aboriginal people with complex social and medical backgrounds. The program was able to significantly improve engagement with primary care and reduce emergency department presentations but not frequent hospital admissions [17]. A retrospective analysis of primary care and inpatient records for Aboriginal patients with diabetes, also in the Northern Territory, found that a timely diabetes care plan was associated with better short-term blood glucose control and fewer diabetes-related admissions [37]. Although such studies provide promising results for reducing frequent avoidable admissions in Aboriginal people, there is still a need for rigorous, well-evaluated and culturally-appropriate interventions to provide robust evidence of effective strategies to help reduce frequent avoidable admissions.

Interestingly, our study found that Aboriginal people in this study had a significantly shorter median length of stay compared with non-Aboriginal people. As discussed in our previous paper examining unplanned readmissions in this same cohort, [21] this finding may indicate that Aboriginal patients with chronic conditions in NSW are not receiving adequate health care or are at higher risk of discharge against medical advice resulting in poorer health outcomes and increased risk of readmission or frequent avoidable admissions.

Limitations

There are several limitations to this study. Firstly, this study excluded certain ambulatory care sensitive chronic conditions, namely nutritional deficiencies, iron deficiency anaemia and rheumatic heart disease, whose frequent admission outcomes may have influenced the results for our study. Secondly our analysis only included a sample of non-Aboriginal admissions compared to all Aboriginal cases, and it is therefore possible that the non-Aboriginal sample may not be representative of all non-Aboriginal people meeting the study eligibility criteria. Thirdly, the 'ever identified' method conducted in our data preparation for identifying Aboriginal patients

in the linked data has been found to have some limitations, namely that those with more admissions may have at least one false positive record of Aboriginal status which could potentially increase the frequency for patients reported as Aboriginal [38]. Future analyses could compare the 'ever identified' algorithm with a more sophisticated algorithm such as the 'weight of evidence' to help determine the amount of bias. Lastly, it is important to keep in mind that not all avoidable admissions may be avoidable. While many admissions could have been prevented through effective chronic disease management in the primary care setting, other admissions may reflect necessary admissions for seriously ill patients [39].

Conclusion

Over the nine year period from 2005/6 to 2013/14, Aboriginal people in NSW were significantly more likely to experience frequent avoidable admissions compared to non-Aboriginal people. This disproportionate risk remained consistent over the study period. The higher rates of frequent avoidable admissions reflect the higher rate of chronic conditions among Aboriginal people but also the need for further intervention research to establish evidence for effective and culturally appropriate programs which can successfully reduce frequent avoidable admissions among this group.

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12913-020-05950-8>.

Additional file 1. Selection of ambulatory care sensitive chronic diseases included in eligibility criteria as a principal diagnosis.

Abbreviations

ABS: Australian Bureau of Statistics; ACS: Ambulatory care sensitive; APDC: NSW Admitted Patient Data Collection; ARIA: Accessibility/Remoteness Index of Australia; CCI: Charlson Co-morbidity Index; CHEREL: Centre for Health Record Linkage; CHF: Congestive heart failure; CI: Confidence interval; COPD: Chronic obstructive pulmonary disease; IRR: Incidence rate ratio; IRSD: Index of Relative Socio-economic Disadvantage; NSW: New South Wales; OR: Odds ratio; RBDM: NSW Registrar of Births, Deaths and Marriages

Acknowledgements

We respectfully acknowledge the traditional custodians of NSW, Australia, the Aboriginal people and pay our respects to the Elders past, present and future.

Authors' contributions

AJ, CO and MC contributed to the design of the study. AJ drafted the manuscript. AJ and CO conducted the analysis, with advice from JA, and TE prepared the datasets. JB, CO, MC, ST, TE, R S-F and SE provided critical review of the manuscript. All authors contributed to the interpretation of findings and have read and approved the final manuscript.

Funding

This study received funding from the Priority Research Centre for Health Behaviour, University of Newcastle. The funder had no role in the research study.

Availability of data and materials

The data used in this study came from the Centre for Health Record Linkage and are available from NSW Ministry of Health. However availability of this data is restricted and not freely available to the public without application to the data custodians, NSW Ministry of Health.

Ethics approval and consent to participate

Ethical approval for the study was granted by the NSW Population & Health Services Research Ethics Committee (HREC/15/CIPH/18) and the Aboriginal Health and Medical Research Council of NSW Ethics Committee (1090/15). Administrative permission to use the NSW APDC and the NSW RBDM was granted by the data custodians at the NSW Ministry of Health. The Centre for Health Record Linkage, who maintain robust data governance, provided the de-identified data. In view of the State Privacy Commissioner's Guidelines for Research and the Health Records and Information Privacy Act 2002 (NSW), both Ethics Committees granted a waiver of the usual requirement for the consent of the individual to the use of their health information for research which meant de-identified linked data could be used without consent.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Received: 6 July 2020 Accepted: 19 November 2020

Published online: 25 November 2020

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Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

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Chapter 4: Paper Two

Introduction to paper two

Paper one demonstrated that Aboriginal people are at a higher risk of frequent avoidable admissions compared to non-Aboriginal people, and that there was no significant change in this risk over the 9-year period examined. While frequent avoidable admissions are an important indicator of gaps in quality of care in the community, unplanned readmissions to hospital following an index admission provide valuable information about where care can be improved at the hospital level. Aboriginal people have significantly higher rates of all-cause unplanned hospital readmissions compared to non-Aboriginal people. However, there is limited information about rates of unplanned readmissions for Aboriginal people with chronic disease, and any trends in unplanned readmissions over time compared to non-Aboriginal people.

Paper two reports on a study that aimed to examine whether rates of unplanned hospital readmissions, or death, significantly differed between Aboriginal and non-Aboriginal people in NSW between 2005–2006 and 2013–2014. This study focused on the following diseases: cardiovascular disease, chronic respiratory disease, diabetes and renal disease. These diseases were selected because they are the most prevalent chronic diseases among Aboriginal people in Australia and are also associated with high rates of unplanned readmissions. For this analysis, the dataset used for the study reported in paper one was linked to death data from the NSW Registry of Births Deaths and Marriages data collection.

Paper two has been published in *BMC Health Services Research*. The statements of contribution from co-authors are shown in Appendix 1.

Citation: Jayakody A, Oldmeadow C, Carey M, Bryant J, Evans T, Ella S, Attia J, and Sanson-Fisher R. Unplanned readmission or death after discharge for Aboriginal and non-Aboriginal people with


chronic disease in NSW Australia: a retrospective cohort study. BMC Health Services Research (2018) 18:893.

RESEARCH ARTICLE

Open Access



Unplanned readmission or death after discharge for Aboriginal and non-Aboriginal people with chronic disease in NSW Australia: a retrospective cohort study

Amanda Jayakody^{1,2,3*} , Christopher Oldmeadow^{4,5}, Mariko Carey^{1,2,3}, Jamie Bryant^{1,2,3}, Tiffany Evans^{4,5}, Stephen Ella⁶, John Attia^{4,5} and Rob Sanson-Fisher^{1,2,3}

Abstract

Background: Admitted patients with chronic disease are at high risk of an unplanned hospital readmission, however, little research has examined unplanned readmission among Aboriginal people in Australia. This study aimed to examine whether rates of unplanned 28 day hospital readmission, or death, significantly differ between Aboriginal and non-Aboriginal patients in New South Wales, Australia, over a nine-year period.

Methods: A retrospective cohort analysis of a sample of de-identified linked hospital administrative data was conducted. Eligible patients were: 1) aged ≥ 18 years old, 2) admitted to an acute facility in a NSW public hospital between 30th June 2005 and 1st July 2014, and 3) admitted with either cardiovascular disease, chronic respiratory disease, diabetes or renal disease. The primary composite outcome was unplanned readmission or death within 28 days of discharge. Generalized linear models and a test for trend were used to assess rates of unplanned readmission or death over time in Aboriginal and non-Aboriginal patients with chronic disease, accounting for sociodemographic variables.

Results: The final study cohort included 122,145 separations corresponding to 48,252 patients (Aboriginal = 57.2%, $n = 27,601$; non-Aboriginal = 42.8%, $n = 20,651$). 13.9% ($n = 16,999$) of all separations experienced an unplanned readmission or death within 28 days of discharge. Death within 28 days of discharge alone accounted for only a small number of separations (1.4%; $n = 1767$). Over the nine-year period, Aboriginal separations had a significantly higher relative risk of an unplanned readmission or death (Relative risk = 1.34 (1.29, 1.40); p -value < 0.0001) compared with non-Aboriginal separations once adjusted for sociodemographic, disease variables and restricted to < 75 years of age. A test for trend, including an interaction between year and Aboriginal status, showed there was no statistically significant change in proportions over the nine-year period for Aboriginal and non-Aboriginal separations (p -value for trend = 0.176).

Conclusion: Aboriginal people with chronic disease had a significantly higher risk of unplanned readmission or death 28 days post discharge from hospital compared with non-Aboriginal people, and there has been no significant change over the nine year period. It is critical that effective interventions to reduce unplanned readmissions for Aboriginal people are identified.

Keywords: Aboriginal health, Unplanned readmission, Health services research, Data linkage, Chronic disease

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Background

On average Aboriginal and Torres Strait Islander people (Aboriginal people hereafter)¹ experience, on average, a 10 year gap in life expectancy compared with non-Aboriginal Australians. Two thirds of this gap is accounted for by chronic disease [1]. Chronic diseases in Aboriginal people are both more prevalent and occur at a much younger age [1, 2]. Aboriginal people have higher self-reported rates of cardiovascular disease, respiratory disease, diabetes and renal disease than non-Aboriginal people [1, 2].

Although most chronic diseases should ideally be managed in the community health setting, admissions to hospital related to chronic disease are common and represent the largest proportion of potentially avoidable hospitalisations [3]. Factors such as poor discharge planning, poor community follow up from health care services, and a lack of support for the patient and carer in chronic disease self-management skills mean that many hospital admissions for chronic disease are followed by an unplanned hospital readmission [4–8]. Unplanned readmissions are defined as admissions to hospital which were not planned and which usually occur within one month of discharge from an initial (i.e. index) admission [9, 10]. Unplanned readmissions are a financial burden to the health system, and cause an emotional and time burden on patients and their families [11, 12]. Admitted patients with chronic disease are known to be at high risk of an unplanned hospital readmission, with readmission highest amongst patients with cardiovascular disease, respiratory disease and diabetes [11, 13, 14]. In the Australian state of New South Wales (NSW) 13% of patients with COPD and 9% of patients with CHF were readmitted within 28 days [3]. In Australia, unplanned readmissions are considered an indicator relating to “high quality and affordable hospital and hospital related care” in the Australian National Healthcare Agreement, and unplanned readmissions are included in the NSW service performance indicators to provide a mechanism for monitoring and managing the performance of hospitals [9, 15].

However there is limited knowledge of the rate of unplanned readmission for Aboriginal people with chronic disease. In a NSW Chief Health Officer’s report on the health of Aboriginal people of NSW, the all-cause (all medical and surgical) unplanned readmission rate within 28 days for Aboriginal people was 8.1% (compared with 6.3% for non-Aboriginal people) [9]. The all-cause readmission rate has remained consistently higher for Aboriginal people [9]. However little is known regarding the patterns over time for unplanned readmissions amongst Aboriginal people with chronic disease. An analysis of readmission rates within one regional western NSW hospital found the proportion of Aboriginal patients readmitted to hospital had increased from 11.7% in 1996 to 18.3% in 2005, however there was no significant trend over time

[16]. This analysis did not look specifically at trends in chronic diseases for Aboriginal patients, and the data may not be representative of NSW Aboriginal people as a whole.

Given the high burden of chronic disease and high rates of unplanned readmission rates among Aboriginal people, there is a need for more specific analysis of unplanned readmissions related to chronic disease in order to identify potential differences and patterns amongst Aboriginal and non-Aboriginal people over time. The purpose of our study was to examine amongst Aboriginal and non-Aboriginal people with chronic disease in NSW from 2005/6 to 2014/15: 1) whether the proportion of separations with an unplanned 28 day readmission or death significantly differ between Aboriginal and non-Aboriginal patients; 2) the extent to which sociodemographic, disease and separation factors are associated with any differences; and 3) how the proportion of separations with an unplanned 28 day hospital readmission or death changed over the nine-year period.

Methods

Ethics approval

The study was approved by the NSW Population & Health Services Research Ethics Committee (HREC/15/CIPHS/18) and the NSW Aboriginal Health and Medical Research Council Ethics Committee (1090/15).

Study design and data sources

This study was a retrospective cohort analysis of de-identified linked hospital administrative data. The linked data were derived from three datasets:

- 1) NSW Admitted Patient Data Collection (APDC): the APDC contains records of all admitted patient services provided by NSW public hospitals, private hospitals/centres and psychiatric hospitals.
- 2) NSW Emergency Department Data Collection (EDDC): the EDDC contains records for patient presentations to emergency departments in NSW public hospitals.
- 3) NSW Registrar of Births, Deaths and Marriages (RBDM): the RBDM contains mortality information for the NSW population.

Study sample

Eligibility criteria

The study sample included patients who were: 1) aged 18 years and older at the time of admission; 2) admitted to an acute facility in a NSW public hospital between 30th June 2005 and 1st July 2014; 3) discharged from hospital to the community; and 4) had one or more of the following ICD-10 defined chronic diseases as a principle

or additional diagnosis: cardiovascular disease, diabetes, respiratory disease and renal diseases (See Additional file 1 for a list of ICD-10 codes). Figure 1 outlines how the dataset was generated.

Sampling

All patients meeting the eligibility criteria who had at least one APDC separation in the period of interest, and where status was recorded as Aboriginal and/or Torres Strait Islander person on any APDC record were selected. In order to obtain a comparison sample of non-Aboriginal persons, a sampling frame was then generated consisting of a list of patients meeting the eligibility criteria recorded in the APDC, excluding the list of Aboriginal persons obtained above. A random sample of person identification numbers (of the same number as the Aboriginal cases) was selected from the sampling frame, forming the

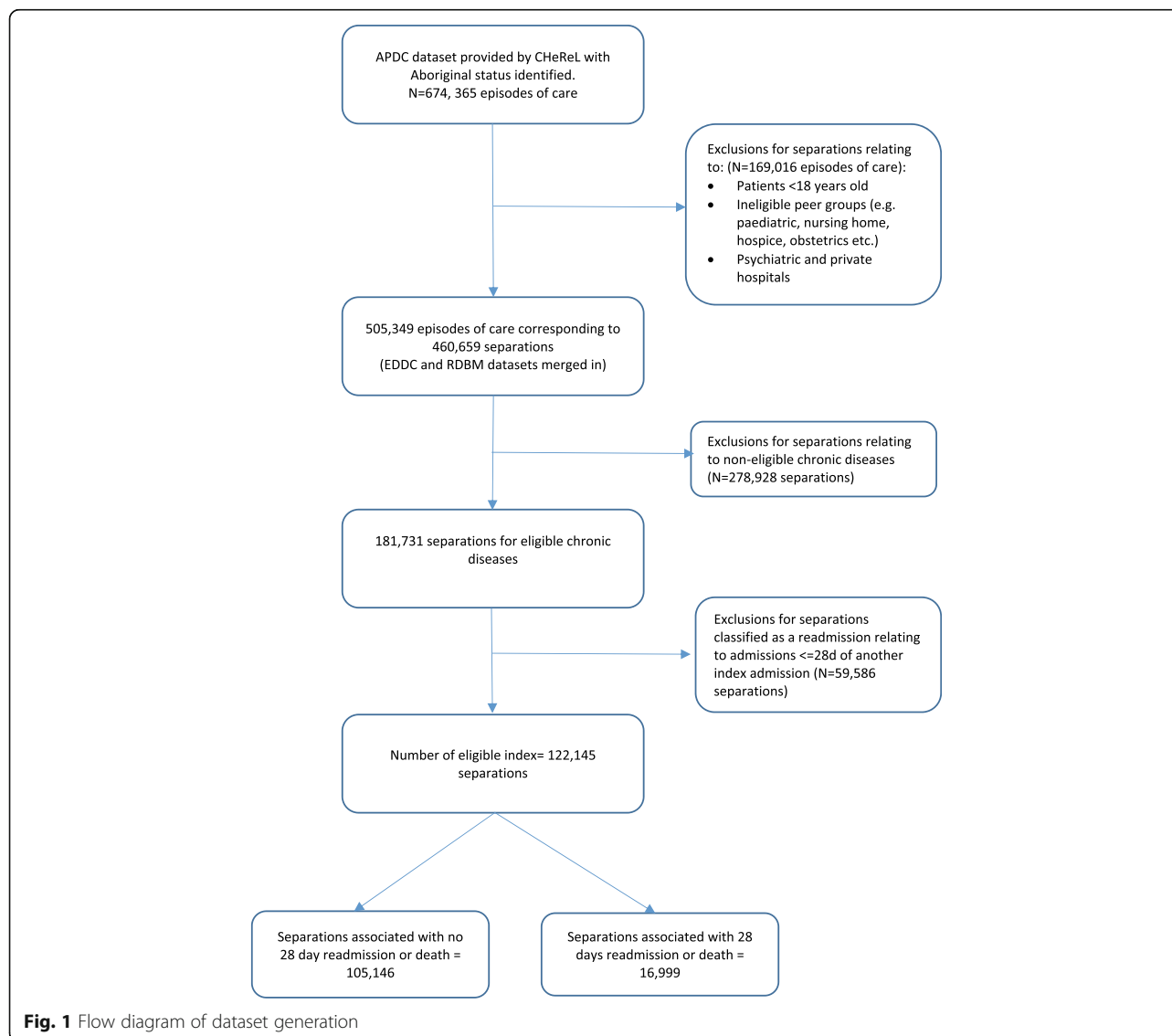
non-Aboriginal patient sample. These patients had no APDC records with Aboriginality coded as 'yes'. EDDC and RDBM death records which linked to the patients were extracted and included in the final sample.

Data linkage

The data sources were linked by the Centre for Health Record Linkage using probabilistic record linkage methods [17]. All data were provided in a de-identified format. The data were supplied as episodes of care. Each episode of care ends with a statistical discharge; each statistical discharge occurs due to discharge, death, transfer, or change of care type.

Data cleaning

Duplicate records were excluded. Separations were defined by combining nested, overlapping and contiguous



episodes of care creating periods for which patients were hospitalised. Therefore separations are defined as the total hospital stay (from admission to discharge from hospital). For our analyses we retained the diagnosis codes and admission data from the first episode of each separation, but our discharge date, from which 28 day readmission or death is considered, was the latest discharge date for the period of hospitalisation. The unit of analysis was separations.

Variables

Primary outcome: The primary composite outcome was all-cause unplanned hospital readmission or death within 28 days of separation from any acute facility in a NSW public hospital. An unplanned readmission is defined as occurring within 28 days of discharge from an initial (i.e. index) admission. ‘Unplanned’ refers to separations coded as an ‘emergency status recode’ in the APDC. Readmissions due to mental health, cancer, hospital in home care, chemotherapy or dialysis were excluded. Separations were excluded if death occurred during admission or if the patient was discharged to palliative care. Sensitivity analyses were conducted to examine the effect of deaths or discharge to palliative care during admission which is described in the statistical analysis section. Each subsequent separation that fell outside of the 28 day timeframe was counted as a new index separation (see Fig. 1). All-cause readmission or death was calculated as follows: Numerator: total number of 28 day unplanned readmission or death for any cause associated with an eligible index admission. Denominator: number of admissions with an included chronic disease (principal or additional diagnosis) and an index admission.

Explanatory variables

The following explanatory variables correspond to those recorded at the beginning of each separation.

1. Sociodemographic variables: Patient’s gender, age, Aboriginal status and marital status. The Accessibility/Remoteness Index of Australia (ARIA) and the Index of Relative Socio-economic Disadvantage (IRSD) quintile were also included. ARIA is the standard Australian Bureau of Statistics (ABS) endorsed measure of remoteness and is derived from measures of road distances between populated localities and service centres [18]. The IRSD is a general socio-economic index that summarises a range of information about the economic and social conditions of people and households within a geographic area [19].
2. Disease-related variables: the Charlson Co-morbidity Index (CCI) was included [20]. The CCI is an index

of the risk of mortality from comorbidity during the next 12 months and calculates a score from secondary diagnoses of admissions weighted for type of condition. The CCI scores were dichotomised into three groups of 0, 1 and 2 or more. Zero indicating the lowest score and 2 or more indicating the highest scores.

3. Separation variables: The following variables were included for each hospital separation: financial year of separation and length of stay (days).

Statistical analysis

Chi-square and t-tests were used to examine crude associations between Aboriginal status and sociodemographic, disease and separation factors. A log-binomial generalised linear model (GLM) was used to determine the association between Aboriginal status and unplanned readmission or death over the nine year period, and then restricted to patients aged ≤ 75 years due to the differential age structures between Aboriginal and non-Aboriginal patients. Exponentiated parameter estimates from this model (interpreted as relative risks) are presented together with 95% confidence intervals and *p*-values. A propensity score analysis was conducted to account for potential selection bias due to differences in the probability of dying during admission to hospital between Aboriginal and non-Aboriginal people [21]. The propensity score was estimated using a logistic regression model (death in hospital or discharged to palliative care as the outcome, sociodemographic, disease and separation factors as predictors), and stabilised propensity scores were used as weights (inverse probability of “treatments”) in the GLM. Unplanned readmission or death within 28 days trends over the study period were assessed by including a term for financial year (as a continuous variable) in the GLM, as well as an interaction term between Aboriginal status and year, which assessed differences in the trends by Aboriginal status. The model was adjusted for sociodemographic and disease variables. A sensitivity analysis was conducted to examine any potential differences in results obtained using an all-cause compared to a chronic disease specific readmission rate. All analyses used Stata V.11.2 [22].

Results

In the linked dataset there were 674,365 hospital episodes of care for Aboriginal and non-Aboriginal patients. After separations not meeting inclusion criteria were excluded, the final study cohort included 122,145 separations (Aboriginal = 77,427; Non-Aboriginal = 44,718), corresponding to 48,252 patients (Aboriginal = 57.2%, *n* = 27,601; non-Aboriginal = 42.8%, *n* = 20,651). Table 1 describes the characteristics of separations by Aboriginal status. Aboriginal separations were significantly younger and had a

Table 1 Characteristics of separations by Aboriginal status ($n = 122,145$)

		Aboriginal ($n = 77,427$) n (%)	Non-Aboriginal ($n = 44,718$) n (%)	p -value
Sex	% Female	42,982 (55.5)	22,422 (50.1)	> 0.001
Age	Mean (SD)	53.5 (16.5)	66.7 (17.9)	> 0.001
Marital status	Married/de facto	30,992 (40.1)	23,815 (53.3)	> 0.001
	Single	25,178 (32.5)	5673 (12.7)	
	Widowed	9385 (12.1)	9884 (22.1)	
	Divorced/separated	10,434 (13.5)	4720 (10.6)	
	Not known	1372 (1.8)	592 (1.3)	
Chronic diseases present at admission	Diabetes	32,865 (39.5)	11,853 (26.5)	> 0.001
	Chronic respiratory disease	15,403 (19.9)	6135 (13.7)	
	Cardiovascular disease	41,977 (54.2)	29,231 (65.4)	
	Renal disease	20,133 (26.0)	12,638 (28.3)	
Charlson Co-morbidity Index score	0	43,888 (56.7)	25,454 (56.9)	< 0.0001
	1	18,835 (24.3)	9979 (22.3)	
	2+	14,704 (19.0)	9285 (20.8)	
IRSD	1st quintile - most disadvantaged	19,505 (25.2)	5823 (13.0)	< 0.0001
	2nd quintile	22,584 (29.2)	10,529 (23.6)	
	3rd quintile	16,701 (21.6)	8788 (19.7)	
	4th quintile	14,286 (18.5)	9985 (22.3)	
	5th quintile - least disadvantaged	4351 (5.6)	9593 (21.4)	
ARIA	Highly Accessible (major cities)	29,855 (38.6)	31,521 (70.5)	< 0.0001
	Accessible (inner regional)	29,132 (37.6)	10,348 (23.1)	
	Moderately Accessible (outer regional)	13,692 (17.7)	2560 (5.7)	
	Remote / Very Remote	4748 (6.1)	289 (0.7)	
Year of separation	2005–06	7547 (10.3)	4680 (11.2)	< 0.0001
	2006–07	7840 (10.7)	4719 (11.3)	
	2007–08	7980 (10.9)	4693 (11.2)	
	2008–09	6905 (9.5)	4143 (9.9)	
	2009–10	7041 (9.6)	4169 (10.0)	
	2010–11	7010 (9.6)	4061 (9.7)	
	2011–12	7807 (10.7)	4343 (10.4)	
	2012–13	10,243 (14.0)	5391 (12.9)	
	2013–14	10,643 (14.6)	5644 (13.5)	
Length of stay (days)	Mean (SD)	5.6 (14.2)	6.9 (17.2)	< 0.0001

higher proportion of female separations, compared with non-Aboriginal separations. A smaller proportion of Aboriginal separations corresponded to individuals who were married or in a de facto relationship compared with non-Aboriginal separations. Compared to non-Aboriginal separations, there were a higher proportion of separations associated with diabetes and chronic respiratory disease among Aboriginal separations. Cardiovascular disease was significantly higher amongst non-Aboriginal separations and is evidenced in the higher Charlson comorbidity index which gives greater weight to cardiovascular disease. A

higher proportion of Aboriginal separations correspond to individuals residing in the most disadvantaged geographic and remote/very remote areas of NSW. Aboriginal separations had a lower average length of stay compared with non-Aboriginal separations.

13.9% ($n = 16,999$) of all separations experienced an unplanned readmission or death within 28 days of discharge. Death within 28 days of discharge accounted for only a small number of separations overall (1.4%; $n = 1767$). An unadjusted regression, demonstrated that Aboriginal separations had a significantly higher risk of an unplanned

readmission or death within 28 days of discharge compared with non-Aboriginal separations (Table 2; Relative risk (RR) = 1.16; 95% confidence intervals (CI):1.13, 1.19; p -value: < 0.0001). To account for the younger age distribution in Aboriginal people compared with non-Aboriginal people, the model was restricted to people aged < 75 years old. This resulted in the relative risk increasing to 1.36 (95% CI:1.30, 1.41; p -value: < 0.0001). A sensitivity analysis, was conducted to examine any potential differences between using an all-cause compared to a chronic disease specific readmission rate, and results were broadly similar.

Propensity score weighted analyses

Aboriginal people were significantly less likely to die during admission or be discharged to palliative care compared with non-Aboriginal people (Odds ratio = 0.73; 95% CI: 0.68, 0.79; < 0.001; AUC = 0.7714; pseudo R^2 = 0.1096). Sample weights were created using a stabilised propensity score to account for the potential selection bias due to the difference in probability of dying during admission. The propensity score sample weight was included in the following regression analyses whilst separations which ended in death during admission or the patient being discharged to palliative care were excluded from the analysis (2.84%, n = 3570).

Adjusted regression analyses

Table 3 shows the unadjusted and adjusted regression models examining the effect of sociodemographic and disease variables on the association of Aboriginal status and unplanned readmission or death. Aboriginal separations continued to have a significantly higher risk of an unplanned readmission or death compared with non-Aboriginal separations once adjusted for sociodemographic (including the age restriction) and disease variables, including the propensity score sampling weight (RR = 1.34; CI:1.29, 1.40; p < 0.0001). Length of stay was not included in the final model because of the direction of its relationship with Aboriginal status and readmission. Although it was associated with both Aboriginal status and readmission, a sensitivity analysis including length of stay in the adjusted model showed that the overall results were broadly similar. Apart from financial year, all sociodemographic and disease variables

remained significantly associated with readmission after controlling for all variables in the table.

Figure 2 displays the raw proportions and predicted probabilities (obtained from the final GLM model shown in Table 4) of unplanned readmission or death by Aboriginal status. There was no statistically significant change in the proportion of separations that resulted in an unplanned readmission or death over the nine-year period for Aboriginal and non-Aboriginal separations (p -value for trend = 0.176). The apparent gap between the fitted values and raw proportions are due to the fact that the fitted values are adjusted for sociodemographic variables.

Discussion

This paper provides unique data on unplanned hospital readmission or death over a nine year period amongst a large cohort of Aboriginal and non-Aboriginal patients with chronic disease. To our knowledge, such an overview of unplanned readmission by Aboriginal people with chronic disease has not been undertaken before in Australia.

Aboriginal people with chronic disease have a significantly higher risk of an unplanned readmission or death within 28 days of discharge compared with non-Aboriginal people. This higher rate of unplanned readmission or death has remained unchanged over the nine year period examined. Direct comparisons of our estimates with other studies are challenging because of a paucity of comparable data analyses for unplanned readmissions in Aboriginal Australians with chronic disease. However when considering readmissions for any-cause, our findings are consistent with NSW government data which reports significantly higher rates of all-cause (medical and surgical) unplanned readmissions rates between Aboriginal and non-Aboriginal people, and that this rate has not significantly changed from 2005 to 2011 [9]. However the chronic disease readmission rates reported in our analysis are higher compared to readmissions for any cause. Our findings are consistent with other broader analyses of hospitalisation patterns among Aboriginal people with chronic disease which also report significantly higher rates of unavoidable or potentially preventable hospitalisations in Aboriginal with chronic disease compared with non-Aboriginal people [23, 24]. Yet these studies do not consider unplanned readmissions which measure a distinctly different indicator compared to unavoidable

Table 2 Differences in separations that resulted in an unplanned readmission or death by Aboriginal status, for the period 2005/6–2013/14

	Unplanned readmission or death (n = 122,145)		Unadjusted relative risk (RR), (95% CI; P -value)	RR restricted to patients aged < 75 yrs., (95% CI; P -value)
	Yes	No		
Aboriginal n (%)	11,349 (14.7)	66,078 (85.3)	1.16 (1.13, 1.19; < 0.0001)	1.36 (1.30, 1.41; < 0.0001)
Non-Aboriginal n (%)	5650 (12.6)	39,068 (87.4)	ref	ref

Table 3 Unadjusted and adjusted GLM regression models of unplanned readmission or death by Aboriginal status for the study period 2005/6 to 2013/14

	Unplanned readmission or death Relative risks (RR) (95% CI)					P-value
	Unadjusted RR with propensity score (PS) weight	Unadjusted RR without PS weight	Adjusted ^a RR with PS weight	Adjusted ^a RR without PS weight	Adjusted ^a RR with PS weight and restricted to < 75 years	
Aboriginal status						
Non-Aboriginal	ref	ref	ref	Ref	ref	
Aboriginal	1.15 (1.12, 1.19)	1.16 (1.13, 1.20)	1.29 (1.24, 1.33)	1.29 (1.24, 1.33)	1.34 (1.29, 1.40)	< 0.0001
Year	1.00 (0.99, 1.01)	1.00 (0.99, 1.01)	1.00 (0.99, 1.01)	1.00 (0.99, 1.01)	1.00 (0.99, 1.01)	0.529
Gender	–	–	–			
Male	–	–	ref	ref	ref	
Female	–	–	0.89 (0.86, 0.92)	0.89 (0.86, 0.91)	0.87 (0.84, 0.90)	< 0.0001
Age	–	–	1.01 (1.01, 1.01)	1.01 (1.01, 1.01)	1.01 (1.00, 1.01)	< 0.0001
Marital status	–	–				
Married	–	–	ref	ref	ref	
Single	–	–	1.19 (1.15, 1.24)	1.20 (1.15, 1.24)	1.20 (1.15, 1.25)	< 0.0001
Widowed	–	–	1.18 (1.13, 1.23)	1.18 (1.13, 1.23)	1.21 (1.13, 1.28)	< 0.0001
Divorced/separated	–	–	1.15 (1.10, 1.20)	1.15 (1.10, 1.20)	1.18 (1.12, 1.24)	< 0.0001
Not known	–	–	0.92 (0.81, 1.05)	0.93 (0.82, 1.06)	0.97 (0.84, 1.12)	0.685
IRSD						
1st quintile - most disadvantaged	–	–	ref	ref	ref	
2nd quintile	–	–	0.94 (0.90, 0.98)	0.94 (0.90, 0.98)	0.94 (0.90, 0.99)	< 0.05
3rd quintile	–	–	0.94 (0.90, 0.99)	0.94 (0.90, 0.99)	0.93 (0.88, 0.98)	< 0.05
4th quintile	–	–	0.93 (0.88, 0.98)	0.93 (0.88, 0.98)	0.94 (0.88, 0.99)	< 0.05
5th quintile – least disadvantaged	–	–	0.88 (0.83, 0.94)	0.88 (0.83, 0.94)	0.80 (0.74, 0.87)	< 0.0001
ARIA						
Highly Accessible	–	–	ref	ref	ref	
Accessible	–	–	0.93 (0.89, 0.96)	0.93 (0.89, 0.96)	0.93 (0.90, 0.97)	> 0.01
Moderately Accessible	–	–	0.87 (0.84, 0.93)	0.87 (0.84, 0.93)	0.87 (0.82, 0.92)	< 0.0001
Remote/Very Remote	–	–	0.67 (0.61, 0.73)	0.67 (0.61, 0.73)	0.65 (0.59, 0.72)	< 0.0001
Charlson Index score						
0	–	–	ref	ref	ref	
1	–	–	1.43 (1.38, 1.48)	1.43 (1.38, 1.48)	1.45 (1.39, 1.51)	< 0.0001
2+	–	–	1.63 (1.57, 1.69)	1.63 (1.57, 1.69)	1.69 (1.62, 1.77)	< 0.0001

^aRRs are adjusted for all variables given in the table

hospitalisations which generally reflects sub-optimal community health care, compared to unplanned readmissions which reflect a combination of poor hospital care as well as poor community follow up.

