Benchmarking Nurse Maude's Long-Term Care Hospital against Canterbury and National Comprehensive Standardised Long-Term Care Data: Targeting Falls, Unintentional Weight Loss and Pressure Injuries

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ABS	Aggressive Behaviour Scale
ADL	Activities of Daily Living
ARC	Aged Residential Care
ARRC	Aged-Related Residential Care
BMI	Body mass index
CAP	Clinical Assessment Protocol
CCA	Comprehensive clinical assessment
CHESS	Changes in Health, End Stage Disease and Signs and Symptoms
CI	Confidence interval
COPD	Chronic obstructive pulmonary disease
CPS	Cognitive Performance Scale
DHB	District Health Board
DRS	Depression Rating Scale
GBD	Global Burden of Disease
HC	Home care
HL	Hospital level
HQSC	Health Quality Safety Commission
IHME	Institute for Health Metrics and Evaluation
interRAI	International Resident Assessment Instrument
LTC	Long term care
LTCF	Long term care facility
MDS	Minimum Data Set
MELAA	Middle Eastern Latin American African
MNA	Mini Nutritional Assessment
MOH	Ministry of Health
NHI	National Health Index
Nurse Maude	Nurse Maude
OECD	Organization for Economic Cooperation and Development
PHO	Primary Health Organisations
PI	Pressure injury
PU	Pressure ulcer
PURS	Pressure ulcer risk scale

RAI	Resident Assessment Instrument
RAI-MDS	Resident Assessment Instrument Minimum Data Set
RN	Registered nurse
RR	Relative risk
SHELTER	Services and Health for Elderly in Long Term Care
TAS	Technical Advisory Centre
TFR	Total fertility rate
WHO	World Health Organization

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Abstract

Background

Aged residential care (ARC) facilities throughout New Zealand will experience a higher demand over the subsequent decades, with many older people presenting with multimorbidity. In 2015, the International Resident Assessment Instrument for Long-Term Care Facilities (interRAI-LTCF) became the primary assessment tool nationwide in ARC facilities, making it possible to monitor and benchmark health outcome profiles between ARC facilities. Falls, pressure injuries (PI), and unintentional weight loss are geriatric conditions that are largely preventable when risk factors are properly managed. Nurse Maude ARC hospital, premier provider in Canterbury and invested in continuous quality improvement, tasked this research with clear priorities to improve the monitoring and reporting of their interRAI data, particularly targeting falls, PI, and unintentional weight loss.

Aims

The primary aim of this study was to benchmark Nurse Maude's interRAI-LTCF data with other hospital-level ARC facilities nationwide and in the Canterbury District Health Board (DHB) region, targeting falls, unintentional weight loss and PI. In doing so, this research would establish a procedure that could be used by Nurse Maude to carry out benchmarking on a range of health outcomes and indicators, in relation to themselves (over time), and national and Canterbury indicators. The secondary aim in this research was to determine if there are salient advantages in using the benchmarking procedure established in this research that offer Nurse Maude more than what is included in the two quarterly reports produced by Technical Advisory Centre (TAS). In the context of this research, benchmarking refers to a snapshot comparison at a point in time against two datasets that are expected to be similar (e.g., hospital-level of care).

Methods

A cross-sectional study, of older people (aged 65 years and older) residing in hospital-level ARC that completed an interRAI-LTCF assessment between 1 July 2016 and 1 July 2017, inclusive, and who had consented to their data being used for planning and research purposes. Prevalence and risk of falls, unintentional weight loss, and PI were elicited within the interRAI-LTCF assessment, using the relevant assessment items, Clinical Assessment Protocols (CAPs) and Pressure Ulcer Risk (PUR) scale. Descriptive statistics were performed, and two-way cross-tabulation was conducted using Fisher's exact test to determine that there was no statistically significant difference between the frequencies of interRAI-LTCF items/variables compared between datasets. A binominal test of significance was conducted to assess the probability of obtaining spurious significant result when comparing each

dataset. The quality indicators for prevalence of falls, unintentional weight loss, and PI were calculated utilising the TAS definitions (i.e., numerator, denominator and exclusions). Nurse Maude interRAI-LTCF data was extracted through the interRAI analytics software, and the comparative Canterbury and national interRAI-LTCF data were provided by TAS. Clearance for this study was approved by University of Canterbury Human Ethics Committee. This study only required a low risk application given the use of de-identified routinely collected administrative data, which poses very low risk to the participants, community and research team.

Findings

This study includes interRAI-LTCF assessments from 35 Nurse Maude hospital-level residents, as well as 1,698 and 14,021 residents from comparative Canterbury and national hospital-level datasets, respectively. This study found that Nurse Maude had a similar prevalence of falls (20%) and unintentional weight loss (11%) as national and Canterbury hospital-level datasets. However, Nurse Maude residents had a lower prevalence of PI (3%), than national and Canterbury hospital-level datasets (5% and 6%, respectively), and a higher risk of undernutrition (52% compared with 40% and 44% in Canterbury and national hospital-level datasets, respectively). In general, there was little variation between national and Canterbury hospital-level datasets for most interRAI-LTCF outcomes measured in this study.

Discussion

Nurse Maude appeared to perform the same as or better than the national and Canterbury datasets (e.g., PI and falls quality indicators), but had slightly lower performance in other areas (e.g., undernutrition risk and low BMI score). However, the relatively small sample, which results in increased variability, is likely to be responsible for some of these patterns. Repeated analysis over time, and then employing using data stabilisation methods, would mitigate this issue and is recommended for the future. Overall, the benchmarking procedure established in this research provides some additional advantages for Nurse Maude compared with the TAS reports. These advantages include the real-time data access, indicator flexibility, supplemented missing weight and height data, and potential to use data stabilisation over time.

Implications

These conditions remain prevalent in hospital-level ARC facilities throughout New Zealand, reinforcing the need for targeted, evidence-based initiatives to reduce the risk and prevalence of these modifiable and costly health care outcomes. This research established a procedure that can be used by Nurse Maude to carry out benchmarking on a range of health outcomes and indicators, in

relation to themselves (over time), and national and Canterbury datasets. This process could complement the information provided to Nurse Maude in the TAS quarterly reports.

1 Introduction

1.1 Ageing context

1.1.1 Global, New Zealand, Local

The accelerated ageing population is a phenomenon affecting the economies, health systems and social welfare of countries globally. It is estimated that 800 million people are aged over 60 years worldwide; this is expected to reach 2 billion in the next four decades (Bloom et al., 2015). *Population ageing* refers to a growing proportion of the population entering older age groups (World Health Organization, 2015). This shift in population's age structure can be accounted for by three main reasons; the decrease in infant and child mortality, continued gains in life expectancy, and the overall decline in fertility rates (Mathers, Stevens, Boerma, White, & Tobias, 2015; World Health Organization, 2015).

The Global Burden of Disease (GBD) study reported the global life expectancy reached 70 years for males and 75 years for females in 2017, an increase of over 20 years for both sexes since 1950 (Dicker et al., 2018). In almost all countries, women have a higher life expectancy than men and are over-represented in the older age groups, although the gap has been decreasing in high-income countries since 1990 (Dicker et al., 2018). Large reductions in mortality of young children have been identified as a leading cause of gains in life expectancy worldwide (Dicker et al., 2018; Wang et al., 2017). In 1950, 44.5% of total deaths globally were before the age of five years compared with 9.6% in 2017 (Dicker et al., 2018). Conversely, there has been a large increase in the proportion of deaths at 75 years and older (Dicker et al., 2018), demonstrating that more people are living through adulthood into the older age groups (World Health Organization, 2015).

Although the global population is increasing (average of 83.8 million people per year), total fertility rates (TFR) around the globe have declined substantially, from 4.7 livebirths in 1950 to 2.4 livebirths in 2017 (Murray et al., 2018). Contributing factors to the falling fertility rates may be increased access and use of contraception, the improved educational achievement for females, and a higher likelihood of children surviving through to adulthood (Murray et al., 2018; World Health Organization, 2015).

The ageing of the New Zealand population, much like other countries, has been occurring for many years. In 2016, older people made up a larger proportion of the total population than in previous decades, with approximately 12% (711,200 people) aged 65 years and over (Ministry of Social Development, 2017). By 2046, this figure is projected to increase two-fold to approximately 1.4 million people or 23% of the total population. Of particular importance to aged residential care

(ARC) is the higher proportions of New Zealanders entering the oldest age groups, for whom ARC use is greatest (Ernst & Young Limited, 2018b). Between 2016 and 2036, the number of people aged over 80 years is forecasted to increase by over 130%, reaching approximately 400,000 people (Statistics New Zealand, 2017a).

According to the GBD study, life expectancy at birth in New Zealand was 79.7 years for males and 83.6 years for females in 2017 (Institute for Health Metrics and Evaluation [IHME], 2017). An increase of approximately nine years for males and twelve years for females since 1950. Though there have been gains in life expectancy for all New Zealanders over time, substantial inequities between groups of the population remain. Both Māori males and females could expect to live approximately seven years less than non-Māori males and females in 2012–14 (Statistics New Zealand, 2015). The other major contributor to the New Zealand ageing population is low fertility rates. Although the New Zealand population continues to grow (reaching an estimated 4.9 million people in 2018), fertility rates have decreased from 3.6 livebirths in 1950 to 1.8 livebirths in 2017 (Statistics New Zealand, 2018).

Current researchers and governments are looking to health expectancy to answer the heavily contested question – are increasing life expectancy accompanied with longer and healthier lives? Some studies show that high-income countries have seen a reduction in the amount of time spent with a disability (Chatterji, Byles, Cutler, Seeman, & Verdes, 2015). While others argue that although there has been an increase in chronic diseases among the elderly, they are living with less severe limitations and disabilities, which could be partially accounted for by early detection, improved treatment options and health technologies (Christensen, Doblhammer, Rau, & Vaupel, 2009; Graham, Blakely, Davis, Sporle, & Pearce, 2004). However, recent comprehensive data from the GBD study found that between 1990 and 2017 life expectancy increased at a faster rate than healthy life expectancy across the globe, resulting in additional years lived in poor health (Hay et al., 2017).

In New Zealand, both life expectancy and health expectancy has increased over the past decade. However, life expectancy has improved faster than health expectancy (Hay et al., 2017). As a result, New Zealanders are spending more years in poor health than they were previously (IHME, 2016). This will have a significant impact on long-term care use, as greater numbers of older people with complex health conditions will require high quality care.

In 2017 the leading causes of health loss among New Zealanders aged over 65 years, were cardiovascular disease, dementia, chronic obstructive pulmonary disease (COPD) and lung cancer (IHME, 2017). The contribution of non-communicable disease to health loss in New Zealand is not surprising given findings out of the GBD study identified that a majority of age-related diseases were

non-communicable (88%), followed by injuries (6.5%) and communicable (5.4%) (IHME, 2017). Consistent with international findings, older New Zealanders are also experiencing higher rates of other long-term conditions such as functional limitations, impairments and disabilities, and are more likely to experience multi-morbidity (Foreman et al., 2018; Hay et al., 2017; IHME, 2016; Ministry of Health, 2016b). Those that live with multi-morbidities are more likely to experience poor health and have greater dependency levels, which is likely to impact the demand and care-level required in ARC (Mangin, Heath, & Jamoulle, 2012).

1.1.2 Global and national ageing policy

In response to the complex health conditions and inequities prevalent in the ageing population, creating multi-sectoral policy that supports healthy ageing, as well as the providing quality long-term care, will be essential for the wellbeing of societies. The World Health Organization (WHO) is a specialised agency within the United Nations system, with a primary role to direct and coordinate international public health.[1] In 2015, WHO released the *World Report on Ageing and Health*, outlining a framework that fosters action on the concept *Healthy Ageing*. Healthy ageing refers to the ability of all older people to maintain intrinsic capacity and functional ability, through interactions with their environment (World Health Organization, 2015). Following on from this, WHO released the *Global strategy and action plan on ageing and health* (*GSAP)* and *10 priorities towards a decade of Healthy Ageing* in 2016 and 2017, respectively. These documents highlight the importance of age-friendly environments; integrated health systems that support older person needs; adaptable long-term care systems; and collecting robust data and research on older people (World Health Organization, 2015, 2017a, 2017b). This aligns with the use of a comprehensive and standardised assessment to measure and assess the status of older people residing within ARC, to maintain wellbeing and quality of life.

In 2016, the New Zealand government responded to the challenges and opportunities of population ageing with the Healthy Ageing Strategy (the Strategy) (Ministry of Health, 2016b). The Strategy draws heavily on the Healthy Ageing framework and research developed by WHO (figure 1) including a key theme of improving and maintaining the lives of all older people to age well in age-friendly communities. Figure 1 presents a life-course approach to healthy ageing, highlighting that no matter where an older person enters the health system the goal is to foster functional ability by either building and maintaining wellbeing, and by supporting those with declining wellbeing to achieve things that are meaningful to them (Ministry of Health, 2016b; World Health Organization, 2015).

[1] https://www.who.int/about

National data demonstrates that some older New Zealanders are experiencing unjust and unfair health outcomes, many of which are avoidable, in particular, older Māori, Pacific and those with intellectual disabilities (Health and Ageing Research Team, 2018; Ministry of Health, 2016b). Te Tiriti o Waitangi (the Treaty of Waitangi), is an agreement signed in 1840 between more than 500 Māori chiefs and representatives of the British Crown, declaring British sovereignty over New Zealand. Under the articles of te Tiriti, the government has an obligation to protect the health and wellbeing of all Māori (Durie, 1998). The Ministry of Health (MOH), New Zealand's leading agency for the health and disability system, recently released an official definition of equity, highlighting that achieving equitable health outcomes for people with different levels of advantage requires a variety of approaches and resources (Ministry of Health, 2019). This aligns with Te Tiriti o Waitangi and aims to go beyond reducing Māori inequities but to promote Māori wellbeing to flourish. Furthermore, this definition incorporates all types of equity, not just socio-economic and indigenous but also those that may occur because of disability or geographical place (Ministry of Health, 2016b).

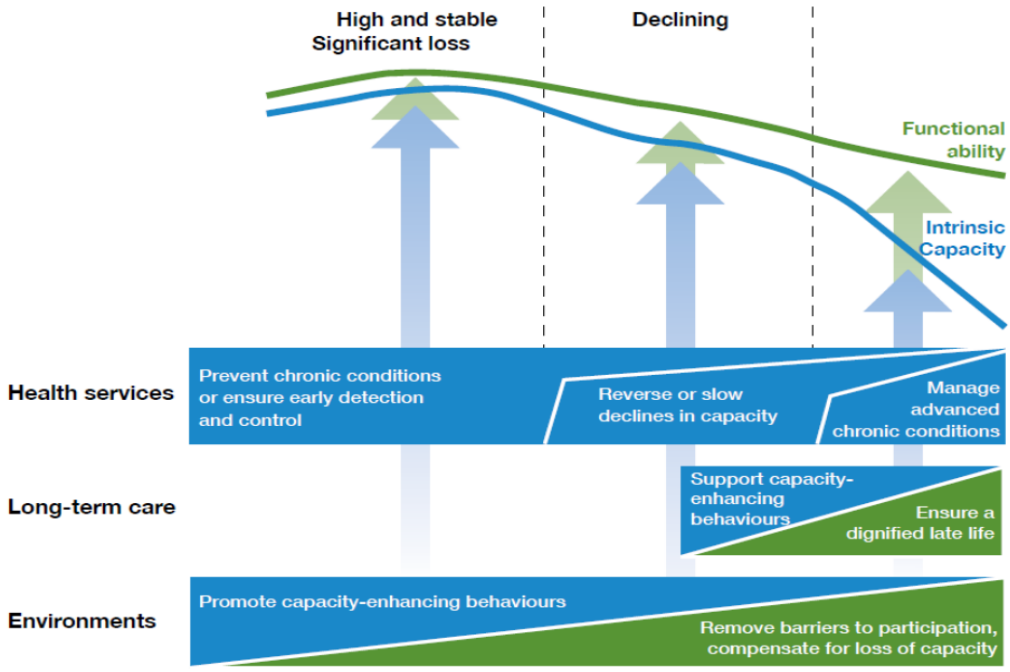

Figure 1 Framework for Healthy Ageing: a public health response
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The number of people in ARC facilities in New Zealand is expected to reach around 38,400 by 2020 (Ernst & Young Limited, 2016). Current national and regional policies aim to reduce demand on ARC through community-based wrap-around services that keep people living in their own home for longer (Gullery & Hamilton, 2015). Therefore, people entering ARC facilities have complex health needs and higher patient dependency levels than community-dwelling adults (Boyd, Bowman,

Broad, & Connolly, 2012). It is important that ARC aims to improve older person's quality of life and support them to adapt to their functional ability (Ministry of Health, 2016b).

The Strategy identifies that "quality is an ongoing progress that needs to be supported by the provision of up-to-date evidence to inform and spread best practice" (Ministry of Health, 2016b, p. 30). Monitoring the quality of care in ARC helps to improve service provision and informs resource allocation to provide high quality and economical care (Organization for Economic Cooperation and Development (OECD) & European Commission, 2013; World Health Organization, 2015). A government policy that aligns with this occurred in 2015 when the New Zealand MOH made history by being the first country to implement the International Resident Assessment Instrument for long-term care facilities (interRAI-LTCF) as the primary assessment tool nationwide in ARC facilities (Technical Advisory Centre [TAS], 2017c). The interRAI-LTCF is a comprehensive and standardised assessment to measure and assess the status of older people residing within ARC. Health professionals can generate care plans with this information; also it provides an electronic record on the outcomes of older people, which will become increasingly valuable for District Health Boards (DHBs), Primary Health Organisations (PHOs), the MOH and ageing research (Ministry of Health, 2016b). These strategies highlight the commitment and expansion of ageing research in New Zealand.

1.2 Ageing and ARC

1.2.1 Global, New Zealand, Local

ARC sits within the broader long-term care (LTC) system, which can be described as a variety of services for those dependent on assistance with basic activities of daily living over a long period of time (OECD & European Commission, 2013). New Zealand is providing more LTC within communities and homes to keep people living longer and healthier lives in their own homes while also reducing the financial and resource burden on the health system and ARC facilities (Ministry of Health, 2016b). This was a substantial shift compared to the 1980s when many of the residents in ARC had substantially lower dependency and in some cases stayed in residential care as a lifestyle or housing solution (Boyd et al., 2012; Boyd et al., 2009). In more recent years, those with low to medium dependency receive LTC in the community, until their dependency level requires 24-hour care (Ernst & Young Limited, 2018b). In New Zealand, the increasing provision and investment of home-based care have demonstrated a modest relationship to the decline in ARC use (Ernst & Young Limited, 2018b).

ARC facilities serve older residents, especially the oldest of the old, those with limited functional and cognitive ability, and high care needs. The nature and scope of ARC vary tremendously, resulting in

various definitions, often determined by the services and activities undertaken in a facility (Australian Institue of Health and Welfare, n.d.). In this research, ARC is defined as ongoing live-in care provided in a facility to individuals assessed as requiring a higher level of daily assistance to experience improved quality of life and functional capacity (Ferrino, 2013). An often overlooked basic element of ARC is that the facility is a person's home, as well as providing a range of services including personal and nursing care, meals and cleaning services (New Zealand Labour Party & Green Party of Aotearoa New Zealand, 2010).

ARC in New Zealand has four levels of care including, dementia, psychogeriatric, rest home, and hospital-level, with the latter two facility-types being the most common. Rest homes are suitable for people who have low dependency and care needs but require a caregiver 24-hours a day. Whereas, hospital-level care is provided to those who have high dependency and require 24-hour nursing care (Boyd et al., 2012). In New Zealand, non-governmental organisations provide residential care services contracted by DHBs and funded by the MOH through the Aged-Related Residential Care (ARRC) Service Agreement (Ministry of Health, 2019). Eligibility for government-subsidised ARC is determined through needs assessment (e.g., mobility, health conditions, and support networks) and income and asset testing, determining the level of care required and the amount of subsidy (Ministry of Health, 2019). It is estimated that DHBs spend around $1 billion on ARC services per year and residents of ARC facilities are estimated to contribute an additional $800 million (Ernst & Young Limited, 2016).

It is estimated that ARC is used at one time by approximately 4-6% of those aged 65 years and over in high-income countries, including New Zealand (Broad et al., 2015). In 2016/17, on average 32,640 New Zealanders lived in ARC facilities; by 2026, it is estimated that this number will reach 44,000, an increase of approximately 140% (Ernst & Young Limited, 2018a). In recent years the bed days for hospital-level and dementia care in New Zealand have been increasing while rest home bed days have been decreasing (Boyd et al., 2009; Ernst & Young Limited, 2018a). This supports national findings that high dependency, in particular, dementia-related dependency, is increasing within older residents in ARC facilities (Boyd et al., 2012; Boyd et al., 2009).

The average age of those entering ARC was 85 years (Ernst & Young Limited, 2018a), which is similar to that in other high-income countries (Boyd et al., 2012; Onder, Carpenter, et al., 2012). Over half of ARC residents in New Zealand have a form of cognitive impairment, and many have several co-morbidities (Ernst & Young Limited, 2018b). In New Zealand, residents were more likely to be female (66%), and nine out of ten residents identified as European ethnicity (TAS, 2019b). The remainder of residents identified as Māori (4.3%), Asian (2.5%), Pacific (2.4%), Middle Eastern, Latin American,

African (MELAA) (<1%) and Other (<1%) ethnic groups (TAS, 2019b). Within New Zealand, a higher proportion of Māori had an interRAI assessment in the community or home (7%), rather than in ARC (4%) (TAS, 2018c). This is consistent with findings that Māori are underrepresented in ARC use and instead are more likely to receive care from someone within the same household (Kerse, Lapsley, Moyes, Mules, & LiLACS NZ, 2017).

1.2.2 Nurse Maude

This study was initiated by Nurse Maude to improve the monitoring and reporting of their interRAI data, to better inform the provision of care. In Canterbury, the Nurse Maude Association is one of the largest providers for older person care, with a long history of serving vulnerable people and working for the community, not for profit (Allan, 1996). Nurse Maude is a leading health care provider of community and home-based care, including domestic assistance, rehabilitation, and district nursing (Nurse Maude, 2018). During 2017, Nurse Maude carried out over 200,000 nursing visits in the community, ensuring people could access health care in their own homes and communities. While the community care aspect of Nurse Maude is perhaps best known, they have also been providing care in a hospital setting for over 70 years. The Nurse Maude Hospital provides hospital, palliative, and rest-home level care (The DAA Group Limited, 2017, 2018).

Nurse Maude's history dates back to 1896, when nurse Sibylla Maude pioneered community and district nursing in New Zealand (Allan, 1996). Nurse Maude, as she was known, had a mission to nurse the most marginalised in the community. Over the years, Nurse Maude responded to several community health challenges, including setting up two camps in the early 20th century for men and women suffering from tuberculosis. In 1934, Nurse Maude was honoured with the OBE (Order of the British Empire) and died the following year, although her legacy lives on through the dedicated work of Nurse Maude (Allan, 1996).

During 1920 there were 12,000 annual Nurse Maude visits around the community, by 2016 that had expanded to 198,697 district nursing home visits and 599,621 support worker home visits (Nurse Maude Association, 2016). During the past 100 years of service to Canterbury, they have developed a reputation for providing high-quality care throughout numerous settings. This is directed by their legacy statement:

> At Nurse Maude we remain committed to making life better for those experiencing ill health or the infirmities of old age; we continually develop the expertise of our staff through education and research and our motivation is not profit but the wellbeing of our community (Nurse Maude, n.d., p. 13).

This legacy statement applies to all services delivered by the Nurse Maude Association, including district nursing and homecare, speciality nursing, hospice and community palliative care, the health and mobility shop, and the Nurse Maude hospital.

Nurse Maude LTC hospital, can be classified as 'high dependency' as they provide 24-hour nursing care and many of their patients have high levels of dependency (Nurse Maude, n.d.). Unlike most ARC facilities in New Zealand which tend to be for profit and privately owned, Nurse Maude is not for profit. Some research in the US, suggests that not for profit facilities provide a higher quality of care when compared with privately owned facilities, often due to lower staffing levels in the privately-owned facilities (Harrington, 1984). Over the past few years, mandatory audits of Nurse Maude hospital completed by the DAA Group (an auditing agency) reported the residents and families spoke positively about the care provided (The DAA Group Limited, 2017, 2018). In the 2018 certification audit report no areas were identified as requiring improvements, and the auditors commended Nurse Maude for their continuous and best practice quality improvement initiatives (The DAA Group Limited, 2018). The audit also identified that Nurse Maude had achieved a reduction in the number of residents' falls, decreases in skin tears, and improved wound care documentations.

In December 2018, Nurse Maude recently finished construction of a new ARC facility, with 70 beds, courtyards, gardens, a café, ensuited rooms and large family areas (Nurse Maude, 2018). At the time of data collection (2016-2017), Nurse Maude hospital could be defined as a small ARC facility (<35 beds), however the new hospital is considered a medium facility.[2] The increase in facility capacity materially signifies a response to the growing demand for hospital-level residential care in Christchurch (Canterbury District Health Board, 2019).

1.3 ARC and the interRAI

1.3.1 History – pre interRAI

Prior to the introduction of the interRAI-LTCF assessment as the primary assessment tool in New Zealand, each ARC facility had autonomy over the assessment instruments used to monitor residents (New Zealand Guidelines Group, 2003). In 2003, the New Zealand's Guideline Group identified there was a lack of standardised assessment collection and tools for older people in New Zealand, potentially impeding quality of care (New Zealand Guidelines Group, 2003). The lack of standardised assessments throughout the country also made it difficult to compare quality indicators (e.g., the

[2] Evaluation Consult defined a small provider as <35 beds, medium as 36-80 beds, and large as >81 beds (Bandaranayake & Campin, 2017)

percentage of residents that experienced a fall) between facilities and compare the health outcomes of community-dwelling adults with those residing in ARC facilities.

The quality of care in residential facilities has come into question over the past several decades. In 2009, investigations carried out by the Health and Disability Commissioner exemplified horror stories within New Zealand, including one older woman who had not been showered in over a year (Health and Disability Commissioner, 2009). A joint inquiry into the ARC sector conducted by the New Zealand Labour and Green parties summarised their concerns back in 2010:

> We found a sector fast reaching crisis point, struggling to meet the growing needs of an ageing population and residents' rising acuity levels. The result is that many older New Zealanders are receiving substandard care (New Zealand Labour Party, & Green Party of Aotearoa New Zealand, 2010, p. 5).

These findings within ARC settings are not uncommon; many developed countries, including the US and the United Kingdom (UK) report poor quality and neglectful care of vulnerable older people (Ferrino, 2013). Many older people living in residential care continue to experience a range of potentially avoidable poor quality of care including elder abuse (OECD & European Commission, 2013), pressure injuries (PI), falls (Onder, Carpenter, et al., 2012), and poor quality of life (Kane, 2001).

In recent years, the Health Quality & Safety Commission New Zealand (HQSC) have begun to take a more active role in ARC quality improvement, after first acknowledging their lack of familiarity and activity within the sector:

> We do not currently have a high profile in ARC despite being responsible for health care improvement across the whole sector… We have limited knowledge of the ARC sector, and this has limited our ability to define where we are best placed to add value to ARC quality improvement initiatives. (HQSC, 2018, p. 4).

The current work by the HSQC identified both capacity (e.g., funding) and capability (e.g., knowledge) quality challenges in the ARC setting, including: the growing dependency of residents, a workforce with high turnover and varying levels of experience, lack of access to tools and equipment, and inadequate care planning (Health Quality & Safety Commission New Zealand, 2018). In response to these findings, they outlined a programme to ameliorate quality and care in ARC, which identifies the use of interRAI assessment data and quality indicators, and evidence-based practice as key aspects of quality improvement. These strategic priorities and goals are an integral

part of this current research, illustrating the relevance and importance of this research to the current New Zealand ARC context.

1.3.2 InterRAI

InterRAI[3], International Resident Assessment Instrument, is a collaborative international research and clinical network, involving over 35 countries, whose focus is on the development and application of comprehensive clinical assessment (CCA) systems (www.interrai.org). The interRAI collaborative aims to promote evidence-based practice and policy decision-making through the collection and interpretation of high-quality data about the outcomes and characteristics of people across a range of health and social services settings (interRAI, 2009). InterRAI instruments are reliable, standardised tools used in over 35 countries such as Canada, the US, France, South Korea, Australia, and Switzerland (OECD & European Commission, 2013). To date, interRAI has developed over 20 clinical instruments used in different care contexts varying from Home Care to Community Mental Health. Although each instrument has been developed for a particular healthcare setting, the interRAI suite is designed to work together as an integrated suite of assessment tools (interRAI, 2009).

The principal purpose of interRAI assessments is to assist healthcare professionals by producing observations and outputs about a person; allowing healthcare professionals to accurately understand the full range of a person's needs and tailor care plans (Gray et al., 2009). The interRAI instruments produce a range of outputs including clinical observations and profiles, numerous scales (e.g., the Activities of Daily Living (ADL), and Cognitive Performance Scale), Clinical Assessment Protocols (CAPs), case-mix tools, and quality indicators (Gray et al., 2009). The array of information generated by an instrument provides unprecedented access to information for a diverse range of stakeholders. For example, the interRAI instruments can inform evidence-based decision making, resource allocation and regional, national and international comparison (Fries et al., 2003; OECD & European Commission, 2013). InterRAI data has also been used for research purposes in a variety of settings (OECD & European Commission, 2013; Onder, Carpenter, et al., 2012; Onder, Liperoti, et al., 2012; Schluter, Ward, Arnold, Scrase, & Jamieson, 2016).

New Zealand became the first country in the world where interRAI assessments are implemented nationwide in home and community settings, and residential care. The New Zealand's Guideline Group was tasked to find a standardised assessment tool for older people in New Zealand, to improve the level of care and evidence-based practice for those using LTC (New Zealand Guidelines Group, 2003). The group identified the interRAI suite as the top assessment instruments to ensure

[3] InterRAI as a term can be used to refer to both the international collaboration responsible for developing comprehensive clinical assessment systems and the suite of clinical assessment instruments (Health Quality & Safety Commission New Zealand, 2018).

consistent, standardised assessment nationwide and to improve evidence-based practice. Since then interRAI in New Zealand has had a long journey of evolution, with the implementation of five CCAs within the interRAI suite.

After a successful pilot, the interRAI Home Care (interRAI-HC) assessment became the first mandatory interRAI instrument adopted within New Zealand. By July 2015, the interRAI-LTCF assessment became the primary assessment instrument for residents in ARC. Three other interRAI instruments are used in New Zealand, the Contact assessment, Community Health assessment, and most recently the Palliative Care assessment in 2017 (TAS, 2019d). In all these cases, the CCA was integrated at the national level, rather than at a DHB level in order to streamline a complex process and reduce costs (Downes, Dever, & Douglass, 2010). InterRAI Services is New Zealand's national provider for interRAI and is a business group within TAS – a shared agency for health services (TAS, 2019c).

The interRAI-LTCF assessment is a comprehensive, standardised instrument developed to assess the care needs, strengths and preferences of those in ARC (Kim et al., 2015; Onder, Carpenter, et al., 2012). Although this instrument is used primarily to inform patient care and wellbeing, it has the benefit of providing routinely collected health data which has been utilised for research and quality purposes in a variety of settings (Kijowska & Szczerbińska, 2018; OECD & European Commission, 2013; Onder, Carpenter, et al., 2012). The interRAI-LTCF assessment provides an electronic record on the outcomes of older people, which enables comparison at the facility level, something not achieved prior to the implementation of interRAI in New Zealand. Comparing interRAI-LTCF and interRAI-HC national data is also an increasingly valuable tool for DHBs, Primary Health Organisations (PHOs), the MOH and ageing research.

1.3.3 Post-interRAI adoption

A snapshot of current interRAI statistics in New Zealand helps to understand how rapidly this system has evolved within the past decade. The New Zealand interRAI data warehouse has 500,000 completed interRAI assessments stored (TAS, 2019c). During 2017/18, ARC facilities completed 72,000 assessments, while over 37,000 home care assessments were completed in the same period. The national interRAI database provides a rich evidence-base that is National Health Index (NIH)-linked[4], and uses standardised measures. Each year more research is conducted within New Zealand using national and international interRAI data.

[4] NHI is a unique identifier assigned to each individual that uses New Zealand's health and disability support services

Much of this research on older people has used interRAI-HC assessment data, some examples include: describing the interRAI-HC epidemiological profile (Jamieson, Gibson, et al., 2018), risk factors for entry into ARC (Schluter, Ward, et al., 2016), and work surrounding the Drug Burden Index to predict adverse outcomes (Jamieson, Nishtala, et al., 2018). Less national research has been conducted on the interRAI-TCF data; however, some relevant examples include nurses' perceptions of interRAI-LTCF (Vuorinen, 2017), the use of LTCF assessment for case-mix and funding (The University of Auckland, 2018), and the change in health outcomes of residents after entry into ARC (New Zealand Aged Care Association, 2017).

1.4 Key indicators and needs for benchmarking

Quality indicators can be used as a surrogate measures of quality, potentially displaying an association between the indicator and the actual quality of care provided (Castle & Ferguson, 2010). At the resident level, the quality indicator measures the presence or absence of a health outcome. This information provides health professionals with a resident's health and care status, aiding them to evaluate the effectiveness of a care plan targeting a preventable condition (Carpenter & Hirdes, 2013). When resident-level data is aggregated at the facility-level, quality indicators can demonstrate the proportion of residents in a facility that have a particular outcome (Zimmerman et al., 1995). Facility-level indicators illustrate a pattern that may be influenced by the care or policy of an ARC facility, allowing facilities to identify areas where they are doing well, further opportunities for quality-improvement, and monitor the success of a quality improvement initiative (Mor, Berg, et al., 2003; OECD & European Commission, 2013).

Benchmarking health outcomes and quality indicators in ARC is a method of continuous quality improvement and can support evidence-based practice (Ettorchi-Tardy, Levif, & Michel, 2012). Benchmarking provides clinical staff and ARC providers a means to interpret whether the proportion of residents with a health outcome is higher or lower than should be expected. In some healthcare settings, benchmarks are established based on evidence and consensus of what can be achieved or is plausible under optimal conditions or environments (Mor, Angelelli, Gifford, Morris, & Moore, 2003). However, it is often difficult to set clear-cut standards (or outcomes) in ARC due to different levels of dependency or morbidity across facilities. Canada have recently established standards for a small number of interRAI-LTCF quality indicators, in instances of strong evidence and expert consensus (Health Quality Ontario, 2017). However, these standards in ARC are at this stage, relatively uncommon.

In the absence of a standard, Mor and Colleagues (2003), suggest a probabilistic approach is more feasible, such as comparing a facilities performance to a regional or national performance. This

process allows facilities to prioritise areas where they are performing below others and identify initiatives that have worked well. As there are currently no national benchmarking standards set in New Zealand for interRAI-LTCF quality indicators, this study has used the latter benchmarking technique. In the context of this research, benchmarking refers to a snapshot comparison at a point in time against two datasets that are expected to be similar (e.g., hospital-level of care). For benchmarking to be valid and effective, it requires that the ARC facilities and their resident populations are mainly comparable (i.e., in case-mix and dependency of residents, size of facilities, or level of care) (Frijters et al., 2013). Risk adjustment techniques enhance the comparison of health outcomes between facilities. Frijters et al. (2013) found that after risk adjustment the values of quality indicators differed less between facilities, compared with the unadjusted values. In instances where risk adjustment is not possible, matching the population through level of care, may reduce some of these differences.

The health outcomes or quality indicators were identified by Nurse Maude as areas of potential quality improvement and when reviewed by the researcher were considered feasible, valid, and comparable indicators, that had the ability to improve the quality of care for residents. It is essential to gain information at the patient and facility level, to enable healthcare workers to be proactive and plan interventions for residents who are at a higher risk of developing these conditions.

1.4.1 Falls, unintentional weight loss and pressure injuries

Pressure injuries, unintentional weight loss and falls are geriatric conditions that are largely preventable, when risk factors are properly managed (Murakami & Colombo, 2013; World Health Organization, 2015). However, national statistics describe that many older people in New Zealand ARC facilities are still at risk, with 24% of LTCF residents at moderate to very high risk of developing PI, 28% at risk of undernutrition and 35% at risk of falling (TAS, 2017c). Falls and PI both have been linked to lower quality of life and limitation of mobility (World Health Organization, 2015). Several studies suggest that significant unintentional weight loss is associated with death, and one study reported unintentional weight loss causes death for 9% to 38% of the older people population residing in ARC facility (McMinn, Steel, & Bowman, 2011).

Research continues to demonstrate how these conditions interact; it has been shown that PI in nursing home patients are significantly related to unintentional weight loss, poor nutrition and low body mass index (BMI) (Shahin et al., 2010). Furthermore, older people who are bedridden, incontinent or walking impaired are at a high risk of developing PI (Coleman et al., 2013), this is a likely consequence after suffering from a fall or hip fracture (Rapp, Becker, Lamb, Icks, & Klenk, 2008). It is essential to gain information at the patient and facility level, to enable healthcare workers to be proactive and plan interventions for residents who are at a higher risk of developing

one or all of these conditions. This will enable the individuals to maintain wellbeing and functional ability in the older years.

1.5 Statement of the problem

ARC facilities throughout New Zealand will experience a higher demand over the subsequent decades, with many older people presenting with multi-morbidities (Ernst & Young Limited, 2016; Ministry of Health, 2016b). In 2016, ARC spending in New Zealand accounted for 60% out of the total MOH budget spent on services to support older people (Ministry of Health, 2016a). As people age and become frail, they are at an increased risk of experiencing modifiable health conditions such as malnutrition, falls, and incontinence (Carryer et al., 2017). The MOH and ARC providers have a responsibility to ensure the care provided are actively improving the lives of the older people residing in them (Ministry of Health, 2016b). A key component of achieving this is utilising standardised assessment data to improve the reporting and identification of modifiable health conditions. This facilitates the provision of evidence-based care for those residents experiencing or at risk of these health outcomes.

Evidence has shown that monitoring quality outcomes influences the quality of life for residents in ARC (Courtney, O'Reilly, Edwards, & Hassall, 2010), and as the end-points of care, they provide an indication of whether the quality care processes have been successful (O'Reilly, Courtney, Edwards, & Hassall, 2011). Previously in New Zealand, the lack of standardised assessment tools in ARC has limited the ability to monitor preventable health outcomes and benchmark those outcomes with other ARC facilities (Carryer et al., 2017). The introduction of the interRAI-LTCF as the primary ARC assessment tool throughout New Zealand made it possible to benchmark modifiable clinical outcomes, scales, and CAPs between facilities. However, at the inception of this research project, there was no system in place for between facility benchmarking (prior to the introduction of the quarterly ARC reports produced by TAS).

1.6 Purpose statement

This project was initiated by Nurse Maude in late 2016, when they approached the researcher to undertake a process to benchmark their interRAI-LTCF data within other hospital level facilities in New Zealand and Canterbury. They had clear priorities to improve the monitoring and reporting of their interRAI data, to better inform the provision of care. At the time, there was no template nationally or at the facility level to benchmark a facilities health outcome profile with comparative national or regional facilities. Nurse Maude was interested in researching if there was a benchmarking procedure that would allow them to compare their interRAI-LTCF data with other hospital-level ARC facilities regionally and nationally, particularly focusing on preventable health

outcomes. Nurse Maude identified three priority outcome areas that they were interested in monitoring within their facility: falls, pressure injuries and unintentional weight loss. They wanted to be able to track these outcomes over time and include other outcomes in the future. the techniques and procedures established in this research can provide insight for Nurse Maude on how they could carry out benchmarking on a range of health outcomes and indicators, in relation to themselves (over time), and the changing national and Canterbury indicators in the future.

Since the inception of this research project, interRAI Services have evolved rapidly, with substantial implications for this research project. In mid-2017, and after the inception of this project, interRAI services developed individualised quarterly reports for all ARC facilities across New Zealand (TAS, 2018c). The report enabled facilities to review their own interRAI-LTCF data for that quarter, and benchmark themselves with regional and national facilities providing the same level of care, or similar in bed-size. Therefore, carrying out a very similar purpose to the original request from Nurse Maude. By 2018, TAS developed a suite of interRAI quality indicators and provided ARC facilities with a quarterly report benchmarking their quality indicator performance with regional and national datasets. Additionally, interRAI services publicly released the definitions for their quality indicators.

Considering the new TAS reports, a secondary aim was established to assess the salient advantages of this current research project and the quarterly ARC reports produced by TAS. Nurse Maude wanted to understand how completing their own benchmarking could complement the information provided by the TAS ARC reports.

1.7 Research aims

The primary aim of this research was to benchmark Nurse Maude's ARC hospital interRAI-LTCF data with similar (i.e., hospital-level) ARC facilities nationwide and in the Canterbury region, targeting three majorly preventable medical outcomes. A secondary aim for this research was to establish a procedure that could be used by Nurse Maude to carry out benchmarking on a range of health outcomes and indicators, in relation to themselves (over time), and national and Canterbury hospital-level datasets. The final aim of this study is to determine if the salient advantages of the benchmarking procedures established in this study offer Nurse Maude more than what is included in the TAS quarterly reports.

1.7.1 Research questions

1. Is the prevalence and risk of falls, pressure injuries, and unintentional weight loss at Nurse Maude long-term care hospital better or worse than national and Canterbury data?

2. When compared to the quarterly TAS ARC reports, does this benchmarking procedure provide Nurse Maude with salient advantages, in factors including, but not limited to, flexibility, indicators, timing and data reliability?

1.8 Outline of Thesis

This thesis is comprised of six chapters: introduction, literature review, methods, results, discussion and conclusion. This introduction chapter began with an overview of the ageing context globally and within New Zealand, highlighting the opportunities and challenges this will bring to health care and ARC system. It also introduced Nurse Maude Hospital, the interRAI collaboration and suite of assessment tools, including the interRAI-LTCF assessment and quality indicators. The final section of this chapter discusses the rationale and need for the study, including why the request for this study was initiated by Nurse Maude, the impacts of the TAS quarterly report to the aims and research questions, and the adjustments that were consequently made to this study. Finally, the research aims, and specific questions are outlined.

Chapter 2 reviews the literature surrounding this study, beginning with identifying how evidence-based care is implemented within ARC and how the interRAI-LTCF assessment tool facilitates evidence-based practice. The review seeks to identify the purpose and validity of the interRAI-LTCF, including outcome scales and CAPs. The implementation of the interRAI-LTCF assessment within New Zealand is also discussed, including the timeline of interRAI within ARC, challenges experienced during implementation and the opportunities the assessment provides for ARC quality improvement initiatives. Following on from this, the purpose and rationale of quality indicators are analysed, as well as the established validity of some interRAI quality indicators. Next, the three modifiable health outcomes studied in this research are reviewed: falls, unintentional weight loss, and pressure injuries. Each health outcome is discussed in regard to the associated health burden and costs, measurement methods (including limitations), the prevalence in ARC residents, common risk factors, and evidence-based practice to prevent the health outcome. Finally, a short summary and critique of the literature is provided.

Chapter 3 provides information on the methodology and context of the study and provides a rationale and justification for the quantitative and ethical approaches undertaken. The interRAI instrument is described in detail, including descriptions of each primary (prevalence and risk of falls, PI, and unintentional weight loss) and secondary variable analysed, definitions of each quality indicator and CAPs. This section also thoroughly outlines the procedures used to obtain the secondary data, and an explanation and justification of the statistical analyses that were undertaken.