Our findings showed that unplanned readmission or death in Aboriginal people remained significantly higher than the non-Aboriginal rates, even once adjusted for sociodemographic, disease and admission variables, and for potential selection bias. The fact that Aboriginal status remains a significant risk factor, even after accounting for other variables, is consistent with chronic disease preventable hospitalisation studies in

Aboriginal people, [23, 25] and the international literature which shows significant associations with ethnicity and readmission even after adjusting for sociodemographic or disease factors [26–28]. However considering the socio-demographic profile of Aboriginal patients with chronic disease is informative for program planning. Our study found a higher proportion of Aboriginal patients were female, younger, more likely to be single, live in the most disadvantaged and remote areas of NSW. This difference in socio-demographic profile should be considered in strategies aimed at reducing unplanned readmissions in Aboriginal people with chronic disease.

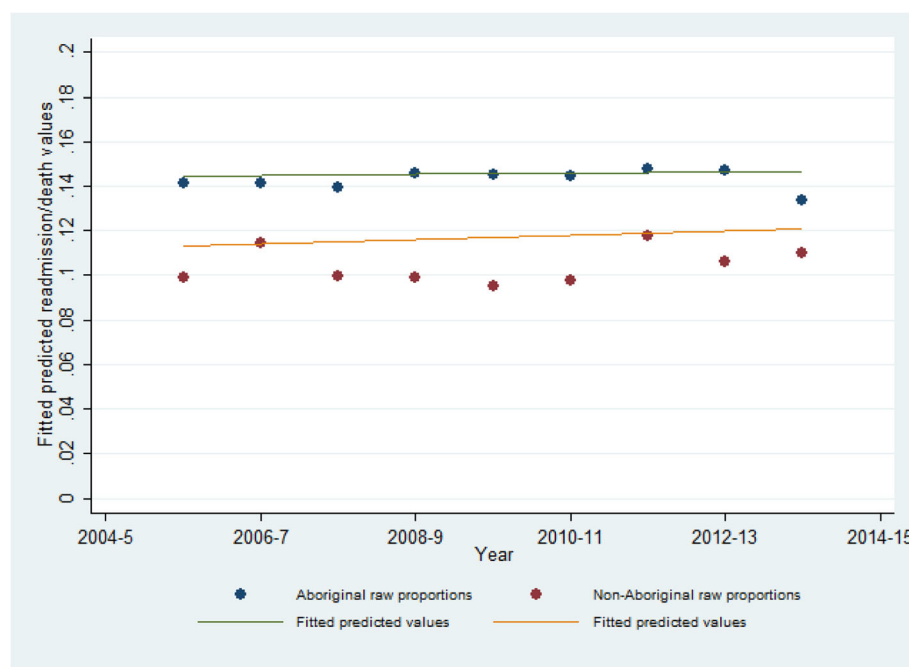


Fig. 2 Trend analysis for unplanned readmission or death calculated for each year of the study period (2005–6 to 2013–14) by Aboriginal status

The fact that the significant difference in readmission or death rates has consistently remained over the nine years highlights the ongoing disparity between Aboriginal and non-Aboriginal health outcomes. Therefore, further targeted programs need to address the gap in effective care for high risk Aboriginal patients with chronic disease. The high prevalence of chronic diseases among patients, particularly the presence of multiple comorbidities in adults, requires intensive case management in both hospital and community settings, to ensure follow up post discharge is adequately conducted [29]. Qualitative work on the effectiveness of discharge planning and post-acute care for Aboriginal patients in improving health outcomes such as readmission, suggests good outcomes are dependent on the availability, knowledge and use of post-acute services and better access to primary health care [30]. One current NSW Health program targets Aboriginal patients recently discharged from hospital with a chronic disease and provides telephone follow-up within 48 h. It demonstrated a significant decrease in emergency department presentations, but not in unplanned readmissions, in Aboriginal people who received the follow up compared with eligible Aboriginal people who did not [31]. Further research is needed to determine the types of interventions that are effective in reducing unplanned readmissions in Aboriginal people with chronic disease.

Our finding that length of stay was shorter for Aboriginal people compared to non-Aboriginal differs to other studies. Banham and colleagues in their study of

potentially preventable hospitalisations in Aboriginal people with chronic disease report higher length of stay compared to non-Aboriginal people [23]. Although shorter length of stay is often considered more efficient, it may indicate either a higher risk of discharge against medical advice in this group of patients, or that they are not receiving the sufficient care resulting in poorer health outcomes and increased risk of readmission [32, 33]. Further research should investigate length of stay in Aboriginal people with chronic disease.

Limitations

Study findings should be considered in light of several limitations. There may be an underrepresentation in unplanned readmission rates due to underreporting of Aboriginality in hospital data, and therefore caution is needed in interpreting all hospital-level data for Aboriginal people. Further, not all data on non-Aboriginal separations is included in this analysis, only a sample of non-Aboriginal separations were included who met the eligibility criteria (compared to all Aboriginal cases where all cases meeting the criteria were selected). Therefore it is possible that the non-Aboriginal sample is not representative of all non-Aboriginal people meeting the study eligibility criteria.

We could not exclude the possibility that a selection bias was induced through selecting only those that survived the admission. Our propensity score analysis attempted to resolve this by weighting the analysis

Table 4 Testing for a trend over time in unplanned readmission or death: Unadjusted and adjusted GLM regression models of unplanned readmission or death by Aboriginal status including an interaction term for year and Aboriginal status (2005/6 to 2013/14)

	Unplanned readmission or death with interaction term Relative risks (RR) (95% CI)					P-value
	Unadjusted RR with propensity score (PS) weight	Unadjusted RR without PS weight	Adjusted ^a RR with PS weight	Adjusted ^a RR without PS weight	Adjusted ^a RR with PS weight and restricted to < 75 years	
Aboriginal status						
Non-Aboriginal	ref	ref	ref	Ref	ref	
Aboriginal	1.15 (1.11, 1.19)	1.16 (1.12, 1.20)	1.28 (1.23, 1.32)	1.28 (1.23, 1.33)	1.33 (1.27, 1.39)	< 0.0001
Year	1.00 (0.99, 1.01)	1.00 (0.99, 1.01)	1.00 (0.99, 1.01)	0.99 (0.99, 1.01)	1.01 (0.99, 1.02)	0.140
Interaction term						
Year and Aboriginal status	1.00 (0.99, 1.02)	1.01 (0.99, 1.02)	1.01 (0.99, 1.02)	1.01 (1.00, 1.02)	0.99 (0.97, 1.00)	0.176
Gender	–	–	–			
Male	–	–	ref	ref	ref	
Female	–	–	0.89 (0.86, 0.92)	0.89 (0.86, 0.92)	0.88 (0.84, 0.91)	< 0.0001
Age	–	–	1.01 (1.00, 1.01)	1.01 (1.01, 1.01)	1.00 (1.00, 1.01)	< 0.0001
Marital status	–	–				
Married	–	–	ref	ref	ref	
Single	–	–	1.19 (1.15, 1.24)	1.20 (1.15, 1.25)	1.21 (1.16, 1.26)	< 0.0001
Widowed	–	–	1.18 (1.12, 1.23)	1.18 (1.13, 1.24)	1.24 (1.16, 1.32)	< 0.0001
Divorced/separated	–	–	1.15 (1.10, 1.21)	1.15 (1.10, 1.21)	1.20 (1.13, 1.26)	< 0.0001
Not known	–	–	0.93 (0.81, 1.07)	0.94 (0.82, 1.07)	0.97 (0.83, 1.13)	0.714
IRSD						
1st quintile - most disadvantaged	–	–	ref	ref	ref	
2nd quintile	–	–	0.95 (0.91, 0.99)	0.95 (0.91, 0.99)	0.95 (0.90, 1.00)	0.061
3rd quintile	–	–	0.94 (0.90, 0.99)	0.94 (0.90, 0.99)	0.94 (0.90, 0.99)	< 0.05
4th quintile	–	–	0.92 (0.87, 0.97)	0.93 (0.87, 0.98)	0.94 (0.87, 0.98)	0.051
5th quintile – least disadvantaged	–	–	0.88 (0.82, 0.94)	0.88 (0.82, 0.94)	0.80 (0.74, 0.87)	< 0.0001
ARIA						
Highly Accessible	–	–	ref	ref	ref	
Accessible	–	–	0.93 (0.89, 0.97)	0.93 (0.89, 0.97)	0.94 (0.90, 0.98)	> 0.01
Moderately Accessible	–	–	0.88 (0.83, 0.93)	0.88 (0.83, 0.93)	0.86 (0.81, 0.92)	< 0.0001
Remote / Very Remote	–	–	0.67 (0.61, 0.73)	0.67 (0.61, 0.73)	0.65 (0.59, 0.72)	< 0.0001
Charlson Index score						
0	–	–	ref	ref	ref	
1	–	–	1.43 (1.38, 1.49)	1.43 (1.38, 1.49)	1.46 (1.40, 1.52)	< 0.0001
2+	–	–	1.63 (1.57, 1.70)	1.63 (1.57, 1.69)	1.69 (1.62, 1.77)	< 0.0001

^aRRs are adjusted for all variables given in the table

sample such that the distribution of selection confounders was similar to those that died during admission, however there may have been unmeasured confounders which biased the results. Caution should also be used in interpreting data on unplanned readmission as these data do not differentiate between avoidable and unavoidable unplanned readmissions, and therefore inevitably includes some readmissions which are appropriate and unavoidable. Finally, while it is likely that some patients had

readmissions prior to 2005, our retrospective cohort study design allows us to only examine admissions within a defined time period only.

Conclusion

Aboriginal people with chronic disease had a significantly higher risk of unplanned readmission or death compared with non-Aboriginal people, and there has been no significant change over the nine year period. It is

critical that effective interventions to reduce unplanned readmissions for Aboriginal people are identified.

Endnotes

¹The importance of using correct, respectful and appropriate terminology for Aboriginal and Torres Strait Islander people is acknowledged. In keeping with NSW Health recommendations and acknowledging that Aboriginal people are the original inhabitants of NSW, the term Aboriginal people will be used (NSW Health “Communicating positively: A guide to appropriate Aboriginal terminology”, NSW Department of Health 2004).

Additional file

Additional file 1: ICD-10 codes. A list of ICD-10 codes for eligible chronic diseases for this retrospective cohort study. (DOCX 18 kb)

Abbreviations

ABS: Australian Bureau of Statistics; APDC: NSW Admitted Patient Data Collection; ARIA: Accessibility/Remoteness Index of Australia; CCI: Charlson Co-morbidity Index; CI: confidence interval; RR: relative risk; EDDC: Emergency Department Data Collection; GLM: generalised linear model; IRSD: Index of Relative Socio-economic Disadvantage; NSW: New South Wales; RBDM: NSW Registrar of Births, Deaths and Marriages

Acknowledgements

We would like to acknowledge the traditional custodians of NSW, Australia, the Aboriginal people and pay our respects to the Elders past, present and future.

Funding

This study received funding from the Priority Research Centre for Health Behaviour, University of Newcastle. The funder had no role in the research study.

Availability of data and materials

The data that support the findings of this study (The Centre for Health Record Linkage linked NSW government administrative datasets) are available from NSW Health but restrictions apply to the availability of these data and so are not publicly available. Access to the data is available by application to the data custodians, NSW Health.

Authors' contributions

AJ, CO and MC contributed to the design of the study. AJ drafted the manuscript. AJ and CO conducted the analysis, with advice from JA, and TE prepared the datasets. JB, CO, MC, TE, R S-F and SE provided critical review of the manuscript. All authors contributed to the interpretation of findings, and have read and approved the final manuscript.

Ethics approval and consent to participate

The study was approved by the NSW Population & Health Services Research Ethics Committee (HREC/15/CIPH/18) and the NSW Aboriginal Health and Medical Research Council Ethics Committee (1090/15). The Ethics Committees granted a waiver of the usual requirement for the consent of the individual to the use of their health information in a research project, in line with the State Privacy Commissioner's Guidelines for Research and the Health Records and Information Privacy Act 2002 (NSW). The Centre for Health Record Linkage preserve privacy and maintain robust data governance. As researchers are only able to access de-identified linked data, the Centre for Health Record Linkage enable ethically approved research in the public interest to be carried out without consent.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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Received: 3 August 2018 Accepted: 16 November 2018

Published online: 26 November 2018

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Chapter 5: Paper Three

Introduction to paper three

The findings from paper one and paper two provide unique statewide information on frequent avoidable admissions and unplanned readmissions for Aboriginal people with chronic disease. However, to understand why unplanned readmissions occur at a higher rate among Aboriginal people compared to non-Aboriginal people, it is important to explore the perceptions and experiences of Aboriginal people who have experienced unplanned readmissions.

Paper three reports the findings from qualitative in-depth interviews with Aboriginal people readmitted to hospital with chronic disease. The study aims to provide a deeper understanding of this unique context and explore any barriers and enablers to chronic disease management which can help decrease rates of unplanned readmissions.

This paper is published in the *Australian Health Review*. Under the journal's License to Publish, only the accepted final version of the Word manuscript can be included in a PhD thesis, not the published pdf version. The statements of contribution from co-authors are shown in Appendix 1.

Citation: Jayakody A, Carey M, Bryant J, Ella S, Hussein P, Warren E, Davidson C, Bacon S, Field B, Sanson-Fisher R. Exploring experiences and perceptions of Aboriginal people readmitted to hospital with chronic disease in NSW, Australia: a qualitative study. *Australian Health Review* (2021).

Exploring Experiences and Perceptions of Aboriginal and Torres Strait Islander Peoples Readmitted to Hospital with Chronic Disease in New South Wales, Australia: A Qualitative Study

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5.1 Abstract

Objective: This study explored the experiences and perceptions of unplanned hospital readmissions from the perspective of Aboriginal and Torres Strait Islander peoples with chronic disease.

Method: We conducted semi-structured interviews with Aboriginal and Torres Strait Islander patients readmitted to hospital with chronic disease. Interviews covered perceptions of avoidable readmissions, experiences of health care, medications and carer support. Inductive thematic analysis was used to code and analyse the data.

Results: Fifteen patients with multiple chronic diseases were interviewed. Several participants believed their readmission was unavoidable due to their poor health, while others considered their readmission was avoidable due to perceived health professional and system failures. Enablers to chronic disease management included the importance of continuity of care and strong family networks, although a few participants struggled with isolation. Four themes emerged as barriers: poor communication from health professionals; low levels of health literacy and adherence to chronic disease management; poor access to community services; and health risk behaviours.

Conclusions: The participants in our study identified complex and interacting patient-, environmental-, encounter and organisational-level factors as contributing to chronic disease management and unplanned readmissions. Our findings suggest systemic failures remain in access to basic services and access to culturally appropriate care. Family support and continuity of care were valued by participants.

What is known about the topic? Aboriginal and Torres Strait Islander peoples with chronic diseases are more likely to be readmitted to hospital compared with non-Aboriginal people. Unplanned readmissions are associated with high health system costs, as well as poorer quality of life and psychological distress for the patient.

What does this paper add? This paper describes the experiences and perceptions of unplanned readmissions by Aboriginal and Torres Strait Islander peoples with chronic disease. Our findings suggest systemic failures exist in access to basic services for a safe and secure living environment,

and access to culturally appropriate care that is delivered in a manner which promotes health literacy and self-management capacity.

What are the implications for practitioners? Practitioners and policy makers should consider involving family members in discharge planning and other medical care, and funding for Aboriginal and Torres Strait Islander health and community services to enhance transport, care coordination, culturally appropriate disability and housing services, and health promotion.

Keywords: Aboriginal and Torres Strait Islander health, patient readmission, quality of health care, Indigenous health services, health care access, medication adherence, culturally appropriate care, unplanned readmissions, chronic disease management, health literacy, self-management capacity.

5.2 Introduction

Chronic diseases are more common among Aboriginal and Torres Strait Islander peoples (hereafter respectfully referred to as Aboriginal people) compared with non-Aboriginal people in Australia.^{1,2} There is a life expectancy gap of up to 8.6 years between Aboriginal and non-Aboriginal people, of which chronic diseases accounts for 70% of this difference.^{2,3} The most common self-reported chronic diseases for Aboriginal people are cardiovascular diseases, renal disease, diabetes, and respiratory diseases.⁴

Chronic disease is associated with high rates of unplanned hospital readmissions.^{5,6} Rates of unplanned readmissions related to chronic disease (diabetes, chronic respiratory disease, cardiovascular disease, and renal disease) are 1.3 times higher among Aboriginal people than among non-Aboriginal people.⁷ Unplanned readmissions are associated with health system costs,⁸ as well as poorer quality of life and psychological distress for patients and carers.⁹ As such, in Australia and internationally, unplanned readmissions are considered a measure of the quality of health care.^{10,11}

Exploring and understanding which factors may contribute to or protect against unplanned readmission is a vital step towards informing existing and future health interventions aimed at reducing unplanned readmissions. Vest et al.'s adapted health services conceptual framework explains health care as a junction of population health (factors operating at the patient and environmental levels) and clinical care (factors operating at the encounter and organisational levels).¹² Vest et al. propose that factors influencing unplanned readmission can be explored and understood as largely operating at these four levels. Research in unplanned readmission for general populations have identified encounter-level barriers, such as poor discharge planning and poor community health follow up,^{13,14} and patient-level barriers, such as poor health, poor health literacy and low medication adherence.^{12,15} At the environmental level, barriers such as housing and deprivation¹² and a lack of support from a carer or health professional for chronic disease self-management (which intersects with encounter levels) have been identified.^{12,16} Organisational-level factors, although less researched,

may include factors such as hospital type, policies and procedures.¹² However, there is a lack of research and understanding of the factors that are protecting against and contributing to unplanned readmissions for Aboriginal people with chronic diseases.

To improve the management of chronic diseases and prevent avoidable hospitalisation, it is important to understand the factors that may be associated with unplanned readmission from the perspectives of Aboriginal patients. This qualitative study explored the experiences and perceptions of unplanned hospital readmissions from the perspective of Aboriginal people with chronic disease readmitted to hospital.

5.3 Method

5.3.1 Study design

A qualitative study was conducted using semi-structured in-depth interviews of a convenience sample of Aboriginal people readmitted to hospital between May 2018 and January 2019. The findings were considered within the context of Vest et al.'s adapted health services conceptual framework.¹² The study methodology adhered to the Consolidated Criteria for Reporting Qualitative Research (COREQ) guidelines which provides an evidence-based reporting framework.¹⁷

5.3.2 Setting

Patients were readmitted to one of two tertiary public hospitals on the Central Coast, New South Wales (NSW), Australia. Aboriginal Hospital Liaison Officers (AHLO) from Nunyara Aboriginal Health Unit visit Aboriginal patients, provide cultural support and help them navigate the health system.

5.3.3 Ethics and governance

The Aboriginal Health and Medical Research Council of NSW and the Hunter New England Human Research Ethics Committees granted ethical approval for the study. The study advisory committee consisted of: Yerin Aboriginal Health Service, Nunyara Aboriginal Health Unit, and the University of Newcastle research team. The committee provided guidance on the study design, data interpretation, and ensured there was appropriate Aboriginal oversight of the research.

5.3.4 Sample

Participants were of Aboriginal and/or Torres Strait Islander descent, aged ≥ 18 years, and readmitted to hospital within 3 months of the index admission with a chronic disease as a principal or secondary diagnosis. The following chronic diseases were included: cardiovascular disease, chronic respiratory disease, diabetes, renal disease, and cancer.¹⁸ Patients readmitted primarily for mental health conditions were excluded.

5.3.5 Recruitment

The female interviewer (AJ) had interest in the study topic, which formed part of her PhD thesis. She was non-Aboriginal but had completed cultural competency training, had experience conducting qualitative research and working with Aboriginal communities. She accompanied the AHLO on ward visits. For eligible patients, the AHLO sought the patient's permission for the interviewer to discuss the research and seek informed consent. The interviewer explained her role and interest in the study. The AHLO and interviewer ensured a good rapport was established before interview commencement. Participants could request the AHLO or a family member be present during the interview.

5.3.6 Interview procedure and schedule

Interviews were conducted with participants on the ward or in a private room, with interviews lasting ~15 to 50 min. Questions were open-ended and informed by themes that the advisory committee and literature suggested may be of importance to Aboriginal communities.^{19–22} The topics covered in the

interviews are presented in Table 5.1. The interviews were audio recorded and the interviewer took field notes during the interviews. The research team judged that sufficient data had been gathered when interviews were no longer providing new insights.

Table 5.1: Outline of interview participant guide

Main topics
Reasons for index and unplanned readmissions
Experiences of any post discharge follow up
Experiences of any health-related support by friends/family/carer
Experiences of taking prescribed medications
Whether or not participant has a regular doctor and their experiences
Participants' perceptions on whether their unplanned readmission was avoidable
General experiences of unplanned readmissions

5.3.7 Data analysis

Interviews were transcribed verbatim. An inductive thematic analysis approach was used to analyse the data whereby emergent themes were identified from the data rather than fitting into a priori defined codes.²³ One author (AJ) coded all interviews and two authors (MC and JB) independently coded half of the transcripts each to ensure rigour. The three authors independently identified emerging themes from the transcripts and then discussed and agreed upon a potential code book. The code book was then applied to all the transcripts by one author (AJ), and again reviewed by all three authors. If a theme or sub-theme did not fit into the code book, further codes were developed to ensure all potential themes were captured. Themes and subthemes were refined until agreement between the three authors was achieved.²⁴ The themes were discussed with the advisory committee for further cultural understanding and interpretation. Analysis was conducted using NVivo 12 (QSR International Pty Ltd). The themes of the interviews were organised into two sections: 1) perceptions

of whether readmissions could have been avoided, and 2) enablers and barriers to chronic disease management.

5.4 Results

All 15 participants identified as Aboriginal and were readmitted to hospital at the time of the interview. Two patients declined to participate due to feeling unwell. Six participants were male, and nine were female. Their ages ranged from 37 to 83 years (median age = 68). One carer was interviewed on behalf of her father. All participants had multiple chronic diseases: cardiovascular disease (n = 9); chronic respiratory disease (n = 7); diabetes (n = 5); cancer (n = 5); renal disease (n = 2); osteoporosis (n = 2); mental health conditions (n = 3). Nine patients were readmitted (unplanned) for the same primary diagnoses as for their index admission. For the remaining six patients, it was unclear as to whether their index admission and unplanned readmission were directly linked.

5.4.1 Perceptions of whether readmissions could have been avoided

Several participants reported their readmission was unavoidable because they were extremely sick. Participants described how unplanned readmissions were just part of their illness journey and a consequence of their complex health needs.

I knew I would have to be backwards and forwards to hospital for the rest of my life now. With this cancer, you know. I knew that [...] I'd love to be able to say 'Na I don't need to come back no more'. No I can't even after this stay. Sad but true.

[Participant 8]

Several participants, however, perceived their readmission was avoidable due to health professional and organisational failures. This included being discharged too early from their index admission due to hospital bed shortages, or because the hospital staff presumed the patient was well enough. Other participants perceived their general practitioner (GP) or hospital doctor misdiagnosed them, which resulted in worsening symptoms and an unplanned readmission. One participant felt her GP had not

listened to her health concerns over a long period of time and hospital doctors did not thoroughly investigate her illnesses.

Participant: I felt if they [hospital doctors] kept me in the first time and did the test like this time, I don't feel I'd have all this.

Participant's mother: Yeah if they'd checked her bowels whilst she was in the first time, it wouldn't have burst it.

[Participant 7]

5.4.2 Enablers and barriers to chronic disease management

Six main themes emerged as barriers or enablers to managing health in the lead up to and immediately following an unplanned readmission: 1) poor communication from health professionals; 2) health literacy and adherence to chronic disease management; 3) importance of continuity of care; 4) poor access to community services; 5) strong family networks; and 6) health risk behaviours.

1) Poor communication from health professionals

Some participants reported hospital doctors and GPs did not listen to their concerns and did not explain their treatment in a way the participant could understand, which led to a lack of trust. One participant who took up to 17 tablets daily reported she did not understand her treatment and had asked her GP for help but felt she was ignored.

My doctor keeps saying she's going to look into it [health literacy help] but she never does.

[Participant 11]

Another participant explained how her medications were suddenly changed whilst admitted to hospital without explanation, resulting in new side effects.

I don't see a reason when they don't come and talk to me about it. They just do it. I know it's not explained to me and the worst ones that do it are the med students.

[Participant 9]

Good communication was very important to participants and a sign of respect.

My biggest bugbear is a doctor who comes in, looks at ya, asks you one or two questions. And they go and talk to their little companions and you know you can't understand a word they're saying and then they walk out without telling you what exactly is going on. But I like to be told what I'm taking and what it's going to do for me and what it is for.

[Participant 4]

2) Health literacy and adherence to chronic disease management

Poor communication from health professionals was also evident in the health literacy and adherence needs of participants. All participants had complex medication regimes and high frequency of medical appointments. Many reported taking their medication on time with the use of pharmacy-provided medicine packs and were able to attend their medical appointments without difficulty. However, some participants reported poor understanding of key aspects of chronic disease management including struggling to take multiple medications, understanding what medications were for, and understanding the importance of attending medical appointments. For some, this lack of understanding resulted in a passive approach towards health management.

Well I think I do [understand] but sometimes I just chuck 'em down and hope for the best!

[Participant 8]

Poor understanding of medications also resulted in nonadherence to prescribed medication regimes for some participants.

I've sworn myself off the pills. They were keeping me on about 15 pills [...] I said after a week I said these pills aren't doing me any good. So I made up my mind to cut 'em out. As I thought there might be something in one of their pills which [were causing me problems] which I still do.

I only chop it down to about 3 now.'

[Participant 10]

Several participants also appeared to have limited understanding of the importance of attending their medical appointments. One participant reported that she did not attend her appointments unless the doctor chased her up.

*I just didn't feel like it was anything important. If they think
it's something really important they'll ring me back and say
look we've got to see you. [Participant 4]*

3) Importance of continuity of care

Having a regular and long-term GP was important to many participants. Trust could be built with the GP over time, allowing doctors to get to know the participant and their health needs.

She [GP] knows me better than I know myself.

[Participant 6]

*I've been seeing him for about 4 years. And the doctor I saw
before that I saw for 19 years. I don't like swapping doctors.*

[Participant 1]

Many participants had a long-term relationship with the local Aboriginal medical and community services. Aboriginal services were considered a central place of health, practical and emotional support, and provided access to GPs, specialised clinics, hospital liaison, health education, home visiting and transport. Many participants described how Aboriginal staff were able to explain medical terminology in a way that they understood.

*Well my [Aboriginal medical service] takes me [to my appointments].
If I need to they'll have one of the nurses come visit me and what have ya.
They'll explain what the doctor says better than what I can. So I tell her
and she'll just write it down and tell [Aboriginal medical service].*

[Participant 3]

4) Poor access to community services

Some participants described poor access to several community and social services, which impacted their chronic disease management. Several participants reported having to sometimes miss their appointment due to a lack of transport.

Participant: Me mate drives me.

Interviewer: Do you find you miss any appointments?

Participant: Yeah cos he can't do it all the time.

Interviewer: So if you can't get transport, you miss out on your appointments?

Participant: Yeah sometimes or I catch a cab.

[Participant 13]

Two participants reported problems with access to disability modifications. One participant (a carer) described how her father had been admitted to hospital due to slipping in the bathroom. She felt this could have been avoided if their landlord had allowed disability modifications to be made in their rental house.

Modifications to the home are not feasible from an owners' point of view. They're not going to rip up stuff and add things that are you know to accommodate a disability. They'll just up the rent if that's the case. It's a catch 22 [y] Until I get a lifter [patient hoist] they [community services] won't touch us.

[Participant 2]

Some participants were homeless or did not have access to adequate stable housing. For some, not having access to safe housing led to vulnerability to theft and violence. Such social factors had a compounding effect on self-management of their illnesses and access to treatment.

Homelessness is another issue. That's a big thing. I can't have treatment cos I'm homeless. [Participant 14]

Some participants reported gaps in the services they were receiving. When asked, some participants were not aware of having a GP management plan or post-discharge telephone follow up or a home

visit. Although some participants had access to most of the community services they needed, some high-need patients felt the services were unreliable.

Everything is just so up in the air at the moment with them [community services]. I don't know whether I'm coming or going. So I can't trust them [...] I haven't even got a ramp to get in and out of my house. But now I have to throw myself over a railing to get in and out of the house cos there's no ramp. [Participant 12]

5.4.3 Strong family networks

Most participants reported having a strong family and/or friendship network that provided most of the care and support they needed. Family members cooked meals, washed clothes, cleaned, provided transport to appointments and reminded participants to take their medication.

She [participant's daughter] gets my medications, she gets my clothes out for me, just about everything like. Daily clothing, dressing, everything she gets for me. [Participant 5]

Some participants also emphasised the importance of their friendship networks. They provided emotional support as well practical assistance, such as transport to medical appointments.

I've got 10 or 12 friends who drop in for coffee you know, talk with them you know what I mean. It's good for everybody [...] They're good like that [in providing transport to appointments]. And one of my other mates would turn around if I asked. [Participant 15]

However, a few participants lived on their own or were homeless and reported they were isolated and had little social support. One participant felt reluctant to burden family with her care and preferred to be independent. However, she conceded her current readmission could have been avoided if she'd had family support at home.

I'm mainly on me own, I don't have anyone to stay with me to help me. I had my own place and I don't like to have anyone living with me. I'm very independent but it proved in the end that I have to have someone stay.

[Participant 8]

5.4.4 Health risk behaviours

Some participants identified health risk behaviours they felt contributed to poor health and unplanned readmissions. They described how smoking, lack of good nutrition or exercise, and a lack of self-motivation to look after their health were factors that they could try to change themselves. One participant reflected on events leading up to her readmission and felt she often lacked self-motivation to look after herself and to adhere to her GP's recommendations.

I feel I could have done more for myself [...] it's more of my own lack of motivation.

[Participant 7]

5.5 Discussion

The findings of this study highlight areas of resilience but also barriers to effective chronic disease management and reduction in unplanned readmissions. Our findings show that access to assistance and support for basic household tasks, stable housing, transport and disability support have a strong influence on the way in which participants were able to manage their chronic disease. The importance of continuity of care and strong family networks emerged as enabling factors for chronic disease management. Although some participants felt their readmission was unavoidable due to their poor health, others believed health professional and organisational-level failures led to their readmission.

At the environmental level, the family network was a foundational support for participants in the management of their illnesses, with participants dependent on their families for assistance with medications, getting to medical appointments and household tasks. Strong family networks have also been highlighted in other studies examining Aboriginal people's perceptions of health care.^{19,25,26}

Aspin *et al.* argue that family members relieve the health system greatly and that their important role

within Aboriginal communities should be acknowledged.¹⁹ In line with our findings, research has also shown the importance of health professionals identifying and addressing isolation in vulnerable patients due to the risk of repeat hospitalisations.²⁷

Participants expressed the importance of encounter-level factors, particularly having a long-term and regular GP, confirming existing evidence of the role of continuity in community chronic disease management, which in turn helps prevent high cost hospitalisations.²⁸ Participants described the importance of their Aboriginal medical service in providing practical and cultural support. For many Aboriginal people, attending a mainstream general practice or hospital can feel alien and strange.^{19,20,25} Aboriginal health services provide a culturally safe space for Aboriginal people, and Aboriginal health workers play an important role in improving the cultural security of chronic disease management care for patients.²⁹

Several encounter-level factors were also identified as barriers to chronic disease management. Some participants reported poor communication from health professionals. This confirms the need for comprehensive cultural competency training for health professionals, to ensure responsive and culturally appropriate care for Aboriginal people.^{22,30} Poor communication was often reflected in patient-level factors such as non-adherence and low health literacy among some participants who lacked medication understanding and support. Interviews with Aboriginal health workers in NSW demonstrated that many Aboriginal patients were uncomfortable seeking medication advice, and that medication information was hard to understand and not culturally appropriate.²¹ There not only remains a need for health literacy programs for Aboriginal people, but also health promotion to address the health risk behaviours identified by many participants.

Our findings show that Aboriginal health services play an important role in improving health literacy by helping patients to understand their medical management. Our findings suggest some Aboriginal patients readmitted to hospital experience poor access to reliable community and social services, whereby these environmental- and encounter level-factors have profound impacts on the ability of

patients to successfully manage their illnesses in the community setting. Although some participants reported accessing and valuing transport services provided by Aboriginal health or community services, further support is needed for these services to address and coordinate the transport needs of their communities.³¹ There is also a vital need for community and social services to address gaps in adequate and culturally appropriate disability and housing services.

Key enabling factors, family support and continuity of care, could be strengthened through specific programs to help services and families better support vulnerable people living with chronic disease. For example, involvement of family members in discharge planning and other medical care, and funding for Aboriginal health and community services to enhance transport, care coordination, and health promotion.

5.5.1 Limitations

Despite efforts to make participants feel culturally safe with the presence of the AHLO and family members, there is the potential that some participants may not have felt fully comfortable to discuss all issues with a non-Aboriginal interviewer. However, the interviewer and AHLO felt a good rapport was established with all participants before the interview formally began.

5.6 Conclusion

Our study provides unique insights of the experiences of unplanned hospital readmissions among a high-risk population group. Participants identified complex and interacting patient-, environmental-, encounter- and organisational-level factors which contribute to chronic disease management and unplanned readmissions. These factors suggest systemic failures exist in accessing basic services for a safe and secure living environment, and in accessing culturally appropriate care that is delivered in a manner which promotes health literacy and self-management capacity. Family support and continuity of care through primary care services, in particular those delivered by Aboriginal health services, was highly valued by participants.

Competing interests

The authors declare that they have no competing interests.

Declaration of funding

This study received no funding. JB is funded by an NHMRC ARC Dementia Research Development Fellowship.

Acknowledgements

The manuscript will form part of Amanda Jayakody's PhD and she is enrolled at the University of Newcastle. We acknowledge the sovereignty of Aboriginal and Torres Strait Islander peoples as the original custodians of Australia and acknowledge and pay respect to Elders past, present and future. We thank Cathy Davidson, Aboriginal Hospital Liaison Officer, Aboriginal Health Unit, for her time and commitment in assisting in the interview process. We thank the participants involved for their time and for sharing their important experiences and opinions.

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Chapter 6: Paper Four

Introduction to paper four

Paper two demonstrated that rates of unplanned readmissions remained consistently higher for Aboriginal people compared to non-Aboriginal people from 2005–2006 to 2013–2014. Given the adverse impacts of unplanned readmissions on patients, families, and the health system, it is important to identify strategies to reduce these high rates. The international research literature provides some evidence that unplanned readmissions can be reduced in general, and in some high-risk populations with appropriate interventions. Significant impacts have been found for strategies such as improved discharge planning and chronic disease management, telephone follow-up, and patient and family education. Telephone follow-up is a common component of interventions to reduce unplanned readmissions and has been shown to be effective in general medical and surgical patient groups. However, its effectiveness among patients with various types of chronic disease has not been systematically examined.

Addressing a gap in the literature, the following systematic review focused on patients with chronic disease. The systematic review explored the international literature to examine the effectiveness of interventions which utilise telephone follow-up with the aim of reducing hospital unplanned readmissions for patients with chronic disease. At the time of conducting the review, there were no published studies that examined the effectiveness of telephone follow-up strategies to reduce unplanned readmission rates in Aboriginal people. It was therefore not possible to conduct a review looking specifically at the impact of telephone follow-up for Aboriginal people with chronic disease, and the review focuses instead on patients with chronic disease broadly. The authors acknowledge that the relevance of the findings of this systematic review to Aboriginal people requires further exploration with Aboriginal people and communities.

This paper was published in *BMC Health Services Research*. The statements of contribution from co-authors are shown in Appendix 1.

Citation: Jayakody A, Bryant J, Carey M, Hobden B, Dodd N and Sanson-Fisher R. Effectiveness of interventions utilizing telephone follow up in reducing hospital readmission within 30 days for individuals with chronic disease: a systematic review. *BMC Health Services Research* (2016) 16:403.

RESEARCH ARTICLE

Open Access



Effectiveness of interventions utilising telephone follow up in reducing hospital readmission within 30 days for individuals with chronic disease: a systematic review

Amanda Jayakody^{*} , Jamie Bryant, Mariko Carey, Breanne Hobden, Natalie Dodd and Robert Sanson-Fisher

Abstract

Background: Rates of readmission to hospital within 30 days are highest amongst those with chronic diseases. Effective interventions to reduce unplanned readmissions are needed. Providing support to patients with chronic disease via telephone may help prevent unnecessary readmission. This systematic review aimed to determine the methodological quality and effectiveness of interventions utilising telephone follow up (TFU) alone or in combination with other components in reducing readmission within 30 days amongst patients with cardiovascular disease, chronic respiratory disease and diabetes.

Methods: A systematic search of MEDLINE, the Cochrane Library and EMBASE were conducted for articles published from database inception to 19th May 2015. Interventions which included TFU alone, or in combination with other components, amongst patients with chronic disease, reported 30 day readmission outcomes and met Effective Practice and Organisation of Care design criteria were included. The titles and abstracts of all identified articles were initially assessed for relevance and rejected on initial screening by one author. Full text articles were assessed against inclusion criteria by two authors with discrepancies resolved through discussion.

Results: Ten studies were identified, of which five were effective in reducing readmissions within 30 days. Overall, the methodological quality of included studies was poor. All identified studies combined TFU with other intervention components. Interventions that were effective included three studies which provided TFU in addition to pre-discharge support; and two studies which provided TFU with both pre- and post-discharge support which included education, discharge planning, physical therapy and dietary consults, medication assessment, home visits and a resident curriculum. There was no evidence that TFU and telemedicine or TFU and post-discharge interventions was effective, however, only one to two studies examined each of these types of interventions.

(Continued on next page)

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Conclusions: Evidence is inconclusive for the effectiveness of interventions utilising TFU alone or in combination with other components in reducing readmissions within 30 days in patients with chronic disease. High methodological quality studies examining the effectiveness of TFU in a standardised way are needed. There is also potential importance in focusing interventions on enhancing provider skills in patient education, transitional care and conducting TFU.

Keywords: Patient readmission, Telephone follow up, Chronic disease

Abbreviations: CBA, Controlled before and after studies; COPD, Chronic obstructive pulmonary disease; EPOC, Cochrane Effective Practice and Organisation of Care; ITS, Interrupted time series designs; MeSH, Medical Subject Heading; NRCT, Non-randomized controlled trials; RCT, Randomized controlled trials; TFU, Telephone follow up; UK, United Kingdom; US, United States

Background

Readmissions to hospital within 30 days of discharge are generally considered an unplanned or potentially avoidable event [1, 2]. In the United States (US), 1 in 5 Medicare fee-for-service patients are readmitted to hospital within 30 days of discharge and it is estimated that up to 90 % of readmissions within 30 days are unplanned [3]. Reported estimations of annual health system costs due to readmission range from \$12 billion to \$17.4 billion in the US [3, 4] and £1.6 billion in the United Kingdom (UK) [5]. Readmissions are also associated with human costs such as feelings of frustration and time lost from an individual's usual role within the workplace and family [6].

Readmissions are highest amongst those with chronic diseases, in particular amongst patients with cardiovascular disease, chronic respiratory disease and diabetes [3, 7–10]. Patients with chronic heart failure have been reported to be at the highest risk of readmission to hospital within 30 days [7, 8, 11] with reported rates of 26.9 % amongst Medicare fee-for-service patients [3]. Individuals with chronic obstructive pulmonary disease (COPD) and diabetes also have high reported readmission rates (22.6–20 % respectively [3]) [7, 8, 12]. Patients with chronic disease discharged from hospital often have complex health care needs and treatment plans, which means the early discharge period is a challenging time for the patient and their carer [9, 13].

Inadequate discharge planning, poor follow up from community health care services, and a lack of patient and carer education in chronic disease self-management skills are believed to contribute to unplanned readmission [14, 15]. Healthcare guidelines in the UK and the US penalise hospitals by restricting government payments for excess unplanned readmissions within 30 days of discharge, based on the rationale that readmissions result from suboptimal care and are preventable [4, 16–18]. This has led to increased motivation to find effective strategies to reduce unplanned readmissions [1, 14, 19].

The effectiveness of a number of intervention strategies, including discharge planning, patient education,

telephone follow up (TFU), home visits, and transition coaching, have been explored to reduce readmissions. Research to date has found no consistent evidence of a singular or multicomponent intervention in reducing readmission [14]. However previous systematic reviews have highlighted that TFU is a common component of successful randomised trials of multi-component interventions in reducing readmissions [14, 20]. Therefore it is a potentially promising intervention amongst patients with chronic disease. TFU, where a hospital or community health worker calls a recently discharged patient at home, is used to provide ongoing education, management of symptoms and prescribed medication, recognition of complications and reassurance to patients with the aim of facilitating a smooth transition into community or specialist health care [21, 22]. TFU is considered easy to implement and low cost [2, 21]. Telephone contact has been linked to increased patient satisfaction [23].

Several reviews to date have examined the effectiveness of TFU [2, 14, 21, 24]. Hansen and colleagues examined the effectiveness of 43 studies which used different types of singular and multi-component interventions in reducing 30 day readmissions in both surgical and medical patients [14]. Following assessment of included studies against Cochrane Effective Practice and Organisation of Care (EPOC) criteria, they found most were observational studies and there was extensive heterogeneity in content and context. They concluded there was no intervention, including TFU, which was consistently effective in reducing readmissions [14]. A Cochrane systematic review examined the effectiveness of TFU delivered by hospital-based staff on health outcomes in 33 studies involving 5110 surgical and medical patients [21]. While the main focus of the review was on psychosocial and physical outcomes, four studies reporting readmission outcomes amongst patients with cardiac disease were pooled together and no effect was found at three months. Again applying EPOC criteria, they found studies were of low methodological quality. Readmission outcomes at 30 days

were not assessed. Another review by Bahr and colleagues focused on hospital based TFU as a singular intervention amongst medical and surgical patients, with no impact on readmissions within 30 days [2]. However they included descriptive studies and no formal assessment of methodological quality was performed. Crocker and colleagues in their review of three included studies also concluded that TFU alone is ineffective in reducing readmissions amongst general medical patients [24]. Risk of bias in study design was assessed but no formal scoring was reported. They did not assess 30 day outcomes and focussed solely on TFU delivered by a primary care team member, and therefore the results are not generalizable to more common hospital based models of TFU where calls are made by the discharge nurse.

While overall, these reviews suggest that the evidence for TFU in reducing readmissions is inconclusive, none have focussed specifically on hospitalised chronic disease patients, and therefore it is unclear to which results are generalizable to this population. Given the increasing prevalence and healthcare burden of chronic diseases, its disease complexity, and the development of government chronic disease strategies [25, 26], it is pertinent to examine the effectiveness of TFU in patients with one or more chronic disease separately from general medical and surgical patients. Therefore, the aim of this review is to assess the methodological quality and effectiveness of interventions using TFU in reducing readmission within 30 days amongst patients with cardiovascular disease, chronic respiratory disease and diabetes.

Methods

Data sources and searches

A systematic search of the MEDLINE, Cochrane Library, and EMBASE electronic databases was conducted from database inception to 19th May 2015. A medical librarian was consulted to develop Medical Subject Heading (MeSH) search terms and keywords under three main groups: hospital readmission, TFU and chronic diseases (see Additional file 1 for search strategies for each database). The search was limited to papers published in English and human studies. Previous reviews of relevant literature and the reference lists of retrieved articles were manually searched to identify additional relevant papers.

Study selection

Studies were included if: (1) they tested the effectiveness of TFU, either on its own or in combination with other intervention components. TFU was defined as a telephone call to the chronic disease patient initiated by the health provider post-discharge; (2) they met the EPOC criteria for study design [27], i.e., randomized controlled trials (RCTs), non-randomized controlled trials (NRCT), controlled before and after studies (CBA) with adjustment

for confounders or interrupted time series designs (ITS); (3) it had a primary objective to reduce hospital readmissions within 30 days amongst individuals with one or more of the following chronic diseases: cardiovascular disease (such as heart disease and stroke), chronic respiratory disease (such as COPD or asthma) and diabetes (types 1 or 2); and (4) readmission was clearly defined and measured as readmission to hospital within 30 days of discharge. Studies which included patients with diabetes, cardiac or respiratory diseases as well as other diseases/ conditions were included if: a) the results were reported separately for the chronic diseases of interest to the present review; or b) patients with diabetes, respiratory or cardiac disease comprised 75 % or more of the sample. Studies were excluded if they: (1) only offered a hotline or a 24 h telephone service that allowed a patient to initiate contact with a health provider, or telemedicine interventions where the patient only answered pre-recorded questions over the telephone without any additional TFU; (2) did not report readmission outcomes separately from other outcomes such as mortality; or (3) examined readmissions in paediatric, obstetric, or psychiatric populations.

Data extraction and quality assessment

The titles and abstracts of all papers identified in the literature search were initially assessed for relevance and rejected on initial screening if the reviewer (AJ) could determine that the study did not meet inclusion criteria. If an article did not clearly indicate whether inclusion criteria were met, the article was retained for full-text review. Full text versions of the remaining papers were assessed against the inclusion criteria separately by two authors (AJ and JB) with discrepancies resolved through discussion. Studies which met all criteria were retained for inclusion in the review (Additional file 2). Included studies were assessed separately by two of four authors (AJ, BH, ND, MC) against the EPOC risk of bias methodological criteria [27]. The nine standard criteria examined whether allocation sequence was adequately generated and adequately concealed, whether baseline outcome measurements or characteristics were similar, whether incomplete outcome data was adequately addressed, whether knowledge of the allocated interventions was adequately prevented during the study, whether the study adequately protected against contamination, whether the study was free from selective outcome reporting or from other risks of bias [27]. Discrepancies were resolved by discussion between the authors.

Data synthesis and analysis

To assess intervention effectiveness, the following data was extracted from each study which met the inclusion criteria: (1) sample characteristics, (2) type of intervention and comparison group, (3) outcomes and measures,

and (4) main findings regarding readmissions within 30 days. The included studies' intervention components were organised around the pre-discharge and post-discharge periods. In order to reflect these periods, components were classified into five intervention categories for narrative synthesis.

Results

Search results

A total of 6,739 articles were identified based on the specified search strategy. After removal of duplicates and assessment against eligibility criteria, ten articles met criteria for inclusion in the review. A flow chart of the literature search and paper identification is provided in Fig. 1.

Characteristics of included studies

Additional file 2 summarises the characteristics of included studies. Only one study was identified as a RCT [28], eight were NRCTs [29–36], and one was a CBA study [37]. Most studies were conducted with patients with heart failure ($n=7$) [29, 31–36], two studies involved

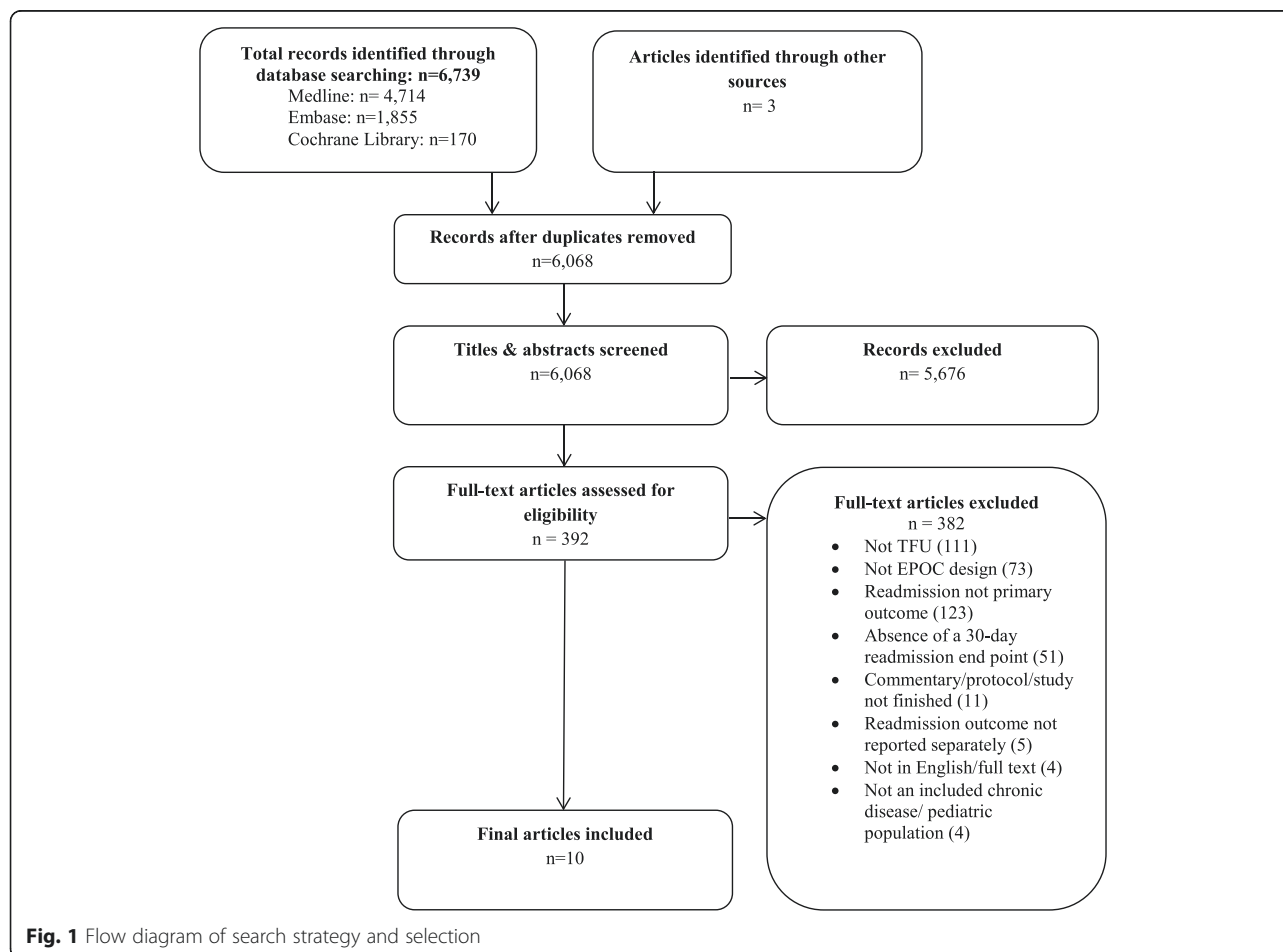
patients with COPD [28, 30], and one study included stroke patients [37]. No included studies targeted patients with diabetes. Studies were conducted in : US [29, 31, 34–36], Taiwan [37], Ireland [33], Denmark [28, 30], and The Netherlands [32]. Two studies examined readmission across multiple hospital sites [28, 31], whilst the remaining examined readmission within a single hospital site. Study sample sizes ranged from 70 [33] to 375 [34].

Intervention delivery

TFU was provided by nurses in seven of the ten studies [28–32, 36, 37], and by resident doctors in one study [34]. One study used trained volunteers who were university students pursuing a premedical track [35], and one study did not report who made the follow up call [33].

Intervention intensity and content

Varying numbers of telephone calls were provided as part of follow-up, ranging from one [29, 32, 34] up to approximately 16 [31]. Seven studies reported the content of the TFU calls, however the level of detail



reported varied [29, 31, 32, 34–37]. Four studies reported TFU which included an assessment of the patient's health and adherence to treatment, for example, symptom control, medication compliance, dietary adherence, care-management orders, and activity capacity [29, 31, 35, 37]. Two studies reported TFU which included education or coaching for the patient regarding self-care skills or what to do if they are not feeling well [31, 35]. Two studies monitored patients' health [32, 36], and the nurse intervened as necessary [36] but provided no further detail of the call content. Record and colleagues used TFU to assess the patient's experience of the care transition and their understanding of the hospital stay [34]. Appointments were made during TFU for follow up care in two studies [32, 34]. Dai and colleagues also asked the patient about any readmissions they had since discharge [37]. Three of the studies which provided information on the content of the call, reported using a structured format which followed a set of questions or a script [29, 31, 35].

Outcome measurements

Two studies measured unplanned readmission [33, 37] whilst the remaining studies did not distinguish between planned or unplanned readmissions. Four studies reported a chronic disease specific readmission outcome [29, 33, 35, 36], one study reported all-cause readmissions [37], four studies reported both all-cause and chronic disease readmission outcomes [28, 30–32], and one study did not specify the cause of readmission [34].

Methodological quality of included studies

The methodological quality of included studies is shown in Table 1. One study was rated as low methodological risk on eight of the nine criteria [28], however most studies scored low risk on only two to five of the nine criteria [29–37]. Studies performed poorest on generation of allocation

sequence, allocation concealment, outcome and baseline similarities and all but one study [34] scored a high risk for contamination.

Effectiveness of interventions in reducing readmission

Table 2 presents the included studies by effectiveness and intervention category. No included studies tested the effectiveness of TFU as a singular intervention.

TFU and pre-discharge interventions

Three studies evaluated pre-discharge education or discharge planning interventions in addition to TFU, with mixed results [35–37]. The first study, a NRCT amongst patients with congestive heart failure, used trained volunteers to provide patient education, and medication instructions pre-discharge. This was followed by four structured telephone calls post-discharge reiterating discharge instructions and coaching about when to call primary care physician if not feeling well [35]. Compared with standard care, the intervention group had lower rates of 30-day readmissions (7 % vs 19 %; $P < .05$). The second study, a NRCT amongst elderly cardiac patients, involved specialist nurses providing an individualised discharge planning protocol and a minimum of two telephone follow up calls by the nurse within two weeks of discharge [36]. The discharge planning included ongoing assessment, development of a discharge plan with the patient and health care team, education, coordination and interdisciplinary communication. Readmissions within two weeks were reduced in the medical intervention group compared with the control group (4 %; 16 % $P < 0.02$), but there was no significant difference between surgical intervention and control groups (7 %; 11 %). Dai and colleagues reported on a CBA study amongst stroke and craniotomy patients [37]. Intervention participants received discharge planning, including a needs assessment, pre-discharge instruction, health care coordination and referrals, followed

Table 1 Methodological quality of included studies assessed by the EPOC risk of bias criteria

Study	Design	Allocation sequence	Allocation concealment	Baseline outcome	Baseline characteristics	Incomplete outcomes	Blinding	Contamination	Selective reporting	Other bias
Anderson, 2005 [29]	NRCT	H	H	U	H	U	L	H	L	U
Dai, 2003 [37]	CBA	H	H	U	H	L	U	H	L	H
Jaarsma, 1999 [32]	NRCT	U	U	L	L	U	L	H	L	L
McDonald, 2001 [33]	NRCT	U	U	U	L	L	L	H	L	L
Naylor, 1994 [36]	NRCT	U	U	U	H	U	L	H	L	L
Record, 2011 [34]	NRCT	H	U	L	H	U	L	U	L	L
Riegel, 2006 [31]	NRCT	U	L	U	U	L	L	H	L	L
Sales, 2014 [35]	NRCT	U	U	U	L	L	L	H	L	L
Sorknaes, 2011 [30]	NRCT	H	H	U	L	L	L	H	L	L
Sorknaes, 2013 [28]	RCT	L	L	L	L	L	L	H	L	L

Studies coded as high risk are labelled with "H", those coded as low risk are labelled with an "L" and those studies coded as unclear (which did not provide sufficient information to assess risk of bias) are labelled with "U"

Table 2 Categories of interventions by effectiveness

Intervention categories	References	
	Effective	Not effective
Telephone follow-up and pre-discharge interventions		
• Pre-discharge patient education and telephone follow-up	Sales et al. [35]	-
• Pre-discharge planning and telephone follow-up	Dai et al.-craniotomy [37]; Naylor et al.-medical [36]	Dai et al.-stroke [37]; Naylor et al.-surgical [36]
Telephone follow-up and post-discharge interventions		
• Telephone follow-up, printed education materials and case management	-	Riegel et al. [31]
Telephone follow-up and pre-and post-discharge interventions		
• Pre-discharge education, telephone follow-up, and home visits	-	Jaarsma et al. [32]
• Pre-discharge education, physical therapy and dietary consult, discharge planning, telephone follow up and home visits	Anderson et al. [29]	-
• Patient-centred, transition-focused care curriculum for residents, medication assessment, telephone follow up and home visits	Record et al. [34]	-
• Pre-discharge education, dietetic consults, telephone follow-up, and primary care or specialist follow-up	-	McDonald et al. [33]
Telephone follow-up and telemedicine		
• Telephone follow-up, telemedicine and telephone hotline	-	Sorknaes et al. 2011 [30]; Sorknaes et al. 2013 [28]

by TFU conducted by a nurse over two sessions. Unplanned readmission was significantly reduced in the craniotomy intervention group (5.4 %) compared to the control group (17.8 %; $P = 0.04$) at one month follow-up, but not among stroke patients (1 % intervention compared to 4.2 % control; $P = 0.31$).

TFU and other post-discharge interventions

Riegel and colleagues examined the effectiveness of a heart failure TFU case management intervention delivered by nurses combined with the provision of post-discharge printed education pamphlets and consultation with physicians in community hospitals on the US-Mexico border [31]. Nurses used a decision support software program when telephoning intervention patients and conducted a mean of 10.5 calls per patient starting 5 days post-discharge. The program provided guidance to the nurse about decisions related to patient medication adherence, diet, signs and symptoms of worsening illness, and determined the frequency of calls. There was no effect of the intervention on all-cause (8.7 % vs 13.8 %; $P = 0.42$) and heart failure readmissions at one month post-discharge (15.9 % vs 20.0 %; $P = 0.65$).

TFU and pre-and post-discharge interventions

Four studies evaluated TFU with both pre- and post-discharge components with heart failure patients, with mixed evidence of effectiveness [29, 32–34]. Record and colleagues compared standard care to a physician-led intervention which incorporated a patient-centred, transition focused care curriculum for resident doctors at

one teaching hospital in the US [34]. The trained doctors provided patients with a medication review, a call to their “outpatient provider”, a home visit and one TFU call to assess the patients’ experience of transition care and plans for follow up. The exact timing and length of the TFU call was not reported. The probability of survival 30 days post-discharge, without readmission for heart failure, was higher for the intervention group ($P = .046$). Anderson compared standard care for patients to a nurse case manager-delivered intervention comprising of pre-discharge education, physical therapy and dietary consultations, discharge planning, one TFU call and 6–20 home visits [29]. TFU, conducted within two weeks of discharge, involved assessment of symptom control, medication compliance, dietary adherence, and activity capacity. Readmission within 30 days was reduced significantly in the intervention group compared with standard care ($I = 6.0$ % vs. $C = 22.1$ %; $P = 0.01$). Jaarsma and colleagues tested a comprehensive intervention which included inpatient education, dietary and physical therapy consults, discharge planning and home visits with TFU by nurses within one to two weeks post-discharge [32]. No effect on reducing readmissions within 30 days of discharge was observed. A fourth small study ($n = 70$) tested an intervention involving inpatient education with the patient’s carer, dietetic consults, follow up appointments in an outpatient clinic, and TFU calls three days post-discharge and weekly thereafter [33]. No differences between the groups were observed, with both groups having a zero rate of unplanned admissions within 30 days.

TFU and information technologies for monitoring patients by distance (telemedicine)

Sorknaes and colleagues conducted two separate studies to examine the effectiveness of a daily teleconsultation by video with a nurse for five to nine days after discharge amongst COPD patients compared to patients receiving usual care [28, 30]. Nurses made clinical observations, measured oxygen saturation levels and lung function, and informed patients how to prevent exacerbations and how to use their medication. The nurses made one TFU call one week after the teleconsultations however no call detail was reported. Neither study reported a significant difference in mean total readmissions or COPD readmissions between intervention and control groups.