Chapter 4 provides information on the key findings of this research, beginning with a description of the sample, then a section by section analysis comparing each dataset's interRAI health outcomes is presented (e.g., Nurse Maude hospital with the national dataset). This data is displayed as descriptive statistics with accompanying analyses. Following on from this, the three quality indicators for each dataset (Nurse Maude hospital, national dataset, and CDHB dataset) are compared with each other, along with a short analysis. The final element of Chapter 4 is the analysis of the TAS ARC quarterly report, compared to this research process. The salient advantages and limitations for both are considered in regard to flexibility, indicators, timing and data reliability.

Chapter 5 discusses the key findings of this research in comparison to the literature and previous research, aiming to establish the implications of this research to ARC. Finally, the strengths and limitations of this study and the interRAI-LTCF tool are described, as well as the implications to ARC. Chapter 6 concludes the thesis by reviewing the overall purpose, key findings and resulting implications of this study.

2 Literature Review

2.1 Introduction

This chapter briefly reviews the literature related to the use of the interRAI-LTCF assessment to benchmark prevalent and modifiable health outcomes in ARC settings, for the purpose of improving resident care. The chapter begins with an overview of the theoretical approaches to evidence-based practice and how evidence-based care is implemented within ARC. This leads to a discussion of why standardised assessments and indicators support the application of evidence-based care, and how standardised comparison between facilities can further this effort. Next, the interRAI-LTCF tool is reviewed: including the purpose and validity of the assessment tool, as well as the relevant outcomes, scales and CAPs. New Zealand's experience implementing the interRAI-LTCF tool is then reviewed, highlighting the challenges and opportunities facing the ARC sector in New Zealand.

The review also discusses the ability and potential of quality indicators to monitor and improve the quality of care provided within ARC. Here, the purpose, prior implementation, validity and limitations of quality indicators in ARC are discussed. Next, the three preventable health outcomes identified by Nurse Maude (and included in this research) are reviewed: falls, unintentional weight loss, and pressure injuries. Each health outcome is discussed regarding the associated health burden and costs, measurement methods (including limitations), the prevalence in ARC resident populations, common risk factors, and evidence-based practice to prevent the health outcome.

2.2 Evidence-based care in ARC

2.2.1 What counts as evidence and how is it applied?

Evidence-based practice is a widely accepted and utilised model across much of the westernised world, involving clinical decision-making that is grounded in the best available evidence (i.e., rigorous, well-designed and systematic) while also recognising other factors, such as clinical expertise, context and patient preference (Pearson, Wiechula, Court, & Lockwood, 2005). It is suggested that evidence-based medicine has philosophical origins dating back to the mid-19th century, and was accelerated by the work of the Cochrane Collaboration and other organisations that disseminate rigorous systematic reviews of the effectiveness of health care interventions (Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996). At the time, the emerging opinion held by some of these institutions was that evidence-based medicine should focus on clinical research as evidence rather than clinical intuition and anecdotal evidence (Evidence-Based Medicine Working Group, 1992).

Several academics and health professionals have critiqued this perspective, citing that it overly emphasises scientific, systematic and rigorous evidence, and discounts other types of evidence

relevant to medical decision-making such as clinical experience and patient values (Kitson, Harvey, & McCormack, 1998; Pearson et al., 2005). Conversely, other early conceptualisations of evidence-based medicine, such as the well-cited work by Sacket and colleagues (1996), describe it as "integrating clinical expertise with the best available external clinical evidence from systematic research" (p. 71), thereby emphasising a bottom-up approach. This viewpoint suggests that external research should be used to inform a clinician's decisions but not replace them; the clinician can decide whether the external evidence suits the case of the patient and how to integrate it into the care plan. The Joanna Briggs Institute (JBI) model highlights the need for evidence to be reviewed in terms of the feasibility, appropriateness, meaningfulness (i.e., does the intervention positively impact the patient experience), and effectiveness (Pearson et al., 2005).

Beyond the debate of what counts as 'evidence' in evidence-based practice, there is a lack of consensus on the most effective methodology to implement a 'model of change' in health care settings (Masso & McCarthy, 2009). Despite a wealth of frameworks and models on implementation, many health care interventions found to be effective in high-quality research fail to translate into improved practice and patient outcomes (Damschroder et al., 2009; Grol & Wensing, 2004). Previously, implementing evidence into practice was conducted at the individual level, specifically through evidence-based guidelines aiming to change the behaviours of clinicians' (Kitson et al., 2008). It is now widely accepted that this method is insufficient and implementing a change in practice is determined by several factors at multiple levels (e.g., individual, organisation, and political).

Frameworks in evidence-based practice often provide limited how-to support for employing a new practice because the determinants described are too generic and lack specific detail to guide an implementation process (Nilsen, 2015). Other researchers instead have developed process or action models that "facilitate implementation by offering practical guidance in the planning and execution of implementation endeavours" (Nilsen, 2015, p. 4). Several process models derive from nursing-led research, such as the well-known ACE (Academic Center for Evidenced-Based Practice) star model of knowledge transformation©. This model utilises both new and old conceptualisations of evidence-based practices and applies nursing's previous research work within the context of evidence-based practice. Depicted by a five-point star, the model demonstrates five stages of knowledge transformation[5] (Stevens, 2012).

[5] The authors describe knowledge transformation as the conversion of the initial research findings, through numerous stages and forms, to provide evidence-based care that improves health outcomes (Stevens, 2012).

1. Discovery research: discovering and exploring new knowledge through primary research (e.g., single qualitative or quantitative studies).
2. Evidence summary: synthesising large volumes of research and summarising the key findings via systematic reviews, meta-analysis, and literature reviews.
3. Translation to guidelines: generating clinical practice guidelines by combining best evidence with other forms of knowledge (e.g., clinical expertise and patient preference) and embedding the guidelines into care standards, protocols, and clinical pathways.
4. Practice integration: changing the practices of individuals and organisations and addressing any barriers to implementation.
5. Process, and outcome evaluation: evaluating the wide range of endpoints and outcomes, including health outcomes, provider and patient satisfaction, efficacy, efficiency, and economic analysis.

The star model has been utilised in both education and healthcare settings (Stevens, 2013) and provides a higher level of practical detail than a framework. Schaffer and colleagues (2013) describe that this model validates the contribution of nursing interventions to quality improvement, making it an appropriate fit within ARC, where nurses provide a majority of clinical care. However, the model lacks in some aspects, specifically the organisational culture and context that influence the implementation of a practice (Schaffer, Sandau, & Diedrick, 2013).

2.2.2 Application in ARC

Much of the literature on implementing research into practice is based on acute health care settings and hospitals, and the generalisability to an ARC context is often unknown. Reviewing examples of evidence-based practice within residential care may aid in understanding the factors that lead to success. The Encouraging Better Practice in Aged Care (EBPRAC) programme funded by the Australian government, is an example of a comprehensive government-led and nationwide initiative (Masso, Westera, Quinsey, Morris, & Pearse, 2011). The programme aimed to improve the evidence-based care within ARC facilities and to support nationally consistent application of clinical practice. Consistent with international literature, the programme took a multifaceted approach to implement evidence-based practice, including education, use of local facilitators, provision of resources (for example, tool kits and evidence summaries), and evaluation of the programme.

Between 2007 and 2010, the EBPRAC programme undertook two funding rounds involving 111 ARC facilities across 108 locations. The programme covered nine areas of clinical practice including pain management, oral health, fall prevention, nutrition and hydration, and wound management (Masso & McCarthy, 2009; Masso et al., 2011). The evaluation of the programme found that patient outcomes had improved in some but not all clinical areas. For example, there was consistent

evidence that practice and patient outcomes had improved in behaviour management, pain management, oral health and wound management. On the other hand, nutrition and hydration did not report the same improvements, although difficulty in measuring outcomes may contribute to this result. The evaluation also highlighted factors that were identified by key stakeholders as key to successful implementation, such as a receptive context for change, stakeholder engagement, and adequate resources (Masso et al., 2011).

Other examples within ARC have also utilised a multifaceted approach to implementing evidence-based care. For example, a longitudinal study evaluated the process and outcomes of an evidence-based wound care model, implemented into seven ARC facilities in Australia (Edwards et al., 2017). The model included education, workshops on skills and where to access resources, multidisciplinary clinical networks, and the use of local champions. The evaluation found that the model fostered the implementation of wound management and prevention practices and led to an improvement in patient outcomes.

A systematic review of falls prevention initiatives in ARC reaffirmed the influence of organisational and social factors in determining successful implementation (Vlaeyen et al., 2015). For example, good communication between shifts, involvement and empowerment of staff, sufficient equipment, and use of guidelines were factors influencing the application of effective fall prevention practice. These findings are similar to a review of literature on factors that facilitate the adoption of best practice in ARC, informed the development of the EBPRAC programme. This review identified eight factors, including a receptive context for change, having a plan to guide change, adequate resources, stakeholder engagement, and staff with necessary skills were more likely to foster evidence-based care (Masso & McCarthy, 2009).

Evidence-based practice is based on the best evidence and technology available, and research is continuously evolving (Donabedian, 1988). A substantial challenge is converting large volumes of rapidly developing evidence into practical forms, such as care guidelines. Another challenge for researchers and organisations is the range of diverse and equivocal implementation theories, models and frameworks that can be or have been applied within health care settings. Suggesting that no one approach is perfect, and further research in implementation science is needed to understand better the factors that led to successful implementation. Residential care settings encounter specific barriers, including the high turnover of staff, duplication and inconsistency in guidelines, access to suitable resources, and the high dependency of residents (Masso & McCarthy, 2009; Masso et al., 2011). Further to this, the EBPRAC programme noted sustainability as the most challenging aspect, summarising that “it depends more on factors within each facility (e.g., presence

of leadership and management support), rather than what was done by each project" (Masso et al., 2011, p. 6). Overall, there is no "magic bullet" to implementing evidence-based practice in ARC, however factors aiding the process may include diligent planning, a receptive context, and adequate communication.

2.2.3 The need for systematic standardised indicators and benchmarking

Although those entering ARC may have complex health conditions, ARC facilities also provide a setting for healthy ageing and improving the health outcomes and capabilities of older people. The New Zealand Aged Care Association (NZACA) conducted a comparative analysis of outcome scores from the interRAI-HC assessment (before entry into ARC), and interRAI-LTCF reassessment, after six months in ARC (New Zealand Aged Care Association, 2017). The study found that key indicators of health and wellbeing (including ADL, pressure injuries, depression, pain, cognitive performance) had improved during the six months after entering ARC. For example, six months after entry in ARC, 37.5% of people had noted an improvement in ADL Hierarchy score, and 82% of people who felt lonely in the home reported not feeling lonely in ARC. This demonstrates the ability of ARC to facilitate healthy ageing among high dependent older people.

However, national survey data continues to demonstrate that several preventable health outcomes are still prevalent within New Zealand ARC (Carryer et al., 2017; Weststrate & Adams, 2013). Although an individual's health status can be influenced by a range of factors beyond clinical care provision, monitoring health outcomes with a standardised assessment tool can enable a facility to investigate what the causes of poor health outcomes might be (Courtney et al., 2010; Donabedian, 1988). Quantifying the incidence and prevalence of these health conditions among ARC residents contributes to quality improvement by targeting poor health outcomes with evidence-based care.

Monitoring resident health outcomes over time provides clinical staff with a means to evaluate the successfulness of a quality care intervention (O'Reilly et al., 2011). This is most effective when the assessment tools are standardised and reliable, allowing the real difference before and after the intervention to be quantified accurately (Carryer et al., 2017). To interpret the quality indicator results, facility managers and clinical staff require some sense of whether the proportion of residents with a health outcome is higher or lower than should be expected. One way to achieve this is by benchmarking or comparing outcomes between comparative facilities. This allows providers to evaluate whether their facility is performing above or below the average for a particular outcome and make necessary changes to care provision. A lack of standardised definitions and measurements for quality care outcomes in ARC have impeded benchmarking efforts within ARC (Carpenter & Hirdes, 2013; O'Reilly et al., 2011). Benchmarking is only possible when ARC facilities are assessing

residents with the same standardised assessment tool, to ensure the health outcomes are measured consistently, using the same definitions.

As discussed in Chapter 1.4, benchmarking health outcomes in ARC can be achieved through various ways (Mor, Angelelli, Gifford, et al., 2003). For instance, in some countries, benchmarks or standards are established based on evidence and consensus of what can be achieved or is plausible under optimal conditions (O'Reilly et al., 2011). However, in ARC compared with acute care, the main focus may not be improving overall health status, but instead assisting dependent persons with maintaining or improving some health outcomes, and reducing dependency where possible (OECD & European Commission, 2013). Therefore, it might be challenging to establish a standardised benchmark or end-point goal in a health care setting with a diverse range of high care needs.

In this current research project, comparative ARC hospital-level datasets are benchmarked with Nurse Maude Hospital. Some have argued that inter-provider comparison does not account for the diversity in structural characteristics of ARC facilities (Castle & Ferguson, 2010; Courtney et al., 2010). For example, facilities with small average numbers of beds may limit statistical power. Furthermore, one or two residents who have experienced a fall in a facility may sway the average one way. In the case of a small facility, it is necessary to look at the trends over time and identify when an outlier may be influencing the results.

2.3 InterRAI-LTCF

The interRAI-LTCF assessment is a comprehensive, standardised instrument developed to assess the care needs, strengths and preferences of those in ARC (Kim et al., 2015; Onder, Carpenter, et al., 2012). This information is designed to be used by health care professionals to identify care needs and develop an individualised, evidence-based care plan (Morris et al., 2011). The prototype of the LTCF assessment was the RAI-MDS (Minimum Data Set) used in United States' nursing homes during the 1990s. Decades later, the current (third-generation) interRAI-LTCF assessment is the most widely used instrument among the interRAI suite, adopted by over 15 countries. Although this instrument is used primarily to inform patient care and wellbeing, it has the benefit of providing routinely collected health data which has been utilised for research and quality purposes in a variety of settings (Kijowska & Szczerbińska, 2018; OECD & European Commission, 2013; Onder, Carpenter, et al., 2012).

The interRAI-LTCF includes 311 individual items, assessed over 19 domains, which generate ten validated and reliable scales (e.g., Activities of Daily living hierarchy and Pressure Ulcer Risk scale) and 27 CAPs. The clinical scales and CAPs aid care professionals to interpret the findings of the assessment and guide patient treatment, by highlighting the severity of a health condition or risk of

problems across all domains (OECD & European Commission, 2013). Table 2.1 shows the 19 domains covered in the interRAI-LTCF assessment and the numbers of core and additional items (Morris et al., 2011). For example, oral and nutritional status has eleven core interRAI suite items and three additional items for the LTCF instrument. The skin condition and health conditions domains elicit information on items including the presence and severity of a PI and the number of falls (in a range of time periods).

Table 2.1: InterRAI-LTCF assessment instrument domains and the number of core and additional items

Domain	Core items	Additional items	Domain	Core items	Additional items
Identification Information	24	11	Admission and initial history	11	8
Cognition	9	1	Communication and vision	4	3
Mood and behaviour	20	1	Psychosocial wellbeing	3	16
Physcial functioning	15	4	Continence	2	0
Disease diagnosis	25	0	Health conditions	33	2
Oral and nutritional status	11	3	Skin condition	7	0
Activity pursuits	0	18	Medications	11	0
Treatment and procedures	2	46	Respondsibility and directives	0	10
Discharge potential	0	4	Discharge	2	3
Assessment information	2				

Trained registered nurses (RNs) primarily complete interRAI assessments; however other health care professionals such as therapists may also be trained to complete it (Morris et al., 2011; TAS, 2018b). The time to complete an interRAI- LTCF assessment may be between 20 to 90 minutes; interRAI organisation states it likely takes 60 to 90 minutes, and OECD (2013) suggests an assessment may take 40 to 60 minutes. While some nursing publications highlight that in reality one assessment in an ARC facility can take numerous hours, sometimes even days (INsite, 2015; Vuorinen, 2017). The assessment process involves the assessor having a conversation with the ARC resident being assessed, covering all relevant domains such as mood, preferences for activities, and pain (OECD & European Commission, 2013). Some domains and items require the assessor to review clinical records, discuss with other care staff, and residents' family members (associated with their care) to gain all necessary information. The assessment characterises each item in several ways, for example the severity, frequency, and presence or absence of conditions (Gray et al., 2009). Items also provide clear definitions, coding, and specific timeframes. For example, under the health conditions domain, falls are elicited through response options: no falls in the last 90 days; no falls in the last 30 days but

fell 31-90 days; one fall in last 30 days; two or more falls in last 30 days (Morris et al., 2011). The specificity of each item and clear definitions ensure the high inter and intra observer reliability.

The reliability and validity of the interRAI-LTCF assessment has been tested in numerous academic studies and found to be of high-quality in multiple languages and countries (Carpenter & Hirdes, 2013; Hirdes et al., 2008; Kijowska & Szczerbińska, 2018; Kim et al., 2015; Onder, Carpenter, et al., 2012). A large international study conducted by Hirdes et al. (2008), tested several interRAI suite instruments. They found the interRAI-LTCF instrument had the highest mean weighted kappa value (k = 0.74), indicating substantial reliability (Landis & Koch, 1977).[6] Other interRAI instruments also demonstrated excellent reliability, including acute care hospitals (averaged weighted kappa of items in the instruments = 0.82), home care (k = 0.74), and palliative care (k = 0.80). The study also reported high average weighted kappa values for individual items in the interRAI-LTCF, including falls (k = 0.86), stage of PI (k = 0.85), and height and weight (k = 0.82). The methods for this study were robust; trained paired assessors completed the interRAI assessments on 783 individuals, within 72 hours of each other, and blinded to the others' assessment. However, the authors of the study note the study was conducted by researchers on the board of directors of the interRAI corporation; this could be a potential issue of bias and conflict of interest. However, interRAI supports their Fellows to carry out research, as well as independent researchers, to continually improve the instruments through rigorous research (interRAI, 2009).

The results of Hirdes and colleagues, supports findings from the Services and Health for Elderly in Long Term Care (SHELTER) international study, where all interRAI-LTCF items tested met or exceeded general standards for test-retest and inter-rater reliability (Onder, Carpenter, et al., 2012). In this study, the reliability of categorical items (such as falls and PI) were assessed using the average weighted kappa values, and continuous variables (such as weight and height) were assessed using Pearson's correlation coefficients. The study reported the falls (k = 0.82), oral/nutritional status (k = 0.81), and skin conditions (k = 0.79) items demonstrated at least substantial level of agreement and reliability. For weight and height, Pearson's correlation coefficients for test-retest reliability were 0.99 for height and 0.89 for weight, indicating good to excellent reliability.

2.3.1.1 Clinical Assessment Protocols

The interRAI assessment generates CAPs by using the clinical findings of the assessment and computer algorithms to identify when an individual may be at risk of an adverse outcome. CAPs specifically focus on outcomes that have demonstrated to be preventable and provide clinicians with

[6] Landis and Koch (1977) suggest that a kappa value between 0.41-0.60 has a moderate strength of agreement between observers, 0.61-0.80 a substantial, and 0.81-1.0 almost perfect. While those under 0.40 were considered to have a fair (0.21-0.40), slight (0.00-0.20) and poor (<0.00) strength of agreement.

a set of evidence-based guidelines to intervene appropriately (Gray et al., 2009). They are an integral part of each interRAI instrument and provide not only problem definition (e.g., the person has a PI or at risk of developing a PI), but also indicate an opportunity to intervene (e.g., prevention of PI or improvement of ADL function) (Carpenter & Hirdes, 2013). Each CAP in the interRAI instruments has been developed by a group of academics and clinicians selected for their expertise in the CAP domain. This process included an extensive review of the literature, expert opinion, and analysis of interRAI data sets to identify sub-population with adverse outcomes across multiple assessment periods (Gray et al., 2009). Clinical focus groups and ongoing scientific research ensure each CAP is validated thoroughly (interRAI.org).

The interRAI-LTCF instrument has 27 relevant CAPs across four domains: clinical issues (e.g., incontinence), functional performance (e.g., ADL), cognition/mental health (e.g., delirium), and social life (e.g., social relationships) (Morris et al., 2011). The clinical outcomes of the interRAI assessment are included in the CAP algorithms. For example, the dehydration CAP considers clinical issues, including diarrhoea, weight loss, low fluid intake, dizziness, blood pressure, and shortness of breath (Gray et al., 2009). Therefore, the dehydration CAP identifies the underlying risk factors for dehydration. Each CAP or scale determines the level of risk the resident is considered for developing a condition. Generally, these range from low, medium and high risk but this varies for each CAP. If a CAP is triggered at the end of an assessment, it can guide health workers in developing an individualised care plan utilising evidence-based care, or identify if a referral needs to be made (Carpenter & Hirdes, 2013). For example, the undernutrition CAP guidelines suggest the care team conduct a dietary analysis on the individual to assess the overall suitability and calorie intake of their diet (TAS, 2017c).

2.3.1.2 Scales

Like the interRAI CAPs, several well-validated scales are generated out of an interRAI assessment through assessment outcomes and computer algorithms (Morris, Berg, Fries, Steel, & Howard, 2013; TAS, 2019d). These scales provide diagnostic screening (e.g., whether a person has incontinence), severity measures (e.g., the extent of ADL dependency), and a measure for outcome monitoring overtime (Gray et al., 2009). Scales are developed from information recorded in the assessment for care purposes only. For example, the ALD self-performance hierarchy scale is constructed from four interRAI assessment items, personal hygiene, locomotion, toilet use, and eating (OECD & European Commission, 2013). The scale is then generated by the assessment software and informs the care professionals of the degree of disablement to complete daily activities. The integration of well-known and validated scales into an existing assessment instrument reduces assessment burden, without loss of fidelity (Xie, Peel, Hirdes, Poss, & Gray, 2016). There are approximately ten scales in

the interRAI-LTCF assessment, encompassing cognition, mood, ADL, pain and health stability, social engagement.