Discussion

This systematic review examined the effectiveness of TFU in reducing readmission within 30 days of discharge among patients with cardiovascular disease, chronic respiratory disease and diabetes. Of the ten intervention studies which met the EPOC research design criteria, five were effective in reducing readmissions within 30 days. However the methodological quality of studies was poor. Apart from one low risk study, most had similar limitations, which weakens the overall strength of evidence. There was a lack of uniformity in how readmission was measured which highlights the need for consistency and precision in the measurements used in studies aiming to reduce readmission. Most studies identified were single site interventions and thus findings may have limited generalisability. In addition, the studies presented wide variation in standard care provided to control groups. Some studies included very little information on what constituted standard care. This made it difficult to interpret study results in relation to the circumstances under which the interventions were likely to be effective or ineffective.

All identified studies combined TFU with other intervention components. All three studies evaluating TFU with pre-discharge interventions showed effectiveness, however in two studies readmission was significantly reduced in only one of the two intervention groups, i.e. in the craniotomy group and not the stroke group [37]; and in the medical group and not the surgical group [36]. Two of four studies evaluating TFU with both pre- and post-discharge components were effective [29, 34]. There was no evidence that TFU and telemedicine or TFU and post-discharge interventions was effective, however, only one to two studies examined each of these types of interventions. On balance, the evidence for TFU is equivocal. There is some suggestion however that combining TFU with pre-discharge intervention components may be promising but further interventions are needed to confirm whether this is the case for both

medical and surgical patients with chronic disease. Although the effective studies all offered some form of continuity or bridging for the patient from the hospital to the community setting, none included components distinctive from the ineffective studies. This equivocal finding aligns with that of Hansen and colleagues, who also found no conclusive evidence for a multi-component intervention in reliably reducing readmissions amongst general and surgical patients [14].

Questions also still remain as to whether TFU itself is the effective component or not. The outcomes of TFU may be masked by many factors such as individual professional and patient actions and behaviour, social interactions and environmental settings [21]. Further randomised trials of high methodological quality examining the effectiveness of TFU in a standardised way are needed. In particular, given the lack of detail given in many included studies with regards to TFU, it may be warranted to examine the intensity, content and length of calls needed to achieve a significant effect for such patients. TFU is a popular feature of interventions in reducing readmissions, however given limited health resources, the specific details surrounding the effectiveness of TFU for patients with chronic disease still needs to be tested.

Seven of the ten included studies focused on patients with heart failure. Although chronic diseases share common features in terms of intermittent exacerbation of disease, persistence over time and are rarely cured [38], there are differences with respect to the type and intensity of treatment, symptoms and the professional care needed. Therefore, study results derived from one chronic disease population cannot necessarily be generalised to other chronic disease groups. Given this, there is a need for more intervention research on reducing 30 day readmissions for patients with other prevalent chronic disease such as diabetes and chronic respiratory disease.

Patient-centred care requires communication between hospital and community based physicians; ensuring patients do not experience a gap in care and understanding. The roles of these health professionals are critical to preventing readmission [39]. One included study focused on training hospital doctors in patient-centred transitional care through telephoning community physicians, home visits to the patient and conducting TFU which resulted in a significant reduction in 30 day readmissions [34]. However, most studies focused on patient-level interventions rather than provider-level change. Record and colleague's study points to the potential importance of enhancing provider skills in patient education, transitional care and conducting TFU calls.

This review had a number of limitations. Firstly, a meta-analysis was not possible due to the wide variation

in interventions between studies and readmission measures used. Secondly, many included studies were of low methodological quality and lacked detail making it difficult to determine the content or effectiveness of the interventions and to draw firm conclusions applicable to other hospitals and communities. Lastly, it is acknowledged that data on rates of readmissions will inevitably include some readmissions which are appropriate and unavoidable, for example, when a readmission is medically necessary due to an unavoidable change in chronic condition [40, 41]. Although two of the included studies measured unplanned readmissions, no studies measured avoidable readmissions. This is mainly due to the fact there is no agreed method of measuring avoidable readmissions [40]. Therefore data on rates of readmissions included in this review may be overestimated in terms of true avoidability.

Conclusions

Although there is increasing priority being placed on reducing readmissions within 30 days, the evidence for the effectiveness of TFU alone or in combination with other intervention components in reducing readmissions in patients with chronic disease remains inconclusive. However despite the equivocal findings, there remain important implications for practice. Due to a lack of studies, there is no well-controlled evidence to suggest that TFU in isolation is an effective strategy. TFU combined with pre-discharge interventions show some promise, however, results are not consistent across patient groups. This may suggest the importance of ensuring that the pre-discharge and / or TFU intervention components are carefully tailored to the needs of the patient group. There is also potential importance in focusing interventions on enhancing provider skills in patient education, transitional care and conducting TFU. In generating good research evidence in this area, priority should be given to conducting studies of high methodological quality. Where possible, studies should be multi-site in order to enhance generalisability, and measurements of readmission need to be consistent across studies. In order to build upon the existing evidence-base, there is merit in focussing research efforts on the evaluation of delivery of standardised TFU in combination with pre-discharge interventions.

Additional files

Additional file 1: Database search strategies. A complete list of the search strategies conducted in Medline, Embase and the Cochrane library. (DOCX 22 kb)

Additional file 2: Study characteristics of included studies. Extracted data from each included study is presented and is organised by: (1) sample characteristics, (2) type of intervention and comparison group, (3) outcomes and measures, and (4) main findings regarding readmissions within 30 days. (DOCX 38 kb)

Acknowledgements

All persons contributing to the manuscript met the criteria of authorship. There was no external funding for this paper.

Funding

This systematic review received no external funding.

Availability of data and materials

Data, on which this systematic review's conclusions are based, is available in Additional file 2.

Authors' contributions

Conception and design: AJ, JB and RS *Collection and assembly of data:* AJ, BH and ND. *Analysis and interpretation of the data:* AJ, JB and MC. *Drafting of the article:* AJ, JB, MC, BH, ND and RS. *Final approval of the article:* AJ, JB, MC, RS, BH and ND. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

Consent for publication

Not applicable.

Ethics approval and consent to participate

Not applicable.

Received: 22 March 2016 Accepted: 10 August 2016

Published online: 18 August 2016

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Chapter 7: Paper Five

Introduction to paper five

The evidence for the effectiveness of telephone follow-up in reducing unplanned readmissions is undetermined but promising for general populations with chronic disease. From 2008 to 2010, the Walgan Tilly Clinical Services Redesign Project was a collaboration among several NSW programs to develop innovative solutions and share experiences to address barriers in accessing chronic care services for Aboriginal people. The NSW Health 48 Hour Follow Up program was created in response to this work. The program aimed to follow up (via telephone), within two working days of discharge, all Aboriginal people with chronic disease aged 15 years and older.

The following paper reports on an evaluation which aimed to explore whether Aboriginal people who received 48 Hour Follow Up had lower rates of unplanned readmissions, emergency department presentations and mortality compared with Aboriginal people who did not receive 48 Hour Follow Up. The results of this paper provide insight into the success of telephone follow up in reducing adverse events for Aboriginal people with chronic disease.

This evaluation was one component of a commissioned NSW Ministry of Health evaluation undertaken by the Health Behaviour Research Collaborative at the University of Newcastle. The PhD student worked closely with the University of Newcastle evaluation team and the Ministry of Health from the inception of the evaluation. This involved planning the evaluation approach, submission of ethics applications, seeking advice from the study's advisory group on the planned approach, and working closely with the Ministry of Health to ensure that relevant data could be linked and added to the program dataset. The full evaluation included a literature review, a process evaluation of the implementation of the 48 Hour Follow Up program, and an evaluation of the reach and impact of the 48 Hour follow Up program. The full report can be read at:

<https://www.health.nsw.gov.au/research/Documents/48-hour-evaluation-report.pdf>

This paper was published in the *International Journal for Equity in Health*. The statements of contribution from co-authors are shown in Appendix 1.


Citation: Jayakody A, Passmore E, Oldmeadow C, Bryant J, Carey M, Simons E, Cashmore A, Maher L, Hennessey K, Bunfield J, Terare M, Milat A, and Sanson-Fisher R. The impact of telephone follow up on adverse events for Aboriginal people with chronic disease in New South Wales, Australia: a retrospective cohort study. *International Journal for Equity in Health* (2018) 17:60.

RESEARCH

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The impact of telephone follow up on adverse events for Aboriginal people with chronic disease in new South Wales, Australia: a retrospective cohort study

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Abstract

Background: Chronic diseases are more prevalent and occur at a much younger age in Aboriginal people in Australia compared with non-Aboriginal people. Aboriginal people also have higher rates of unplanned hospital readmissions and emergency department presentations. There is a paucity of research on the effectiveness of follow up programs after discharge from hospital in Aboriginal populations. This study aimed to assess the impact of a telephone follow up program, 48 Hour Follow Up, on rates of unplanned hospital readmissions, unplanned emergency department presentations and mortality within 28 days of discharge among Aboriginal people with chronic disease.

Methods: A retrospective cohort of eligible Aboriginal people with chronic diseases was obtained through linkage of routinely-collected health datasets for the period May 2009 to December 2014. The primary outcome was unplanned hospital readmissions within 28 days of separation from any acute New South Wales public hospital. Secondary outcomes were mortality, unplanned emergency department presentations, and at least one adverse event (unplanned hospital readmission, unplanned emergency department presentation or mortality) within 28 days of separation. Logistic regression models were used to assess outcomes among Aboriginal patients who received 48 Hour Follow Up compared with eligible Aboriginal patients who did not receive 48 Hour Follow Up.

Results: The final study cohort included 18,659 patients with 49,721 separations, of which 8469 separations (17.0, 95% confidence interval (CI): 16.7–17.4) were recorded as having received 48 Hour Follow Up. After adjusting for potential confounders, there were no significant differences in rates of unplanned readmission or mortality within 28 days between people who received or did not receive 48 Hour Follow Up. Conversely, the odds of an unplanned emergency department presentation (Odds ratio (OR) = 0.92; 95% CI: 0.85, 0.99; $P = 0.0312$) and at least one adverse event (OR = 0.91; 95% CI: 0.85, 0.98; $P = 0.0136$) within 28 days were significantly lower for separations where the patient received 48 Hour Follow Up compared with those that did not receive follow up.

(Continued on next page)

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Conclusions: Receipt of 48 Hour Follow Up was associated with both a reduction in emergency department presentations and at least one adverse event within 28 days of discharge, suggesting there may be merit in providing post-discharge telephone follow up to Aboriginal people with chronic disease.

Keywords: Unplanned readmission, Telephone follow up, Aboriginal health, Health services research

Background

Aboriginal and Torres Strait Islander people in Australia (hereafter 'Aboriginal people') experience considerably poorer health outcomes compared with non-Aboriginal people, and also compared with other Indigenous people in New Zealand, Canada and the United States [1]. In Australia, Aboriginal men, on average, live 10.6 years less than non-Aboriginal men, while Aboriginal women, on average, live 9.5 years less than non-Aboriginal women [2]. This difference is largely accounted for by chronic diseases such as cardiovascular diseases, type 2 diabetes, chronic respiratory diseases and renal diseases, which are more prevalent among Aboriginal people and occur at a much younger age [3, 4].

Aboriginal people also have higher rates of unplanned hospital readmissions and emergency department (ED) presentations. In New South Wales (NSW), Australia, Aboriginal people are 1.3 times more likely to have an unplanned hospital readmission within 28 days of discharge from hospital, and 1.3 times more likely to re-present to the ED within 48 h compared with non-Aboriginal people [5]. These higher hospital utilisation rates may indicate the health needs of Aboriginal people are not being met during their hospital stay and post-discharge.

Telephone follow up (TFU) is a strategy that has been frequently used to support patients after discharge from hospital. TFU involves a hospital or community health professional telephoning a discharged patient at home to provide ongoing education and management of symptoms with the aim of reducing problems post-discharge [6]. Systematic reviews have highlighted that TFU is a common part of successful multi-component interventions in reducing readmissions in general medical and surgical patients [7, 8]. A systematic review by Jayakody and colleagues examined 10 interventions utilising TFU in combination with other strategies amongst patients with chronic disease [9]. Of the 10 studies identified, five were found to be effective in reducing unplanned readmission within 30 days of discharge. Interventions that were effective included three studies which provided TFU in addition to pre-discharge support; and two studies which provided TFU with both pre- and post-discharge support such as education, discharge planning, and home visits [9]. Despite a developing evidence base for the effectiveness of TFU in reducing unplanned hospital readmissions, no studies have examined

the effectiveness of TFU in Aboriginal populations, either in Australia or elsewhere.

The 48 Hour Follow Up program is a NSW Health state government initiative to improve coordination and management of care for Aboriginal people with chronic diseases. The program aims to reduce unplanned hospital readmissions and improve health outcomes for Aboriginal people with a chronic disease. The program involves identifying, from hospital records, Aboriginal people meeting the following eligibility criteria: 1) Aboriginal and/or Torres Strait Islander person; 2) aged 15 years and older; 3) admitted to an acute care facility; and 4) has a chronic disease. An attempted telephone call is made to the identified eligible patient within two working days of discharge from an acute care facility. The phone call is ideally conducted by an Aboriginal health professional but in some cases a non-Aboriginal staff member may make the call. The call covers, at a minimum: access to medications; whether the patient has referrals and follow up appointments in place; and general wellbeing. The caller seeks to identify and resolve any issues with the patient's post-discharge care, and to ensure appropriate links to general practitioners, Aboriginal Community Controlled Health Services, specialists and other services that are able to assist the patient with receiving appropriate post-discharge care. The program commenced in 2009 and is currently delivered in all 15 local health districts (LHD) (government corporations responsible for managing public hospitals and providing health services to defined geographical areas of the state) in NSW.

Due to the high rates of chronic disease and unplanned hospital readmission amongst Aboriginal people, it is critical to develop evidence about what strategies are effective in reducing unplanned readmission within 28 days of discharge. This study addresses the paucity of research evidence in this field for Aboriginal populations by providing state-wide data on the impact of a telephone follow up service for Aboriginal people with chronic disease. It provides novel data to assist policy makers in determining the impact of the 48 Hour Follow Up program and determining its future directions. Furthermore, this study provides a unique evaluation of a system-level intervention which is rarely published in the literature [10, 11]. Specifically, the study aims to assess the impact of the 48 Hour Follow Up program on rates of unplanned hospital readmissions

within 28 days of discharge among Aboriginal people with chronic disease in NSW. As a secondary aim the impact of the program on unplanned ED presentations, mortality and at least one adverse event (unplanned hospital re-admission, unplanned ED presentation or mortality) within 28 days of discharge were also examined.

Methods

Study design

A retrospective cohort was obtained through linkage of routinely-collected health datasets.

Data sources

Data were obtained from the 48 Hour Follow Up Program Register, a public health register established under the *NSW Public Health Act 2010* [12], comprising linked data from the following five sources:

- 1) *48 Hour Follow Up Program Dataset* comprises records from each participating LHD for all patients identified by the LHD as eligible to receive 48 Hour Follow Up. Data includes the dates of admission and separation from hospital, unique patient identifiers and whether or not the patient received 48 Hour Follow Up;
- 2) *NSW Admitted Patient Data Collection (APDC)* comprises records of all separations in NSW private and public hospitals, including discharges, transfers and deaths;
- 3) *NSW Register of Births, Deaths and Marriages (RBDM)* provides fact of death for all deaths registered in NSW;
- 4) *NSW Emergency Department Data Collection (EDDC)* comprises records of all presentations to EDs in NSW public hospitals;
- 5) *NSW Chronic Disease Management Program (CDMP) Minimum Dataset* comprises records from the NSW Health Chronic Disease Management Program, which provides care coordination and self-management support to people with chronic disease. The dataset also holds information on participation in Healthways, a telephone health coaching service offered to a subset of CDMP participants (this service was offered in a number of LHDs to patients who had one unplanned hospital admission in the previous 12 months relating to one of the five chronic conditions that were part of the CDMP (i.e. diabetes, hypertension, coronary artery disease, heart failure, chronic obstructive pulmonary disease)).

Study population

Eligibility criteria

The study sample included all patients who met the eligibility criteria of the 48 Hour Follow Up Program in

the period May 2009 to December 2014. Eligible patients were: 1) Aboriginal and/or Torres Strait Islander people; 2) aged 15 years and older at the time of admission; 3) admitted to an acute facility in a NSW public hospital; 4) discharged from hospital to the community; and 5) had one or more of the following ICD-10-defined chronic diseases as a principal or additional diagnosis: cardiovascular disease, diabetes, respiratory disease and renal diseases (Additional file 1). Eligible patients for this data analysis included all those identified in the 48 Hour Follow Up Program Dataset (indicating LHD staff assessed the patient as eligible for 48 Hour Follow Up), plus patients identified through the APDC as meeting the eligibility criteria for 48 Hour Follow Up.

Exclusion criteria

Patients were excluded if they were readmitted to hospital within 48 h of discharge, as the LHD may not have been able to follow up the patient prior to the readmission. Duplicate records were also excluded.

Data linkage

The data sources were linked by the Centre for Health Record Linkage using probabilistic record linkage methods [13]. Following linkage, disease-related, sociodemographic and admission variables (see *Explanatory variables* below) were derived from the APDC dataset. Any missing data were populated from the 48 Hour Follow Up Program dataset. The exception to this was Aboriginality; patients were considered an Aboriginal person if they were listed as being an Aboriginal and/or Torres Strait Islander person on any APDC record, or if they were identified in the 48 Hour Follow Up Program dataset (May 2009 to December 2014). This method was selected based on the advice of the study's advisory committee, which had Aboriginal representation. This was considered the most accurate method available for retrieving Aboriginal status. The APDC is estimated to correctly report Aboriginal status at a level of 90.7% (95% CI 84.6–94.2) [14]. The inclusion and exclusion criteria were then applied to give the final dataset for analysis. All data were de-identified.

Analysis variables

Primary and secondary outcomes

The primary outcome was unplanned hospital readmissions within 28 days of separation from any acute facility in a NSW public hospital. 'Unplanned' refers to emergency admissions where admission is required within 24 h of diagnosis. Readmission refers to an admission with an admission date within 28 days of the discharge date for any purpose other than mental health, chemotherapy or dialysis. Transfers from other facilities were not considered as readmissions, and excluded from analysis. Secondary outcomes were mortality within 28 days of separation; unplanned ED

presentation within 28 days of separation ('unplanned' refers to either an 'emergency presentation' or an 'unplanned return visit for continuing condition' as reported in the EDDC); and an "adverse event" defined as mortality, unplanned ED presentation or unplanned hospital readmission within 28 days of separation.

Explanatory variables

The main explanatory variable of interest was receipt of 48 Hour Follow Up. Eligible individuals were classified as either having: 1) received 48 Hour Follow Up; or 2) not received 48 Hour Follow Up. The 48 Hour Follow Up Program Dataset reports whether the patient was followed up within two working days of discharge or outside two working days. Sensitivity analyses, conducted to examine any significant differences between the two timeframes of follow up, found results were broadly similar (results are provided in Additional file 2). Therefore, for the purpose of this analysis patients followed up both within or outside two working days were classified as having received 48 Hour Follow Up.

Based on discussions with content experts and a review of the literature the following variables were considered as potential confounders:

- Models of care: Although all LHDs implement the 48 Hour Follow Up phone call, the model of program delivery varies. There are four primary models: 1) a *centralised* model, where all 48 Hour Follow Up phone calls for the LHD are conducted from a central call centre (five LHDs implement this model); 2) a *shared care* model, where there is close integration between hospital and community-based services, and the most appropriate staff member conducts the phone call (three LHDs); 3) a *localised* model, where an Aboriginal Health Worker at each inpatient facility conducts the phone call, and sometimes also a home visit (six LHDs); and 4) an *Aboriginal Medical Service (AMS)-contracted* model, where the local AMS conducts calls to patients currently case-managed by the AMS, and the LHD conducts calls to non-AMS patients (one LHD).
- Enrolment in a CDMP or a Healthways program at the date of separation.
- Disease-related variables: Charlson Comorbidity Index [15], and the number of additional diagnoses (less than 2; 2 or more).
- Sociodemographic variables: Patient's gender, age, marital status, and Index of Relative Socio-economic Disadvantage (IRSD) quintile. The IRSD is a general socio-economic index that summarises a range of information about the economic and

social conditions of people and households within a geographic area [16].

- Admission variables: The following variables were collected for each hospital admission: year of admission, length of stay, and number of previous admissions within the study period.

Statistical analysis

Logistic regression models were used to assess rates of unplanned hospital readmissions, mortality, unplanned ED presentations and adverse events within 28 days of discharge among Aboriginal patients who received 48 Hour Follow Up compared with eligible Aboriginal patients who did not receive 48 Hour Follow Up. Potentially confounding variables (models of care, enrolment in a CDMP or Healthways program, Charlson Comorbidity Index, number of additional diagnoses, sociodemographic factors, year of admission, length of stay and number of previous admissions) were identified by comparing the characteristics of patients who received 48 Hour Follow Up compared with eligible patients who did not receive 48 Hour Follow Up using logistic regression models. Variables which were associated at a 5% significance level with both receipt of 48 Hour Follow Up and the adverse event were included in the logistic regression models. Clustering from repeated admissions for the same patient was accounted for by using generalised estimating equations with an exchangeable correlation structure, and robust Hubert-White standard errors were used. A detailed description of this analysis is available online as part of a wider evaluation report. [17] All analyses were done using SAS 9.4 software [18].

The study was approved by the University of Newcastle Human Research Ethics Committee (H-2013-0381) and the NSW Aboriginal Health and Medical Research Council Ethics Committee (967/13).

Results

In the linked dataset there were 407,729 hospital separations for Aboriginal patients aged 15 years or older who attended a public hospital in NSW between May 2009 and December 2014. Of these, 350,954 separations which did not meet the 48 Hour Follow Up program criteria were excluded. An additional 7054 records were removed due to being duplicate records or because the separation was followed by a readmission within 48 h. The final study cohort included 18,659 Aboriginal patients, with 49,721 separations. The mean number of separations per patient was 2.6 (Standard deviation (SD) = 4.5).

Of the 49,721 eligible separations, 8469 (17.0%, 95% CI 16.7–17.4) were recorded as having received 48 Hour Follow Up. Among patients who received 48 Hour Follow Up, 73.6% ($n = 6230$) were followed up within two working days of discharge from hospital, and the

remaining 26.4% ($n = 2239$) were followed up outside two working days. Table 1 presents the characteristics associated with receiving 48 Hour Follow Up, adjusted for model of care and year. Relative to the least socially disadvantaged quintile (1st quintile), all increasing quintiles of social disadvantage had higher odds of follow up (2nd quintile OR = 1.44; 95% CI = 1.30, 1.60; 3rd quintile OR = 1.37; 95% CI = 1.24, 1.52; 4th quintile OR = 1.09; 95% CI = 0.98, 1.21; 5th quintile OR = 1.38; 95% CI = 1.24, 1.54). Hospital stays of longer than one day had higher odds of being followed up compared with stays of one day or less (OR = 1.28; 95% CI = 1.21, 1.35). Patients with two or more diagnoses had lower odds of being followed up compared with patients with less than two diagnoses (OR = 0.80; 95% CI = 0.75, 0.86). Similarly, patients with a higher Charlson Comorbidity Index had

lower odds of follow up (OR = 0.72; 95% CI = 0.70, 0.75). There was no significant association between gender, age, marital status, participation in CDMP and Healthways, and the number of previous admissions with receiving 48 Hour Follow Up.

Adverse events following hospital separation

Table 2 presents rates of adverse events within 28 days of discharge from hospital. Compared with eligible patients who did not receive 48 Hour Follow Up, patients who received 48 Hour Follow Up had lower rates of unplanned hospital readmissions, unplanned ED presentations, mortality and adverse events (unplanned readmission, unplanned ED presentation or mortality) within 28 days of discharge from hospital (Table 2).

Table 1 Characteristics associated with receiving 48 Hour Follow Up among Aboriginal patients, adjusted for model of care and year ($N = 49,721$)*

Variable	Category	N (%)		OR (95% CI)	P-value
		Not followed up ($n = 41,252$)	Followed up ($n = 8469$)		
Gender	Male	18,765 (83%)	3818 (17%)	ref	0.9040
	Female	22,319 (83%)	4591 (17%)	1.00 (0.94,1.07)	
Marital status	Married/de facto	15,448 (84%)	2874 (16%)	ref	0.1269
	Single	13,710 (84%)	2619 (16%)	1.01 (0.93,1.09)	
	Widowed	5185 (86%)	877 (14%)	1.04 (0.92,1.17)	
	Divorced/separated	5672 (85%)	1014 (15%)	1.03 (0.93,1.14)	
	Not known	441 (92%)	37 (7.7%)	0.63 (0.44,0.90)	
IRSD quintile	1st quintile - least disadvantaged	7098 (87%)	1087 (13%)	ref	<.0001
	2nd quintile	7631 (82%)	1642 (18%)	1.44 (1.30,1.60)	
	3rd quintile	9039 (83%)	1809 (17%)	1.37 (1.24,1.52)	
	4th quintile	8016 (86%)	1357 (14%)	1.09 (0.98,1.21)	
	5th quintile - most disadvantaged	8671 (85%)	1484 (15%)	1.38 (1.24,1.54)	
Participation in CDMP	Did not participate	40,206 (83%)	8160 (17%)	ref	0.1445
	Participated	1046 (77%)	309 (23%)	1.16 (0.95,1.40)	
Participation in Healthways	Did not participate	41,230 (83%)	8456 (17%)	ref	0.1270
	Participated	22 (63%)	13 (37%)	1.91 (0.83,4.41)	
Length of stay	1 day or less	15,652 (85%)	2729 (15%)	ref	<.0001
	More than 1 day	24,835 (84%)	4692 (16%)	1.28 (1.21,1.35)	
No. of previous admissions	None	15,269 (82%)	3390 (18%)	ref	0.3259
	1 or more	25,983 (84%)	5079 (16%)	0.97 (0.92,1.03)	
No. of additional diagnoses	Less than 2	11,118 (76%)	3526 (24%)	ref	<.0001
	2 or more	30,134 (86%)	4943 (14%)	0.80 (0.75,0.86)	
Age	mean (SD)	55 (16)	53 (18)	1.00 (1.00,1.00)**	0.9970
Charlson Comorbidity Index	mean (SD)	2 (1)	1 (2)	0.72 (0.70,0.75)***	<.0001

*Frequencies are calculated using all eligible hospital separations ($N = 49,721$). Odds ratios are calculated for hospital separations with complete patient characteristic data ($N = 47,803$)

Odds ratio is the increase in odds for each additional year of age. *Odds ratio is the increase in odds for each one unit increase on Charlson Comorbidity Index

Data source: 48 Hour Follow Up Program Register. Study period: May 2009 to December 2014 [17]

Table 2 Hospital separations of Aboriginal patients that resulted in an adverse event within 28 days of discharge, by whether the patient received 48 Hour Follow Up ($n = 49,721$)

Variable	Number of events among separations that did not receive 48 Hour Follow Up N (%) ($n = 41,252$)	Number of events among separations that received 48 Hour Follow Up N (%) ($n = 8469$)	Total number with event (% of total sample)
Unplanned hospital readmission within 28 days	3119 (7.6%)	455 (5.4%)	3574 (7.2%; 95% CI 7.0, 7.4)
Mortality within 28 days	460 (1.1%)	75 (0.9%)	535 (1.1%; 95% CI 0.98, 1.2)
Unplanned ED presentation within 28 days	9535 (23%)	1745 (21%)	11,280 (22.7, 95% CI 22.3, 23.0)
At least 1 adverse event	10,136 (25%)	1810 (21%)	11,946 (24%; 95% CI 23.6, 24.4)

Data source: 48 Hour Follow Up Program Register. Study period: May 2009 to December 2014 [17]

Rates of adverse events by receipt of 48 Hour Follow Up

Results of multivariable logistic regression modelling of adverse events associated with receipt of 48 Hour Follow Up, which are adjusted for all variables given in the table, are shown in Table 3. After adjusting for potential confounders, there was no statistically significant association between receipt of 48 Hour Follow Up and unplanned re-admission or mortality within 28 days of discharge.

After adjusting for potential confounders, the odds of an unplanned ED presentation within 28 days were significantly lower for separations where the patient received 48 Hour Follow Up compared with those that did not receive 48 Hour Follow Up (OR = 0.92; 95% CI: 0.85, 0.99; $P = 0.0312$). The adjusted odds of at least one adverse event for those that received 48 Hour Follow Up was also significantly lower (OR = 0.91; 95% CI: 0.85, 0.98; $P = 0.0136$) compared with separations that did not receive 48 Hour Follow Up.

Discussion

To the best of our knowledge, this is the first study to examine the effectiveness of TFU for recently discharged Aboriginal people with chronic disease. While there was no evidence of an effect of the 48 Hour Follow Up program on unplanned readmissions or mortality within 28 days of discharge, receipt of 48 Hour Follow Up was significantly associated with both fewer unplanned ED presentations and at least one adverse event within 28 days of discharge.

There are a number of potential reasons for the lack of a significant reduction in unplanned hospital readmissions. Firstly, the target population for 48 Hour Follow Up (i.e. all Aboriginal people aged 15 years and older, with a specified chronic disease and who have been discharged from hospital) is broad, and there is no state-wide protocol for prioritizing the order in which patients receive 48 Hour Follow Up. Melton and colleagues conducted a randomised controlled trial among patients with gastrointestinal, heart, and lower respiratory diagnoses [19]. The intervention group received TFU within 24 h of discharge, and calls were prioritized so that patients with the greatest

likelihood of readmission due to poorer health status were contacted first. A control group received TFU three days after discharge, and calls were not made in any health risk order. The prioritized treatment group had significantly fewer 30 day intent-to-treat readmissions (5.7% vs 7.3%; $p < .05$) compared with the non-prioritized control group [19]. This suggests the effectiveness of 48 Hour Follow Up may be enhanced by prioritizing ‘high risk’ patients for earlier follow up. However, there remain gaps in the evidence of what makes an effective TFU program. Mistiaen and Poot in their systematic review of TFU stress the need for further research to establish the ideal person to make the follow up call, the frequency and timing of calls, the content of the calls, and to identify the potential patient, health system and country differences in TFU interventions [6].

A second potential reason for the lack of a significant reduction in readmissions may be due to 48 Hour Follow Up being a standalone intervention. Although some LHDs have expanded the program to have additional components (e.g. in the localised model, some patients receive home visits), the centralised model delivers TFU as a standalone strategy. Hansen and colleagues comment on the merit of “bridging interventions” which combine pre- and post-discharge care to act as a “bridge” between hospital-, home- and community-based health care. [8] Studies conducted with other population groups have demonstrated the effectiveness of multi-component programs incorporating TFU with other intervention strategies such as discharge planning, patient education, home visits and transition coaching. [7, 8] For example, a non-randomised trial by Sales and colleagues amongst cardiac patients used trained volunteers to provide pre-discharge patient education and medication instructions and post-discharge TFU [20]. Compared with standard care, the intervention group had lower rates of 30-day readmissions [20]. Jayakody and colleagues in their systematic review of interventions utilising TFU amongst patients with chronic disease found all 10 included studies combined TFU with other components [9]. Although they report that the studies did not

Table 3 Association between receipt of 48 Hour Follow Up and adverse events among Aboriginal patients: Logistic GEE models adjusting for variables associated with both receipt of 48 Hour Follow Up and the adverse event (n = 49,721)*

Variable	Category	Unplanned readmission		Mortality		ED presentation		At least 1 adverse event	
		OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	P-value
Follow up	Not followed up	reference	0.1352	reference	0.4760	reference	0.0312	reference	0.0136
	Followed up	0.84 (0.66,1.06)		0.91 (0.69,1.19)		0.92 (0.85,0.99)		0.91 (0.85,0.98)	
Care type	Centralised					reference	<.0001	reference	<.0001
	Shared care					1.00 (0.91,1.10)		1.02 (0.93,1.11)	
	Localised					0.77 (0.72,0.83)		0.81 (0.76,0.87)	
	AMS-contracted					1.01 (0.76,1.33)		0.94 (0.72,1.24)	
Year	2009			reference	0.0003	reference	<.0001	reference	<.0001
	2010			1.19 (0.81,1.73)		1.10 (0.99,1.23)		1.06 (0.95,1.18)	
	2011			1.40 (0.96,2.05)		1.24 (1.11,1.38)		1.20 (1.08,1.33)	
	2012			1.50 (1.06,2.12)		1.29 (1.15,1.43)		1.22 (1.10,1.35)	
	2013			1.50 (1.08,2.08)		1.32 (1.19,1.46)		1.24 (1.12,1.37)	
	2014			0.75 (0.50,1.12)		1.21 (1.07,1.36)		1.12 (1.00,1.26)	
IRSD quintile	1st quintile - least disadvantaged					reference	<.0001	reference	0.0005
	2nd quintile					0.91 (0.82,1.00)		0.92 (0.83,1.01)	
	3rd quintile					0.99 (0.89,1.09)		0.99 (0.91,1.09)	
	4th quintile					0.82 (0.74,0.90)		0.85 (0.77,0.94)	
	5th quintile - most disadvantaged					0.80 (0.72,0.89)		0.85 (0.77,0.94)	
Length of stay	1 day or less			reference	<.0001	reference	0.0007	reference	<.0001
	More than 1 day			1.93 (1.53,2.42)		1.11 (1.04,1.17)		1.13 (1.06,1.19)	
No. of additional diagnoses	Less than 2	reference	0.2646	reference	0.1804	reference	0.0187	reference	0.0870
	2 or more	1.13 (0.91,1.40)		1.24 (0.91,1.68)		1.09 (1.01,1.17)		1.06 (0.99,1.14)	
Charlson Comorbidity Index		1.11 (1.06,1.17)	<.0001	1.46 (1.40,1.53)	<.0001	1.08 (1.06,1.11)	<.0001	1.10 (1.08,1.13)	<.0001

*Odds ratios are from the logistic regression GEE model and are adjusted for all variables given in the table
 Data source: 48 Hour Follow Up Program Register. Study period: May 2009 to December 2014 [17]

uniformly demonstrate significant reductions in readmission rates, the findings did suggest some merit in combining TFU with pre-discharge interventions such as discharge planning and patient education. Therefore standalone TFU interventions such as the 48 Hour Follow Up program may be strengthened by being combined with other interventions.

The association of 48 Hour Follow Up with both reductions in unplanned ED presentations and at least one adverse event is encouraging. Our results are similar to an intervention conducted in the United States by Dudas and colleagues who randomly assigned general medicine patients to receive a telephone call from a pharmacist within two days of discharge [21]. The study resulted in a significant reduction in unplanned ED presentations but not readmissions within 30 days. Although the patient group and person making the call were different to

the 48 Hour Follow Up program, the call timing and content were similar. TFU calls may improve patients' ability to self-manage their health issues and/or connect with community-based health services such as their general practitioner, rather than presenting to the ED. A key strength of TFU is its relative ease of implementation: it is less labour intensive than interventions such as home visits, is low cost, and is scalable to reach large populations [6, 22]. Although 48 Hour Follow Up did not significantly reduce unplanned hospital readmissions, the findings related to reduced unplanned ED presentations and adverse events suggest the program has some health benefits for patients. Future research may seek to identify which program characteristics (e.g. inclusion of home visits, whether the person conducting the 48 Hour Follow Up call is an Aboriginal person) influence the impact of 48 Hour Follow Up. In addition, the potential

economic and health system benefits of reduced hospital utilization are worthy of further study [21].

Our study found that patients with more comorbidities (i.e. a higher Charlson Comorbidity Index and those with two or more chronic diseases) had lower odds of receiving 48 Hour Follow Up. This was an unexpected finding as there is no prioritisation of patients for 48 Hour Follow Up, and therefore we would expect there to be no association between comorbidity and receipt of follow up. A similar “treatment-risk paradox” [23] was observed by Wong and colleagues, who found that among patients presenting to Canadian EDs with chest pain, those with more comorbidities were less likely to receive physician follow-up after discharge [24]. One possible explanation is that 48 Hour Follow Up staff may refer patients with comorbidities directly to other chronic disease management programs more tailored to supporting patients with complex needs, without conducting the 48 Hour Follow Up call; however 48 Hour Follow Up program staff interviewed in our process evaluation did not indicate that this was the case [17]. Another possible explanation is that patients with comorbidities may be less likely to answer or accept the 48 Hour Follow Up call, for example because they are already linked with other community-based health services and do not feel a need for additional support. Regardless of the reason why patients with comorbidities were less likely to receive 48 Hour Follow Up, this finding highlights the importance of prioritising high-risk patients to receive 48 Hour Follow Up, and more broadly the importance of integration of services to ensure patients with comorbidities do not fall through the net of service delivery.

Limitations

This evaluation had a number of limitations. Firstly, an experimental design such as a randomised controlled trial would have provided the most robust information about effectiveness. However, randomized designs are not always feasible for population-level interventions [25]. In this case it was not possible given the program has been implemented state-wide for several years, aims to reach the entire population of Aboriginal people with chronic disease, and has variability in implementation across LHDs. A non-randomised cohort design was considered the most feasible approach to balance the tension between scientific rigour and the practicalities of evaluating an established state-wide government program. Secondly, the study relied on routinely-collected health data, rather than data collected for research purposes. Some limitations of routinely-collected data include the possibility of underreporting of Aboriginality in hospital data [14], and limited capacity to adjust for confounding variables. For example socio-economic status, a strongly confounding variable in this study, was measured based on patients’ postcode, and therefore may not have been an accurate measure of individuals’ socio-economic status. Thirdly, as the analysis

explored one primary and three secondary outcomes, there is an elevated risk of declaring spuriously positive associations.

Conclusions

The effectiveness of TFU in reducing adverse events has not previously been shown for Aboriginal people. Such findings help address the paucity of published research describing the effectiveness of policies and programs that target Aboriginal people. Our study found that the 48 Hour Follow Up program was not associated with reduced hospital readmissions or mortality within 28 days of hospital discharge among Aboriginal people with a chronic disease. However, receipt of 48 Hour Follow Up was associated with both a significant reduction in unplanned ED presentations and at least one adverse event (hospital readmission, ED presentation or mortality) within 28 days of discharge, suggesting there may be some merit in providing post-discharge TFU to Aboriginal people with chronic disease.

Additional Files

Additional file 1: ICD-10 codes used for 48 h follow up (Principle or an additional diagnosis). A list of all ICD-10 codes for chronic diseases meeting the eligibility criteria for the 48 Hour Follow Up program. (DOCX 22 kb)

Additional file 2: Sensitivity analysis results. Results of sensitivity analyses: factors associated with being followed up either within or outside 48 h; summary of the number of admissions that resulted in an adverse event by whether or not they received Follow Up; and Crude (Unadjusted) Models for “Not followed up” compared to “Followed up within 48 hours”. (DOCX 29 kb)

Abbreviations

AMS: Aboriginal Medical Service; APDC: NSW Admitted Patient Data Collection; CDMP: NSW Chronic Disease Management Program; CI: Confidence interval; ED: Emergency department; EDDC: NSW Emergency Department Data Collection; IRS: Index of Relative Socio-economic Disadvantage; LHD: Local health districts; NSW: New South Wales; OR: Odds ratio; RBD: NSW Register of Births, Deaths and Marriages; SD: Standard deviation; TFU: Telephone follow up

Acknowledgements

We would like to acknowledge the traditional custodians of NSW, Australia, the Aboriginal people and pay our respects to the Elders past, present and future. We would also like to acknowledge the many NSW Health staff who have supported the implementation, monitoring and evaluation of the 48 Hour Follow Up program and the 48 Hour Follow Up Program Evaluation Advisory Committee members for their advice and guidance throughout the study design and implementation.

Funding

This study was funded by NSW Health.

Availability of data and materials

The data that support the findings of this study (48 Hour Follow Up Register) are available from NSW Health but restrictions apply to the availability of these data and so are not publicly available. Access to the data is available by application to the data custodians, NSW Health.

Authors’ contributions

AJ and EP provided equal contributions as first authors. RSF, AM, EP, J Bryant, MC, LM, MT, J Bunfield and AC contributed to the design of the study. AJ and EP drafted the manuscript. CO conducted the analysis with data

verification support from EP and AC. ES, KH, EP and AC contributed to data collation. All authors contributed to the interpretation of findings, and have read and approved the final manuscript.

Ethics approval and consent to participate

This study received full ethical approval from the Aboriginal Health and Medical Research Council Ethics Committee (967/13) and the University of Newcastle Research Ethics Committee (H-2013-0381).

Competing interests

AJ, EP, ES, AC, LM, KH, J Bunfield, MT and AM acknowledge a competing interest in that they are employed or affiliated with NSW Health which is the funding body for this study.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

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Received: 7 September 2017 Accepted: 8 May 2018

Published online: 18 May 2018

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Chapter 8: Discussion

8.1 Introduction

Australian Aboriginal people continue to experience health inequities, and in particular, a disproportionate chronic disease burden compared to non-Aboriginal Australians.¹ Aboriginal people have higher rates of chronic diseases such as diabetes, chronic respiratory disease, and cardiovascular disease.² They are also more likely to develop these diseases at a younger age and are less likely to have access to appropriate healthcare for effective chronic disease management.^{1, 2} Without culturally appropriate community care, resources for self-management, and appropriate specialist input, Aboriginal people can face worsening and severe chronic disease symptoms³⁻⁵ which may contribute to high-cost avoidable admissions and unplanned readmissions.^{1, 6, 7}

Avoidable admissions and unplanned readmissions to hospital are health system performance indicators.^{1, 8, 9} Avoidable admissions are regarded as reflecting sub-optimal community healthcare,¹ whilst unplanned readmissions may reflect poor-quality hospital care and continuity of care between hospital and community in the weeks following discharge.⁹ It is well established in the research literature that people with chronic disease are at high risk of unplanned readmissions,¹⁰⁻¹² and that people with poorly managed chronic disease are at risk of avoidable admissions.¹³ These types of hospitalisations pose a substantial financial burden on both the health system and on patients and their families.¹⁴⁻¹⁶ In NSW, Aboriginal people have higher rates of avoidable admissions and all-cause unplanned readmissions compared to non-Aboriginal people.^{17, 18} However, very little is known about the prevalence, trends, and experience of frequent avoidable admissions and unplanned readmissions for Aboriginal people with chronic disease in NSW.

The gap in health outcomes and life expectancy experienced by Aboriginal people in Australia can be explained, in part, by complex and interconnected factors such as dispossession and racism.^{19, 20} There is, however, a need to understand the modifiable factors that are associated with increased risk of

unplanned readmissions and frequent avoidable admissions amongst Aboriginal people with chronic disease. Environmental-, patient-, encounter- and organisational-level factors need to be identified to understand their contribution to avoidable hospitalisations.

Identifying modifiable factors that contribute to unplanned readmissions and avoidable admissions can be used to develop interventions to improve hospital and community healthcare for Aboriginal people. Telephone follow-up (TFU) is used in multi-component interventions to reduce readmissions,^{21, 22} but it is not known whether TFU on its own or in combination with other components is effective in reducing unplanned readmissions for Aboriginal people with chronic disease who have been recently discharged from hospital.

This thesis aimed to address these key gaps in knowledge by:

- examining the frequency and trends of avoidable admissions, and prevalence and trends of unplanned readmissions amongst Aboriginal and non-Aboriginal people with chronic disease by analysing NSW state-wide hospital administrative data (papers one and two)
- qualitatively exploring the experiences of Aboriginal people who have experienced unplanned readmissions due to chronic disease (paper three)
- reviewing the published international literature on the effectiveness of TFU after hospital discharge in reducing unplanned readmissions amongst patients with chronic disease (paper four)
- examining the effectiveness of a state-wide TFU service in reducing unplanned readmissions for Aboriginal people recently discharged from hospital with chronic disease in NSW (paper five).

This body of work offers preliminary information to inform policy decisions and planning of programs aimed at reducing unplanned readmissions and frequent avoidable admissions and

improving hospital and community healthcare for Aboriginal people with chronic disease. This knowledge may, in turn, help to reduce the gap in health outcomes for Aboriginal people in Australia.

8.2 Main findings

8.2.1 Finding 1: Aboriginal people in NSW who are hospitalised with chronic disease are at higher risk of frequent avoidable admissions and unplanned readmissions compared to non-Aboriginal people (papers one and two)

A retrospective cohort analysis of a sample of linked NSW health administrative data aimed to examine any trends in avoidable admissions among Aboriginal and non-Aboriginal people with chronic conditions from June 2005 to June 2014 (paper one). The sample included all patients identifying as Aboriginal and an equal number of randomly sampled patients identifying as non-Aboriginal. Individuals were included in the sample if they were aged ≥ 18 years old and had been admitted to a NSW public hospital with one or more of the following ambulatory-care-sensitive chronic conditions as a principal diagnosis: diabetic complications, asthma, angina, hypertension, congestive heart failure and chronic obstructive pulmonary disease. The two primary outcomes were the number of avoidable admissions per financial year, and the proportion of individuals with three or more avoidable admissions per financial year. The final dataset had 27,467 eligible avoidable admissions, corresponding to 19,025 patients. Aboriginal patients were 15% more likely than non-Aboriginal patients to have a higher number of avoidable admissions per financial year (Incidence rate ratio = 1.15; 95% confidence interval (CI): 1.11, 1.20). Aboriginal patients were almost twice as likely as non-Aboriginal patients to experience three or more avoidable admissions per financial year (Odds ratio = 1.90; 95% CI = 1.60, 2.26). These findings remained significant after adjustment for sociodemographic variables, financial year and Charlson Co-morbidity Index. Among both Aboriginal and non-Aboriginal patients, a small proportion of patients accounted for a disproportionate share of frequent avoidable admissions. However, the proportion of people experiencing three or more admissions per year was higher for Aboriginal people compared to non-Aboriginal people (11% and 6% respectively). A test for trend showed there was no statistically

significant change in either primary outcome when comparing Aboriginal and non-Aboriginal people over the nine-year period ($p = 0.859$; 0.860 respectively).

Further analysis of the linked administrative data was undertaken to examine unplanned readmissions within 28 days of discharge from an index admission (paper two). For this analysis, individuals were included in the sample if they were aged ≥ 18 years old and were admitted to a NSW public hospital with cardiovascular disease, chronic respiratory disease, diabetes or renal disease. Once eligibility criteria were applied, there were 122,145 eligible admissions, corresponding to 48,252 patients. Over the nine-year period, Aboriginal patients had a significantly higher relative risk of unplanned readmissions or death (Relative risk = 1.34 (1.29, 1.40); p -value < 0.0001) compared with non-Aboriginal patients, after adjustment for sociodemographic variables, financial year and Charlson Co-Morbidity Index, with the sample restricted to those < 75 years of age. A test for trend showed there was no statistically significant change in proportions of readmissions when comparing Aboriginal and non-Aboriginal people over the nine-year period examined ($p = 0.176$).

The findings from papers one and two show that Aboriginal people with chronic disease are at a higher risk of experiencing frequent avoidable admissions and unplanned readmissions compared to non-Aboriginal people, and that there has not been a statistically significant change in this risk over a nine-year period. The results reflect, in part, the disproportionate burden of chronic disease amongst Aboriginal people and its subsequent impacts on avoidable admissions and unplanned readmissions, i.e. people with greater healthcare needs access more health services.^{2, 23, 24} However, the higher rates may also reflect inequities in primary healthcare utilisation and quality hospital care experienced by Aboriginal people with chronic disease in NSW.^{1, 9} Community health services can intervene earlier in the chronic disease process through prevention, early diagnosis and chronic disease management.^{1, 25} However, the higher rates of frequent avoidable admissions found in paper one may indicate gaps in provision of and access to community health services for Aboriginal people. Whilst the higher unplanned readmission rates may indicate in some cases that Aboriginal people are not receiving quality hospital care such as tailored discharge planning,⁹ or the appropriate outpatient or community

healthcare and support that is needed to prevent unplanned readmissions.¹⁷ These failures in the health system for Aboriginal people must be addressed.

The higher risk of frequent avoidable admissions for Aboriginal people with chronic disease compared to non-Aboriginal people is consistent with NSW Government reporting for potentially preventable hospitalisations for chronic diseases.²⁶ NSW Health reports for the period 2018–2019 indicate that Aboriginal people with chronic disease had a potentially preventable hospitalisation rate per 100,000 of the population of 2565.5 compared to 834.4 for non-Aboriginal people.²⁶ The rate of potentially preventable hospitalisations for Aboriginal people has remained higher than that for non-Aboriginal Australians since 2006–2007.²⁶ However, this reporting does not consider frequent avoidable admissions per year. Research in the area of frequent admissions for Aboriginal people has largely been restricted to frequent emergency department attendance^{27 28} and has not examined avoidable admissions for Aboriginal people with chronic conditions. However, a period prevalence analysis of avoidable admissions amongst South Australian Aboriginal people with chronic conditions found that Aboriginal people experienced more avoidable admissions per year than non-Aboriginal people (2.6 vs 1.9 avoidable admissions per year, respectively).¹⁶ Higher rates of frequent avoidable admissions are, therefore, occurring outside NSW, warranting the need for state-wide and national monitoring of frequent avoidable admissions. Further explorative research can also help in understanding any risk factors for frequent avoidable admissions amongst Aboriginal people. Such research findings may inform effective intervention to improve preventative community healthcare for Aboriginal people with these selected chronic conditions.

The disparate unplanned readmission rates for chronic disease between Aboriginal and non-Aboriginal people found in our study are consistent with differences reported by NSW Health for unplanned readmissions for all causes for a similar time period.¹⁷ The NSW Chief Health Officer's report on Aboriginal health demonstrated an all-cause unplanned readmission rate for Aboriginal people of 8.1% compared to 6.3% for non-Aboriginal people in 2011.¹⁷ Our analysis for the period 2005–2014 found a chronic disease unplanned readmissions or death rate for patients with chronic

disease of 14.7% for Aboriginal people and 12.6% for non-Aboriginal people. The higher unplanned readmission rates reported in people with chronic disease are similar to rates in the international research literature^{7, 12, 29} and Australian studies.^{10, 11, 30} For example, a NSW Bureau of Health Information analysis reported unplanned readmission rates in chronic obstructive pulmonary disease and heart failure patients of up to 13%, a finding which reiterates the significant risk of unplanned readmissions for patients with chronic disease.³⁰

Conversely, a more recent NSW Health report for the period between 2010–11 and 2016–2017 showed no observable gap in all-cause unplanned readmission rates between Aboriginal and non-Aboriginal people⁹. This finding appears in contrast to our findings of no significant improvement in unplanned readmissions for Aboriginal people with chronic diseases from 2005 to 2014. These differences in findings from our study and this report may be attributed to the NSW Health findings not reporting chronic-disease-specific unplanned readmission rates.^{9, 17} Given our and other research study findings, the current NSW all-cause unplanned readmission rates are likely to be higher among Aboriginal people with chronic disease. The difference in findings indicates that the gap in health outcomes between Aboriginal and non-Aboriginal people is closing for all-cause readmissions but remains for chronic disease readmissions. This highlights where preventative resources should be placed, and the importance of reporting and monitoring unplanned readmissions separately for chronic diseases.

This present research, in combination with other studies, highlights that there are significant differences between Aboriginal and non-Aboriginal people with chronic disease in relation to frequent avoidable admissions and unplanned return to hospital after discharge.

8.2.2 Finding two: Environmental, patient, encounter and organisational factors were identified as potentially contributing to chronic disease management and unplanned readmission (Paper three)

Paper three reported the findings of a qualitative study which explored the perceptions and experiences of Aboriginal people with chronic disease who had undergone unplanned readmissions.

Semi-structured interviews were conducted with a sample of 15 admitted patients who identified as Aboriginal and/or Torres Strait Islander. The interviews covered perceptions of avoidable readmissions, and experiences of healthcare, medications and carer support. The themes which emerged from the interview findings may be understood through Vest *et al.*'s adapted conceptual framework, which proposes that environmental-, patient-, encounter- and organisational-level factors may contribute to or protect against unplanned readmissions.³¹ Factors at the environmental-level reflect the quality of an individual's environment and may include factors such as social support and geographical area.³¹ Patient-level factors include sociodemographic factors, patient behaviour and disease status. Encounter-level factors include events and activities related to the delivery of healthcare,^a and the organisational-level refers to factors such as hospital or primary care type and location, and availability of inpatient and outpatient services.³¹

It is important to acknowledge that whilst a small sample is appropriate for qualitative research methods, this does limit the conclusions that can be drawn about the generalisability of the findings to all Aboriginal people.

Environmental-level factors

At the environmental-level, social support was reported as strong for most participants in our study and came in the form of strong family networks. Participants reported that family were able to assist in day-to-day chronic disease management, such as filling scripts, reminding them to take their medication on time and taking them to follow-up specialist and general practitioner (GP) appointments. Families were also able to take care of personal care needs (e.g., showering) as well as homecare needs (e.g., cleaning and cooking meals). Family support has been shown to be critical for chronic disease management for Aboriginal people.³²⁻³⁵ It has been recommended that family structures are acknowledged and respected,³⁵ and that families are included in all aspects of their relatives' healthcare, from hospital discharge planning to post-discharge follow-up services.³² This

^a Vest *et al.* refer to encounter-level factors in relation to the index admission. However, the study reported in paper three also considers healthcare received in the community setting.³¹

support may strengthen and support Aboriginal people in their rehabilitation and recovery, and may help prevent unnecessary unplanned readmissions.

However, our qualitative study findings suggest that not all Aboriginal people who have been readmitted to hospital with a chronic disease have supportive family networks. Several participants reported they were either homeless or living alone. They had little to no regular support and reported difficulties in accessing GPs, filling scripts and taking medications, and experienced feelings of isolation. Living alone or being single has been found to be a risk factor for unplanned readmissions in a number of studies.^{31, 36-38} An analysis of 2,056 women using linked data from the Australian Longitudinal Study of Women's Health and the NSW Admitted Patient Data Collection (APDC) showed that risk of unplanned readmissions was higher for those who did not have a partner (hazard ratio = 1.43, 95% CI: 1.05–1.95).¹⁰

Other environmental-level factors reported by participants in our study included barriers to accessing some community and social services. Participants described unreliable transport, not being able to get appropriate disability modifications to their homes and not having access to stable housing. Access to health and health-related community services is recognised as an important factor in the health status of Aboriginal people.^{23, 39, 40} Lack of access to essential services is amenable to change and could be targeted by interventions which aim to reduce unplanned readmissions for Aboriginal people.

Although access is mostly considered an environmental factor, access to these services may in part reflect organisational- or system-level failures in providing effective and high-quality community services to cater for and meet the essential needs of the most vulnerable. Vest *et al.* acknowledge the potential interactions among factors in their conceptual model.³¹

Patient-level factors

Our study findings suggest several patient-level factors that may be associated with unplanned readmissions for Aboriginal people with chronic disease. Some participants reported that their

unplanned readmissions occurred because they were so unwell. In a systematic review of studies analysing factors associated with unplanned readmissions, patients with worse health status were at higher risk of unplanned readmissions because of their complex health conditions.³¹

Chronic disease self-management emerged as an important issue from the perspective of interview participants. People's ability to self-manage their chronic diseases is considered crucial to chronic disease control.⁴¹ Chronic disease self-management refers to actions taken to help manage a health condition, such as adhering to medication and treatment plans, attending all necessary GP and specialist appointments, eating well, exercising, self-regulating and changing unhealthy lifestyle choices.^{41, 42} Being health literate and having a good level of self-efficacy enables individuals to self-manage, make informed decisions, understand their care plans,⁴² and decrease their risk of unplanned readmissions.⁴³ However, the findings from our qualitative study suggest that some Aboriginal people readmitted to hospital experience difficulties with self-management of their conditions. Participants reported they were struggling to take multiple medications, did not understand their treatment plans and often did not prioritise attending follow-up appointments. Research has shown that younger age (<55 years), being female and having only one chronic disease are strongly associated with a higher level of health literacy for Aboriginal people.⁴⁴ All participants in our study had multiple chronic diseases which pose complex challenges for self-management, especially when facing social disadvantage. Given that health literacy is critical for empowering people with access to and skills in using health knowledge,⁴⁴ further health literacy support is needed for Aboriginal people admitted to hospital because of chronic disease.

Aboriginal people's capacity to self-manage their chronic diseases may also be impacted by psychological distress, intergenerational trauma and caring responsibilities, particularly for Aboriginal women.⁴⁵ Thirty-one per cent of Aboriginal adults have high to very high levels of psychological distress compared to only 13% of non-Aboriginal people.¹ Whilst 38% of those who had experienced being removed from their families or had relatives removed from their family had high or very high levels of psychological distress compared to 26% who had not experienced removal.¹ The impacts of

intergenerational trauma for Aboriginal people on health caused by forced removal of children, policies of dispossession, dislocation from lands, incarceration, and homelessness, must also be acknowledged.^{1, 45} Psychological distress and intergenerational trauma has been shown to influence Aboriginal women's ability to manage their own health.⁴⁵ Additionally caring roles and responsibilities for family members can create a barrier for Aboriginal women to look after their own health and self-manage their chronic diseases.⁴⁵

Some participants also reflected on their own actions and health risk behaviours that contributed to their poor health. Smoking, poor nutrition, not exercising and a lack of motivation were considered by participants to be their responsibility to change. It is important to note that there are complex factors and reasons for health risk behaviours for Aboriginal people, some of which may be in response to stress.⁴⁶ Such self-reflections by participants may also be a sign of internalised blame that may have been conveyed by health workers.⁴⁶ Despite some participants reporting the importance of the support received from their local Aboriginal Medical Service, our findings suggest there is still a need for targeted, culturally appropriate and wholistic medication and chronic disease education, social support, smoking cessation assistance, health promotion and psychological services. Such a targeted intervention has the potential to better equip and empower Aboriginal people at risk of unplanned readmissions.⁴⁷

Encounter-level factors

Although patient-level factors are an important consideration in chronic disease management, in our study it appeared that some patient-level factors were related to encounter-level factors. In our study, some participants reported not feeling heard by their doctors and feeling confused about their conditions and treatments. Poor communication by health professionals within the hospital and local community health service appeared to act as a barrier to quality healthcare for some participants in our study. The impact of poor health literacy and medication adherence on patients' ability to self-manage their chronic diseases can be mitigated by a health professional using culturally appropriate

communication skills and a wholistic approach to health, and providing tools for self-management.^{34,}

⁴⁸ Effective and respectful communication between health professionals and Aboriginal patients, and their carers, is essential to ensure there are no gaps in understanding and support.^{35, 49}

Poor communication has been documented in other studies of healthcare provision for Aboriginal people,^{32, 49, 50} and Indigenous people worldwide.⁴⁸ In a meta-synthesis of 21 qualitative studies of Indigenous people's experience of hospitalisation across the world, Mbuzi *et al.* found a common theme of patients' experiences of dysfunctional encounters with health professionals.⁴⁸ Indigenous patients reported negative stereotyping, and feeling patronised, not listened to and not respected.⁴⁸ Despite mandatory cultural competency training for all NSW Health staff,⁵¹ our findings suggest there is still much room for improvement in applying cultural competence skills in hospital work practice. Cultural competency training goes beyond cultural awareness and being sensitive; it encapsulates practising cultural safety, which recognises power imbalances and discrimination, and how they impact Aboriginal patients.⁴⁸ Cultural safety requires health professionals to genuinely listen and build trust with patients so they are empowered.^{52, 53}

Although many unplanned readmission studies focus on the delivery of care received at the index admission, the role of timely post-discharge community healthcare has been increasingly recognised as an important modifiable factor in preventing unplanned readmissions.²¹ Most participants in our study reported that having regular GPs who knew them well was important for their chronic disease management. The local Aboriginal Medical Service was described as a central place for health and practical help. Aboriginal Medical Services (Aboriginal Community Controlled Health Services) are best placed to overcome common barriers in accessing healthcare, providing a culturally safe primary healthcare service.^{4, 32} Further research that examines how to effectively streamline coordinated, accessible, and culturally appropriate primary healthcare for Aboriginal people with chronic disease who have recently been discharged from hospital is warranted.

Organisational-level factors

Organisational-level factors that are associated with unplanned readmissions may include the type of hospital, hospital policies and procedures in healthcare.³¹ One participant in our study reported that he was discharged too early as the hospital staff told him there were not enough beds. He felt he was not well enough to be discharged and perceived that this was the main reason for his unplanned readmission just a few days later. Apart from the suggestion of hospital bed shortages, organisational-level factors did not emerge as a dominant theme in our qualitative study. This may reflect that participants had greater insights into their own actions, those of family members and healthcare staff with whom they interacted, than with organisational-level factors. Whilst organisational factors may be less observable from a patient's perspective, it is possible that these factors underlie some of the encounter-, environmental- and patient-level factors reported by participants. For example, regarding cultural competency of health professionals, Wilson *et al.* argue that whether a health professional communicates clearly and respectfully with Aboriginal patients is predominantly influenced by the culture of the organisation and whether cultural competency training is valued and promoted.⁵⁴

Although only one participant in our study reported potential organisational factors (i.e. bed shortages) being associated with their unplanned readmissions, it is important to highlight that this finding may be consistent with a growing body of literature.^{34, 49} Several studies report accounts of Aboriginal people experiencing different levels of care delivery compared to non-Aboriginal people.^{49, 55} The organisational culture and policies of a hospital may encourage stereotypes of Aboriginal people, possibly leading to early discharge, discharge against medical advice or differential medical treatment.^{1, 55} This issue is further explored in the limitations section.

The study findings reported in paper three suggest there are factors operating at the environmental-, patient-, encounter- and organisational-levels which are associated with protecting against an increasing risk of unplanned readmissions. The family network and having a regular GP were identified by participants as factors which helped them maintain chronic disease management. The findings suggest that complex and connected factors act as barriers to chronic disease management,

providing information about where the health system and healthcare services are failing to meet the needs of Aboriginal people with chronic disease. Further research is needed to investigate these factors in a larger sample of Aboriginal people so that potential areas for intervention are identified.