The pressure ulcer risk scale (PURS) is included in this current study to assess ARC residents' risk of developing a PI. This scale can trigger the PU CAP and allows targeted preventative care of PIs to protect the resident's quality of life (TAS, 2017c). The PURS is constructed from six interRAI assessment items: history of PIs, impaired bed mobility, impaired walking, bowel incontinence, shortness of breath, and weight loss. This scale has been validated in several settings, including one study that found when derived from the interRAI acute care instrument, the PURS had good to strong ability to screen for PI outcomes in acute care (Xie et al., 2016).

2.3.1.3 InterRAI-LTCF New Zealand

The interRAI-LTCF assessment was first piloted in Canterbury, the Bay of Plenty and Waitemata DHBs during 2008, and was considered "a success" (interRAI NZ, 2019). No official data has been publicly released about the pilot programme, leading some within the nursing community, to question how the pilot was deemed to be a success (INsite, 2015). Nonetheless, in 2010 DHBs, in conjunction with the Aged Care Association, supported the voluntary adoption of the interRAI-LTCF assessment in ARC facilities during 2011-2015 (interRAI NZ, 2019). Two years later Associate Minister of Health announced that by 2015 the assessment would become mandatory for all ARC providers. By July 2015, the interRAI-LTCF assessment was the primary assessment tool nationwide for assessing older people in ARC. The assessment was made mandatory in ARC to support, continuity of care, quality improvement, evidence-based care plan development, outcome measurement and equitable access to care.

The New Zealand version of the interRAI-LTCF includes 311 questions, assessed over 20 domains, which generate 11[7] validated scales and 22 CAPs (Morris et al., 2011). The interRAI-LTCF assessment shares around 80% of the items with the Community Health, Contact and Home Care assessments (Bandaranayake & Campin, 2017). Every ARC resident is assessed by the interRAI-LTCF tool on admission to a facility, and every six months or if there is a significant change in a resident's condition. This is a condition of the Age-Related Residential Care Service Agreement, an agreement between DHBs and ARC providers (TAS, 2019a). Trained assessors complete interRAI assessments (usually by a RN), and must be completed within three days after the assessment has been undertaken (TAS, 2018b). Residential facilities are provided with the interRAI-LTCF assessment form

[7] Depression Rating Scale (DRS); Changes in Health, End Stage Disease and Signs and Symptoms (CHESS); Pain scale, ADL self-performance Hierarchy Scale; ADL Long Form; Aggressive Behaviour Scale (ABS); interRAI PURS; Cognitive Performance Scale (CPS); communication and BMIs

and user's manual, along with the national standards for completing an assessment, to ensure reliable and consistent coding (TAS, 2018b).

Implementation of the interRAI assessment in New Zealand ARC facilities has not been without challenges. An independent review of the implementation of the interRAI-LTCF assessment in ARC (2011-2015) was commissioned by TAS and undertaken by *Evaluation Consult* in June 2016 (Bandaranayake & Campin, 2017). The review surveyed ARC providers and facilities and identified several challenges including the training of staff, changing from a predominantly paper-based system to an electronic web-based system, and duplicating assessment information as many facilities used another assessment tool alongside the interRAI-LTCF. Several respondents viewed the interRAI assessment as a compliance and audit exercise, rather than perceiving the benefit to resident care and planning process.

Another finding from this review (Bandaranayake & Campin, 2017), also supported by international literature (Carpenter & Hirdes, 2013), was that the time taken to complete an interRAI assessment was too long. ARC providers felt it took longer than previous assessments, and far longer than the two hours they were initially told an interRAI assessment would take. A survey of providers revealed ARC hospitals had the highest average time to complete an estimate, taking on average 5.6 hours, whereas ARC rest homes took 5.2 hours. Respondents suggested the time spent completing the web-based assessment impacted on the time spent at the bedside and potentially the quality of care.

On the other hand, many respondents acknowledged there was a need for a standardised clinical assessment tool in ARC (Bandaranayake & Campin, 2017). Respondents identified that an interRAI assessment could improve the quality of care; precisely due to the triggering of CAPs to prompt staff to residents needs and the ability to inform care planning. This supports findings from a qualitative study about New Zealand RNs' opinions and views on the interRAI-LTCF (Vuorinen, 2017). This study found most nurses interviewed had positive attitudes towards the mandatory application of the interRAI-LTCF assessment. Factors influencing this perspective were supportive trainers and standardisation of the assessment tool. Negative opinions towards the interRAI assessment were time taken to complete the assessment, limiting patient care and duplication of data as many ARC facilities use other patient monitoring assessment to monitor residents (Vuorinen, 2017).

In response to the review and consultation with the broader ARC sector, interRAI Services (TAS) and the interRAI Governance Board have addressed some of these issues over the past few years (TAS, 2017b, 2019d). For instance, to reduce the duplication with other assessments and time taken to complete an assessment, interRAI services ran workshops with ARC assessors on how to best embed

interRAI into their individual systems and examples of best practice (TAS, 2017b). Furthermore, the interRAI education and support team train new assessors, randomly select approved assessors for quality review and have developed an e-learning programme. InterRAI services acknowledge that the interoperability[8] between interRAI and other ARC clinical systems (e.g., VCare ARC system[9]) is still an issue for ARC providers, as facilities still use their regular patient monitoring system, as well as interRAI, resulting in a duplication of clinical information and staff time.

InterRAI services have developed several initiatives to demonstrate the benefits of interRAI and better disseminate data to ARC providers, assessors and stakeholders. Initiatives include interRAI data analysis annual reports; publicly available data visualisation tool;[10] ARC quality indicators, and quarterly individualised ARC reports (TAS, 2019c). The interRAI-LTCF quality indicators are presented by the HQSC as a key source of information to identify areas for improvements within ARC, at the local, regional, and nation levels (Health Quality & Safety Commission New Zealand, 2018). Moreover, the InterRAI Corporation highlights the forward-thinking innovations by New Zealand interRAI Services; regularly featuring in the international interRAI newsletter (interRAI, 2019).

2.4 Quality indicators

2.4.1 Rationale/purpose for need

Quality indicators can be used as a surrogate measure of quality of care, potentially displaying an association between the indicator and the actual quality of care provided (Castle & Ferguson, 2010). The outcomes may be desirable such as improved continence, or undesirable such as presence of PI or falls. At the resident level, the quality indicator measures the presence or absence of a health outcome; when resident-level data is aggregated at the facility-level, quality indicators demonstrate the proportion of residents of a facility that have a particular outcome (Zimmerman et al., 1995). Facility-level indicators illustrate a pattern that may be influenced by the care or policy of an ARC facility, thereby allowing facilities to identify areas where they are doing well, to further opportunities for quality-improvement, and to monitor the success of a quality improvement initiative (Mor, Berg, et al., 2003; OECD & European Commission, 2013). The reporting of interRAI-LTCF quality indicators in the Netherlands was studied in a randomised-controlled trial (RCT) and was found to have had a positive effect on the quality of care (Boorsma et al., 2011). Conversely, a

[8] Interoperability between ARC software systems can be defined as the ability for two software systems to exchange information (TAS, 2017b).
[9] https://www.vcaresoftware.com/
[10] The data visualisation tool provides national aggregated interRAI data for interRAI home care, contact, and ARC assessments. The publicly accessible tool is interactive and free. It provides breakdowns by area (e.g., DHB and regions), year, and for several outcomes, CAPs, and scales (https://www.interrai.co.nz/data-and-reporting/).

RCT conducted in the US between 1997 and 1998 found simply that providing the MDS quality indicator report (sent to facilities quarterly) did not improve resident outcomes (Rantz et al., 2001).

Previously ARC quality indicators have been guided by health and safety standards set by regulating bodies. Several studies have demonstrated that there is a large variation between countries in the sets of ARC indicators systematically collected and reported (Castle & Ferguson, 2010; Ferrino, 2013; Mor, 2005; OECD & European Commission, 2013). A study of OECD and EU countries found a majority of countries report process and structural quality outcomes such as staff ratios or the number of skilled workers, but few countries report outcome indicators on functional status and clinical diagnosis (OECD & European Commission, 2013). In countries that did collect outcome quality indicators, the most commonly reported were outcomes of care effectiveness and user safety (e.g., incidence of physical restraints), rather than user-experience (e.g., self-reported quality of life) (Murakami & Colombo, 2013). The six most common indicators were falls, PI, use of physical restraints, over medication, unplanned weight loss and incidence of depression. Among interRAI quality indicators there are both prevalence-based and incidence-based indicators. Prevalence indicators examine the quality at a single point in time; and incidence indicators examine changes in residents' status between two assessments and can identify new quality issues (Courtney et al., 2010).

There is little consensus on which sets of ARC quality indicators are the most valid and likely to improve quality of care in ARC (Hutchinson et al., 2010). Even in countries such as the US and Canada, where interRAI-LTCF quality indicators (or the RAI-MDS equivalent) have been implemented for decades, the sets of indicators, as well as indicator definitions and exclusion criteria are regularly refined and adjusted (Health Quality Ontario, 2015; Hutchinson et al., 2010). Nevertheless, several studies agree certain attributes should be present in a robust quality indicator (Department of Health & Human Services, 2015; Mor, Berg, et al., 2003; Murakami & Colombo, 2013; Zimmerman et al., 1995), including:

- clinical importance –there is a strong evidence-based that the presence of the clinical outcome causes significant mortality or morbidity to residents;
- reliability and validity – a clear and unambiguous definition of what is being measured, use of a standardised measure or assessment tool, and clear evidence that the measurement reflects the provision of care;
- capacity to improve – measures are sensitive enough to detect a real difference and the indicator can direct an improvement process; and

- data feasibility and comparability– data is gathered efficiently and easily accessible; and indicators can be compared between facilities through risk adjustment.

As quality indicators have the capacity to identify potential quality issues and inform quality initiatives, the validity and reliability of indicators is of fundamental importance. Reliability of quality indicators refers to consistency of measurement and the inter-rater reliability. The validity of a quality indicator is more complex. According to Hutchinson and colleagues (2010) the aim of interRAI quality indicators is to provide indicators of potential high- or low-quality practice, and therefore, to establish validity the data needs to reflect the quality of practice, particularly, resident outcomes. For instance, in an ARC facility with a low rate of falls (i.e. a good facility), it is expected that there would be care processes and standards in place that are intended to prevent the occurrence of a fall.

The evidence of the reliability and validity of interRAI-LTCF quality indicators is mixed, although considerable research in various continents has been undertaken to assess the validity (Boorsma et al., 2011; Frijters et al., 2013; Hutchinson et al., 2010; Mor, Angelelli, Jones, et al., 2003; Mor, Berg, et al., 2003; Morris et al., 2003; Zimmerman et al., 1995). Numerous studies in the late 1990s assessed the RAI-MDS quality indicators and found many of the indicators had a high level of validity (Rantz et al., 1997; Zimmerman et al., 1995). That is, the quality indicators effectively identified potential quality problems within ARC facilities, could determine the difference between ARC facilities that provided high and low care quality, were generally stable over time, and were sensitive enough to identify quality differences.

However, further studies on the RAI-MDS 2.0 quality indicators in the US reported mixed validity and reliability. One large study including over almost 6,000 residents across 200 ARC facilities tested inter-rater reliability and found all quality indicators (including PI and weight loss) except one (little or no physical activity) met an acceptable inter-rater reliability (Frijters et al., 2013). Morris et al. (2003) assessed to what extent the quality indicators were able to discriminate between “high” and “low” quality performance (i.e. assessing indicator validity). The method was comprehensive. In brief, it sought to identify care processes and structures that could potentially influence a resident’s outcome, for each quality indicator. To identify these processes and structures for each indicator, the project used a multi-step approach including observation, survey, and record reviews.

The study reported that out of 38 indicators for residential care facilities, 12 indicators had the highest validity, among them was the prevalence of residents with PI (high-risk and low-risk

residents).[11] Prevalence of falls demonstrated acceptable validity (mid-valid category), and prevalence of unexplained weight loss was not found to be valid at the time of the research, indicating the provision of thorough care processes did not necessarily relate to a resident's outcome. However, another study conducted by Simmons et al. (2003) found the weight loss RAI-MDS indicator was able to discriminate the differences in quality between facilities who provide good quality weight loss prevention, with facilities that do not. Another study looked solely at the RAI-MDS falls indicator and concluded that the inter-rater reliability of falls was fair to moderate and the assessment may underreport falls due to a lack of clear definition (Hill-Westmoreland & Gruber-Baldini, 2005).

A resident's clinical outcome can be influenced by several known and unknown factors, making it difficult to assess whether an observed outcome is due to the quality of care provided or due to many other factors (Courtney et al., 2010; Donabedian, 1988). It is important to identify person level risk factors that legitimately increase or reduce the chance of an individual recording on the indicators (Frijters et al., 2013). Residents experiencing poorer health or multi-morbidities are more likely to develop further complications and have worse outcomes (Zimmerman et al., 1995). By excluding those residents with existing health outcomes that may led to or predict the development of a measured outcome, it delivers a more accurate measure of the actual quality of care being provided (Mor, Angelelli, Gifford, et al., 2003; Mor, Angelelli, Jones, et al., 2003).

2.4.2 Modifiable health outcomes studied

The following section discusses three clinical outcomes, identified in the literature as among the most commonly measured quality indicators in ARC: falls, unintentional weight loss, and PI. These conditions are largely preventable, when risk factors are properly managed (Murakami & Colombo, 2013; World Health Organization, 2015). However, national statistics describe that many New Zealand older people in ARC facilities are still at risk (TAS, 2017c).

Each health outcome will be discussed in regard to the associated health burden and costs, measurement methods (including limitations), prevalence in ARC residents, common risk factors, and evidence-based practice to prevent the health outcome.

2.4.2.1 Falls

Falls are a major health concern for older adults, often leading to severe disability and health loss (Tinetti, Speechley, & Ginter, 1988). A fall is defined as an event that causes the resident to unintentionally fall to the ground or a lower level, irrespective of the cause (Rapp, Becker, Cameron,

[11] High-risk and low-risk distinguishes between the prevalence of residents who were at a high-risk of developing a PI, and those that were at a low risk. This is different to the PI quality indicator reported in this study.

König, & Büchele, 2012). Among community-dwelling older adults, it is estimated that 30% to 40% experience a fall each year (Gibson, Harden, Byles, & Ward, 2008; Jones et al., 2016). The rates of falls and the related consequences rise substantially with age (Rubenstein, 2006). The New Zealand LiLacs study (Kerse & LiLACS NZ, 2014), reported that 37% of people in their advanced age cohort had fallen in the last 12 months. Of those who had fallen, over 20% needed hospitalisation and physiotherapy care. Falls have also been found to be an independent predictor of early admission to residential care (Tinetti et al., 1988). The occurrence and risk of falling are considerably higher within residential care (Rubenstein, 2006). This is not surprising, given ARC residents have higher levels of cognitive impairments, medication use, balance impairments and other functional limitations that may be underlying risk factors for falls (Lord et al., 2003; Rubenstein, 2006).

Several studies have estimated that between 50 to 60 percent of residents in ARC experience one or more falls each year (Cameron et al., 2012; Kerse, Butler, Robinson, & Todd, 2004; Lord et al., 2003). A study of New Zealand ARC facilities between 2000-2001, reported 40% of all residents experienced at least one fall, and 80% of fallers had an injurious fall (Butler, Kerse, & Todd, 2004). A smaller study of New Zealand ARC residents reported 13% had experience a fall in the past 30 days (Carryer et al., 2017). The incidence of falls in the United States ARC facilities is reported to be approximately 1.6 falls per bed per year (Rubenstein, 2006), however there is a wide range in the rates reported (0.26 to 3.6) (Cameron et al., 2012). In a study of over 500 nursing homes in Germany, the rate of falls was higher among men than women (2.18 and 1.49 falls per person-year, respectively) (Rapp 2011). Moreover, many studies suggest the incidence of falls is underreported in ARC facilities, this may be due to staff not being present when a resident has fallen, and the resident not reporting the fall to staff (Cameron et al., 2018; Cameron et al., 2012; Hay et al., 2017; Lord et al., 2003; Miller et al., 2009; Pitama, Huria, & Lacey, 2014; Rapp et al., 2012).

The consequences of falls in older people are often traumatic and can lead to serious morbidity and even loss of life in older people (Butler et al., 2004). Falls in ARC facilities may cause serious conditions such as physical injuries (e.g., hip fractures) and psychological issues including loss of confidence and fear of further falls (Carryer et al., 2017; Jones et al., 2016; Weststrate & Adams, 2013), the latter can lead to a limitation of activities, potentially reducing the quality of life (Gaxatte et al., 2011). Wrist fractures are a common injury related with falls; more common among fallers aged 65 to 75 years old (Rubenstein, 2006). Whereas, hip fractures become more common than wrist fractures after that age, likely due to slower reflexes and functional ability to 'break the fall' with the wrist (Jones et al., 2016; Rubenstein, 2006).

Hip fractures are a serious consequence of experiencing a fall and can have devastating consequences for the individual (Ehlers, Nielsen, & Bjerrum, 2018). In those aged over 80 years, many will not regain their mobility and it is estimated that only half of those who survive a hip fracture will walk unaided again (Jones et al., 2016). Additionally, there are severe impacts on society from osteoporosis and hip fracture care, reaching a total cost of NZ$1 billion and NZ$105 million in 2007 respectively (Osteoporosis New Zealand, 2012). Hip fractures are ten times higher in ARC facilities that in the community (Jones et al., 2016) and Rapp et al. (2009) reported that the incidence rate for hip fractures in ARC were 50.8 per 1000 person-years for women and 32.7 per 1000 person-years in mean. The study reported hip fractures increased with age and were most likely to occur after the first months after ARC admission. Furthermore, the risk of mortality increased significantly in residents with a hip fracture (hazard ratio: 1.72 for women and 2.14 for men). A study of Australian ARC facilities reported that over six months 13% of falls resulted in a hip fracture and 3.6% of falls resulted in a hospital admission. Among those admitted, over 40% reported to have a fractured neck of femur (hip fracture), and the estimated 3-month survival follow-up was low (rate ratio of 1:3) (Gibson et al., 2008).

Several studies have been undertaken to identify those most at risk at experiencing a fall in ARC settings. The risk of falls is related to a combination of environmental hazards and individual susceptibility to those hazards due to effects of age and disease (Rubenstein, 2006). Reported risk factors for falls in older people include muscle weakness, balance deficit, gait deficit, visual impairment, mobility limitations, cognitive impairment, functional impairments (Rubenstein, 2006). Moore and colleagues (2014), reported that ARC residents with severe cognitive impairment were at a higher risk of falling than residents with moderate cognitive impairment. Whereas, residents with a higher BMI were at a decreased risk of falls. Several studies have found the association between ambulant status and risk of falling. One study reported being ambulant with a gait aid increased residents' risk of falling two-fold when compared with non-ambulant residents (K. Moore et al., 2014). Lord et al. (2003) reported that fall rates were lower in older residents who were unable to rise from a chair or stand unaided and were the highest in residents with fair standing balance. In those who were able to stand unaided, risk factors included older age, male sex, higher care need, medication use, previous falls, and incontinence.

The study of Bavarian ARC facilities reported an association with care need, finding residents with increased care needs (i.e., high level of dependency) experienced a decreased rate of falls than those with lower care needs. Furthermore, falls occurred disproportionately when residents were walking or transferred between locations and 70% of all falls occurred in a residents' room or bathroom (Rapp, 2012). A New Zealand study reported a similar finding, suggesting almost all falls reported in

ARC occurred indoors, and over two-thirds of these occurred in a residents rooms (Butler et al., 2004).

While falls increase with age, they are not inevitable and can be predicted, especially in a care setting (Health Quality & Safety Commission New Zealand, 2019). To reduce the burden on both the individual and society it is paramount to have evidence-based strategies in place to reduce the incidence or number of falls in ARC. In 2018, a Cochrane review conducted an update of interventions for preventing falls in older people in ARC settings. The findings suggest that when pooling data from studies together, preventing falls through vitamin D supplementation likely reduces the rate of falls (risk ratio (RR) 0.72, 95% confidence interval (CI) 0.55-0.95) but likely makes no difference to the risk of falling (RR 0.92, 95% CI 0.76-1.12). This is consistent with findings from a systematic review conducted in the US reporting vitamin D supplementation significantly reduced the number of falls per person and possibly decreased the risk (not statistically significant) (LeBlanc, Zakher, Daeges, Pappas, & Chou, 2015). Other interventions included in the Cochrane review, such as exercise and multifactorial interventions were reported to have an uncertain effect on the rate of falls, due to low-quality evidence and likely make little to no difference to the risk of falls. The Cochrane review applied strict GRADE criteria[12] to assess the quality of studies, and reported that the quality of evidence for individual interventions was generally low to very low (Cameron et al., 2018).

Recent evidence has emerged that an individualised care plan addressing identified intrinsic and environmental risk factors should be implemented for any older person at risk of falling (Cameron et al., 2018; Jones et al., 2016). In 2013, the Health Quality and Safety Commission (HQSC) launched a programme from 2013 to 2015 to reduce the incidence and harm from falls in New Zealand, across multiple settings (Health Quality & Safety Commission New Zealand, 2019). This programme focused on making many small gains in several areas, such as individual-specific risk factors, environmental factors and safe mobilising (Jones et al., 2016). The intention is that these small changes, as well as performance measures, will generate awareness and lead to proactive fall prevention. The interRAI-LTCF assessment aids in facilitating multifactorial interventions, by triggering the falls CAP which identifies at-risk residents and suggests a change in care plan is necessary (TAS, 2017c).