8.2.3 Finding three: Evidence for the effectiveness of telephone follow-up in reducing unplanned readmissions is inconclusive. However, telephone follow-up for recently discharged Aboriginal patients with chronic disease was associated with a significant decrease in emergency department presentations (papers four and five)

A systematic review of the international literature was conducted to determine the methodological quality and effectiveness of interventions utilising TFU in reducing readmissions within 30 days amongst patients with chronic disease (paper four). A search of MEDLINE, the Cochrane Library and EMBASE was conducted for articles reporting on interventions which included TFU alone, or in combination with other components, in patients with cardiovascular disease, chronic respiratory disease, and diabetes. Those that reported 30-day readmission outcomes and met Cochrane Effective Practice and Organisation of Care (EPOC)⁵⁶ design criteria were included. Ten eligible studies were identified, five of which reported on interventions that were effective in reducing 30-day readmissions. The methodological quality of included studies was poor. Overall, all identified studies combined TFU with other intervention components. At the time of the review, no eligible studies examining TFU in isolation were identified, and none specifically focused on Aboriginal people. Effective interventions were reported in five studies. Three of these reported on interventions that provided TFU in addition to pre-discharge support, and two reported on interventions that provided TFU with both pre- and post-discharge support. Pre- and post-discharge support included patient education, medication instructions, individualised discharge planning, physical therapy, dietary consultations, medication assessments, home visits and a transition-focused care curriculum for medical residents.

A major limitation identified by the systematic review was the poor methodological quality of the included studies. Each included study was assessed using the EPOC⁵⁶ criteria. The studies scored

poorly particularly for the generation of allocation sequence and concealment, baseline outcomes and characteristics, and contamination. A failure to not minimise all potential bias within the study design lowers the strength of evidence.⁵⁷ Given these methodological weaknesses and the fact that no studies focused on Aboriginal people, further research is needed to explore whether a TFU intervention would be effective in reducing unplanned readmissions for Aboriginal people with chronic disease.

Overall, our systematic review suggests that TFU in combination with other components, particularly pre-discharge interventions, demonstrated some success in reducing readmissions for patients with chronic disease. Future work on interventions utilising TFU alongside pre-discharge components is therefore warranted. The evidence base could be strengthened by including the effectiveness of TFU across multiple sites to enhance generalisability,²¹ standardised TFU delivery,⁵⁸ and consistent use of unplanned readmission classifications, and examining the effectiveness of TFU combined with other components for certain high-risk and vulnerable populations such as Aboriginal people with chronic disease.

Given that TFU features in many continuity-of-care strategies after hospitalisation,²¹ and the potentially promising results of some studies found in our systematic review, there is merit in exploring the effectiveness of TFU in reducing unplanned readmissions for Aboriginal people. Although implementing a well-controlled and implemented randomised controlled trial would have provided the most compelling evidence of the effectiveness for TFU, this was not feasible within the funding and time limitations of the PhD candidature. However, there was an opportunity to evaluate a “real world” health program using telephone follow-up for Aboriginal people discharged from hospital.

Paper five aimed to assess the impact of a NSW state-wide TFU program, 48 Hour Follow Up, on rates of unplanned hospital readmissions, unplanned emergency department presentations, mortality and occurrence of at least one adverse event (i.e., unplanned readmission, emergency presentation or mortality) within 28 days of discharge amongst Aboriginal people with chronic disease. The study

sample included Aboriginal and/or Torres Strait Islander people who were aged 15 years and older, were admitted to a NSW public hospital, and had been diagnosed with cardiovascular disease, diabetes, respiratory disease or renal disease. We conducted a retrospective cohort analysis of eligible Aboriginal people who received 48 Hour Follow Up compared to Aboriginal patients who did not, using linked routinely collected datasets for the period May 2009 to December 2014.

Of the 49,721 admissions (18,659 patients) included in the final study cohort, 17% of admissions (n=8469) were for those who had received 48 Hour Follow Up. Receipt of 48 Hour Follow Up was associated with both a reduction in emergency department presentations and at least one adverse event within 28 days of discharge. Unplanned readmissions and mortality were not significantly reduced. However, the finding that emergency presentations were significantly reduced suggests that the 48 Hour Follow Up program may have merit in bridging the gap in patients' care from the hospital to the community setting, and consequently may prevent emergency presentations. Given this positive finding and paper four findings' suggestion that TFU combined with other components significantly reduced unplanned readmissions, it is worth exploring whether enhancing the 48 Hour Follow Up program could lead to a positive impact on unplanned readmissions. However, it is important to keep in mind the methodological weakness of this evaluation design (non-experimental), and caution is needed therefore in interpreting the findings.⁵⁹

Enhancements could include adding extra components to the program. The full evaluation report of the 48 Hour Follow Up program demonstrated that whilst the program was designed as a stand-alone intervention, there were four different models of delivery across the local health districts.⁶⁰ Three of the models (centralised, shared care and Aboriginal Medical Service-contracted) implemented only the 48 Hour Follow Up calls. The localised model included a ward visit and sometimes a home visit, and this was implemented by six of the 15 local health districts. In this model, an Aboriginal health worker visited the patient in hospital before discharge and introduced the program. Once the patient was discharged the Aboriginal health worker conducted the TFU. If the patient could not be contacted by phone, a home visit was conducted. Staff reported that visiting the patient in hospital facilitated

cultural understanding between hospital health staff and the patient, and provided a good connection to community care.⁶⁰ It is interesting to note that the localised model had a significant reduction in ED presentations when compared to the centralised model suggesting this model of care warrants further exploration to identify its effectiveness in other LHDs (Odds Ratio=0.77 (95% Confidence Interval= 0.72,0.83) Paper five, Table 3).

Paper three findings reiterate the value of hospital visits, whereby participants described the importance of the Aboriginal hospital liaison officers' providing help in understanding medical terminology and practical support. Taylor *et al.* explored the role of Aboriginal health workers in the hospital setting among Aboriginal patients with cardiovascular diseases, and described how the health workers facilitated good communication between the patients and health professionals, and helped with follow-up and referral processes in the community.⁶¹ Such in-patient supports help to provide a bridge from the hospital to community healthcare.^{21, 62} The 48 Hour Follow Up program therefore may be strengthened by all local health districts including further supports in addition to TFU, which may maximise the impact of the program and lead to significant reduction in unplanned readmissions.

Enhancing the 48 Hour Follow program could include optimising the TFU call, but it remains unclear what this would entail. There are many variations of TFU that have been reported in the international literature.^{21, 58} Our systematic review (paper four) described how the included studies showed no consistency in who delivered the TFU call (e.g. nurse, doctor or trained volunteers), the intensity of calls (e.g. ranging from one to sixteen calls) and their content (e.g. assessment of patients' health, and patient education). The full evaluation report of the 48 Hour Follow Up program demonstrated that some local health districts only used Aboriginal health workers to conduct TFU, whilst others used nurses (mostly non-Aboriginal).⁶⁰ Some staff interviewed for the full evaluation also identified the timing of the call (within 48 hours of discharge) as a potential barrier to effectiveness.⁶⁰ They reported difficulty in contacting patients and that some patients did not return home immediately after discharge but stayed with family members instead. Some local health districts tried calling the patient outside the 48-hour timeframe instead.⁶⁰ Further research could identify which aspects of TFU, such

as timing, content and intensity, are likely to be most effective in reducing unplanned readmissions amongst Aboriginal people.

Together, the results of papers four and five suggest that although the evidence for the effectiveness of TFU in reducing unplanned readmissions for both the general population and Aboriginal people is inconclusive, TFU may have some health benefits (i.e., reduction in emergency presentations), and in combination with other components, could successfully reduce unplanned readmission rates in patients with chronic disease.

8.3 Strengths and limitations

This body of work is one of the first to explore unplanned readmissions and frequent avoidable admissions in Aboriginal people with chronic disease in NSW. The mixed-methods approach draws on both quantitative and qualitative methods to explore the main research questions. Utilising mixed methods in research has the advantage of providing a deeper understanding of a subject area,⁶³ particularly for areas not commonly explored and where multifactorial and complex factors are at work. We were privileged to include the findings of in-depth interviews with Aboriginal people admitted to hospital. We were able to complement this work by conducting a large data linkage study of administrative datasets for Aboriginal and non-Aboriginal admitted patients, thus allowing for a long follow-up period to examine associations between explanatory factors and health outcomes.^{64, 65} It is a particular strength of this thesis to have included an evaluation of a health program, albeit utilising a non-experimental design, of a state-wide intervention.

Nevertheless, there are several limitations of this thesis which are important to consider: 1) the limitations of International Classification of Diseases (ICD) -10 codes in hospital administrative data; 2) the “ever-identified” method of enhancing Aboriginal reporting; 3) the use of a non-experimental design to evaluate the 48 Hour Follow Up program; 4) the incorrect classification of some unplanned readmission rates as avoidable; and 5) organisational-level factors that were not directly addressed.

8.3.1 The limitations of ICD-10 codes in hospital administrative data

Papers one and two used ICD-10 defined chronic diseases for primary and additional diagnoses from the NSW Admitted Patient Data Collection which was used to create the eligible chronic disease cohorts and calculate the Charlson Comorbidity Index. However it is important to keep in mind the potential under reporting of chronic diseases in hospital administrative data.⁶⁶ Retrospective studies have analysed and compared hospital administrative and self-report data and have highlighted variations in the reporting and recording of secondary diagnoses in hospital administrative data, with greater underreporting in rural hospitals⁶⁷ and for certain chronic diseases.⁶⁶

8.3.2 The “ever-identified” method of enhancing Aboriginal reporting

Correct reporting of Aboriginal status in routinely collected health data is important for accurately reporting health outcomes and healthcare utilisation for Aboriginal people. However, Aboriginal status may be under-reported.⁶⁸ Ideally, every patient is asked on admission whether they identify as Aboriginal and/or Torres Strait Islander, and this information is entered into NSW administrative datasets.⁶⁸ The accuracy of reporting of Aboriginal status in the NSW APDC has been reported to be 90.7% (95% CI 84.6–94.2).⁶⁸ Statistical methods are needed to correct inconsistencies in Aboriginal status between datasets. We used an “ever identified” algorithm whereby if a patient is identified as Aboriginal on any APDC record, then they were considered Aboriginal. A patient was considered non-Aboriginal only if they had no records that stated they identified as Aboriginal. The limitation of this method is that those with more hospital records are more likely to have at least one false positive record of Aboriginal status, potentially biasing the frequency upwards for patients reported as Aboriginal.⁶⁵ A “weight of evidence” algorithm might have been a more accurate method to deal with inconsistent reporting.⁶⁵ For a patient to be recorded as Aboriginal, a patient with three admissions, for example, must have at least two admissions recorded as Aboriginal, whilst a patient with two or fewer admissions must have at least one admission recorded as Aboriginal.^{65, 69} Nelson *et al.* used the self-reporting of Aboriginality in the NSW population survey as a standard, comparing it to the

records in the APDC and the Emergency Department Data Collection, and assessed a number of approaches using linked data to accurately identify Aboriginality.⁷⁰ They concluded that weight of evidence methods were the most accurate method in identifying Aboriginality using data linkage. However Gibberd *et al.* identified the importance of including the Aboriginality of relatives' records; a method which reduces the number of uncategorised Aboriginal people.⁷¹

However, given that many Aboriginal people do not self-identify when admitted to hospital, it is firstly more important to understand and identify any barriers for Aboriginal people in self-identifying so that hospital records capture all Aboriginal people's health outcomes and healthcare utilisation.⁷⁰

8.3.3 The use of a non-experimental design to evaluate the 48 Hour Follow Up program

This thesis used a retrospective cohort design to examine the effectiveness of an intervention that had already been implemented state-wide. The design used in paper five has some limitations that should be considered. The retrospective cohort design of the 48 Hour Follow Up evaluation included two groups of patients: those who received 48 Hour Follow up; and those who were eligible but did not receive 48 Hour Follow Up. It may be that the two groups differed in ways other than the exposure of interest (receipt of 48 Hour Follow Up or not), and therefore the size of the effect (reduction in unplanned readmissions) might have been impacted.⁶⁴ Future research could examine the impact of an enhanced TFU intervention for Aboriginal people using an experimental design. This is further explored in the recommendations section.

8.3.4 Incorrect classification of some unplanned readmission rates as avoidable

An assumption has been made in this thesis that all unplanned readmissions are potentially avoidable. The definition of an unplanned readmission used for this thesis is an admission to a hospital within one month of discharge from an initial (i.e., index) chronic disease admission, where this readmission was considered to be not planned. This definition and measurement method were based on that used by NSW Health¹⁷ and was one of the most commonly used in the research literature at the

commencement of this thesis.²¹ This definition does not differentiate between avoidable and unavoidable unplanned readmissions.⁷² Some unplanned readmissions are not preventable.^{11, 31} This limitation has been discussed in the international literature, and there is wide variation in the methods used to identify avoidable readmissions.^{21, 72} Some studies have adopted certain criteria that reviewers used to judge, case by case, whether readmissions were avoidable,⁷³ but this method is difficult to implement at a population level. Other studies have used administrative data and classified readmissions based on combinations of diagnostic codes to include only certain diseases or complications.⁷² Van Walraven *et al.* in their meta-analysis of these studies estimated that the proportion of 30-day readmissions deemed avoidable ranged from 5% to 59%, with a mean of 23%.⁷⁴ Studies in the United States and the Netherlands have estimated proportions of 12% and 13%, respectively.^{73, 75} Despite the variability and the lack of an Australian-specific estimate, these studies demonstrate that definitions and measurements of unplanned readmission should take into consideration those readmissions that are potentially unavoidable.

In 2019, the Australian Commission on Safety and Quality in Health Care recognised the limitations of reporting using current methods of measuring unplanned readmissions.⁷⁶ They have defined an *avoidable* hospital readmission as occurring when:

“a patient who has been discharged from hospital (index admission) is admitted again within a certain time interval, and:

- *The readmission is clinically related to the index admission, and*
- *The readmission has the potential to be avoided through improved clinical management and/or appropriate discharge planning in the index admission.”*(page 5, ⁷⁶)

The main difference from the definition used in this thesis is that this new measure of readmissions includes only readmissions that are deemed avoidable by the classification of certain diagnoses, namely, pressure injuries, infections, surgical complications, respiratory complications, venous thromboembolism, renal failure, gastrointestinal bleeding, medication complications, delirium, cardiac complications, constipation, nausea and vomiting.⁷⁶ Rather than the timeframe for readmission

being within 28 days of the index admission, the new definition recommends that timeframes should vary according to each diagnosis and be clinically determined.⁷⁶ All Australian governments have agreed to adopt this new measure of avoidable readmissions.⁷⁷

This new definition and measurement method of avoidable readmissions is timely given the focus of this thesis on high-risk diagnoses, that is, chronic diseases known to be associated with high proportions of unplanned readmissions. The diagnoses included by the Australian Commission on Safety and Quality in Health Care further refine our measurement of unplanned readmissions by only including common complications for patients with chronic disease, such as renal failure, medication complications, delirium, cardiac complications, and respiratory complications.⁷⁶ However, the Australian Commission's definition does not explicitly state whether only unplanned or unexpected avoidable admissions are included. Restricting the definition of readmissions to those that were unplanned ensures that the measurement includes only unexpected or urgent readmissions, and adding this to the definition acts as a further proxy for potentially avoidable readmissions. Future research in the area of unplanned readmissions for Aboriginal people with chronic disease could use the new Australian Commission definition and measurement method for avoidable admissions, but it is recommended that the definition be restricted to unplanned readmissions.

8.3.5 Organisational-level factors were not directly addressed

Paper two did not address potential organisational factors that may be associated with higher rates of unplanned readmissions. For this data linkage analysis, there is a possibility that the admitting hospital might have been associated with unplanned readmissions. In Vest *et al.*'s literature review of studies which identified significantly associated patient-, environment-, encounter- and organisational-level factors, a number of studies found a significant association with an organisational factor, namely that readmissions differed by hospital.³¹ However, if certain hospitals are identified as being associated with unplanned readmissions, further explorative research is needed to identify specific organisational risks which may be amenable to change and therefore can be targeted for

intervention. Examples include the hospital's emergency department guidelines regarding patient waiting times, triage system and availability of beds.³¹

With regard to avoidable admissions, by definition, amenable change needs to be undertaken at the community level rather than in the hospital setting.⁸ Therefore, to identify potential associated organisational-level factors, our data linkage study (paper one) would have needed to link to community health services data to explore whether factors such as general practice and ACCHS policies, practices and procedures are associated with subsequent frequent avoidable admissions for Aboriginal people.

It is important to acknowledge in examining the possible factors associated with unplanned readmissions and avoidable admissions for Aboriginal people with chronic disease that organisational factors may include institutional racism within hospital and community health systems.^{78, 79} Racism in this context can be defined as, "*organised systems within societies that cause avoidable and unfair inequalities in power, resources, capacities and opportunities across racial or ethnic groups*".⁸⁰

Racism can occur at an encounter (interpersonal) or organisational (system) level.⁸⁰ Aboriginal health research highlights racism as a contributor to Aboriginal healthcare utilisation and health outcomes.⁴

⁸⁰ In interviews with Aboriginal people with chronic disease, Aspin *et al.* report that participants in their qualitative study discussed their experiences of discrimination and stigma in both hospitals and non-Aboriginal community health services.³² Such experiences, they argue, lead to inequitable access to health services and an increase in chronic disease risk factors.³² In our study (paper three), participants might not have felt comfortable discussing their experience of racism, given that the interviewer was non-Aboriginal. However, it is important to acknowledge that the participants' accounts of inequitable access to basic services for a safe and accessible living environment and culturally appropriate care are in themselves potential indicators of systemic or institutionalised racism. Future research could explore the impact of experiences of racism and discrimination within the health system on unplanned readmissions by surveying and interviewing patients, health

professionals and system managers. This research could explore these issues to understand how they may operate at the environmental-, patient-, encounter- and organisational-levels.

8.4 Recommendations for practice

Aboriginal people in NSW have higher rates of frequent avoidable admissions and unplanned readmissions compared to non-Aboriginal people. These differences reflect inequity between these two population groups, which may be due to sub-optimal community healthcare and poor hospital care. Corresponding with these disparities, our qualitative study suggests that Aboriginal people readmitted to hospital experience poor communication by health professionals, low levels of health literacy and adherence to chronic disease management, poor access to community services, and health risk behaviours. Changes in practice and policy are needed to significantly decrease potentially avoidable hospitalisations and barriers to chronic disease management for Aboriginal people with chronic disease. The following section outlines recommendations for practice and policy in view of the findings of this thesis as they relate to hospital and community health service practices, implementation of the NSW Health 48 Hour Follow Up program, and NSW Health monitoring of unplanned readmissions and avoidable admissions.

8.4.1 Hospital and community health service practices

Hospital staff and managers receiving admissions from Aboriginal people with chronic disease need to consider how they can best support these patients in a culturally appropriate way to help prevent unplanned readmissions. Consideration needs to be given to communication practices, discharge planning, involvement of carers and families, patient and carer education in medications, and how best to transition the patient to coordinated care in the community by involving Aboriginal hospital liaison officers, ACCHSs, GPs and chronic disease case workers who can together engage and support patients with complex and multiple chronic conditions.

At an organisational-level, local health districts need to ensure that Aboriginal cultural training, such as the NSW Health “Respecting the Difference” face-to-face training, is undertaken and implemented into practice by all staff, and be included in ongoing professional development.^{81, 82} These cultural practices will facilitate better communication between health staff and Aboriginal people.

Furthermore, in order to support better cultural understanding and practices, local health districts are recommended to provide the needed resources and support for Aboriginal hospital liaison officers, and also Aboriginal nurses and doctors.³² Aboriginal health workers have a crucial role in facilitating culturally safe practices and spaces for Aboriginal people in the hospital setting.³² It is also important to acknowledge the importance of the growing and strengthening Aboriginal population health workforce who are able to provide leadership at a health system level to enhance Aboriginal health outcomes.⁸³

Internal reviews of hospital discharge procedures and medication reconciliation would be helpful to identify ways that Aboriginal patients with more complex and multiple comorbidities can be better supported. Effective discharge planning should be culturally appropriate and ensure good communication and understanding of medications.³² Reviews should also consider how discharge planning can be integrated with community healthcare to ensure that patients experience smooth transitions from hospital to community healthcare.⁷⁶ In order to do this, hospitals should ensure there are good working partnerships with their Aboriginal health workers, local ACCHSs and GPs to enable coordinated multi-disciplinary care provision for Aboriginal patients.^{32, 84} Furthermore, prevention of frequent avoidable admissions should occur in the community health setting.¹⁶ Aboriginal patients with ambulatory-care-sensitive chronic conditions need support for good-practice chronic disease management strategies from their regular GPs to manage their conditions, given the high risk of frequent avoidable admissions.¹

Given our findings that participants in our qualitative study (paper three) reported inequitable access to secure housing, support systems, and healthcare in the community, there is a need for improvement in housing and community support systems, not just in hospitals. Non-Aboriginal agencies are

recommended to partner with Aboriginal communities, elders and organisations to address these inequalities.

8.4.2 Implementation of the NSW Health 48 Hour Follow Up program

At the time of writing, the 48 Hour Follow Up program continues to be implemented in each local health district in NSW. The findings from this thesis suggest that the 48 Hour Follow Up program is useful in reducing emergency presentations, whilst paper four suggests that consideration could be given to enhancing the program by adding other pre-discharge and post-discharge components. It is possible that combining the existing TFU with other components, such as patient education, medication instruction, individualised discharge planning and home visits, may result in a reduction in unplanned readmissions. Which components are most effectively combined with TFU for Aboriginal people with chronic disease should be examined using a methodologically rigorous research design, with meaningful engagement with Aboriginal communities and expertise to ensure components are culturally appropriate.^{85, 86}

8.4.3 NSW Health monitoring of unplanned readmissions and avoidable admissions

There is no current state-wide reporting of unplanned readmission rates for Aboriginal people with chronic disease in NSW. Given the high risk for these communities and the recent Australian Commission on Safety and Quality in Health Care avoidable readmission indicator,⁷⁶ it is important to include avoidable readmission rates for Aboriginal people with chronic disease in current NSW Health monitoring and reporting. Adding this more detailed indicator would enable policymakers to identify state-wide and local health district trends which would build a more complete picture of Aboriginal health status, and areas where additional resourcing may modify health outcomes. These data can inform improvements in the quality and safety of delivery of care in hospital and post-discharge for Aboriginal people. Given the new avoidable readmission indicator, NSW Health should consider reporting these rates by each diagnosis and Aboriginal status. Reporting this indicator by each diagnosis, as well as a combined rate, would enable clinicians and policymakers to identify how

specific chronic disease complications are faring in terms of readmissions for Aboriginal people. As mentioned earlier, it is recommended that avoidable readmissions are restricted to *unplanned* avoidable readmissions only. These data should also be reported back to local health districts and Aboriginal communities to allow understanding of local needs.

Despite avoidable admissions by Aboriginal status being currently included in NSW Health monitoring and reporting (reported as “potentially preventable hospitalisations”), frequent avoidable admissions are not included. Given the high rates of frequent avoidable admissions shown in our analysis (paper one), it is recommended that the proportion of frequent avoidable admissions per year by Aboriginal status is monitored and reported. Again, this would enable policymakers to provide additional support to local health districts that are experiencing high rates of frequent avoidable readmissions. Local health districts may consider utilising real-time data to enable flags to alert treating hospital staff and GPs that a patient has been hospitalised for a third time in a year. Three or more admissions to hospital is considered a useful indicator of frequent admissions.^{30, 87, 88} Hospital staff and GPs can then act to help prevent the patient having to come back to hospital. However, there is still a need for further research to identify factors that are associated with frequent avoidable admissions for Aboriginal people with chronic disease, factors which may be amenable to change through evidence-based intervention.

Monitoring and reporting of frequent avoidable admissions and unplanned readmissions could also be strengthened by establishing a financial incentive system for local health districts that lower these rates for Aboriginal people. Several countries have introduced financial incentives regarding unplanned readmissions.⁷⁶ For example, in the United States, the Hospital Readmission Risk Reduction Program for Medicare patients established a benchmark for unplanned readmissions, and hospitals with higher rates are financially penalised.¹² The Australian Government does not have any current financial incentives for hospitals. However, plans are being made to include a financial incentive program for the Australian Commission on Safety and Quality in Health Care list of avoidable hospital readmissions.⁷⁶ A financial incentive program for hospitals and local health

districts could also be explored as a strategy for lowering rates for high-risk populations such as Aboriginal people with chronic disease. Such an incentive may spur local health district action to provide better health outcomes for Aboriginal people. There is evidence that such financial incentives work well for vulnerable populations in the United States, such as people with low income or people with high co-morbidity scores.⁸⁹ However, it must be acknowledged that financial incentives could lead to a lack of access to healthcare services for vulnerable populations; in particular, people with genuine health needs may not be readmitted to hospital.⁹⁰ If financial incentives are used for hospitals, careful monitoring must be in place to ensure such practices are effective and do not lead to adverse, unintended outcomes for Aboriginal people.

8.5 Recommendations for further research

Despite there being many health programs and policies for improving health outcomes for Aboriginal people in Australia,⁹¹ few high-quality evaluations have been conducted, particularly using experimental designs.^{91, 92} Furthermore, there has been criticism that many Australian Aboriginal health programs and policies, and the few evaluations, have not been culturally appropriate and have not engaged Aboriginal communities and expertise in a meaningful way.⁹³ The recent Indigenous Evaluation Strategy⁹⁴ recommends that there is active engagement of Aboriginal communities and Aboriginal leadership in health program design, implementation and evaluation.⁹³ This enables, “*centring Aboriginal and Torres Strait Islander people, perspectives, priorities and knowledges in all stages of evaluation*” (page 6,⁹⁴). Active and meaningful engagement necessitates that policy-makers, commissioners of evaluation and evaluators must be flexible, and open to new approaches, methods and time scales.^{93, 94} It has also been recommended to start with a formative evaluation rather than moving straight to an outcome or summative evaluation of a health program.⁹³ Formative evaluation allows for further engagement with Aboriginal communities and health workers to understand whether implementation is going well and, if not, what can be changed or added to the program for it to work well for communities.⁹³

With the recent Indigenous Evaluation strategy⁹⁴ and good-practice ethical and culturally appropriate evaluation principles in mind,⁸⁵ and building on the findings of this thesis, it is recommended that the 48 Hour Follow Up program be enhanced into a community-led and multi-component intervention with a high-quality, flexible^b evaluation. The program enhancement, implementation and evaluation study would occur in two phases. Sufficient time would be needed for the initial engagement phase with Aboriginal communities and Aboriginal health workers, to inform the research and evaluation questions and the design of a community-led and multicomponent intervention.^{85, 93} To ensure a genuine strength-based approach,⁹⁵ it is recommended that an evaluation working group with membership of Aboriginal evaluators and researchers, ACCHS staff, local health district Aboriginal health directors, Aboriginal community members and Aboriginal health workers would be established. This research working group would enable Aboriginal leadership and oversight of the program and its evaluation.^{85, 94}

8.5.1 Community engagement regarding culturally appropriate and effective strategies to reduce unplanned readmissions and frequent avoidable admissions

Cross-sectional survey to gather quantitative data on factors associated with readmissions

Our qualitative study explored the experiences and perceptions of Aboriginal people who had been readmitted to hospital (paper three), and enablers and barriers to chronic disease management were identified. However, these themes need to be explored in a wider sample of Aboriginal people to confirm their importance and identify other potential factors operating at the environment, patient, encounter- and organisational-levels that could be addressed in an enhanced 48 Hour Follow Up intervention. A 15-minute cross-sectional survey administered on computer tablets with Aboriginal people with chronic disease in ACCHS waiting rooms could be a time-efficient way of obtaining a large number of responses. In a similar-length survey of Aboriginal patients in a primary care setting, 80% of participants managed to complete the touch screen survey before their GP appointments.⁹⁶ The survey would ask validated and reliable questions on individual behaviour and perceptions based

^b More complex interventions may require flexible or tailored evaluation methods to meet local Aboriginal community needs.⁸⁷

on the themes that arose from paper three: carer and family support, attendance at a regular GP or ACCHS, perceived barriers to accessing health and community services, communication with health professionals, chronic disease management (e.g. medication understanding and ease of adherence, attending medical appointments), health risk behaviours, and open-ended responses to identify other important factors. A descriptive analysis would identify the most common responses by sociodemographic variables (e.g., age, sex, education, employment).

The findings of the survey, and of paper three, would then be considered by the evaluation working group. The group would also need to consider the findings of the systematic review (paper four), and any recent intervention research aimed at reducing unplanned readmissions for Aboriginal people. If there is a lack of such intervention research for Aboriginal people, the evaluation group may need to consider interventions more generally focused on improving chronic disease management for Aboriginal people. Potential culturally appropriate pre-discharge, bridging, and post-discharge components which could be combined with TFU would then be formulated. Careful consideration would need to be given to how enhancements could also be beneficial in reducing frequent avoidable admissions. Given the importance of the community healthcare setting for preventing both unplanned readmissions and frequent avoidable admissions,^{16, 21} it would be important for the proposed intervention to include a community healthcare setting component.

Aboriginal health worker and community engagement

The survey findings and new intervention components identified by the evaluation working group would be discussed in a series of meaningful engagement workshops or round tables with Aboriginal health workers and Aboriginal community members from remote, regional and metropolitan locations. The Aboriginal health workers would need to include a good representation from both hospital and community healthcare-based settings. The workshops would be facilitated by an Aboriginal evaluator to ensure that both cultural safety and empowerment for communities are enabled.⁸⁵ Participants would be asked to rank the potential interventions in order of importance.

Feedback would be obtained on any necessary tailoring for local needs. The rankings and feedback would be consolidated and considered by the evaluation working group.

8.5.2 A community-led and multicomponent 48 Hour Follow Up enhancement intervention and evaluation

Given the complexity of and interrelated factors associated with Aboriginal health status and health behaviour,¹ there is increasing recognition that interventions for Aboriginal people need to target this complexity by utilising a multifactorial approach.⁹⁷ The findings from this thesis have provided information on the potential environmental-, patient-, encounter- and organisational-level factors which may contribute towards or protect against high rates of unplanned readmissions and frequent avoidable admissions for Aboriginal people with chronic disease. A community-led and multicomponent enhanced 48 Hour Follow Up intervention would need to address this complexity and scope.

The outcomes of the community and Aboriginal health workers engagement phase of the research study would determine the components that would be combined with TFU. The findings of this thesis suggest the following points should be considered in developing intervention components:

- Family and carers should be actively encouraged and welcomed to be involved in the discharge planning and community healthcare of patients.
- Further resource supports should be provided to enable more Aboriginal hospital liaison officers to help Aboriginal people admitted to hospital, to facilitate patient education and good communication with hospital staff, and to support an effective and culturally appropriate discharge plan.
- Hospital systems should ensure their staff participate in NSW Health Respecting the Difference training to enable cultural competency of hospital staff in interacting with Aboriginal patients.

- Hospital and community healthcare alert systems should be used to flag patients at risk of unplanned readmissions and frequent avoidable admissions.
- GP practices and ACCHSs should actively encourage patients to book appointments with the same GPs to enable continuity of care.
- Resources should be provided to support ACCHSs' targeting of at-risk patients with tailored chronic disease self-management strategies, medication and chronic disease education, health promotion and psychological services.
- Resources should be provided to support ACCHSs and other Aboriginal community organisations to enhance community services such as transport, housing and disability services.