2.4.2.2 Pressure injuries

Pressure injuries affect many older adults leading to disability, pain, hospitalisation and in some cases death. A PI is a “localised injury to the skin and/or underlying tissue, usually over a bony

[12] GRADE (Grading of Recommendations, Assessment, Development and Evaluations) is a framework for developing and presenting summaries of evidence and provides a systematic approach for making clinical practice recommendations https://bestpractice.bmj.com/info/toolkit/learn-ebm/what-is-grade/

prominence, as a result of pressure, or a pressure in combination with shear" (National Pressure Ulcer Advisory Panel (NPUAP), European Pressure Ulcer Advisory Panel (EPUAP), & Pan Pacific PI Alliance (PPPIA), 2014, p. 12). In New Zealand, it is estimated that 55,000 new PI develop each year, and the cost of PI is estimated to be $694 million annually (Accident Compensation Corporation, 2017). Furthermore, around 4 to 8% of people receiving healthcare in New Zealand experience a PI (KPMG, 2015). Pressure injuries can develop within two to three hours, representing a complex challenge to the continuity of care in ARC. Despite this, strong evidence demonstrates that PI can be reduced or prevented through standardised risk assessments and implementing evidence-based care (Berlowitz, Bezerra, Brandeis, Kader, & Anderson, 2000). Due to the serious consequences of PI and consensus that they are preventable, approaches to reduce the burden from PI focus on risk assessment and evidence-based prevention (Berlowitz et al., 2000; Jorgensen, Siette, Georgiou, & Westbrook, 2018).

Recently there has been a change of terminology for pressure injuries, previously known as pressure ulcers (Gillespie et al., 2014). The basis for this change was because the term PI identifies the preventable nature of the condition and acknowledges that they are indeed an injury. Pressure injuries are classified using an internationally accepted system, allowing a consistent and accurate measurement of severity (NPUAP, EPUAP & PPPIA, 2014). The system includes six possible classifications: stage I non-blanchable erythema; stage II partial thickness skin loss; stage III full thickness skin loss; stage IV full thickness tissue loss; unstageable PI; and suspected deep tissue injury.

Hospital-acquired PI are among the highest-burden of avoidable harms to a patient (Jackson et al., 2016). Pressure injuries are a major cause of preventable harm, leading to pain, infection, delayed functional recovery, admission to hospital and decrease in quality of life (Coleman et al., 2013; Jackson et al., 2016; World Health Organization, 2015). Some studies suggest that there is a significant link between PI and mortality, this was more likely in older adults that were institutionalised, had a concurrent infection or high neutrophil counts (Khor et al., 2014; Redelings, Lee, & Sorvillo, 2005). It is estimated that the cost of treating one grade III PI in New Zealand is over $100,000 (KPMG, 2015), demonstrating that PI are associated with significant personal costs to the patient and the wider health sector.

A small study of New Zealand ARC facilities found eight percent of the 276 residents had PI, and a quarter of those reported pain due to the injury (Carryer et al., 2017). Furthermore, nearly 80% of the ARC residents studied were at risk of developing a PI, and over 20% were at high risk (Carryer et al., 2017). Existing international literature estimates that the overall prevalence of PI among ARC

residents varies between 2% and 23% (Jorgensen et al., 2018; Z. Moore & Cowman, 2012; VanGilder, MacFarlane, Harrison, Lachenbruch, & Meyer, 2010). A study of sixty ARC facilities in Australia reported an incidence of 1.33 PI per 1000 resident days (95% CI = 1.29–1.37) (Jorgensen et al., 2018). In this study, residents who were older, male, a previous PI, and poor mobility were more likely to experience a PI. The three most common locations for injuries were gluteus maximus (35.2%), sacrum (13.4%), and foot (12.8%) (Jorgensen et al., 2018). The prevalence of PI among Irish ARC facilities was nine percent, over half of the PI were categorised as stage I or II injuries, and a majority of the injuries were located on the sacrum (58%) (Z. Moore & Cowman, 2012).

Predicting individuals at risk of developing a PI is challenging, given that over a hundred risk factors are associated with the development of a PI (Lyder, 2003). No one factor explains PI risk, but a complex relationship of factors which increase the likelihood of developing a PI (Coleman et al., 2013). Both intrinsic (patient bound) and extrinsic factors (outside of the patient, such as pressure and friction) play a role in causing pressure injuries (Shahin et al., 2010). Evidence on the risk factors for PI include decreased mobility/activity, perfusion (including diabetes, vascular disease and blood pressure), pressure ulcer status, skin moisture, nutrition and age (Coleman et al., 2013; Jorgensen et al., 2018; Reddy, Gill, & Rochon, 2006). It has been shown that PI in nursing home patients is significantly related to unintentional weight loss, poor nutrition and low BMI (Shahin et al., 2010). Furthermore, older people who are bedridden, incontinent or walking impaired are at a high risk of developing PI (Coleman et al., 2013), this could be as a consequence of suffering a fall or hip fracture (Rapp et al., 2008).

One study looking at the inter-facility variation of PI incidence found that after adjusting for resident-level risk factors (e.g., mobility and diabetes), 35% of the inter-facility variation remained. This suggests that the facility in which an individual resides is an important risk factor for PI development (Jorgensen et al., 2018). The study identified facility-level risk factors including low nursing numbers and facilities in higher deprived neighbourhoods as contributing factors.

Implementing PI prevention significantly reduces the incidence of PI and is highly cost-effective for the individual and wider health system (KPMG, 2015). A study carried out by KPMG and endorsed by New Zealand government agencies, predicted that an average annual investment of $5.5 million (over ten years) could potentially reduce the incidence of PI by up to 70% in New Zealand (KPMG, 2015). Similarly, a multi-factorial intervention study aiming to reduce the occurrences of PI was carried out in Counties Manukau hospital between 2011 and 2015. The intervention included the introduction of stricter PI reporting, standardised risk assessments, nurse wound care champions, and improved prevention equipment. The study found a large decrease in the prevalence of PI over

the study period, and the estimated cost of PI for the hospital was over $12 million less in 2015 than in 2011.

Implementing the Champions for Skin Integrity model based on evidence-based wound care and management in Queensland implemented similar initiatives as those applied in Counties Manukau hospital. The study led to a significant decrease in the proportion of residents with a PI (24% pre vs 10% post, $p< 0.001$) and observed an increase in the implementation of evidence-based wound care and prevention. A systematic review found using support surfaces, patient repositioning, optimising nutritional status and moisturising sacral skin to have the strongest evidence of PI reduction (Reddy et al., 2006).

Other individual prevention strategies have also been studied. For example, international clinical guidelines suggest an evidence-based individualised nutrition care plan should be developed for individuals with or at risk of a PI (NPUAP, EPUAP & PPPIA, 2014). Additionally, a modelling study of PI prevention strategies suggested that pressure redistribution mattresses for all residents were both clinically and economically effective (Stern et al., 2011). A Cochrane review on repositioning patients for PI prevention concluded that there was a lack of robust evidence to confidently assess the effectiveness of repositioning tilts and repositioning frequencies for PI reduction (Gillespie et al., 2014). However, the reviewers noted that this finding did not mean these interventions are ineffective, but that current evidence is inconclusive.

Another important aspect of PI prevention is regularly assessing an individual's risk with a reliable and standardised assessment tool (Wipke-Tevis et al., 2004). The most common scales are the Braden Scale and Norton, these are accessible, evidence-based and recommended in national guidelines. However, some literature that suggests some risk assessment tools appeared to be weak or imperfect predictors of PI development (Reddy & Gill, 2014). Although this finding could be due to differences in the case-mix of patients or challenges in implementing effective interventions. The use of a risk assessment tool aligns with the use of the standardised and comprehensive interRAI-LTCF assessment tool, which not only assesses PI status and severity but also identifies the patient risk of developing a PI, using two methods (PURS and PI CAP).

2.4.2.3 Unintentional weight loss

Unintentional weight loss is a common health outcome in ARC residents and one that is linked with adverse and expensive health outcomes such as increases in hospitalisation, morbidity and mortality (Abbasi & Rudman, 1994; Simmons, 2008). Older people in ARC likely have a lower level of energy expenditure, leading to lower energy requirement and reduced food intake (Abbasi & Rudman, 1994). As a result, this group are a particularly high-risk population for unintentional weight loss or

malnutrition, due to multi-morbidities, polypharmacy and dementia (Abbasi & Rudman, 1994; Bell, Tamura, Masaki, & Amella, 2013). Therefore, evidence-based clinical intervention to improve the nutrient density of the diet among ARC residents is necessary to reduce the risk of unintentional weight loss. Several care practice guidelines have been developed to aid health professionals to provide evidence-based care to residents experiencing or at risk of this modifiable health outcome.

Unintentional weight loss, which can be defined and monitored by considering a range of outcomes including BMI, malnutrition, and actual weight loss over 6-12 months (≥5% of body weight or ≥4.5 kilograms) (Simmons, 2008). Definitions of unintentional or involuntary weight loss are not consistent across the literature or countries (Bell et al., 2013). The OECD reported that Iceland measures unintentional weight loss as weight loss of 3kg of total body weight in the past three months. In comparison, Finland uses 5 percent loss of body weight over 30 days or more than 10% of body weight loss over 180 days. It should be noted that the use of BMI for screening the nutritional status among older people raises concerns; ranging from its inability to capture weight loss as a result of physiological changes associated with ageing and the possibility for observer error (Burman et al., 2015; Miller et al., 2009). Instead, many clinicians prefer the Mini Nutritional Assessment (MNA) to evaluate nutritional status in older people, which covers a wider range of variables including BMI, dietary assessment and self-perceived health and nutritional status (Bell et al., 2013; Burman et al., 2015). Although this measure might be preferable, the BMI has a well-established history of providing a simple and clinically meaningful assessment of nutrition among older people and is still utilised world-wide to screen for weight loss (Miller et al., 2009).

A lack of standardised definitions for unintentional weight loss makes it challenging to gain an accurate prevalence of this condition within ARC facilities. A systematic review on the prevalence of unintentional weight loss and malnutrition among ARC residents found the MDS weight loss definition (≥5% in 1 month or ≥10% in 6 months) had the narrowest range of prevalence, with 6% to 15% of residents experiencing unintentional weight loss (Bell et al., 2013). Whereas, low BMI had a wide prevalence range (6% to 69%), and had no consistent definition (Bell et al., 2013). A study conducted by Simmons et al. (2003) reported 21% of older residents in ARC experienced substantial unintentional weight loss. Two small surveys of ARC residents in New Zealand, Carryer et al. (2017) and Weststrate & Adams (2013), reported 10% and 12% of residents experienced unintentional weight loss, respectively.

A majority of studies using the MNA malnutrition found the prevalence rate of malnutrition to be between 20% to 39% of residents and 47% to 62% were found to be at risk of malnutrition (Bell et al., 2013). A study in Sweden and Finland (Burman et al., 2015), reported that 26% of very old people

living in ARC were malnourished, compared with 3% of community-dwelling older adults (measured by the MNA). More women than men experienced malnutrition and the prevalence increased in the older age groups. The study reported that one in five of those in ARC were classified by the MNA as well-nourished, the remainder of residents were experiencing or at risk of malnutrition.

Several studies have identified that unintentional weight loss is an independent predictor of increased mortality (Satheannoppakao, 2004; Stajkovic, Aitken, & Holroyd-Leduc, 2011). One study found that death related to significant unintentional weight loss occurs between 9% to 38% of the older people population in ARC, and is more likely to affect older people who are frail, recently admitted to hospital or had a low baseline weight (McMinn et al., 2011). Similarly, another study reported significant predictors for weight loss during ARC stay included the female gender, presence of chronic diseases at death, a new diagnosis of acute diseases at death, and receiving a therapeutic diet upon admission (Satheannoppakao, 2004).

National statistics describe that 28% of New Zealand older people in ARC facilities are at risk of undernutrition (TAS, 2017c). Causes of unintentional weight loss among older people are often more complex and diverse than in younger adults. One study reported an identifiable cause of the weight loss is not found in 16% to 28% of older people (Gaddey & Holder, 2014). McMinn and colleagues (2011) discuss that the main causes of unintentional weight loss can be classified as physiological (e.g., chronic and acute disease), psychological (e.g., depression, bereavement), social (e.g., isolation) and unknown factors (McMinn et al., 2011; Stajkovic et al., 2011). Some well-documented risk factors include dementia (Volkert et al., 2015), comorbid diseases, polypharmacy (K. Moore et al., 2014), and sensory loss (Abbasi & Rudman, 1994; McMinn et al., 2011). Those residing in ARC facilities are at an increased risk of unintentional weight loss because of issues associated with the ageing process, including feeding assistance due to impaired functional capacity, swallowing problems, and physiological changes such as poor smell and taste affecting appetite (Williams, 2012).

Several Cochrane reviews have investigated interventions targeting unintentional weight loss in older people residing in ARC facilities. For example, a controlled trial of a feeding assistance programme in a nursing home found that the intervention group maintained or gained weight, while the controls often lost weight or had no change (Simmons, 2008). In 2017, a review found that training non-nursing staff to provide caloric supplementation in ARC facilities was cost-effective and had a positive effect on residents' intake (Simmons et al., 2017). Medical nutrition therapy emphasising accurate weight assessments for prevention and treating unintentional weight loss in ARC residents increased the identifications of unintentional weight loss (Simmons et al., 2003).

Furthermore, among those residents who had been identified and provided nutrition care, over half (52%) maintained or gained weight. However, offering these or other nutritional programmes within ARC can be costly and consume staff time, which is already under-resourced (Simmons, 2008).

A key component of these prevention interventions is accurately identifying ARC residents experiencing or at risk of unintentional weight loss (McMinn et al., 2011; Volkert et al., 2015). This involves screening for malnutrition, closely monitoring body weight, and flood and fluid intake (Volkert et al., 2015), particularly in those with dementia. The interRAI-LTCF provides a standardised assessment to regularly record these factors and identifies residents at risk of dehydration and undernutrition, aiding health professionals to manage a resident's condition using evidence-based practices (TAS, 2017c).

2.5 Summary of literature

3 Methods

The methods for this study were informed by the RECORD (REporting of studies Conducted using Observational Routinely-collected Data) guidelines.[13] RECORD is an international collaborative, developing reporting guidelines for studies using routinely collected health data. These guidelines provide researchers with the minimum requirements to appropriately convey the methods and results of their studies.

3.1 Study design

Cross-sectional study with routinely-collected administrative data.

3.2 Setting

The broad setting for this study was hospital-level, ARC facilities that completed interRAI-LTCF assessments between 1 July 2016 and 1 July 2017. Specifically, Nurse Maude Hospital in Christchurch. They provide a fully licensed 36-bed long-term care hospital, specialising in aged care and palliative care. Comparative data was provided by TAS, this included de-identified interRAI-LTCF assessments from regional (Canterbury DHB) and national (New Zealand) hospital-level ARC facilities, within the same timeframe as above.

3.2.1 Nurse Maude background

In 2018, NM opened their new ARC hospital facility, increasing their bed capacity from 35 to 70 beds (Nurse Maude, 2018). It is important to note that the NM interRAI data analysed in this current study was collected in the previous ARC hospital, which provided the same levels of care, in the same location, but with fewer beds. The NM website outlines the purpose and vision for their ARC hospital, "for our residents the NM Hospital is their home; a place where they can have a sense of purpose and receive quality nursing care provided in a safe and compassionate environment" (NM, 2019, p. 1). The provision of high quality and person-centred care has always been fundamental to NM, since the early 20th century.

NM LTC hospital, can be classified as 'high dependency' as they provide 24-hour nursing care and many of their patients have high levels of dependency (Nurse Maude, n.d.). Unlike most ARC facilities in New Zealand which tend to be for profit and privately owned, NM is not for profit. Over the past few years, mandatory audits of NM hospital completed by the DAA Group (an auditing agency) reported the residents and families spoke positively about the care provided (The DAA Group Limited, 2017, 2018). In the 2018 certification audit report no areas were identified as requiring improvements, and the auditors commended NM for their continuous and best practice

[13] http://www.record-statement.org/pubs.php

quality improvement initiatives (The DAA Group Limited, 2018). The audit also identified that NM had achieved a reduction in the number of residents' falls, decreases in skin tears, and improved wound care documentations.

3.3 Participants

All residents in Nurse Maude HL, aged 65 years and over, who have completed an interRAI-LTCF assessment between 1 July 2016 and 1 July 2017, inclusive and who had consented to their data being used for planning and research purposes. Where an individual had more than one interRAI-LTCF assessment within the timeframe, the most recent assessment was utilised. De-identified comparative national and regional interRAI-LTCF data was provided by TAS. The same inclusion and exclusion criteria were applied to this data as described above for Nurse Maude hospital data.

3.4 Instrument

The quantitative data used within this study was collected using the interRAI-LTCF 9.1 instrument, which is used by the Ministry of Health under license and is the primary assessment tool for long-term care facilities in New Zealand (OECD & European Commission, 2013). The interRAI-LTCF assessment is a reliable standardised instrument (Kim et al., 2015; Onder, Carpenter, et al., 2012) used in over 35 countries worldwide (Onder, Carpenter, et al., 2012). Although this instrument is used primarily to inform patient care and wellbeing, it has the benefit of providing routinely collected health data which has been utilised for research purposes in a variety of settings (OECD & European Commission, 2013; Schluter, Ward, et al., 2016). Notably SHELTER international study, where all items tested met or exceeded general standards for test-retest and inter-rater reliability (Onder, Carpenter, et al., 2012). The interRAI-LTCF instrument continues to be subject to research and evaluation to ensure it produces reliable and valid data.

The interRAI-LTCF includes 250 items over 20 domains (including cognition; communication and vision; mood and behaviour; psychosocial wellbeing; functional status; continence; disease diagnosis; health conditions; oral and nutritional status; skin condition; activity pursuit; medications; and treatment and procedures) which generates over 15 validated and reliable scales (e.g., Activities of Daily living hierarchy, CHESS scale, Cognitive Performance scale, and Pressure Ulcer Risk Scale).[14]

The primary measures were gained from interRAI-LTCF assessment data, where possible auxiliary Nurse Maude hospital data was used to supplement any missing Nurse Maude items, particularly for the continuous variables weight and height.

[14] http://www.interrai.org/index.php?id=106

3.5 Primary Variables

Falls prevalence was elicited within the interRAI-LTCF assessment by two questions. The first falls question had response options: no falls in the last 90 days; no falls in the last 30 days but fell 31-90 days; one fall in last 30 days; two or more falls in last 30 days. The additional question asked about recent falls, with a yes or no response option (not applicable if last assessed more than 30 days ago or if this is first assessment).

Unintentional weight loss prevalence was assessed primarily by the interRAI-LTCF question on nutritional issues which has the option response: weight loss of 5% or more in the last 30 days or 10% or more is last 180 days. Additionally, the BMI score of patients was used to provide more information on prevalence of underweight patients. Both height and weight are required items in the interRAI-LTCF assessment, with height required to be measured in the past 12 months and weight in the past 30 days (TAS, 2018b). The BMI score is calculated by the height and weight of residents (the ratio of an individual's height (in cm) to weight (in kg) ratio; defined as weight/height squared) (Miller et al., 2009). Those with a BMI score that was less than 15kg/m^2 or between 16 kg/m^2 and 18 kg/m^2 were considered underweight.

The number of pressure injuries developed was elicited from the interRAI-LTCF assessment question on most severe pressure ulcer, the response options were: no pressure ulcer; any area of persistent skin redness; partial loss of skin layers; deep craters in the skin; breaks in skin exposing muscle or bone.

3.6 Quality indicator definitions

Definitions for the quality indicators were informed by the *Definitions for interRAI quality indicators* report (TAS, 2018a). Table 3.1 shows the numerator, denominator and any exclusion criteria used in the calculations for each quality indicator.

Table 3.1: Description of the definitions and calculations for the interRAI-LTCF quality indicators

Quality indicator	**Definition**
Percent of residents who have a PI stage 2 to 4	Numerator: L1. Most severe pressure ulcer = '2. Partial loss of skin layers' or '3. Deep craters in the skin' or '4. Breaks in skin exposing muscle or bone' or '5. Not codeable' Exclusions: No exclusions Denominator: all remaining assessments

Percent of resident who have unexplained weight loss	Numerator: K2a. weight loss =1 Exclusions: weight loss not answered* Denominator: all remaining assessments
Percent of resident who have fallen in the last 30 days	Numerator: J1. Falls = '2. One fall in last 30 days' or '3. Two or more falls in last 30 days' Exclusions: falls not answered Denominator: all remaining assessments

* TAS include additional exclusion criteria for the quality indicator weight loss, gained from the interRAI-LTCF assessment: J7c. End-stage disease, 6 or fewer months to live = Yes; O2m. Treatments and programmes - Palliative care, = '2. 1-2 of last 3 days' or '3. Daily in last 3 days'.

3.7 Demographic and other variables

The demographic variables measured within this study were age, sex, and ethnicity. Ethnicity was self-identified, residents could select multiple ethnicities, as is the recommended method of reporting in New Zealand. Ethnicity is shown according to Statistics New Zealand's level 1 definition, the six groups include: European, Māori, Pacific People, Asian, Middle Eastern/Latin American/African/ Other Ethnicity (includes residual groups) (Statistics New Zealand, 2017b). Age was elicited by assessment date minus date of birth. Sex was also self-identified, the four genders were male, female, unknown and indeterminant. The latter two categories are included in the female category, as per TAS privacy standards (TAS, 2019e). Further interRAI-LTCF assessment items relevant to the three health conditions falls, unintentional weight loss and pressure injuries were also utilized for context and discussion. These were fluid intake/output, dehydration, one or fewer meals a day, decrease in food or fluid, fluid output exceeds input, mode of nutritional intake, height, weight, and prior pressure ulcer. All demographic and additional variables were gained from the interRAI-LTCF assessment, and variable specific details are included in the appendix.