Depending on the components agreed upon, a community-led and enhanced 48 Hour Follow Up intervention could then be designed and implemented. It may be advisable to implement the enhanced intervention at a smaller number of sites first to assess acceptability, feasibility and effectiveness before implementing at scale across NSW.⁹⁸ As implementation rolls out over the smaller number of sites, a formative evaluation is recommended to ensure the program is being implemented as planned, ensure flexibility is shown in responding to any community needs or concerns, and further refine the program as needed.⁹³

Although randomised controlled trials (RCT) are considered the gold standard in establishing the effectiveness of interventions, they are not practical for implementing community-level interventions.⁹⁹ A cluster RCT can be implemented for community interventions, but this is difficult due to ethical considerations of withholding good support from the control group, and they are expensive to implement.⁹⁷ An intervention to test the effectiveness of the enhanced 48 Hour Follow Up program in reducing unplanned readmissions and frequent avoidable admissions would need to accommodate the complexity and scope of the issues identified in the community and Aboriginal health worker consultations.^{85, 93}

If acceptable to the consulted Aboriginal communities, a stepped-wedge design could be used to evaluate the community-led, multicomponent 48 Hour Follow Up enhancement intervention. A stepped-wedge design is an experimental design that implements the intervention sequentially at each site,¹⁰⁰ which could be a hospital network for the context of the 48 Hour Follow Up program. All sites would be in the control phase at the beginning and then by the end of the study all sites would be implementing the intervention. The timing of the intervention would be randomised. Outcomes would be measured before and after the intervention at each site. Unlike RCTs or cluster RCTs, all people involved would eventually receive the intervention.¹⁰⁰

However, there are disadvantages to implementing a stepped-wedge study design which must be considered. Stepped-wedge designs are relatively complex to design as they involve calculating ultimate numbers of people, clusters and measurements.⁹⁷ It may also be challenging to ensure all sites are ready to implement the intervention at the correct time, given the large number of components that would need to be coordinated and aligned,⁹⁷ and the competing priorities that may occur for hospitals and ACCHSs. Sites may also need localised tailoring, which could impact the efficiency of the design, but a more pragmatic and flexible approach is needed for population-level programs, and for evaluation of Aboriginal health programs.^{63, 93} Nonetheless, an evaluation utilising a stepped-wedge design has the potential to provide strong evidence for the effectiveness of a community-led, multicomponent enhanced 48 Hour Follow Up program in reducing unplanned readmissions and frequent avoidable admissions.

8.6 Conclusion

This thesis has provided valuable and unique information regarding the high risk of unplanned readmissions and frequent avoidable admissions for Aboriginal people with chronic disease in NSW. These high rates need to be urgently addressed to help narrow the gap in Aboriginal health outcomes. Potential enablers and barriers for chronic disease management for Aboriginal people who have

experienced unplanned readmissions have been identified, the effectiveness of TFU combined with pre- and post-discharge components on readmissions was systematically reviewed, and a state-wide TFU program was evaluated for its impact on unplanned readmissions, emergency department presentations and mortality. The findings of this thesis have the potential to be built upon with further explorative research and a community-led, multicomponent 48 Hour Follow Up enhancement intervention across NSW to effectively reduce the high rates of unplanned readmissions and frequent avoidable admissions for Aboriginal people with chronic disease.

8.7 References

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Summary of candidate's contributions towards statistical analyses

Papers one and two

The candidate contributed to the design of the overall study, including the development of the aims and methods, data analysis plan and sample size calculations. The candidate prepared the application for data to the Centre for Health Record Linkage and developed the cohort description and variable lists for data linkage, with advice provided from Dr Christopher Oldmeadow. The candidate prepared the data preparation rules and Tiffany Evans prepared and merged the datasets. The candidate conducted the data analyses.

Paper five

Analysis for this paper was conducted as part of a broader set of analyses conducted for the 48 Hour Follow Up program evaluation by the Health Behaviour Research Collaborative (of which the candidate was a team member) and Clinical Research Design, Information Technology and Statistical Support Unit (CREDITSS). The dataset used for paper five was prepared and merged for the wider 48 Hour Follow Up program evaluation analyses by Dr Christopher Oldmeadow and his colleagues at CREDITSS. The candidate designed the statistical analysis plan for paper five with input from supervisors and conducted preliminary data analyses. However, because of the computing power required to undertake generalized estimating equations with an exchangeable correlation structure, and the robust Hubert-White standard errors needed to account for patient clustering, this part of the analysis was conducted by Dr Oldmeadow. The candidate earned joint first authorship for the paper due to this detailed involvement in the study planning, data analyses, interpretation and for drafting the manuscript.

Co-author statement of the candidates contribution to joint publications

By signing below I confirm that Amanda Jayakody contributed to the design of the study, data analysis and interpretation, and drafting of the manuscript, to the paper/publication entitled, "Frequent avoidable admissions amongst Aboriginal and non-Aboriginal people with chronic disease in New South Wales, Australia: a historical cohort study" BMC Health Services Research 20, 1082 (2020).

Co-authors:

Date:

Signature:

Dr Christopher Oldmeadow

9/12/2020

Prof Mariko Carey

5/8/21

Dr Jamie Bryant

06/08/2021

~~Ms~~
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8/2/2021

Mr Stephen Ella

8th Feb 2021

L/Professor John Attia

9/12/2020

Dr Simon Towle

7 December 2020

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4/08/2021

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Date:

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Co-author statement of the candidates contribution to joint publications

By signing below I confirm that Amanda Jayakody contributed to the design of the study, data analysis and interpretation, and drafting of the manuscript, to the paper/publication entitled, "Unplanned readmission or death after discharge for Aboriginal and non-Aboriginal people with chronic disease in NSW Australia: a retrospective cohort study" *BMC Health Services Research* (2018) 18:893.

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Co-author statement of the candidates contribution to joint publications

By signing below I confirm that Amanda Jayakody contributed to the design of the study, data collection, data analysis and interpretation, and drafting of the manuscript, to the paper/publication entitled, "Exploring experiences and perceptions of Aboriginal people readmitted to hospital with chronic disease in NSW, Australia: a qualitative study"

Australian Health Review. Published online 2 August 2021.

<https://doi.org/10.1071/AH20342>

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Date:

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17 August 2021

Co-author statement of the candidates contribution to joint publications

By signing below I confirm that Amanda Jayakody contributed development of the study idea, searching of the literature, data extraction from included studies, and drafting of the manuscript, to the paper/publication entitled, "Effectiveness of interventions utilising telephone follow up in reducing hospital readmission within 30 days for individuals with chronic disease: a systematic review" *BMC Health Services Research* (2016) 16:403.

Co-authors:	Date:	Signature:
Dr Jamie Bryant	<u>06/08/2021</u>	_____
Prof Mariko Carey	<u>5/8/21</u>	_____
Dr Breanne Hobden	<u>05.08.21</u>	_____
Dr Natalie Dodd	<u>8.12.20</u>	_____
L/Professor Rob Sanson-Fisher	<u>4/08/2021</u>	_____

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Dr Natalie Johnson	Date:	Signature:
	<u>17 August 2021</u>	_____

Co-author statement of the candidates contribution to joint publications

By signing below I confirm that Amanda A. Jayakody contributed an equal contribution as first author alongside Erin Passmore, drafted the manuscript and contributed to the interpretation of findings for the paper entitled "The impact of telephone follow up on adverse events for Aboriginal people with chronic disease in New South Wales, Australia: a retrospective cohort study". International Journal for Equity in Health (2018) 17:60

Co-authors:

Date:

Signature:

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Dr Christopher
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09/08/2021

Dr Jamie Bryant

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Carey

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Eunice Simons

Dr Aaron Cashmore

Dr Louise Maher

Kiel Hennessey

Jacinta Bunfield

Maurice Terare

Dr Andrew Milat

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Dr Natalie Johnson

Signature:

Date: 17/08/21

Paper 2: Co-author statement of the candidates contribution to joint publications

By signing below I, Dr Erin Passmore, confirm that Amanda A. Jayakody contributed an equal contribution as first author alongside myself, drafted the manuscript and contributed to the interpretation of findings for the paper entitled "The impact of telephone follow up on adverse events for Aboriginal people with chronic disease in New South Wales, Australia: a retrospective cohort study".

Co-authors:

Date:

Signature:

Dr Erin Passmore

1/8/2017

Co-authors:

Date:

Signature:

Dr Louise Maher

2/8/17

Jacinta Bunfield

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Eunice Simons	1-09-20	
Kiel Hennessey	1/8/17	

Head of School of Nominee for Higher Degree Research, School of Medicine and Public Health

Dr Natalie Johnson

Signature:

Date: 17/08/21

Additional File 1: Selection of ambulatory care sensitive chronic diseases included in eligibility criteria as a principal diagnosis

Chronic conditions	ICD-10-AM codes
Diabetes complications	E10.0-E10.8, E11.0-E11.8, E12.0- E12.8, E13.0-E13.8, E14.0-E14.8
Hypertension	I10, I11.9
Congestive heart failure	I11.0, I50, J81
Angina	I20, I24.0, I24.8, I24.9
Chronic obstructive pulmonary disease (including Bronchiectasis)	J41-J44, J47, (J20)
Asthma	J45, J46

APPENDIX 3: Supplementary data published for Paper two (and Paper five)

Additional File 1. A list of ICD-10 codes for eligible chronic diseases for principal or additional diagnoses (also 48 Hour Follow Up program eligible chronic diseases used for paper five)

ICD code description	Code	ICD code description	Code
Asthma	J45	Cerebrovascular disorders in dis cl/e	I68
Status asthmaticus	J46	Sequelae of cerebrovascular disease	I69
Rheumatic mitral valve diseases	I05	Emphysema	J43
Rheumatic aortic valve diseases	I06	Other chronic obstructive pulmonary disease	J44
Rheumatic tricuspid valve diseases	I07	Impaired glucose regulation	E09
Multiple valve diseases	I08	Type 1 diabetes mellitus	E10
Other rheumatic heart diseases	I09	Type 2 diabetes mellitus	E11
Angina pectoris	I20	Other specified diabetes mellitus	E13
Acute myocardial infarction	I21	Unspecified diabetes mellitus	E14
Subsequent myocardial infarction	I22	Acute nephritic syndrome	N00
Certain current comp following acute MI	I23	Rapidly progressive nephritic syndrome	N01
Other acute ischaemic heart diseases	I24	Recurrent and persistent haematuria	N02
Chronic ischaemic heart disease	I25	Chronic nephritic syndrome	N03
Acute pericarditis	I30	Nephrotic syndrome	N04

Other diseases of pericardium	I31	Unspecified nephritic syndrome	N05
Pericarditis in dis classified elsewhere	I32	Isolated proteinuria with specified morphological lesion	N06
Acute and subacute endocarditis	I33	Hereditary nephropathy, not elsewhere classified	N07
Nonrheumatic mitral valve disorders	I34	Glomerular disorders in diseases classified elsewhere	N08
Nonrheumatic aortic valve disorders	I35	Acute tubulo-interstitial nephritis	N10
Nonrheumatic tricuspid valve disorders	I36	Chronic tubulo-interstitial nephritis	N11
Pulmonary valve disorders	I37	Tubulo-interstitial nephritis not specified as acute or chronic	N12
Endocarditis valve unspecified	I38		
Endocarditis heart valve disrd dis cl/e	I39	Obstructive and reflux uropathy	N13
Acute myocarditis	I40	Drug- and heavy-metal-induced tubulo-interstitial and tubular conditions	N14
Myocarditis in diseases class elsewhere	I41		
Cardiomyopathy	I42	Other renal tubulo-interstitial diseases	N15
Cardiomyopathy in diseases cl/e	I43	Renal tubulo-interstitial disorders in diseases classified elsewhere	N16
Atrioventricular & L bundle branch block	I44		
Other conduction disorders	I45	Acute renal failure	N17
Cardiac arrest	I46	Chronic renal failure	N18
Paroxysmal tachycardia	I47	Unspecified renal failure	N19
Atrial fibrillation and flutter	I48	Calculus of kidney and ureter	N20

Other cardiac arrhythmias	I49	Calculus of lower urinary tract	N21
Heart failure	I50	Calculus of urinary tract in diseases classified elsewhere	N22
Complications and ill-defined descriptions of heart disease	I51	Unspecified renal colic	N23
Other heart disorders in diseases classified elsewhere	I52	Disorders resulting from impaired renal tubular function	N25
Subarachnoid haemorrhage	I60	Unspecified contracted kidney	N26
Intracerebral haemorrhage	I61	Small kidney of unknown cause	N27
Other and unspecified nontraumatic intracranial haemorrhage	I62	Other disorders of kidney and ureter, not elsewhere classified	N28
Cerebral infarction	I63		
Occlusion and stenosis of precerebral arteries, not resulting in cerebral infarction	I65	Other disorders of kidney and ureter in diseases classified elsewhere	N29
Occlusion and stenosis of cerebral arteries, not resulting in cerebral infarction.	I66		
Other cerebrovascular diseases	I67		



Health
Central Coast
Local Health District



Participant Information statement:

Exploring experiences and perceptions of unplanned hospital readmissions of Aboriginal people currently readmitted to hospital

You are invited to participate in the research project named above which is being conducted by the Health Behaviour Research Collaborative at the University of Newcastle, Yerin Aboriginal Health Services and Nunyara Aboriginal Health Unit. The research is part of Ms Amanda Jayakody's studies at the University of Newcastle, supervised by Laureate Professor Rob Sanson-Fisher, Associate Professor Mariko Carey and Dr Jamie Bryant from the University of Newcastle.

Why is the research being done?

Aboriginal people are more likely to be diagnosed with a chronic disease, such as breathing problems or heart disease, than non-Aboriginal people. Chronic diseases put people more at risk of having an unplanned readmission or a return to hospital that was not planned. This happens when you have had to return to hospital because of complications or the same health problem as your last time you were in hospital. The purpose of the research is to find out about Aboriginal patient's experiences of these unplanned returns to hospital, the factors that may have led to the return, and what could be done to stop any future returns. This research will help researchers and health program developers better understand the reasons for unplanned returns to hospital.

Who can take part in the research?

Patients who:

- ✓ are Aboriginal and Torres Strait Islander people
- ✓ are aged 18 years and over
- ✓ have a chronic disease
- ✓ are back in hospital for the same reason you were in hospital last time (within three months of the last stay in hospital).
- ✓ can speak English
- ✓ are mentally and physically able to participate
- ✓ are not pregnant

What would you be asked to do?

If you decide to take part, you will be invited to participate in an interview. The interview will involve you being asked about your current readmission or return to hospital and your thoughts on what led you to return. The interview will be audio-taped.

What choice do you have?

It is up to you to decide whether you want to take part. Only people who agree will be interviewed. If you decide not to take part, it will not affect your treatment now or in the future. If you want to withdraw from the study once it has started, you can do so at any time without having to give a reason. You can request to have the Nunyara Aboriginal Hospital Liaison Officer or a relative/friend present during the interview. You will be offered an opportunity to review and approve the transcript of the interview.

How much time will it take?

The interview will take about 30 minutes. You can stop the interview whenever you want without providing a reason. You can also do the interview now or schedule a time to do it later.

Are there any risks or benefits to me in taking part in this study?

We cannot promise any benefits for you from taking part in this research. We do not expect that there will be any risks in taking part in this study. If taking part in the interview makes you upset or you have questions or worries about your health, please talk to your nurse or doctor. The Nunyara Aboriginal Hospital Liaison Officer health worker can tell you about support services which you might want to use.

What will you do with the information you collect?

We plan to present the results of this research in journals and to share the information with Aboriginal communities. Information will be reported so that you cannot be identified. The information will also be used by Ms Amanda Jayakody as part of her PhD thesis.

How will your privacy be protected?

We will ensure your privacy is protected. Anything you say during the interview will remain confidential and while some quotes from the interview may be used to illustrate your views, your name will not be used in any reports arising from the research. If you wish to delete your comments from the audiotape please let the interviewer know at the end. All information will be kept in locked cabinets or on a secure computer network. Cabinets and computers can only be accessed by the research team and those involved in your care. At the end of the study, all documents and results will be stored securely at the University of Newcastle.

What do you need to do to participate?

Please read this Information Statement and make sure you understand it before you agree to participate. If you wish to participate, please complete the consent form.

For more information

If you have any questions about the study, please contact L/Prof Rob Sanson-Fisher or Ms Amanda Jayakody on 1800 084 755 or by email on Rob.Sanson-Fisher@newcastle.edu.au or amanda.jayakody@uon.edu.au.

Thank you for considering this invitation.

L/Prof Rob Sanson-Fisher
Laureate Professor of Health Behaviour
University of Newcastle

Ms Amanda Jayakody
University of Newcastle

The Research Team

University of Newcastle: Laureate Professor Robert Sanson-Fisher, A/Professor Mariko Carey, Dr Jamie Bryant, and Ms Amanda Jayakody. *Yerin Aboriginal Health Services:* Mr Paul Hussein and Dr Elly Warren. *Nunyarra Aboriginal Health Unit:* Ms Shanell Bacon.

Complaints about this research

This project has been approved by the Hunter New England Human Research Ethics Committee, Approval No. [17/18/10/4.06] and from the Aboriginal Health and Medical Research Council Human Ethics Committee, Approval No. [1325/17].

Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to the researcher, or, if an independent person is preferred, to Dr Nicole Gerrand, Manager, Research Ethics and Governance Office, Locked bag 1, New Lambton, NSW, 2305, Tel 02 4921 4950, email: nicole.gerrand@hnehealth.nsw.gov.au.

This study has been authorised by the Central Coast Local Health District (CCLHD) for conduct at Gosford and Wyong Hospitals. Any person with concerns or complaints about this study may also contact the CCLHD Research Manager on 02 4320 2085 (or email: CCLHD-Research@health.nsw.gov.au) and quote the local reference number: 0218-011C

Participant interview schedule:

Exploring experiences and perceptions of unplanned hospital readmissions of Aboriginal people currently readmitted to hospital Introduction

"Hi, my name is <name> and I'm a student at the University of Newcastle. You were invited to take part in this study which is exploring patient's experiences of unplanned hospital readmissions. An unplanned readmission is when you have had to return to hospital because of a complication arising from a previous admission and where it was not pre-arranged. For example you may have been admitted into hospital via the emergency department.

Before I begin I would like to ask your permission to record the interview. [If yes, proceed. If no, do not record]. Anything you say during this discussion will remain confidential and while some quotes from today's discussion may be used to illustrate your views, your name will not be used in any reports arising from the research. [If agreed to audio-tape] If you wish to delete your comments from the audiotape please let me know at the end. If you no longer wish to participate at any stage just let me know.

Do you have any questions before we begin? [If yes, answer questions. If no, continue].

Interview questions

The information you give us will not be given to any of your doctors, nurses or anyone at the hospital. We value your honesty in answering these questions.

A. Reasons for first/index admission

1. I wanted to first chat about the last time you stayed in hospital and what some of the reasons were for you having to stay in hospital? **Prompts:**
 - a. What health problems were you having, that meant you had to go to hospital?
 - b. Were there any problems with the meds s you were taking that may have meant you had to go to hospital?
 - c. Were there any other reasons that might have lead you to go to hospital?

B. Post discharge follow up for first/index admission

2. Thinking back to that last hospital stay, were you prescribed any medications for you to take when you got home?

Prompts:

- a. How many?
- b. Were any of your medications changed during your hospital stay?
- c. Were you able to fill all your scripts? If not, why? Was the cost an issue for you?
- d. Do you know about CTG scripts?
- e. Were you able to take all your meds on time? If not, why?
- f. How much do you feel you understood what the meds were for? Did the hospital staff explain them to you?

3. Thinking back to that last hospital stay, can you tell me about any appointments with doctors or specialists that you had after you left hospital?

Prompts:

- a. Who were the appointments with?
- b. Who scheduled the appointments?
- c. How long after you went home were the appointments scheduled?
- d. Were you able to go to all the appointments? If not, can you tell me some of the reasons why?

4. When you returned home from your last hospital stay, did you receive a telephone call about 48 hours after you were discharged to check how you were?

Prompts if yes:

- a. Who called you and when?
- b. What were the kind of things that you talked about?
- c. How did you feel about the telephone call?

5. Since returning home, were you visited by a community nurse or other health worker at home?

Prompts if yes:

- a. Who visited you and how many times?
- b. What were the kind of things that they talked about or checked?
- c. How did you feel about the home visit?

C. Support surrounding patient's health

6. Thinking now about the day-to-day support you receive from your family, friends or a carer, how supported do you feel in managing your health problems?

Prompts:

- a. Do you have someone (family member, friend, carer) who helps you with managing your health?
- b. [If yes] what kind of support do you receive e.g. reminding you to take medication, filling your scripts, driving you to the doctors.
- c. Do you feel supported by your community? If yes, in what ways?

7. Do you have a doctor or GP that you see regularly?

Prompts:

- a. [If no] do you see different doctors at the same practice? And how supported do you feel by these doctors in managing your health problems, and in what ways?
- b. [If yes] how supported do you feel by your doctor regarding your health problems?
- c. Has your doctor organised a care plan to manage your health?
- d. What other ways do you feel supported by your doctor?

D. Reasons that led you to an unplanned hospital readmission

8. I wanted us to chat about some of the reasons about why you are in hospital now. Can you tell me a bit about why you've had to return to hospital?

Prompts:

- a. What **health problems** were you having, that lead you to go to hospital?
 - b. What **medication problems** were you having, that lead you to go to hospital?
 - c. Were there any other reasons or problems that may have lead you to return?
9. Can you describe how you knew you needed to go to hospital?
10. Can you describe how other **family members, friends, neighbours or carers** were involved in deciding that you needed to go to hospital?

E. Patients perceptions on how to avoid another unplanned readmission

11. How do you think your current readmission to hospital could have been prevented?

Prompts:

- a. What kind of things could the hospital do to prevent you having an unplanned readmission again?
- b. What kind of things could your usual doctor/GP do to avoid you having a readmission again?
- c. What could your family help with so that you prevent a readmission?
- d. And lastly, do you think there are there are things you could do to prevent a readmission again?

Thank You

That's all the questions. Thank you very much for taking the time to speak with me today. We really appreciate your participation. Do you have any questions for me about the research study? [If yes, answer questions. If no, continue].

Thanks again. [end of interview]

Additional File 1. Medline, Embase and Cochrane database search strategies.**1. Database: OVID MEDLINE 1946 to May 2015**

Search	Query
#1	(re-admission* or re-admit* or readmission* or readmit* or post discharge* or postdischarge* or re-hospitali* or rehospitali* or multiple admi* or multiple stay*).tw.
#2	Patient Readmission/ OR Patient Discharge/ OR Hospitalization/
#3	1 OR 2
#5	exp Telephone/
#6	telephone follow up.mp.
#7	(telecommunication* or tele?communication* or electronic communication or telephon* or phone or phone call* or follow?up call* or follow up* or call?back or calls or calling or call or tele?health or tele?medicine or tele?nursing or tele* or home monitoring or home care services).tw.
#8	5 OR 6 OR 7
#9	Diabetes Mellitus, Type 2/ or Diabetes Mellitus/ or Diabetes Mellitus, Type 1/
#10	exp Respiratory Tract Diseases/
#11	Cardiovascular Diseases/
#12	exp Heart Diseases/
#13	exp Vascular Diseases/
#14	congestive heart failure.tw.
#15	9 or 10 or 11 or 12 or 13 or 14
#16	3 AND 8 AND 15
#17	limit 16 to (english language and humans)
#18	limit 19 to "all child (0 to 18 years)"
#19	17 not 18
#20	limit 19 to (case reports or comment or congresses or editorial or letter or news or newspaper article)
#21	19 not 20

2. Database: OVID Embase Classic + Embase 1947 to May 2015

Search	Query
#1	(re-admission* or re-admit* or readmission* or readmit* or post discharge* or postdischarge* or re-hospitali* or rehospitali* or multiple admi* or multiple stay*).tw.
#2	Hospital readmission/ OR hospital discharge/ OR hospitalization/
#3	1 OR 2
#4	telephone/ or telephone follow up.mp
#5	(telecommunication* or tele?communication* or electronic communication or telephon* or phone or phone call* or follow?up call* or call?back or calls or calling or call or tele?health or tele?medicine or tele?nursing or tele* or home monitoring or home based services).tw.
#6	4 OR 5
#7	diabetes mellitus/
#8	insulin dependent diabetes mellitus/
#9	non insulin dependent diabetes mellitus/
#10	cardiovascular disease/
#11	exp heart disease/
#12	exp vascular disease/
#13	exp respiratory tract disease/
#14	congestive heart failure.tw.
#15	7 or 8 or 9 or 10 or 11 or 12 or 13 or 14
#16	3 and 6 and 15
#17	limit 16 to (human and english language)
#18	limit 17 to (conference abstract or editorial or letter)
#19	17 not 18

3. Database: The Cochrane Library - from inception to May 2015

Search	Query
#1	MeSH descriptor: [Patient Discharge] explode all trees
#2	MeSH descriptor: [Patient Readmission] explode all trees
#3	MeSH descriptor: [Hospitalization] explode all trees
#4	#1 or #2 or #3
#5	(re-admission* or re-admit* or readmission* or readmit* or post discharge* or postdischarge* or re-hospitali* or rehospitali* or multiple admi* or multiple stay*) .tw.
#6	4 or 5
#7	MeSH descriptor: [Telephone] explode all trees
#8	telephone follow up.mp.
#9	(telecommunication* or tele?communication* or electronic communication or telephon* or phone or phone call* or follow?up call* or call?back or calls or calling or call or tele?health or tele?medicine or tele?nursing or home monitoring or home based services) .mp.
#10	#7 or #8 or #9
#11	MeSH descriptor: [Diabetes Mellitus] explode all trees
#12	MeSH descriptor: [Diabetes Mellitus, Type 1] explode all trees
#13	MeSH descriptor: [Diabetes Mellitus, Type 2] explode all trees
#14	MeSH descriptor: [Cardiovascular Diseases] explode all trees
#15	MeSH descriptor: [Heart Diseases] explode all trees
#16	MeSH descriptor: [Vascular Diseases] explode all trees
#17	MeSH descriptor: [Respiratory Tract Diseases] explode all trees
#18	congestive heart failure.tw.
#19	11 or 12 or 13 or 14 or 15 or 16 or 17 or 18
#20	6 and 10 and 19

Additional File 2. Study characteristics of included studies (Paper four)

Reference	Sample	Intervention	Control	Outcome measures and follow up	Readmission findings within 30 days
Anderson et al., 2005²⁴ USA NRCT	<i>N</i> =121 Mean age: I:81; C:77 % Male: I:39; C:38 Diagnosis: CHF Setting: Bridgeport Hospital, Connecticut. Inclusion: CHF, symptoms consistent with CHF, and radiographic evidence of CHF. Exclusion: refusal to participate, myocardial infarction within prior 12 weeks, unstable angina, confusion, planned discharge to extended care facility, > 5 significant comorbidities, renal failure requiring dialysis, impending cardiac surgery, or continued NYHA class IV CHF despite maximal medical treatment.	<i>N</i> =44. "Clinical pathway program" incl. one-on-one individualised inpatient education by cardiac nurse educator, physical therapy evaluation, a dietary consult, d/c planning with coordinated home care and TFU. • Number of calls: 1 • Conducted: within 2 weeks of d/c. • Mean length of call: 15 mins. • Person who made call: nurse case manager • Content: ten questions designed to assess symptom control, medication compliance, dietary adherence, and activity capacity.	<i>N</i> =77. Education from regular nursing staff; dietary and physical therapy consults at discretion of attending physician; TFU not routinely performed; home health care carried out but not by trained nurses.	Outcome measures: • CHF readmission rate Follow-up: 30 days and 6 months.	• Readmission was reduced in the intervention group at 30 days (I=6.0% vs. C=22.1%; p=0.01)
Dai et al., 2003³² Taiwan CBA	<i>N</i> =283. Mean age (yrs): Craniotomy: 52.28; Stroke:64.96. % Male: Craniotomy: 59; Stroke: 59. Diagnosis: Stroke, Craniotomy. Setting: Teaching hospital, Taiwan. Inclusion: Stroke pts with: physical disability; could follow directions; had potential for functional improvement. Craniotomy pts with: physical disability; cognitive impairment; pressure sore, endotracheal/ tracheostomy or nasogastric tube; chronic disease or complication. Exclusion: NR.	<i>N</i> =56 (craniotomy); <i>N</i> = 99 (stroke). Comprehensive pre d/c planning including early needs assessment; instruction; care co-ordination; referral for continuing care; procurement of medical devices or social resources. • Number of calls: 2/pt. • Conducted: 1 week and at 1 month post d/c. • Mean length of call: NR. • Person who made call: Nurse. • Content: Obtain data on readmission. Responded to questions regarding health matters, self-care and other instruction as needed.	<i>N</i> =56 (craniotomy); <i>N</i> =72 (stroke). General routine care (no pre-d/c planning). • Number of calls: 2/pt • Conducted: 1 week and 1 month post d/c. • Mean length of call: NR • Person who made call: Nurse. • Content: Obtain data on readmission. Instruction given only when pt or caregiver initiated questions.	Outcome Measures: • Rate of all-cause unplanned readmission. Follow-up: 1 month.	• Unplanned readmission was significantly reduced in the craniotomy I group compared to the C Group (3% vs 10%; p=0.04). • No significant difference in readmission was found between the 2 stroke groups (3% vs 1%; p=0.31)
Jaarsma et al., 1999²⁷ Netherlands NRCT	<i>N</i> =179. Mean age (yrs): I:73±9 ; C:73±9. % Male: 58. Diagnosis: HF. Setting: cardiology ward of the University Hospital in Maastricht. Inclusion: (NYHA) functional class III and IV; a diagnosis of heart failure at least 3 months before admission, aged at least 50yrs and literate in Dutch. Exclusion: co-existing, severe, chronic debilitating disease; resided in; or planned to be discharged to a nursing home; psychiatric diagnosis; had CABG; PTCA or valve replacement in the last 6 months or were expected to have such a treatment within 3 months; refused to give informed consent.	<i>N</i> =84. Pre d/c intensive, systematic and planned education by a study nurse about consequences of HF. Home visit post d/c to continue education. • Number of calls: 1. • Conducted: 1 week post d/c. • Mean length of call: NR. • Person who made call: Nurse. • Content: assess potential problems and to make an appointment for a home visit.	<i>N</i> =95. Usual care. May have involved written or oral advice dependent on nurse or physician.	Outcome measures: • All-cause and cardiac readmission rates and days Follow up: 1, 3 and 9 months	• No significant differences noted for 1 month follow-up for either all-cause or cardiac readmissions rates and days.
McDonald et al., 2001²⁸ Ireland	<i>N</i> =70 Mean age (yrs):I: 69.9±11.3; C: 67.9±12.0 % Male: I:71; C:63	<i>N</i> =35. Inpatient specialist nurse-led education and dietetic consults. Education programme on weight monitoring, disease and medication understanding	<i>N</i> =35. Routine care. Normal primary physician follow-up.	Outcome measures: • CHF unplanned readmission rate.	• 20% 30-day readmission rate prior to