3.8 Risk outcomes

Risks of falls, unintentional weight loss and pressure injuries was measured using the Clinical Assessment Protocols (CAPs) and the Pressure Ulcer Risk Scale (PURs) that are generated by the interRAI-LTCF assessment. Each CAP or scale determines the level of risk the resident is considered for developing a condition. Generally, these range from low, medium and high risk but this varies for each CAP/scale. Table 3.2 outlines the definitions and criteria for each risk determinant. (*See below).*

Table 3.2: The definitions and factors included in determining risk of condition

Medical Condition	Definition	Factors included in CAPs	Range of scale	Risk defined in this model
Falls CAP	To identify patients at risk for falls and to adapt potential risk factors that could cause a fall.	Previous history of a fall (only one) or more than one previous fall.	0-2	Level 1 CAP is triggered when the resident has a medium level of risk of falling in the future. Level 2 CAP is triggered when the resident has a high risk of falling in the future
Undernutrition CAP	To identify under nutrition based on BMI and manage the patient's condition.	The BMI is a measurement which considers the ratio of an individual's height to weight. Defined as weight/height squared (Miller et al., 2009).	0-2	Those with a BMI below 19 or 19-21 (with no clear indication that death is near) are considered to be at a high or medium risk of undernutrition, respectively (TAS, 2017c).
Dehydration CAP	To identify and develop a care plan that recognises the possible causes of dehydration	Considers diarrhoea, weight loss, low fluid intake, dizziness, blood pressure, shortness of breath.	0-2	Level 1 is triggered if the resident has experienced one of the items (e.g., diarrhoea). The resident is considered a medium risk of being dehydrated. Level 2 is triggered when a combination of items are experienced and the resident is at a high risk of being dehydrated.
Pressure Ulcer CAP	To avoid the development of pressure injuries; while also identifying and	Includes patients who have a PI and require treatment (level 1 and level 2). Or where a PI has	0-3	Level 2 is triggered when a resident has a stage 1 PI and is at risk of developing to stage 2 or higher PI.

	treating patients that may have them or are at risk of developing them.	not developed but there is a risk that it could (level 3)		Level 3 is triggered when a resident does not have a PI but is considered at risk for developing one. Irrelevant: Level 1 is triggered when a resident already has a stage 2 or higher PI, this is not relevant to the risk of developing a PI.
Pressure Ulcer Risk Scale	Screen for patients that are at risk of PI.	History of PI, weight loss, incontinence, impaired mobility, shortness of breath and pain.	0-8 **Risk Level** Very low to low 0-2 Moderate 3 High to very high 4-8	This is an additive scale, for every item that a resident has, they are given one point, except for 'history of PI' this item adds 2 points. Which leads to a rare, but maximum score of 8 (Xie et al., 2016).

Data gained and altered from the interRAI LTCF National report 2015/16, Table of Clinical Assessment Protocol (CAPs) definitions (TAS, 2017c).

3.9 Comparing this study to TAS ARC reports

To answer the second research question of this study "When compared to the quarterly TAS ARC reports, does this benchmarking procedure provide Nurse Maude with salient advantages, in factors including, but not limited to, flexibility, indicators, timing and data reliability?" the following factors shown in Table 3.3 were considered and analysed.

Table 3.3: Comparative factors to determine notable differences between this research and TAS ARC reports

Factors	Definition	Interpretation/possible questions
Data reliability	Data is considered reliable when there are minimal errors and reflects the 'true score', with limited variation (Webb, Bain, & Page, 2016).	Due to the small sample set at Nurse Maude hospital, it's important to ensure the benchmarking provided is reliable and represents the true difference between datasets.

		Has there been any attempt to stabilise the data?
Flexibility	Considers a range of factors including: the ability to include an assortment of indicators; variety of analytical techniques; access and range of benchmarking data (e.g., regional and national data); frequency of benchmarking reports.	Including, but not limited to, four main factors: indicators, analytical techniques, benchmarking data and frequency of reports.
Indicators	Quantifiable characteristics of a population that may include health outcomes or service outcome measures (World Health Organization, 2010).	This factor is interested in what indicators can be included in the benchmarking. Furthermore, the ability to align with Nurse Maude's goals and targets at a certain point of time. Does the research/report include indicators relevant to Nurse Maude? Is there an ability to change or include indicators not presented?
Accessibility and availability	The ability to get up-to-date data and benchmarking information. It will consider the frequency and accessibility of information.	Is the benchmarking produced at regular intervals? Is it possible to get on demand benchmarks? How accessible is the information needed for benchmarking?

3.10 Procedure

As described above interRAI-LTCF assessment instrument is a reliable standardised instrument (Kim et al., 2015; Onder, Carpenter, et al., 2012) used in over 35 countries worldwide (Onder, Carpenter, et al., 2012). In New Zealand, the interRAI-LTCF instrument was made the primary assessment tool in ARC, allowing all assessments to be held in a national database. Assessors of interRAI-LTCF are trained nurses and registered health care workers who conduct the assessment at the bedside gaining information from clients, staff, caregivers and additional health records (Onder, Carpenter, et al., 2012). Once the assessment is completed data is electronically stored by TAS, as acting

guardian of New Zealand interRAI-LTCF data. The privacy officer from Nurse Maude, wrote an official letter to interRAI Manager authorising the researcher use of Nurse Maude hospital interRAI data. The System Clinician from TAS provided the researcher with interRAI analytics training (through conference call and shared screen technology).

InterRAI analytics is part of the interRAI software available to facility management and staff to review their interRAI-LTCF data (TAS, 2017a). The analytics module enables facilities to view consolidated data collected from their interRAI-LTCF assessment to build reports, displaying the data in graphs and charts. This allows management to analyse a cross section of both client and care information that they are interested in and if preferred, export this data to Microsoft Excel™ for further analysis (TAS, 2017a). Each facility can only access their own interRAI-LTCF assessment data. Nurse Maude hospital interRAI-LTCF data with National Health Index (NHI) numbers were accessed by the researcher through interRAI analytics using a computer at Nurse Maude hospital. A research database was created Microsoft Excel™, and participants were given study IDs, to ensure no identifying data was included in the statistical analysis. All Excel files were stored on a password-protected file and computer.

To gain comparative interRAI-LTCF data an online request was sent to TAS, detailing how privacy and respect will be maintained and how the data will be used. Following ethical approval, TAS released the requested de-identified data through their internal system 'Connex', and Nurse Maude hospital Quality Facilitator downloaded the excel spreadsheet onto her computer at Nurse Maude hospital and emailed the data through to the researcher. Also included within the data from TAS was deidentified aggregated data for Nurse Maude hospital, this allowed the researcher to ensure the data extracted through Nurse Maude's interRAI analytics matched that provided by TAS. Further correspondence with a Senior Analyst from TAS was required to request more specific data, which followed the same process as above. All Excel files were stored on a password-protected file and computer.

3.11 Statistical methods

Data were extracted from Nurse Maude in Microsoft Excel format and a research database was established (see ethical considerations for further detail). TAS also issued their de-identified data in Microsoft Excel format. Descriptive statistics on the de-identified data and the prevalence of each interRAI item assessed was conducted in Microsoft Excel. Two-way cross-tabulation was conducted using Fisher's exact test. A Fisher's exact test of significance was produced to determine that there was no statistically significant difference between the frequencies of interRAI-LTCF items/variables compared between datasets. The Fisher's exact test was selected for its ability to test association in

contingency tables and suitability to use with categorical variables. Due to the small numbers of Nurse Maude HL dataset (n=<40) and larger numbers in the national and Canterbury HL datasets, this test was also selected for its recognised ability to be unaffected by unequal distribution of frequencies within contingency table cells and sensitivity to small sample sizes. In the case that a Fisher's exact test could not be calculated due to large numbers, a chi-square test has been used instead. A binominal test of significance was conducted to assess the probability in getting a significant result when comparing each dataset. The software R (R Core Team, 2014) was employed for this statistical analysis. The quality indicators were calculated in Microsoft Excel, utilising the TAS definitions (i.e.., numerator, denominator and exclusions).

3.12 Ethical considerations

Clearance for this study was approved by University of Canterbury Human Ethics Committee (ref: HC 2017/101/LR). (Refer to Appendix 1 for ethical approval). This study only required a low risk application given the use of de-identified routinely collected administrative data, which poses very low risk to the participants, community and research team. Tripathy (2013), identified that the fundamental ethical considerations for secondary data analysis concerns the potential harm to individual subjects and the matter of return for consent. Although, in the case that the data is provided de-identified or appropriately coded it reduces the risk of harm to an individual. Ethical considerations involved in this study were primarily privacy and confidentiality, and benefits and risks involved.

(1) Privacy and confidentiality - The researcher did not have contact with participants as this data is collected as part of the standard health care of this cohort and as of 2015 a compulsory requirement made by the Ministry of Health (Ministry of Health, 2016b). The permission of the participants was gained through the Nurse Maude admission to service agreement, all new admissions are required to opt in/out of consenting for their de-identified data to be used for research purposes. The researcher signed a confidentiality agreement, privacy statement and consulted with their Māori officer. All comparative data provided by TAS was also consented by participants and de-identified. As per interRAI New Zealand and TAS 'Approved interRAI Data Access Protocols', no data provided by them includes information pertaining to which facilities the data is from to ensure privacy and confidentiality is maintained. This is in line with the British Sociological Association's Statement of Ethical Practice (2004) that researchers or administrations are required to inform participants regarding the use of their data and gain consent for future use as well.

This study aimed to manage the data securely to limit the risk of harm caused by unintentional or intentional disclosure of information. For the data gained from Nurse Maude a research database was created in Microsoft Excel™, and participants were given study IDs, to ensure no identifying data was included in the statistical analysis. All Excel files were stored on a password-protected file and computer. The de-identified data provided by TAS was stored on the researcher's computer and all excel files were password protected.

(2) Benefits and Risk – As this is a retrospective study using secondary data analysis, the researcher did not have contact with participants. The data was collected as part of the standard health care of this cohort and as of 2015 a compulsory requirement made by the Ministry of Health. No additional data was collected, and the staff and residents of the facility were not asked to carry out any tasks that did not occur as part of their standard practice. This research aims to provide evidence to Nurse Maude about the health conditions of their residents and quality of care. Therefore, all current or future residents in the hospital may experience a benefit to their care provided which targets modifiable risk factors and the provision of evidence-based practice. There is a small possibility that it will result in minimal change or negative outcomes. Nurse Maude will monitor any change in practice carefully, to ensure they minimise any risks to their residents.

Further to physical or clinical risk, cultural and other risks were considered. The researcher consulted with Nurse Maude Privacy and Māori officer and Komiti Māori, Nurse Maude, and discussed the importance of cultural sensitivity and the possible implications of this research to current and future Māori residents of Nurse Maude. It is acknowledged that Māori data is tapu (sacred) (Durie, 1998), however this current project does not contain identifying or culturally sensitive data.

4 Results

4.1 Participants

This study includes interRAI-LTCF assessment from 35 Nurse Maude HL residents aged 65 years and over. No residents from Nurse Maude opted out of consenting for their de-identified data to be used for research purposes. The comparative regional and national datasets provided by TAS includes 1,698 Canterbury HL and 14,021 national HL interRAI-LTCF assessments.

4.2 Description of the sample

The demographic characteristics of the study populations are outlined in Table 4.1. Of the three datasets, Nurse Maude HL had the highest proportion of older residents, with 71% aged 85 years and over, followed by Canterbury HL and national HL (both 57%). All datasets had more female than male residents, Nurse Maude HL had a higher proportion of females (74%) than Canterbury or national HL (both 65%).

Table 4.1 shows that most residents identified as European in all three datasets, Canterbury HL had the highest amount with 95%, while Nurse Maude and national HL both had 89%. Māori, Asian, Pacific peoples and 'other' ethnic groups contributed the remaining amount. Asian people made up 6% of Nurse Maude HL and 3% of national HL, Māori accounted for a small amount in each dataset (national HL 4%, Canterbury HL 3% and Nurse Maude HL 1%), as did Pacific peoples.

Overall, the Canterbury and national HL datasets were proportionality similar in age and gender, however the national HL dataset displayed more ethnic diversity than Nurse Maude or Canterbury HL. In comparison, Nurse Maude HL had a higher proportion of older and female residents, than Canterbury or national HL.

Table 4.1: Demographic characteristics of Nurse Maude, Canterbury and national HL datasets

	Nurse Maude HL n (%)	Canterbury HL n (%)	National HL n (%)
Age (years)			
65-74	2(6)	194 (11)	1,664 (12)
75-84	8 (23)	528 (31)	4,392 (31)
85 and over	25 (71)	976 (57)	7,965 (57)
Total	**35**	**1,698**	**14,021**
Gender			
Female	26 (74)	1,102 (65)	9,049 (65)
Male	9 (26)	596 (35)	4,972 (35)
Total	**35**	**1,698**	**14,021**

Ethnicity			
European	31 (89)	1,620 (95)	12,447 (89)
Māori	1 (3)	22 (1)	507 (4)
Pacific peoples	0 (<1)	11 (1)	401 (3)
Asian	2 (6)	23 (1)	487 (3)
MELAA[α]	0 (<1)	4 (<1)	65 (<1)
Other[β]	1 (3)	18 (1)	112 (1)
Total	**35**	**1,698**	**14,021**

[α]Middle Eastern, Latin American or African ethnicity

[β] Other includes all other residual ethnic groups

4.3 Missing height and weight data

The missing height and weight data for each dataset are outlined in Table 4.1. The table shows that Nurse Maude HL was missing height information for one resident but had weight data for all 35 residents. The Canterbury and national HL datasets are both missing similar levels of weight and height data. The largest amount of data is missing for national HL height data, of which 1,168 (8%) residents have no information.

Table 4.2: Missing height and weight data from the interRAI-LTCF assessments for Nurse Maude, Canterbury and national HL datasets

	Nurse Maude HL n (%)	Canterbury HL n (%)	National HL n (%)
Height			
Missing	1 (3)	103 (6)	1,168 (8)
Total	35	1,698	14,021
Weight			
Missing	0 (0)	91 (5)	865 (6)
Total	35	1,698	14,021

4.4 Analysis of interRAI-LTCF items, scales and CAPs

4.4.1 Nurse Maude and Canterbury HL: Differences in data

Table 4.3 presents a comparison of the health profiles of Nurse Maude HL and Canterbury HL. Eighty percent of residents from Nurse Maude HL and Canterbury HL had not had a fall in the past 90 or 30 days. The remaining proportion had one fall in the last 30 days (Nurse Maude HL 9% vs. Canterbury HL 11%) or two or more falls in the last 30 days (Nurse Maude HL 11% vs. Canterbury HL 9%). Both datasets had similar proportions of unintentional weight loss[15], 11% of Nurse Maude HL residents and 13% of Canterbury HL residents had experienced unintentional weight loss. These similarities were also demonstrated in other nutritional variables, such as the proportions of residents that had a decrease in food or fluid, (Nurse Maude HL 14% vs. Canterbury HL 12%). Nurse Maude HL residents had a higher proportion (23%) of residents with a BMI of 18kg/m^2 or less, categorising them as underweight compared with Canterbury HL (14%). Nurse Maude HL and Canterbury HL had similar rates of normal healthy weight residents, 43% and 40% respectively. The two datasets also had a similar proportion of residents with no pressure ulcer, 94% of Nurse Maude HL residents and 90% of Canterbury HL residents. The remaining proportion had any areas of persistent skin redness (Nurse Maude HL 3% vs. Canterbury HL 5%), partial loss of skin layers (Nurse Maude HL3% vs. Canterbury HL 3%) or deep crater in the skin (Canterbury HL 1%).

Canterbury HL had a higher proportion of residents that had a high (9%) or medium (28%) risk of falling in the future, compared with Nurse Maude HL (medium risk 14% and high risk 11%). A majority of Nurse Maude HL (86%) and Canterbury HL (80%) residents did not trigger the pressure ulcer CAP indicating that they were not at a risk of developing a PI, while 9% and 10% of residents, respectively, had no current ulcer but were considered at a risk for developing one. On the PUR scale, just over half (54%) of Canterbury HL residents had very low to low risk of developing a PI, compared with 35% of Nurse Maude HL residents. They had similar proportions of residents at high to very high risk of developing a PI (Nurse Maude HL 17% vs. Canterbury HL 20%) but Nurse Maude HL had more residents at moderate risk of developing a PI. Nurse Maude HL had a higher proportion of residents considered to have a high (26%) or medium (26%) risk of undernutrition, compared with Canterbury HL residents (high risk 22% and medium risk 18%).

All variables produced test results that were not significant ($p>0.05$), indicating there is no difference between the two variables. A binominal test found that out of 17 tests it is expected that 0.85 tests would be significant ($p=0.99$). Therefore, there is no evidence to suggest that the datasets have systematic differences.

[15] Categorised as weight loss of 5% or more in the last 30 days, or 10% or more in the last 180 days.

Table 4.3: Health profiles of Nurse Maude HL and Canterbury HL

	Nurse Maude HL n (%)	Canterbury HL n (%)	*P-value*
Dehydration CAP			0.061
Not triggered	32 (91)	1,597 (94)	
Low level	2 (6)	16 (1)	
High level	1 (3)	85 (5)	
Falls CAP			0.174
Not triggered	26 (74)	1,076 (63)	
Medium risk	5 (14)	474 (28)	
High risk	4 (11)	148 (9)	
Undernutrition CAP			0.302
Not triggered	17 (49)	1,016 (60)	
Medium risk	9 (26)	300 (18)	
High risk	9 (26)	382 (22)	
Pressure Ulcer CAP			0.706
Not triggered	30 (86)	1,355 (80)	
Stage 2 ulcer	1 (3)	87 (5)	
At risk, stage 1 ulcer	1 (3)	79 (5)	
At risk, no ulcer	3 (9)	177 (10)	
Falls			0.263
No fall in last 90 days	26 (74)	1,076 (63)	
No fall in last 30 days	2 (6)	291 (17)	
One fall in last 30 days	3 (9)	183 (11)	
Two or more falls in last 30 days	4 (11)	148 (9)	
Recent Falls			0.119
No	2 (50)	302 (85)	
Yes	2 (50)	55 (15)	
Weight loss			0.999
No	31 (89)	1,479 (87)	
Yes	4 (11)	219 (13)	
Dehydrated			0.414
No	34 (97)	1,673 (99)	
Yes	1 (3)	25 (1)	
Fluid intake			0.445
No	32 (91)	1,603 (94)	
Yes	3 (9)	95 (6)	
Fluid output exceeds input			0.999
No	35 (100)	1,686 (99)	
Yes	0 (<1)	12 (1)	
Decrease in food or fluid			0.595
No	30 (86)	1,500 (88)	
Yes	5 (14)	198 (12)	

	Nurse Maude HL n (%)	Canterbury HL n (%)	*P-value*
One or fewer meals a day			0.429
No	32 (91)	1,609 (95)	
Yes	3 (9)	89 (5)	
Mode of nutritional intake			0.281
Normal	22 (63)	1,012 (60)	
Modified independent	3 (9)	120 (7)	
Requires diet modification (solids)	5 (14)	390 (23)	
Requires diet modification (liquids)	1 (3)	42 (2)	
Can swallow (pureed solids)	3 (9)	115 (7)	
Combined oral/parenteral/tube feeding	1 (3)	3 (<1)	
Nasogastric tube feeding only	0 (<1)	1 (<1)	
Abdominal feeding tube	0 (<1)	8 (<1)	
Parenteral feeding only	0 (<1)	1 (<1)	
Activity did not occur (entire period)	0 (<1)	6 (<1)	
Most severe pressure ulcer			0.999
No pressure ulcer	33 (94)	1,532 (90)	
Any area of persistent skin redness	1 (3)	79 (5)	
Partial loss of skin layers	1 (3)	54 (3)	
Deep crater in the skin	0 (<1)	19 (1)	
Breaks in skin exposing muscle or bone	0 (<1)	8 (<1)	
Unknown[α]	0 (<1)	6 (<1)	
Prior pressure ulcer			0.153
No	33 (94)	1,446 (85)	
Yes	2 (6)	252 (15)	
Pressure ulcer risk scale			0.099
Very low to low (0-2)	12 (35)	908 (54)	
Moderate (3)	17 (49)	459 (27)	
High to very high (4-8)	6 (17)	331 (20)	
BMI (kg/m^2)			0.717
≤15 severely underweight	1 (3)	59 (3)	
16-18 underweight	7 (20)	181 (11)	
19-24 normal healthy weight	15 (43)	683 (40)	
25-29 overweight	6 (17)	383 (23)	
30-34 moderately obese	4 (11)	170 (10)	
35-39 severely obese	1 (3)	63 (4)	
≥40 very severely obese	0 (<1)	22 (1)	
Unknown[β]	1 (3)	137 (8)	

[α] Not codeable

[β] BMI score has not been calculated. This is often due to the weight being unknown.

4.4.2 Nurse Maude and National HL: Differences in data

Table 4.4 presents a comparison of the health profiles of Nurse Maude HL and national HL. Eighty percent of residents from Nurse Maude HL and 81% from national HL had not had a fall in the past 90 or 30 days. Nurse Maude HL had a slightly higher proportion of residents that had two or more falls in the last 30 days compared with National HL (Nurse Maude HL 11% vs. national HL 7%). Both datasets had similar proportions of unintentional weight loss[16] (Nurse Maude HL 11% vs. national HL 12%). These similarities were also evident in other nutritional variables, such as a decrease in food or fluid (Nurse Maude HL 14% vs. National HL 13%). However, Nurse Maude HL had a higher proportion of residents (23%) that had a BMI score of 18 kg/m^2 or less (categorising them us underweight or severely underweight) compared with national HL (14%). Residents' most severe PI were: any areas of persistent skin redness (Nurse Maude HL 3% vs. national HL 5%), partial loss of skin layers (Nurse Maude HL 3% vs. national HL 4%) or deep crater in the skin (national HL 1%). The remaining proportions had no PI.

Nurse Maude HL had a higher proportion of residents (74%) who had not triggered the falls CAP compared with national HL (65%). However, 11% of Nurse Maude HL residents were at high risk of experiencing a fall, compared with 7% of national residents. The remainder of residents were at medium risk. A majority of Nurse Maude HL (86%) and national HL (77%) residents did not trigger the pressure ulcer CAP, however 9% and 12% of residents were considered at risk of developing a PI, respectively. The PUR scale categorised a larger proportion of residents from both datasets to be at high to very high risk of developing a PI (Nurse Maude HL 17% vs national HL 22%), compared with the interRAI-LTCF PU CAP. Both datasets had similar proportion of residents considered at high risk of undernutrition, within one percentage point difference (Nurse Maude HL 26% vs. national HL 25%).

All 17 variables had a Fisher's exact test conducted for Nurse Maude HL and national HL data. All variables produced test results that were not significant ($p>0.05$), indicating there is no difference between the two variables. A binominal test found that out of 17 tests it is expected that 0.85 tests would be significant ($p=0.99$). Therefore, there is no evidence to suggest that the datasets have systematic differences.

[16]Categorised as weight loss of 5% or more in the last 30 days, or 10% or more in the last 180 days

Table 4.4: Health profiles of Nurse Maude HL and national HL

	Nurse Maude HL n (%)	National HL n (%)	*P-value*
Dehydration CAP			0.059
Not triggered	32 (91)	13,063 (93)	
Low level	2 (6)	139 (1)	
High level	1 (3)	819 (6)	
Falls CAP			0.142
Not triggered	26 (74)	9,160 (65)	
Medium risk	5 (14)	3,811 (27)	
High risk	4 (11)	1,050 (7)	
Undernutrition CAP			0.547
Not triggered	17 (49)	7,793 (56)	
Medium risk	9 (26)	2,704 (19)	
High risk	9 (26)	3,524 (25)	
Pressure Ulcer CAP			0.875
Not triggered	30 (86)	10,817 (77)	
Stage 2 ulcer	1 (3)	840 (6)	
At risk, stage 1 ulcer	1 (3)	672 (5)	
At risk, no ulcer	3 (9)	1,692 (12)	
Falls			0.285
No fall in last 90 days	26 (74)	9,160 (65)	
No fall in last 30 days	2 (6)	2,174 (16)	
One fall in last 30 days	3 (9)	1,637 (12)	
Two or more falls in last 30 days	4 (11)	1,050 (7)	
Recent Falls			0.116
No	2 (50)	2,899 (85)	
Yes	2 (50)	531 (15)	
Weight loss			0.999
No	31 (89)	12,309 (88)	
Yes	4 (11)	1,712 (12)	
Dehydrated			0.396
No	34 (97)	13,821 (99)	
Yes	1 (3)	200 (1)	
Fluid intake			0.497
No	32 (91)	13,105 (93)	
Yes	3 (9)	916 (7)	
Fluid output exceeds input			0.999
No	35 (100)	13,936 (99)	
Yes	0 (<1)	85 (1)	
Decrease in food or fluid			0.797
No	30 (86)	12,246 (87)	
Yes	5 (14)	1,775 (13)	

	Nurse Maude HL n (%)	National HL n (%)	*P-value*
One or fewer meals a day			0.463
No	32 (91)	13,188 (94)	
Yes	3 (9)	833 (6)	
Mode of nutritional intake			0.168
Normal	22 (63)	8,049 (57)	
Modified independent	3 (9)	1,051 (7)	
Requires diet modification (solids)	5 (14)	3,511 (25)	
Requires diet modification (liquids)	1 (3)	285 (2)	
Can swallow (pureed solids)	3 (9)	948 (7)	
Combined oral/parenteral/tube feeding	1 (3)	19 (<1)	
Nasogastric tube feeding only	0 (<1)	11 (<1)	
Abdominal feeding tube	0 (<1)	106 (1)	
Parenteral feeding only	0 (<1)	6 (<1)	
Activity did not occur (entire period)	0 (<1)	35 (<1)	
Most severe pressure ulcer			0.999
No pressure ulcer	33 (94)	12,509 (89)	
Any area of persistent skin redness	1 (3)	672 (5)	
Partial loss of skin layers	1 (3)	621 (4)	
Deep crater in the skin	0 (<1)	109 (1)	
Breaks in skin exposing muscle or bone	0 (<1)	49 (<1)	
Unknown[α]	0 (<1)	61 (<1)	
Prior pressure ulcer			0.156
No	33 (94)	11,873 (85)	
Yes	2 (6)	2,148 (15)	
Pressure ulcer risk scale (scores range 0-8)			0.053
Very low to low (0-2)			
Moderate (3)	12 (34)	6,931 (49)	
High to very high (4-8)	17 (49)	4,050 (29)	
	6 (17)	3,040 (22)	
BMI (kg/m^2)			0.604
≤15 severely underweight	1 (3)	455 (3)	
16-18 underweight	7 (20)	1,595 (11)	
19-24 normal healthy weight	15 (43)	5,665 (40)	
25-29 overweight	6 (17)	3,045 (22)	
30-34 moderately obese	4 (11)	1,264 (9)	
35-39 severely obese	1 (3)	393 (3)	
≥40 very severely obese	0 (<1)	186 (1)	
Unknown[β]	1 (3)	1,418 (10)	

[α] Not codeable

[β] BMI score has not been calculated. This is often due to the weight being unknown.

4.4.1 Canterbury HL and national HL: Differences in data

Table 4.5 presents a comparison of the health profiles of national HL and Canterbury HL datasets. Both datasets had comparable proportions of residents that had experienced either, one fall in the last 30 days (national HL 12% vs. Canterbury HL 11%) or two or more falls in the last 30 days (7% and 9%, respectively), however most resident had not experienced a fall in the last 30 or 90 days. Twelve percent of national HL and 13% of Canterbury HL residents had experienced unintentional weight loss, while the majority of resident had not (77% and 87%, respectively). The datasets also had similar proportions of residents who had experienced a decrease in food or fluid (national HL 13% vs. Canterbury HL 12%). Both datasets had 14% of residents with a BMI score of 18 kg/m^2 or less (categorising them as underweight or severely underweight) and 40% of residents (national HL and Canterbury HL) had a BMI score that categorised them as a normal weight. There were small differences in the proportion of PI; 89% of national HL residents and 90% of Canterbury HL residents had no PI and the remaining proportions had any areas of persistent skin redness (national HL 5% vs. Canterbury HL 5%), partial loss of skin layers (national HL 4% vs. Canterbury HL 3%) or deep crater in the skin (both 1%).

Canterbury HL had a slightly higher proportion of residents that had triggered a high-risk response for the falls CAP (national HL 7% vs. Canterbury HL 9%) however a majority of residents from both datasets were not considered to be at risk of a fall. A majority of national HL (77%) and Canterbury HL (80%) residents did not trigger the pressure ulcer CAP. However, 12% of national HL residents and 10% of Canterbury HL residents were considered at risk of developing a PI and 5% of residents from both datasets had a stage 1 PI and were at risk of the injury developing further. On the PUR scale, national HL had a larger proportion of residents that were at high to very high risk of developing a PI (national HL 22% vs. Canterbury HL 19%), and 29% of national HL residents compared with 27% of Canterbury HL residents were at moderate risk of developing one. Canterbury HL had 60% of residents that did not trigger the undernutrition CAP and subsequently had less residents at medium (18%) or high risk (22%) of undernutrition when compared with national HL (65%, 27% and 25%, respectively).

Fifteen out of 17 variables produced test results that were not significant ($p>0.05$), indicating there is no difference between the variables. The variables that produced a significant response ($p<0.05$) were undernutrition CAP and PUR scale. Canterbury HL had a higher proportion of residents that were not considered to be at risk of undernutrition compared with national HL (56% vs. 60%). This was similar for the PUR scale, which showed a higher proportion of Canterbury HL residents had a very low to low risk of a PI compared with national HL (53% vs. 49%). A binomial test found that the

two significant tests are not significantly different (p=0.2) from the one in twenty chance that is expected. Therefore, there is no evidence of any systematic differences between the datasets.

Table 4.5: Health profiles of national HL and Canterbury HL

	National HL n (%)	Canterbury HL n (%)	*P-value*
Dehydration CAP			0.386
Not triggered	13,063 (93)	1,597 (94)	
Low level	139 (1)	16 (1)	
High level	819 (6)	85 (5)	
Falls CAP			0.123
Not triggered	9,160 (65)	1,076 (63)	
Medium risk	3,811 (27)	474 (28)	
High risk	1,050 (7)	148 (9)	
Undernutrition CAP			0.004
Not triggered	7,793 (56)	1,016 (60)	
Medium risk	2,704 (19)	300 (18)	
High risk	3,524 (25)	382 (22)	
Pressure Ulcer CAP			0.079
Not triggered	10,817 (77)	1,355 (80)	
Stage 2 ulcer	840 (6)	87 (5)	
At risk, stage 1 ulcer	672 (5)	79 (5)	
At risk, no ulcer	1,692 (12)	177 (10)	
Falls			0.058
No fall in last 90 days	9,160 (65)	1,076 (63)	
No fall in last 30 days	2,174 (16)	291 (17)	
One fall in last 30 days	1,637 (12)	183 (11)	
Two or more falls in last 30 days	1,050 (7)	148 (9)	
Recent Falls			0.999
No	2,899 (85)	302 (85)	
Yes	531 (12)	55 (15)	
Weight loss			0.411
No	12,309 (88)	1,479 (87)	
Yes	1,712 (12)	219 (13)	
Dehydrated			0.829
No	13,821 (99)	1,673 (99)	
Yes	200 (1)	25 (1)	
Fluid intake			0.143
No	13,105 (93)	1,603 (94)	
Yes	916 (7)	95 (6)	
Fluid output exceeds input			0.621
No	13,936 (99)	1,686 (99)	
Yes	85 (1)	12 (1)	
Decrease in food or fluid			0.261
No	12,246 (87)	1,500 (88)	
Yes	1,775 (13)	198 (12)	

	National HL n (%)	Canterbury HL n (%)	*P-value*
One or fewer meals a day			0.274
No	13,188 (94)	1,609 (95)	
Yes	833 (6)	89 (5)	
Mode of nutritional intake			0.50*
Normal	8,049 (57)	1,012 (60)	
Modified independent	1,051 (7)	120 (7)	
Requires diet modification (solids)	3,511 (25)	390 (23)	
Requires diet modification (liquids)	285 (2)	42 (2)	
Can swallow (pureed solids)	948 (7)	115 (7)	
Combined oral/parenteral/tube feeding	19 (0)	3 (0)	
Nasogastric tube feeding only	11 (0)	1 (0)	
Abdominal feeding tube	106 (1)	8 (0)	
Parenteral feeding only	6 (0)	1 (0)	
Activity did not occur (entire period)	35 (0)	6 (0)	
Most severe pressure ulcer			0.101
No pressure ulcer	12,509 (89)	1,532 (90)	
Any area of persistent skin redness	672 (5)	79 (5)	
Partial loss of skin layers	621 (4)	54 (3)	
Deep crater in the skin	109 (1)	19 (1)	
Breaks in skin exposing muscle or bone	49 (0)	8 (0)	
Unknown	61 (0)	6 (0)	
Prior pressure ulcer			0.617
No	11,873 (85)	1,446 (85)	
Yes	2,148 (15)	252 (15)	
Pressure ulcer risk scale			0.006
Very low to low (0-2)	6,931 (49)	908 (53)	
Moderate (3)	4,050 (29)	459 (27)	
High to very high (4-8)	3,040 (22)	331 (19)	
BMI (kg/m^2)			0.055*
≤15 severely underweight	455 (3)	59 (3)	
16-18 underweight	1,595 (11)	181 (11)	
19-24 normal healthy weight	5,665 (40)	683 (40)	
25-29 overweight	3,045 (22)	383 (23)	
30-34 moderately obese	1,264 (9)	170 (10)	
35-39 severely obese	393 (3)	63 (4)	
≥40 very severely obese	186 (1)	22 (1)	
Unknown	1,418 (10)	137 (8)	

[α] Not codeable

[β] BMI score has not been calculated. This is often due to the weight being unknown

*Fisher's exact test could not be calculated due to large numbers, instead chi-square test has been used.

4.5 Benchmarking the quality indicators

Table 4.6 presents a comparison of the three researched quality indicators of Nurse Maude HL, national HL and Canterbury HL datasets. Nurse Maude HL had the lowest prevalence of residents who had experienced a PI (stage 2 to 4) with 3% of residents (n=1), compared with 5% (n=87) from Canterbury HL and 6% (n=840) from national HL. All three datasets had a comparable prevalence of residents that had experienced unexplained weight loss throughout the study period (Nurse Maude HL 11%, national HL 12%, Canterbury HL 13%). There was little variability between the three datasets for the fall's quality indicator; Nurse Maude HL and Canterbury HL had slightly higher prevalence of residents who had fallen in the last 30 days (20%), when compared with national HL (19%).

Table 4.6: Prevalence of three quality indicators for Nurse Maude HL, national HL and Canterbury HL

Quality indicator	Nurse Maude HL n (%)	National HL n (%)	Canterbury HL n (%)
Prevalence of residents who have a pressure injury stage 2 to 4	1 (3)	840 (6)	87 (5)
Prevalence of resident who have unexplained weight loss	4 (11)	1,712 (12)	219 (13)
Prevalence of residents who have fallen in the last 30 days	7 (20)	2,687 (19)	331 (20)

4.6 Comparative factors between this study and TAS ARC reports

Table 4.7 presents the salient advantages and some similarities between the benchmarking procedure established in this study, compared with the individualised ARC quarterly reports developed by TAS. When considering factors such as the accessibility and availability, data reliability, and flexibility, the process and outputs in this current research provide Nurse Maude with some notable advantages, that likely complement that TAS reports. These include the real-time data access, indicator flexibility, supplemented missing weight and height data, and potential to use data stabilisation over time.

Table 4.7: Salient advantages of the benchmarking procedure established in this study (using interRAI analytics software), compared with the interRAI-LTCF ARC suite report and interRAI-LTCF ARC quality indicator report

	Salient advantages and similarities
Accessibility & availability	Salient advantages - Real-time access to facility data through interRAI analytics software, enabling Nurse Maude to be responsive to any quality issues that may arise in between the arrival of quarterly reports
Data reliability	Salient advantages - Supplement missing height and weight data in interRAI-LTCF assessments, from resident records. This ensures a more accurate measure of interRAI-LTCF outcomes (e.g., unintentional weight loss, BMI) and CAPs (e.g., undernutrition) - Ability to use historical data to stabilise the data over time, such as averaging the data. Particularly useful for a small ARC facility like Nurse Maude Similarities - Data elicited from a reliable, validated and standardised instrument (interRAI-LTCF tool) - Benchmarking Nurse Maude data with other hospital-level ARC facilities, to try to match the level of dependency or case-mix as accurately as possible (without the use of risk-adjustment techniques)
Flexibility of indicators	Salient advantages - Ability to investigate indicators of interests to Nurse Maude, that may not be available in the two TAS reports. Similarities - Ability to generate/calculate quality indicators for NM residents using the interRAI Services standardised definitions and exclusion criteria

5 Discussion

The discussion chapter reviews the findings of this study and seeks to contextualise these results within the national and international research. Firstly, the research questions of the study are reviewed, along with the relevant key findings. Following on from this, a more detailed review of the findings for falls, PI, and unintentional weight loss is presented, including the interpretation of the results in relation to existing research and implications to evidence-based care. Next the issues relating to the comparability between the datasets are discussed, followed by an analysis on the validity and reliability of this research. Subsequently, the salient advantages of the benchmarking procedures established in this study are considered, in relation to what is already available in the TAS quarterly reports. Finally, the strengths and limitations of the interRAI-LTCF and of this study are considered.

5.1 Aim of study

This study was initiated by Nurse Maude to improve the monitoring and reporting of their interRAI data, to better inform the provision of care. Falls, unintentional weight loss, and PI were identified by Nurse Maude as key priority outcome areas that were majorly preventable. This study sought to examine the prevalence and risk of these three key preventable health outcomes (falls, unintentional weight loss, and PI) for older people aged 65 years and over residing in Nurse Maude and benchmark these with comparable Canterbury and national HL datasets. Beyond this, Nurse Maude wanted to use the techniques and procedures established within this research to be easily adapted and applied to other outcomes, including items not reported in the TAS reports. The prevalence of falls, unintentional weight loss, and PI was measured through interRAI-LTCF assessment items and quality indicators. The risk of outcomes was measured through the relevant interRAI-LTCF CAPs and the PUR scale. InterRAI-LTCF assessments completed between 1 July 2016 and 1 July 2017, inclusive, were included.

Since the development of the quarterly reports for every ARC facility in New Zealand, an additional research aim was developed, to assess the salient advantages and limitations of both this current research project and the quarterly ARC reports produced by TAS. Nurse Maude wanted to understand how completing their own benchmarking could complement the information provided by the TAS ARC reports. This is explored in a later part of this chapter (refer to Chapter 5.5).

5.2 Prevalence and risk

The study found that several health outcomes and quality indicators were very similar across all three datasets, including prevalence of unintentional weight loss and falls, and PI risk (determined

by PI CAP). Other outcomes differ somewhat between the datasets, including prevalence of PI, risk of PI (determined by PUR scale). It is difficult to establish whether Nurse Maude performed better or worse than the comparative datasets; in some areas Nurse Maude performed the same as or better than the national and Canterbury datasets (e.g., PI and falls quality indicators), but appeared to slightly lower performance in other areas (e.g., undernutrition risk and low BMI score). This is consistent with evidence that facilities tend not to perform consistently in all areas of quality of care (Courtney et al., 2010; Rantz et al., 2004; Rantz et al., 1997). Although, Nurse Maude numbers were relatively small and subject to short-term fluctuations. In general, national HL and Canterbury HL datasets displayed less variation in most interRAI-LTCF outcomes measured in this study, compared with the variation noted between NM and either dataset. Larger sample sizes increase the stability and accuracy of the percentages, when compared with those based on a smaller number of respondents.

5.2.1 Falls

This study found that Nurse Maude HL had a similar prevalence of falls, as national HL and Canterbury HL datasets. Approximately 20% of all residents across each dataset had experienced one or more falls in the last 30 days. These findings were considerably higher than the 13% reported in both New Zealand studies by Carryer et al. (2017) and Weststrate and Adams (2013). It is helpful to view the national quality indicator report produced by TAS for this quality indicator, to examine the national average and range of values within HL care, compared with the values found in this study. The national report for April to June 2018 demonstrated a national HL average of approximately 16% and a range of values from approximately 8% to 21% of residents (who had experienced a fall in HL care) (TAS, 2018c). Therefore, the prevalence rates reported in this study are somewhat higher when compared with the national HL average in 2018, however, they are still within the HL range.

When compared with international literature the prevalence of falls in this study were also higher than the prevalence reported in Ontario, Canada, which reported 16.4% of ARC residents had experienced a fall in the last 30 days (Canadian Institute for Health Information, 2018). Recently, Health Quality Ontario established a benchmark standard for this indicator, of 9%, based on strong evidence and expert consensus (Health Quality Ontario, 2017). This standard is described as a level of excellence, and a marker of how well a facility is performing (Health Quality Ontario, 2017). All three datasets in this study had a prevalence of approximately double this benchmark, indicating that quality improvement strategies are required. However, the panel of Ontario experts identified that this indicator is not ideal, as it does not distinguish between falls resulting in injury and all other falls (Health Quality Ontario, 2017).

When reviewing those at risk of falling, National HL had the lowest proportion of residents at a high risk of falling with 7%, followed by 9% in Canterbury HL, and 11% from Nurse Maude HL. The factors included in the falls CAP are prior history of falls; as Nurse Maude hospital had the highest prevalence of falls, it is expected that they would demonstrate a slightly higher risk of falls than the other HL datasets.

Another consideration when reviewing these findings is that several studies have demonstrated that falls are underreported in ARC facilities (Cameron et al., 2018; Murakami & Colombo, 2013; Rapp et al., 2012). This may be because the staff were not present when a resident fell, or a fall may have been observed by staff but not reported due to staff workload or other causes (Cameron et al., 2018; Rapp et al., 2012). Furthermore, studies assessing the validity and reliability of the interRAI quality indicators within ARC have suggested that falls quality indicator has a moderate validity and reliability (Hutchinson et al., 2010; Morris et al., 2003), however, it may underreport falls due to a lack of clear definition (Hill-Westmoreland & Gruber-Baldini, 2005).

5.2.2 Pressure injuries

This study found that Nurse Maude HL had a lower prevalence of PI, compared with national HL and Canterbury HL datasets. One resident in Nurse Maude HL experienced a stage 2 to 4 PI throughout the study period (2.9%), whereas the Canterbury HL prevalence was double this (6%) and national HL was also higher (5%). Although Nurse Maude sample is much smaller, our analysis found that the variables between datasets are comparable. Fisher's exact test for this interRAI-LTCF item (most severe PI) was carried out for each comparison between datasets, and every variable produced test results that were not significant ($P>0.05$), indicating there were no differences between the variables. The lower prevalence of PI in the Nurse Maude dataset is supported by other findings in this study; Nurse Maude HL had a higher proportion of residents with no current PI and no prior PI when compared with the other HL datasets.

In the NZ study, Weststrate and Adams (2013) found that approximately 5% of ARC resident had a stage 2 to 4 PI and around 7% had a stage 1 to 4 PI. The current findings from the three datasets were slightly lower than the 8% found in studies by Carryer et al. (2017) and Moore et al. (2014), although these studies included stage 1 to 4 PI. In line with international and national literature, this study found that stage 3 and 4 PI had the lowest prevalence, compared with stage 1 and 2 (Z. Moore & Cowman, 2012; Murakami & Colombo, 2013; VanGilder et al., 2010; Weststrate & Adams, 2013).

In this study, risk of developing a PI was measured using two different tools, pressure ulcer CAP and interRAI PUR scale, the latter has been validated against the Braden scale for PI risk (Xie et al.,

2016).[17] When reviewing those at risk of developing a PI using the PUR scale, a higher proportion of residents were at moderate to very high risk, when compared with the pressure ulcer CAP. This study found that using the PUR scale Nurse Maude HL had the largest proportion of residents at moderate to very high risk of developing a PI (67%), compared with Canterbury and national datasets (47% and 50%, respectively). Alternatively, the pressure ulcer CAP found that Nurse Maude had the highest proportion of residents that did not trigger the CAP (86%, compared with 80% and 77% from Canterbury and national HL datasets). It is difficult to explain this difference, however, the PUR scale considers a wider number of risk factors (e.g., weight loss, impaired mobility, incontinence) than the pressure ulcer CAP, and an interRAI CAP is only triggered when there is an opportunity to prevent or improve an adverse outcome through clinical intervention (Carpenter & Hirdes, 2013). Given the interRAI PUR scale has demonstrated good to strong ability to screen for PI outcome (Poss et al., 2010; Xie et al., 2016), the PUR scale is likely more effective at assessing PI risk than the pressure ulcer CAP.