Reference	Sample	Intervention	Control	Outcome measures and follow up	Readmission findings within 30 days
NRCT	<p><u>Diagnosis:</u> CHF</p> <p><u>Setting:</u> St. Vincent's University Hospital, Ireland.</p> <p><u>Inclusion:</u> CHF if all 4 criteria present: history and examination compatible with CHF, chest X-ray appearance of congestion, echocardiography evidenced left ventricular dysfunction and response to initial therapy</p> <p><u>Exclusion:</u> Pts presenting myocardial infarction or unstable angina, or where failure was not primary problem and illnesses that could compromise survival over duration of study or cognitive impairment.</p>	<p>and salt restriction. Advice given to the pt's carer or next of kin. Pt discharged with physician referral letter. Attended clinic to check clinical status.</p> <ul style="list-style-type: none"> Number of calls: NR Conducted: at 3 days and then weekly until 12 weeks. Mean length of calls: NR Person who made call: NR Content: NR 	Physician told to inform study centre of any admissions.	<p><u>Follow up:</u> 30 & 90 days</p>	enrolment reduced to 0% following index admission in both I and C groups.
<p>Naylor et al., 1994³¹</p> <p>USA</p> <p>NRCT</p>	<p><u>N</u>=276</p> <p><u>Mean age (yrs):</u> Medical: I: 76 ± 5.2; C: 76 ± 4.9. Surgical: I: 75 ± 4.4; C: 75 ± 4.3.</p> <p><u>% Male:</u> Medical: I: 57; C: 41. Surgical: I: 82; C: 61.</p> <p><u>Diagnosis:</u> Medical: CHF and angina/MI. Surgical: coronary artery bypass graft and cardiac valve replacement.</p> <p><u>Setting:</u> Hospital of the University of Pennsylvania</p> <p><u>Inclusion:</u> ≥70 yrs; speak English. be alert and oriented and be able to be reached by telephone after discharge.</p> <p><u>Exclusion:</u> NR</p>	<p><u>N</u>=72 (medical); <u>N</u>=68 (surgical). Pts received routine plan and comprehensive, individualized discharge planning by gerontologic clinical nurse specialists: initial and ongoing assessment of pt needs; development of discharge plan with pts, physician, carer and health care team; education, coordination of discharge plan; interdisciplinary communication; evaluation; telephone hotline.</p> <ul style="list-style-type: none"> Number of calls: min. 2 Conducted: during 2 weeks post-discharge Mean length of call: NR Person who made call: nurse specialist Content: to monitor patients progress and intervene when necessary. 	<p><u>N</u>=70 (medical); <u>N</u>=66 (surgical). Pts received hospital's routine discharge plan. Uncomplicated discharges managed by the pts physician and primary nurse. Discharges which needed coordination of services and external providers, involved social workers and community nursing coordinators.</p>	<p><u>Outcome measures:</u></p> <ul style="list-style-type: none"> heart disease readmission rates <p><u>Follow up:</u> 2, 6 and 12 weeks</p>	<ul style="list-style-type: none"> <u>Medical:</u> within 2 weeks of discharge: I: 3 (4%); C: 11 (16%); P<0.02; Difference = -12% (-22%--2%) <u>Surgical:</u> within 2 weeks of discharge: I: 5 (7%); C: 7 (11%); NS; difference: -4% (-14%-6%)
<p>Record et al. et al., 2011²⁹</p> <p>USA</p> <p>NRCT</p>	<p><u>N</u>=375.</p> <p><u>Mean age (yrs):</u> C: 71.5</p> <p><u>% Male:</u> C: 42.</p> <p><u>Diagnosis:</u> CHF</p> <p><u>Setting:</u> Johns Hopkins Bayview Medical Center.</p> <p><u>Inclusion:</u> NR</p> <p><u>Exclusion:</u> NR</p>	<p><u>N</u>=52. Pt centered, transition-focused care curriculum for internal medicine residents. 1) medication adherence assessment; 2) telephone call(s) to outpatient provider(s). Visited selected pts at home or in nursing facility.</p> <ul style="list-style-type: none"> Number of calls: 1 Conducted: post-discharge Mean length of call: NR Person who made call: Intervention resident Content: to assess pt's experience of the care transition and his or her understanding of the hospital stay and plans for follow-up. 	<u>N</u> = 323. Standard teaching team.	<p><u>Outcome measures:</u></p> <ul style="list-style-type: none"> Survival analysis without HF readmission <p><u>Follow-up:</u> 30 days</p>	<ul style="list-style-type: none"> Probability of survival 30 days without readmission for HF was higher for the intervention team (P=.046).
<p>Riegel et al., 2006²⁶</p> <p>USA</p> <p>NRCT</p>	<p><u>N</u>=134</p> <p><u>Mean age (yrs):</u> I: 72.7±11.2; C: 71.6±10.8.</p> <p><u>% Male:</u> 46.3.</p> <p><u>Diagnosis:</u> HF.</p> <p><u>Setting:</u> Community hospitals close to the US-Mexico border.</p>	<p><u>N</u>=69. Printed HF education materials in desired language mailed to pts monthly and as needed. Pts report given to physician at regular intervals. Telephone call conducted 5 days after discharge and as required thereafter.</p> <ul style="list-style-type: none"> Number of calls: M=13.5 (SD 5.9; Med 13; IR 11-16) 	<p><u>N</u>=65. UC. Pts were educated regarding HF management before hospital discharge, assuming that someone bilingual was available to translate.</p>	<p><u>Outcome measures:</u></p> <ul style="list-style-type: none"> HF readmission rates All cause readmission. <p><u>Follow up:</u> 1, 3 and 6 months.</p>	<ul style="list-style-type: none"> No significant difference between I and C in HF readmission rates at 1 mth (8.7% vs 13.8%; p=0.42).

Reference	Sample	Intervention	Control	Outcome measures and follow up	Readmission findings within 30 days
	<p><u>Inclusion:</u> Self-identified as Hispanic; diagnosis of HF; living in the community; planning to return to the community after hospital d/c.</p> <p><u>Exclusion:</u> History of cognitive impairment; renal insufficiency requiring dialysis; acute MI \leq 30 days without history of CHF; serious or terminal condition; major and uncorrected hearing loss; no access to phone or informed consent.</p>	<ul style="list-style-type: none"> Conducted: Within 5 days after discharge and a matter of judgement thereafter. Mean length of call: NR. Person who made call: Nurse case managers. Content: Nurses guided by "At home with HF" software program, which covered medication adherence, diet, signs and symptoms of worsening illness. Nurse also provided support. 			<ul style="list-style-type: none"> No significant difference between I and C in all cause readmission rates at 1 mth (15.9% vs 20.0%; $p=0.65$).
Sales <i>et al.</i> , 2014 ³⁰ USA NRCT	<p>$N=137$</p> <p><u>Mean age</u> (yrs): I: 72.5 6 14.8; C: 72.6 6 13.4</p> <p><u>% Male</u>: I: 37.1; C: 47.8</p> <p><u>Diagnosis</u>: CHF</p> <p><u>Setting</u>: New York Methodist Hospital</p> <p><u>Inclusion</u>: Cardiologist confirmed CHF as primary diagnosis.</p> <p><u>Exclusion</u>: Dementia or other severe psychiatric illness, and pts transferred to another hospital before d/c.</p>	<p>$N=70$. Trained volunteers gave education to pt before d/c. CHF education, medications review, review of non-pharmacological D/C instructions; and encourage importance of follow-up.</p> <ul style="list-style-type: none"> Number of calls: 4 Conducted: within 24 to 48 hours of d/c.; weekly for 1 month. Mean length of call: 15 mins. Person who made call: trained volunteer Content: How are you doing?; Are you taking your medications as prescribed?; When is your follow-up appointment?; Are you weighing yourself daily?; Are you following a low-salt diet?; Are you exercising? Provided education & coaching. 	<p>$N=67$. Standard care. Standardized d/c instruction sheet; nurse-led review of medications and pt education. Pt provided with schedule appointments with their primary care physician.</p>	<p><u>Outcome measures</u>:</p> <ul style="list-style-type: none"> CHF Readmission <p><u>Follow up</u>: 30 days</p>	<ul style="list-style-type: none"> I: Decreased 30-day readmissions (7% vs 19%; $P < .05$) with relative risk reduction of 63% and absolute risk reduction of 12%.
Sorknaes <i>et al.</i> , 2011 ²⁵ Denmark NRCT	<p>$N=100$.</p> <p><u>Mean age</u> (yrs): I: 74.5; C: 74.5.</p> <p><u>% Male</u>: 43.</p> <p><u>Diagnosis</u>: COPD.</p> <p><u>Setting</u>: Odense University Hospital, Svendborg.</p> <p><u>Inclusion</u>: COPD; exacerbation of COPD; > 40 yrs; >10 pack yrs; able to use a phone.</p> <p><u>Exclusion</u>: Communication problems; participation in other studies; systolic blood pressure < 100 mmHg; pH<7.35 or pO₂ < 7.3 or saturation < 90 %; x-ray with lobar pneumonia or tumour or no X-ray taken; other serious diseases; cancer or severe HF; refused to participate; nurse strike, holiday, not possible to get a suitcase; death before discharge.</p>	<p>$N=50$. Post d/c telemedicine video consultations (TVC) with a nurse over one week period. Nurse made clinical observations, measured oxygen saturation levels and lung function; informed the pts how to prevent exacerbations and how to use the medication. TVC's could be used 8am-3 pm every day and the pt could call telemedicine department in the same period of time using hotline for 28 day intervention period.</p> <ul style="list-style-type: none"> Number of calls: At least 1. Conducted: Within four week period. Mean length of call: NR. Person who made call: Nurse. Content: NR. 	<p>$N=50$. NR.</p>	<p><u>Outcome measures</u>:</p> <ul style="list-style-type: none"> Readmission rates for COPD. All-cause readmission rates. Cumulative days of readmission. <p><u>Follow up</u>: 28 days.</p>	<ul style="list-style-type: none"> No significant difference between I and C for number of pts readmitted for COPD (12% vs 22%) (-10% [-25;5]), or number of pts readmitted for all causes (16% vs 30%) (-14% [-30;2]) or cumulative days of readmission (2.0 vs 5.3 days) (-2 [-6;1]).
Sorknaes <i>et al.</i> , 2013 ²³ Denmark RCT	<p>$N=266$</p> <p><u>Mean age</u> (yrs): I: 71 (10); C: 72 (9)</p> <p><u>% Male</u>: I: 40; C: 38</p> <p><u>Diagnosis</u>: AECOPD</p> <p><u>Setting</u>: 2 hospitals, Denmark.</p> <p><u>Inclusion</u>: COPD verified by spirometry (FEV1/FVC < 70%), admitted with AECOPD (defined by increased need for</p>	<p>$N=132$. In addition to UC, pts received daily teleconsultations by video. Conducted for 5 to 9 days starting within 24 hours of d/c. Pt made measurements and reported to nurse. Advice given: regular treatment, prevention of exacerbation, how to live with the disease and to empower pt.</p> <ul style="list-style-type: none"> Number of calls: At least 1. 	<p>$N=134$. UC according to GOLD guidelines. Outpatient clinic consultation with a nurse 4 and 12 weeks. Nurse and pt made a plan for future course of action.</p>	<p><u>Outcome measures</u>:</p> <ul style="list-style-type: none"> Total hospital readmissions (COPD-related and non-COPD-related) time before first readmission 	<ul style="list-style-type: none"> No significant mean difference in total readmission between I and C (-0.08 [95% CI -0.25, 0.09] P-value=0.35).

Reference	Sample	Intervention	Control	Outcome measures and follow up	Readmission findings within 30 days
	<p>medicine and increased dyspnoea, increased expectorate volume or increased coughing), ≥ 40 years, and if residents of Funen.</p> <p><u>Exclusion:</u> able to use telephone and/or computer screen, in another scientific studies, BP < 100 mmHg, saturation < 90%, chest X-ray showing signs of malignancy or lobar pneumonia, diagnosed cancer or recurrence of cancer within last 5 yrs, septic shock, AMI or other serious medical conditions, CHF with ejection fraction < 30%.</p>	<ul style="list-style-type: none"> Conducted: In the week after teleconsultation. Mean length of call: NR. Person who made call: Nurse. Content: NR. 		<ul style="list-style-type: none"> hospital readmissions per patient <p>Follow up: 4, 8, 12 and 26 weeks</p>	<ul style="list-style-type: none"> No significant mean difference in AECOPD readmission between I and C (-0.09 [95% CI - 0.25, 0.07] P-value= 0.28). No significant difference in time before first readmission and hospital readmissions per patient.

Additional file 1. Please see Appendix 3

Additional file 2. Sensitivity analysis results

Table 1. Factors associated with being followed up either within or outside 48 hours

		LHD eligible data (N = 10302)				HIE eligible data (N = 47908)			
		N (%)		GEE model		N (%)		GEE model	
Variable	Category	Not followed up (n=3384)	Followed up within 48 hours (n=5181)	OR (95% CI)	P-val	Not followed up (n=40487)	Followed up within or outside 48 (n=7421)	OR (95% CI)	P-val
Model of care	Mixed LHD (FW)		2 (100%)		<.0001	559 (93%)	44 (7.3%)	0.31 (0.21,0.44)	<.0001
	Other	120 (65%)	64 (35%)	0.25 (0.17,0.38)		2 (67%)	1 (33%)		
	Centralised (SES HNE IS NBM SWS)	1853 (35%)	3388 (65%)	ref		16324 (81%)	3930 (19%)	ref	
	Integrated (MNC WS NSYD)	795 (60%)	527 (40%)	0.46 (0.40,0.54)		6392 (87%)	972 (13%)	0.55 (0.50,0.61)	
	Localised (SYD NNSW SNSW CC WNSW MUR)	616 (34%)	1200 (66%)	1.01 (0.89,1.15)		17210 (87%)	2474 (13%)	0.59 (0.55,0.63)	
Year	2009	98 (51%)	93 (49%)	ref	<.0001	6674 (99%)	93 (1.4%)	ref	<.0001
	2010	433 (52%)	402 (48%)	0.65 (0.43,0.97)		6163 (91%)	575 (8.5%)	5.96 (4.80,7.41)	
	2011	604 (41%)	863 (59%)	1.05 (0.71,1.56)		6215 (82%)	1373 (18%)	13.15 (10.61,16.30)	
	2012	747 (38%)	1233 (62%)	1.22 (0.82,1.81)		7652 (80%)	1897 (20%)	16.36 (13.23,20.24)	

		LHD eligible data (N = 10302)				HIE eligible data (N = 47908)			
		N (%)		GEE model		N (%)		GEE model	
Variable	Category	Not followed up (n=3384)	Followed up within 48 hours (n=5181)	OR (95% CI)	P-val	Not followed up (n=40487)	Followed up within or outside 48 (n=7421)	OR (95% CI)	P-val
	2013	1279 (39%)	1973 (61%)	1.15 (0.78,1.70)		9082 (77%)	2685 (23%)	20.53 (16.61,25.37)	
	2014	223 (27%)	617 (73%)	1.99 (1.32,3.01)		4701 (85%)	798 (15%)	13.22 (10.57,16.52)	
Gender	Male	1527 (39%)	2407 (61%)	ref	0.6947	18468 (85%)	3384 (15%)	ref	0.9040
	Female	1857 (40%)	2774 (60%)	0.98 (0.89,1.08)		22019 (85%)	4037 (15%)	1.00 (0.94,1.07)	
Marital status	Married/defacto	1230 (38%)	2039 (62%)	ref	0.0733	15448 (84%)	2874 (16%)	ref	0.1269
	Single	1421 (43%)	1854 (57%)	0.85 (0.75,0.95)		13710 (84%)	2619 (16%)	1.01 (0.93,1.09)	
	Widowed	310 (35%)	584 (65%)	0.95 (0.78,1.14)		5185 (86%)	877 (14%)	1.04 (0.92,1.17)	
	Divorced/separated	397 (37%)	673 (63%)	1.00 (0.85,1.18)		5672 (85%)	1014 (15%)	1.03 (0.93,1.14)	
	Not known	26 (46%)	31 (54%)	0.79 (0.44,1.45)		441 (92%)	37 (7.7%)	0.63 (0.44,0.90)	
IRSD quintile	1st quintile -least disadvantaged	404 (33%)	818 (67%)	ref	<.0001	7098 (87%)	1087 (13%)	ref	<.0001

		LHD eligible data (N = 10302)				HIE eligible data (N = 47908)			
		N (%)		GEE model		N (%)		GEE model	
Variable	Category	Not followed up (n=3384)	Followed up within 48 hours (n=5181)	OR (95% CI)	P-val	Not followed up (n=40487)	Followed up within or outside 48 (n=7421)	OR (95% CI)	P-val
	2nd quintile	549 (30%)	1279 (70%)	1.14 (0.96,1.34)		7631 (82%)	1642 (18%)	1.44 (1.30,1.60)	
	3rd quintile	1184 (50%)	1199 (50%)	0.67 (0.57,0.78)		9039 (83%)	1809 (17%)	1.37 (1.24,1.52)	
	4th quintile	561 (38%)	905 (62%)	0.83 (0.70,0.99)		8016 (86%)	1357 (14%)	1.09 (0.98,1.21)	
	5th quintile - most disadvantaged	642 (41%)	932 (59%)	0.92 (0.77,1.10)		8671 (85%)	1484 (15%)	1.38 (1.24,1.54)	
Participation in the CDMP	Did not participate	3293 (40%)	4959 (60%)	ref	0.5342	39445 (85%)	7125 (15%)	ref	0.1445
	Participated	91 (29%)	222 (71%)	1.10 (0.81,1.51)		1042 (78%)	296 (22%)	1.16 (0.95,1.40)	
Participation in the Healthways component	Did not participate	3380 (40%)	5170 (60%)	ref	0.7886	40465 (85%)	7408 (15%)	ref	0.1270
	Participated	4 (27%)	11 (73%)	1.11 (0.51,2.45)		22 (63%)	13 (37%)	1.91 (0.83,4.41)	
Length of stay	1 day or less	1511 (43%)	1996 (57%)	ref	<.0001	15652 (85%)	2729 (15%)	ref	<.0001
	More than 1 day	1873 (37%)	3185 (63%)	1.26 (1.14,1.39)		24835 (84%)	4692 (16%)	1.28 (1.21,1.35)	

		LHD eligible data (N = 10302)				HIE eligible data (N = 47908)			
		N (%)		GEE model		N (%)		GEE model	
Variable	Category	Not followed up (n=3384)	Followed up within 48 hours (n=5181)	OR (95% CI)	P-val	Not followed up (n=40487)	Followed up within or outside 48 (n=7421)	OR (95% CI)	P-val
No of previous admissions	None	2273 (40%)	3370 (60%)	ref	0.1548	14739 (84%)	2872 (16%)	ref	0.3259
	1 or more	1111 (38%)	1811 (62%)	1.08 (0.97,1.20)		25748 (85%)	4549 (15%)	0.97 (0.92,1.03)	
No of additional diagnoses	Less than 2	1091 (39%)	1702 (61%)	ref	0.0186	10353 (81%)	2478 (19%)	ref	<.0001
	2 or more	2293 (40%)	3479 (60%)	0.88 (0.79,0.98)		30134 (86%)	4943 (14%)	0.80 (0.75,0.86)	
Age	mean (SD)	50 (17)	52 (18)	1.01 (1.00,1.01)	0.0004	55 (16)	53 (18)	1.00 (1.00,1.00)	0.9970
Charlson Index	mean (SD)	1 (1)	1 (1)	0.98 (0.94,1.01)	0.2034	2 (1)	1 (2)	0.72 (0.70,0.75)	<.0001

Table 2: Summary of the number of admissions that resulted in an adverse event by whether or not they received Follow Up

Variable	Variable	Not followed up	Followed up within 48hrs	Followed up within or outside 48hr
Readmission <= 28d	N~(n=44947)	37146 (90%)	5747 (92%)	7801 (92%)
	Y~(n=4774)	4106 (10%)	483 (7.8%)	668 (7.9%)
28d mortality	N~(n=49186)	40792 (99%)	6164 (99%)	8394 (99%)
	Y~(n=535)	460 (1.1%)	66 (1.1%)	75 (0.9%)
Re-presentation to ED <=28d	N~(n=38441)	31717 (77%)	4940 (79%)	6724 (79%)
	Y~(n=11280)	9535 (23%)	1290 (21%)	1745 (21%)
At least 1 adverse event	N~(n=37617)	30977 (75%)	4880 (78%)	6640 (78%)
	Y~(n=12104)	10275 (25%)	1350 (22%)	1829 (22%)

Table 3. Crude (Unadjusted) Models for “Not followed up” compared to “Followed up within 48 hours”

		Readmission <= 28d				28d mortality				Representation to ED <=28d			
		N (%)		GEE model		N (%)		GEE model		N (%)		GEE model	
Variable	Category	N (n=42893)	Y (n=4589)	OR (95% CI)	P-val	N (n=46956)	Y (n=526)	OR (95% CI)	P-val	N (n=36657)	Y (n=10825)	OR (95% CI)	P-val
Followup	Not followed up	37146 (90%)	4106 (10%)	ref	0.2937	40792 (99%)	460 (1.1%)	ref	0.5751	31717 (77%)	9535 (23%)	ref	0.2287
	Followed up within 48hrs	5747 (92%)	483 (7.8%)	0.90 (0.73, 1.10)		6164 (99%)	66 (1.1%)	0.93 (0.71, 1.21)		4940 (79%)	1290 (21%)	0.95 (0.88, 1.03)	
Care type	Centralised (SES HNE IS NBM SWS)	17730 (90%)	1928 (9.8%)	ref	0.4172	19437 (99%)	221 (1.1%)	ref	0.8670	14666 (75%)	4992 (25%)	ref	<0.0001
	Integrated (MNC WS NSYD)	6687 (89%)	861 (11%)	1.17 (0.96, 1.43)		7467 (99%)	81 (1.1%)	0.96 (0.73, 1.26)		5586 (74%)	1962 (26%)	0.96 (0.87, 1.05)	
	Localised (SYD NNSW SNSW CC WNSW MUR)	17918 (91%)	1732 (8.8%)	1.00 (0.86, 1.17)		19432 (99%)	218 (1.1%)	0.98 (0.79, 1.20)		15938 (81%)	3712 (19%)	0.75 (0.70, 0.81)	
	Mixed LHD (FW)	535 (89%)	67 (11%)	1.27 (0.83, 1.95)		596 (99%)	6 (1.0%)	0.66 (0.24, 1.79)		448 (74%)	154 (26%)	0.93 (0.71, 1.22)	
	Other	23 (96%)	1 (4.2%)	0.97 (0.07, 13.44)		24 (100%)				19 (79%)	5 (21%)	0.91 (0.28, 2.91)	
Year	2009	6234 (90%)	698 (10%)	ref	0.0429	6863 (99%)	69 (1.0%)	ref	0.0019	5544 (80%)	1388 (20%)	ref	<0.0001

		Readmission <= 28d				28d mortality				Representation to ED <=28d			
		N (%)		GEE model		N (%)		GEE model		N (%)		GEE model	
Variable	Category	N (n=42893)	Y (n=4589)	OR (95% CI)	P-val	N (n=46956)	Y (n=526)	OR (95% CI)	P-val	N (n=36657)	Y (n=10825)	OR (95% CI)	P-val
	2010	6192 (91%)	576 (8.5%)	0.86 (0.64, 1.15)		6698 (99%)	70 (1.0%)	1.09 (0.75, 1.57)		5358 (79%)	1410 (21%)	1.09 (0.97, 1.22)	
	2011	6564 (90%)	715 (9.8%)	1.14 (0.87, 1.50)		7200 (99%)	79 (1.1%)	1.14 (0.78, 1.65)		5624 (77%)	1655 (23%)	1.20 (1.07, 1.34)	
	2012	8274 (90%)	912 (9.9%)	1.16 (0.89, 1.50)		9064 (99%)	122 (1.3%)	1.44 (1.03, 2.02)		6921 (75%)	2265 (25%)	1.29 (1.16, 1.45)	
	2013	10315 (90%)	1176 (10%)	1.27 (0.99, 1.63)		11343 (99%)	148 (1.3%)	1.43 (1.04, 1.97)		8639 (75%)	2852 (25%)	1.35 (1.21, 1.50)	
	2014	5314 (91%)	512 (8.8%)	1.02 (0.77, 1.37)		5788 (99%)	38 (0.7%)	0.76 (0.51, 1.14)		4571 (78%)	1255 (22%)	1.17 (1.04, 1.32)	
Gender	Male	19468 (90%)	2145 (9.9%)	ref	0.0091	21341 (99%)	272 (1.3%)	ref	0.0065	16484 (76%)	5129 (24%)	ref	0.0010
	Female	23229 (90%)	2440 (9.5%)	0.88 (0.80, 0.97)		25415 (99%)	254 (1.0%)	0.77 (0.64, 0.93)		19988 (78%)	5681 (22%)	0.90 (0.85, 0.96)	
Marital status	Married/defacto	16086 (91%)	1521 (8.6%)	ref	0.0004	17405 (99%)	202 (1.1%)	ref	<0.0001	13978 (79%)	3629 (21%)	ref	<0.0001

		Readmission <= 28d				28d mortality				Representation to ED <=28d			
		N (%)		GEE model		N (%)		GEE model		N (%)		GEE model	
Variable	Category	N (n=42893)	Y (n=4589)	OR (95% CI)	P-val	N (n=46956)	Y (n=526)	OR (95% CI)	P-val	N (n=36657)	Y (n=10825)	OR (95% CI)	P-val
	Single	13977 (89%)	1659 (11%)	1.06 (0.91, 1.25)		15519 (99%)	117 (0.7%)	0.64 (0.50, 0.83)		11645 (74%)	3991 (26%)	1.16 (1.07, 1.24)	
	Widowed	5143 (88%)	679 (12%)	1.53 (1.26, 1.86)		5699 (98%)	123 (2.1%)	1.87 (1.47, 2.39)		4389 (75%)	1433 (25%)	1.28 (1.15, 1.42)	
	Divorced/separated	5784 (90%)	628 (9.8%)	1.25 (1.01, 1.55)		6343 (99%)	69 (1.1%)	0.97 (0.72, 1.31)		4959 (77%)	1453 (23%)	1.21 (1.09, 1.33)	
	Not known	428 (92%)	36 (7.8%)	0.94 (0.37, 2.44)		459 (99%)	5 (1.1%)	0.98 (0.40, 2.42)		377 (81%)	87 (19%)	1.07 (0.80, 1.44)	
IRSD quintile	1st quintile -least disadvantaged	7090 (89%)	842 (11%)	ref	0.4293	7835 (99%)	97 (1.2%)	ref	0.8150	5863 (74%)	2069 (26%)	ref	<0.0001
	2nd quintile	8050 (90%)	895 (10%)	1.04 (0.82, 1.32)		8841 (99%)	104 (1.2%)	0.98 (0.72, 1.32)		6795 (76%)	2150 (24%)	0.92 (0.83, 1.02)	
	3rd quintile	9290 (90%)	996 (9.7%)	1.09 (0.87, 1.36)		10168 (99%)	118 (1.1%)	0.93 (0.69, 1.25)		7808 (76%)	2478 (24%)	0.98 (0.89, 1.08)	
	4th quintile	8149 (91%)	837 (9.3%)	0.90 (0.72, 1.12)		8885 (99%)	101 (1.1%)	0.91 (0.67, 1.24)		7136 (79%)	1850 (21%)	0.80 (0.72, 0.88)	

		Readmission <= 28d				28d mortality				Representation to ED <=28d			
		N (%)		GEE model		N (%)		GEE model		N (%)		GEE model	
Variable	Category	N (n=42893)	Y (n=4589)	OR (95% CI)	P-val	N (n=46956)	Y (n=526)	OR (95% CI)	P-val	N (n=36657)	Y (n=10825)	OR (95% CI)	P-val
	5th quintile - most disadvantaged	8813 (90%)	952 (9.7%)	0.97 (0.75, 1.24)		9669 (99%)	96 (1.0%)	0.84 (0.62, 1.14)		7730 (79%)	2035 (21%)	0.78 (0.70, 0.87)	
Participation in the CDMP	Did not participate	41954 (91%)	4247 (9.2%)	ref	0.0168	45723 (99%)	478 (1.0%)	ref	<0.0001	35938 (78%)	10263 (22%)	ref	<0.0001
	Participated	939 (73%)	342 (27%)	1.87 (1.12, 3.11)		1233 (96%)	48 (3.7%)	3.96 (2.90, 5.41)		719 (56%)	562 (44%)	1.77 (1.45, 2.16)	
Participation in the Healthways component	Did not participate	42868 (90%)	4581 (9.7%)	ref	0.2546	46923 (99%)	526 (1.1%)	Cannot be added into model due to zero counts		36638 (77%)	10811 (23%)	ref	0.1825
	Participated	25 (76%)	8 (24%)	1.98 (0.61, 6.46)		33 (100%)				19 (58%)	14 (42%)	1.62 (0.80, 3.30)	
Length of stay	1 day or less	16226 (92%)	1464 (8.3%)	ref	0.2326	17595 (99%)	95 (0.5%)	ref	<0.0001	13984 (79%)	3706 (21%)	ref	<0.0001
	More than 1 day	25220 (89%)	3062 (11%)	1.09 (0.94, 1.27)		27861 (99%)	421 (1.5%)	2.70 (2.14, 3.41)		21389 (76%)	6893 (24%)	1.15 (1.08, 1.22)	
No of previous admissions	None	17043 (96%)	751 (4.2%)	ref	0.0049	17678 (99%)	116 (0.7%)	ref	<0.0001	14945 (84%)	2849 (16%)	ref	<0.0001

		Readmission <= 28d				28d mortality				Representation to ED <=28d			
		N (%)		GEE model		N (%)		GEE model		N (%)		GEE model	
Variable	Category	N (n=42893)	Y (n=4589)	OR (95% CI)	P-val	N (n=46956)	Y (n=526)	OR (95% CI)	P-val	N (n=36657)	Y (n=10825)	OR (95% CI)	P-val
	1 or more	25850 (87%)	3838 (13%)	1.21 (1.06, 1.37)		29278 (99%)	410 (1.4%)	2.30 (1.87, 2.83)		21712 (73%)	7976 (27%)	1.28 (1.21, 1.35)	
No of additional diagnoses	Less than 2	12804 (93%)	925 (6.7%)	ref	0.0325	13655 (99%)	74 (0.5%)	ref	<0.0001	11307 (82%)	2422 (18%)	ref	<0.0001
	2 or more	30089 (89%)	3664 (11%)	1.19 (1.01, 1.40)		33301 (99%)	452 (1.3%)	2.53 (1.93, 3.33)		25350 (75%)	8403 (25%)	1.24 (1.16, 1.32)	
Age	mean (SD)	54 (17)	56 (17)	1.02 (1.01, 1.02)	<0.0001	54 (17)	65 (13)	1.05 (1.04, 1.05)	<0.0001	55 (17)	54 (17)	ref	0.0803
Charlson Index	mean (SD)	2 (2)	2 (1)	1.13 (1.09, 1.18)	<0.0001	2 (1)	3 (2)	1.51 (1.45, 1.57)	<0.0001	2 (1)	2 (2)	1.11 (1.09, 1.13)	<0.0001