When reviewing the literature on PI risk in ARC, they align well with the PUR scale findings of this current study. For example, Moore et al. (2014) used the Norton score to assess the risk of PI and found that over half of ARC residents were at a high to moderate risk of developing a PI. In the New Zealand study by Carryer et al. (2017), they reported that 20% of ARC residents were at a high risk of PI development (measured by the Braden scale), this is a similar proportion of high-risk residents found in the national and Canterbury HL (suing the PUR scale).

5.2.3 Unintentional weight loss

This study found that Nurse Maude HL had a similar prevalence of unintentional weight loss, as national and Canterbury HL datasets. Approximately 12% of all residents across each dataset had experienced unintentional weight loss, categorised as weight loss of 5% or more in the last 30 days, or 10% or more in the last 180 days. Due to the use of aggregated data in this study, we were unable to carry out the proper exclusion criteria (those with end-stage disease, 6 or fewer months to live, or those receiving palliative care treatments) for this quality indicator. Therefore, some residents included in the quality indicator prevalence across all datasets may have unchangeable conditions, and the presence of unintentional weight loss is not a result of the quality of care provided by the ARC facility (Hutchinson et al., 2010; Mor, Berg, et al., 2003).

[17] The Braden Scale for predicting PI risk is composed of six subscales of the most common risk factors for PI risk. This scale has demonstrated reliability and validity to identify ARC residents at risk of PI (Horn et al., 2004).

To review the impact of not excluding those residents with an unavoidable risk of weight loss, we can compare our results with the national quality indicator report produced by TAS, which applies the proper exclusions to all quality indicators. The national report for April to June 2018 demonstrated a national HL average of approximately 9% and a range of values from approximately 7% to 15% of residents (who had experienced unintentional weight loss, with exclusion criteria applied) (TAS, 2018c). Therefore, the prevalence rates reported in this study are slightly higher when compared with the national HL average in 2018, however, they are still within the HL range.

The findings of this current study were within the range of prevalence reported by other studies. As discussed in the literature review, there is not one established definition of unintentional weight loss which may account for some of the variations in prevalence reported in studies (Murakami & Colombo, 2013). One New Zealand study by Carryer et al. (2017) found 10% of ARC residents experienced unintentional weight loss, while Weststrate and Adams (2013) reported a prevalence of 17%. Internationally, Moore and colleagues (2014), reported 12% residents in ARC experienced unintentional weight loss (defined by loss of ≥3kg over 3 months, or any unplanned weight loss for each consecutive months of the quarter).

However, there have been inconsistent findings on the validity of the interRAI unintentional weight loss quality indicator (Hutchinson et al., 2010). Simmons et al. (2003) reported that the quality indicator reflected differences in the prevalence of unintentional weight loss between ARC facilities. Another study found the unintentional weight loss quality indicator met acceptable inter-rater reliability but was not valid at determining between facilities that provided high and low care quality (Morris et al., 2003). As a result, some countries, such as Canada do not include it within their suite of quality indicators (Health Quality Ontario, 2017).

When reviewing those at risk of undernutrition, Canterbury HL had the lowest proportion of residents at a high or medium risk of undernutrition with 40%, followed by 44% in national HL, and 52% from Nurse Maude HL. A consideration of this result is that Nurse Maude HL has the largest proportion of older residents out of the three data sets, and as older age is associated with malnutrition (Covinsky et al., 1999), this could be one contributing factor to the higher undernutrition CAP triggers observed in Nurse Maude HL dataset. Another consideration is that the interRAI-LTCF undernutrition CAP is based on BMI; residents with a BMI below 19kg/m^2 or between 19-21kg/m^2 (with no clear indication that death is near) are at a high or medium risk of undernutrition, respectively. Findings from a thesis conducted by Radich (2013) reported that among community-dwelling older adults the interRAI undernutrition CAP cut-off may be too low to detect nutritional risk, as many older people with a BMI above 21kg/m^2 were still determined to be at

nutritional risk by other nutritional screening tools. In this current study, approximately 40% of residents across all datasets had a BMI between 19-24kg/m^2, therefore some of these residents may also be at risk of undernutrition, but due to the CAP cut-off have not been identified.

5.2.1 Implications to evidence-based practice

Falls, PI, and unintentional weight loss are geriatric conditions that are largely preventable when risk factors are properly managed (Murakami & Colombo, 2013). Similar to the international and national literature on these conditions, this study found that some residents within ARC were experiencing or at risk of experiencing three majorly preventable conditions. As this study used aggregated data, we were unable to associate the co-occurrence of these health outcomes with one another. However, there is a substantial amount of literature demonstrating how these conditions interact and are associated with one another. For example, pressure injuries in ARC residents are significantly related to unintentional weight loss, poor nutrition and low BMI (Coleman et al., 2013; Shahin et al., 2010). Alternatively, ARC residents with a higher BMI were 6% less likely to experience a fall (K. Moore et al., 2014). Weststrate and Adams (2013) found that PI were more common in residents who experienced a fall.

Out of the three priority areas, falls was the most common and prevalent throughout all datasets. Falls have severe consequences for older people, leading to serious morbidities, such as hip fractures and even loss of life (Butler et al., 2004). A New Zealand study by Weststrate and Adams (2013) reported that of the ARC residents that had experienced a fall, 10.8% had no fall preventive measures in place. A major advantage of utilising the interRAI-LTCF assessment within ARC is the triggering of CAPs. These identify when an individual may be at risk of an adverse outcome, specifically focusing on outcomes that have demonstrated to be preventable and provide clinicians with a set of evidence-based guidelines to intervene (Carpenter & Hirdes, 2013). If clinical staff utilise the suggestions and guidelines suggested by the CAP, this could reduce the number of ARC residents not receiving preventative interventions for a majorly preventable condition. Several falls studies have found that when evidence-based fall prevention is implemented within ARC, the risk and occurrence of falls is reduced (Cameron et al., 2018; Cameron et al., 2012; Jones et al., 2016; Rapp et al., 2012).

Over half of the residents across all datasets were at risk of undernutrition, and approximately 12% experienced unintentional weight loss. The risk of undernutrition is likely an underestimation given findings from Radich (2003) that suggested when compared with other validated nutritional screening tools, the undernutrition CAP identified fewer residents at risk. Undernutrition and unintentional weight loss are associated with mortality among older people; one study found that

unintentional weight loss causes death for 9% to 38% of older people residing within ARC (McMinn et al., 2011). Several studies have investigated interventions targeting unintentional weight loss in older people residing in ARC facilities and found some interventions that help at-risk residents maintain or gain weight (Simmons et al., 2003; Simmons et al., 2017). Similar to falls prevention, identifying ARC residents experiencing or at risk of unintentional weight loss is the first step in prevention. Following on from this, it is important that ARC staff actively implement personalised care plans for those residents at risk.

The interRAI-LTCF assessment is a comprehensive and standardised assessment to measure and assess the status of older people residing within ARC. Health professionals can generate care plans with this information. A substantial challenge facing the ARC sector is ensuring that the use of interRAI-LTCF assessments leads to the implementation of evidence-based care to reduce the occurrence of preventable outcomes. This process can be described as "closing the loop" (Weststrate & Adams, 2013). In the past few years, the Ministry of Health has implemented targeted campaigns at PI and falls with hospitals and ARC. For example, in 2013, the HQSC launched a programme to reduce the incidence and harm from falls in New Zealand, across multiple settings (Health Quality & Safety Commission New Zealand, 2019). More campaigns like this, as well as continued education for ARC staff on the benefits of the interRAI assessments, may contribute to this effort.

5.3 Comparability of datasets

Given the large differences in the size of datasets and the high likelihood of small (or empty cells), Fisher's exact test of significance was routinely employed. This test was selected for four main reasons: 1) ability to test association in contingency tables; 2) suitability to use with categorical variables; 3) ability to be unaffected by unequal distribution of frequencies within contingency table cells; and 4) sensitivity to small sample sizes. An exact binomial test of significance was also conducted to assess the probability of obtaining spurious significant results by chance alone, due to the multiplicity of tests undertaken.

In the analysis of Nurse Maude HL and national HL dataset, and Nurse Maude HL and Canterbury HL datasets, all 17 variables included in this study produced a Fisher's exact test result that was not significant ($p>0.05$), indicating no difference between the two variables. In the analysis of Canterbury HL and national HL, 15 of the 17 variables produced not significant test results ($p>0.05$). However, the pressure ulcer CAP and undernutrition CAP produced significant test results ($p\leq0.05$), indicating a difference between the variable. These differences can be explained: Canterbury HL had a higher proportion of residents not considered being at risk of undernutrition compared with

national HL (56% vs. 60%), and Canterbury HL also had a higher proportion of residents with very low to low risk of PI compared with national HL (53% vs. 49%). Furthermore, a binomial test found that the two observed significant tests are not significantly different from what would be expected alone with an α=0.05 (p=0.2). Therefore, it is appropriate to conclude that there is no evidence of any systematic differences between the datasets.

Despite this, Nurse Maude HL dataset size is still small (less than 35 residents). When considering the difference between groups, percentages based on a large number of respondents are more likely to be precise than those based on small numbers of respondents (Mor, Angelelli, Gifford, et al., 2003). For instance, one resident in the Nurse Maude HL dataset was severely underweight as reported by BMI score (15kg/m^2), and this accounted for 3% of their sample. Alternatively, 59 and 455 residents in the Canterbury HL and national HL datasets were underweight, respectively, and this also accounted for 3% of their sample. This demonstrates that one resident in a small dataset can result in a disproportionate prevalence or proportion. This highlights the need to use caution when interpreting results when one dataset is relatively small, as statistical power to detect differences will be relatively small.

5.4 Validity and reliability of benchmarking

Benchmarking health outcomes and quality indicators in ARC is a method of continuous quality improvement and can support evidence-based practice (Ettorchi-Tardy et al., 2012). In the context of this research, benchmarking refers to a snapshot comparison at a point in time against two datasets that are expected to be similar (e.g., hospital-level of care). Some literature defines benchmarking as a criterion or optimal a standard. It is a level of excellence which others may be measured by. These standards are absolute values, based on strong evidence and consensus of what can be achieved or is plausible under optimal conditions or environments (Mor, Angelelli, Gifford, et al., 2003; O'Reilly et al., 2011). However, it is often difficult to set clear-cut standards (or outcomes) in ARC due to different levels of dependency or morbidity across facilities (Carpenter & Hirdes, 2013).

In New Zealand, there are no established benchmark standards for interRAI-LTCF quality indicators. In the absence of a standard, this study adopted a more probabilistic approach; comparing a facility at a point in time to the performance of a regional or national dataset. This process allows facilities to prioritise areas where they are performing below others and identify initiatives that have worked well. It also recognises that facilities have unique combinations of residents – some with more complex needs than others. Thus, on some benchmarks, residents will perform uniformly worse. Therefore, a facility should be interested in the degree of change above and below their baseline, in addition to the comparison with other ARC facilities.

For benchmarking to be valid and effective, it requires the populations to be comparable (i.e., in case-mix and dependency of residents, size of facilities, or level of care) (Frijters et al., 2013). Risk adjustment techniques enhance the comparison of health outcomes between facilities. Frijters et al. (2013) found that after risk adjustment, the values of quality indicators differed less between facilities, compared with the unadjusted values. In instances where risk adjustment is not possible, matching the population by the level of care, may reduce some of these differences. This enables a facility to compare their results with those facilities that most likely have a similar dependency and case-mix of residents. For example, if a hospital-level facility compared their outcomes with rest home facilities, it is expected that the hospital-level facility will perform worse in most outcomes due to the level of dependency of their resident population. The interRAI-LTCF data used in this study was gained from hospital-level ARC facilities, matching the same level of care as Nurse Maude. The aim of this was to match the case-mix and dependency of residents as closely as possible. This is currently a technique employed by TAS in their quarterly ARC reports, although, by 2020, TAS aims to use risk-adjustment for all of their quality indicators (TAS, 2019c).

This study compared health outcomes and quality indicators that were generated from a reliable, standardised assessment tool (Onder, Carpenter, et al., 2012). A salient advantage to using the interRAI-LTCF assessment to benchmark across ARC facilities is the standardised definitions and measurements, which ensure consistency and acceptable levels of inter-rater reliability (Hirdes et al., 2008; Kim et al., 2015; Onder, Carpenter, et al., 2012). This study also utilised the quality indicators generated from the interRAI-LTCF assessment. Quality indicators have the potential to identify quality problems and inform quality initiatives within ARC. However, it is essential that they can distinguish between potential high- or low-quality practice; to establish validity the data needs to reflect the quality of practice, particularly, resident outcomes (Mor, Angelelli, Gifford, et al., 2003; Mor, Angelelli, Jones, et al., 2003).

This study used three quality indicators generated from the interRAI-LTCF assessment. Several studies have investigated the validity and reliability of quality indicators derived from the interRAI-LTCF or MDS assessments, with a variation in findings (Zimmerman et al., 1995). Evidence on the prevalence of falls quality indicator suggests it has a fair to moderate level of validity and inter-rater reliability (Hill-Westmoreland & Gruber-Baldini, 2005; Hutchinson et al., 2010; Morris et al., 2003). There have been inconsistent findings on the validity of the prevalence of unintentional weight loss quality indicator (Hutchinson et al., 2010), with one study reporting it was able to detect differences between ARC facilities (Simmons et al., 2003), while another suggests it could not determine between facilities that provided high and low care quality (Morris et al., 2003). The prevalence of a PI has also been assessed in several studies. Bates-Jensen et al. (2003) reported that the MDS PI

quality indicator did not reflect differences in ARC care processes, whereas … found …. Morris et al. (2003) favoured a PI quality indicator that quantified the proportion of at-risk residents (high & low risk) in an ARC facility that have a PI; a finding that is also supported by Hutchinson et al. (2010). These findings demonstrate that further research establishing the validity and reliability of quality indicators derived from the interRAI-LTCF tool in necessary, it would be particular useful within a New Zealand context.

An observed difference in quality indicators may also be due to chance. Random variation is influenced by the frequency in which the clinical outcome occurs and the number of cases included (Lovaglio, 2012; Mor, Berg, et al., 2003). In some cases, the quality indicators measured are rare events, such as the prevalence of PI, therefore the limited number of residents who experienced the outcome limits the power of the study to detect difference in quality. This study used data collected over a year, rather than within a three-month period, with the aim to increase the duration of the observation period, thereby increasing the potential sample size and occurrences. Although this increases sample size, the drawback of using historical data is that it may decrease the chance the current performance of the facility is presented (Mor, Angelelli, Gifford, et al., 2003). Despite these efforts, the sample size of Nurse Maude was still small (<40 bed) and the occurrences of falls, unintentional weight loss, and PI were relatively rare, leading to a pattern of variation. To improve this in the future, this research suggests repeated analysis over time, and employing data stabilisation methods (e.g., averaging), to mitigate these issues.

The literature has demonstrated that a resident's clinical outcome can be influenced by several known and unknown factors, making it difficult to assess whether an observed outcome is due to the quality of care provided or due to many other factors (Zimmerman et al., 1995). A limitation of the benchmarking undertaken in this study surrounds the inability to control for person-level risk factors or exclude residents at a higher risk of developing a condition (Frijters et al., 2013). For instance, the interRAI quality indicator definition for unintentional weight loss excludes residents who are in palliative care or have six-months or less to live (TAS, 2018a; Zimmerman et al., 1995). Consequently, it is possible that the prevalence of this quality indicator is this study could be a less accurate measure of the actual quality of care being provided, as an existing health condition that may predict the development of unintentional weight loss was not excluded (Mor, Angelelli, Gifford, et al., 2003; Mor, Angelelli, Jones, et al., 2003).

5.5 Comparison between the TAS quarterly reports and this research

The study found that when considering factors such as the accessibility and availability, data reliability, and flexibility, the process and outputs in this current research provide Nurse Maude with

some notable advantages, that likely complement that TAS reports. These include the real-time data access, indicator flexibility, supplemented missing weight and height data, and potential to use data stabilisation over time. Each factor is discussed below.

5.5.1 Accessibility and access to data

The TAS quarterly reports are only provided every three months, whereas the interRAI analytics process allows facilities to view their data at any point in time. In this study, the researcher still had to send a request to TAS for the aggregated de-identified benchmarking data, which could cause a delay depending on TAS capacity and demand. However, since the inception of this research, InterRAI Services established the data visualisation tool online,[18] providing public access to interRAI-LTCF outcomes, scales, CAPs, and quality indicators, by region and level of care. This enables Nurse Maude to use the interRAI analytics software to generate their facility data and compare their performance with that of other hospital level facilities in Canterbury and nationally. It is likely that by the end of 2020, TAS will have completed risk-adjustment techniques for quality indicators presented in the quarterly ARC reports and online.

5.5.2 Data reliability

The two reports and this research are derived from interRAI assessment data. The validity and reliability of the interRAI-LTCF outcomes and quality indicators hinges on the accuracy of the assessment. As it is a mandatory and standardised instrument, carried out by trained assessors it has demonstrated to have a high validity and inter and intra observer reliability (Frijters et al., 2013; Onder, Carpenter, et al., 2012). Currently, the two TAS reports and use level of care to benchmark with similar facilities. As established above (Chapter 5.4), this enables a facility to compare their results with those facilities that most likely have a similar dependency and case-mix of residents. As a result, any difference between facilities are more likely to be because of the quality of care provided (Zimmerman et al., 1995).

InterRAI data in New Zealand has reported issues with missing NHI and weight and height data. Some interRAI outcomes such as BMI, may have missing data, which can affect the reliability of the undernutrition CAP and the prevalence of unexplained weight loss quality indicator (Schluter, Ahuriri-Driscoll, et al., 2016; TAS, 2018c). The interRAI analytics systems has the advantage of being able to supplement the missing weight data for their facility from patient records, to fill in this information. Another advantage of the interRAI analytics system is the ability to use historical data to stabilise the data over time, such as averaging the data. However, the drawback of data

[18] https://www.interrai.co.nz/data-and-reporting/

stabilisation methods are that it may decrease the chance the current performance of the facility is presented (Mor, Angelelli, Gifford, et al., 2003).

5.5.3 Flexibility of indicators

The interRAI analytics software allows a facility to gain a wide range of interRAI assessment data, which may not be included in the interRAI-LTCF ARC suite reports. This enables facility management and staff to select outcomes aligning with current quality initiatives to evaluate the successfulness of a specific quality care intervention over time (O'Reilly et al., 2011).

5.5.4 Summary

Overall, the benchmarking procedure established in this research provides some additional advantages for Nurse Maude compared with the TAS reports. These advantages include the real-time data access, indicator flexibility, supplemented missing weight and height data, and potential to use data stabilisation over time.

5.6 Strengths and limitations of the interRAI-LTCF tool

The validity and reliability of the interRAI-LTCF assessment have been tested in several international studies and found to be of high-quality (Hirdes et al., 2008; Kijowska & Szczerbińska, 2018; Kim et al., 2015). For example, the SHELTER study found that all interRAI-LTCF items met or exceeded general standards for test-retest and inter-rater reliability (Onder, Carpenter, et al., 2012). In New Zealand, the interRAI-LTCF assessment process of using a mandatory and standardised assessment, completed by trained nurses and managed by one authority (i.e., TAS) helps to ensure the reliability and validity of the data (TAS, 2019d). In 2017, interRAI Services released a new national standard for the interRAI-LTCF to provide assessors with clear advice and reduce duplication of information (TAS, 2019d). Furthermore, interRAI Services monitors the quality of assessment and assessors through random quality audits (TAS, 2019c).

Other strengths of the interRAI assessment are that there are several ways to characterise each health condition (e.g., frequency, severity, and presence); every item and response option have precise definitions; and some but not all items refer to a specific time (e.g., in the past three days). This level of specificity generates a wealth of information on one health condition, which many other assessment tools do not (Carpenter & Hirdes, 2013). As interRAI is a standardised assessment, it enables reliable, valid benchmarking and comparison across facilities, regions and countries and eliminates several previous barriers (for example, inconsistent definitions) (Frijters et al., 2013; Onder, Carpenter, et al., 2012).

A limitation of the interRAI-LTCF data, and one acknowledged by interRAI services, is the missing height and weight data (Schluter, Ahuriri-Driscoll, et al., 2016; TAS, 2019c). In the interRAI-LTCF assessment height and weight data is used to inform BMI score, unexplained weight loss, and the undernutrition CAP. In 2019, TAS released information on the missing height and weight data; demonstrating that for both HC and LTCF assessments the proportion of assessments with missing data has decreased over time (TAS, 2019d). In 2015/16, 11% of interRAI-LTCF assessments had missing height or weight data, by 2017/18, this decreased to 8%. As the comparative Canterbury and national data for this study were gained from TAS, these quality issues were also found in this study. National and Canterbury HL dataset had between 8% and 6% of height data and 6% to 5% of weight data missing, respectively. Several studies have reported on missing height and weight data within ARC (Bell et al., 2013), including studies using interRAI-LTCF data (Onder, Carpenter, et al., 2012). This is likely due to the challenges of measuring height and weight among residents with various functional ability (Bell et al., 2013; TAS, 2019d).

5.7 Limitations and strengths

A resident's clinical outcome can be influenced by several known and unknown factors, as such, the quality indicators reported in this study should only be interpreted as surrogate measures of quality of care, that may potentially display an association between the indicators and the actual quality of care provided. This research only intended to study three clinical safety quality indicators. However, quality of care is multidimensional, and no single quality indicator will capture the overall facility quality (Morris et al., 2003), therefore this study is not representative of Nurse Maude's overall quality of care.

There are number of factors in this study that might limit the accuracy of the outcomes and comparison between facilities. Firstly, this study reported the prevalence of falls, PI, unintentional weight loss, however the prevalence is only a snapshot at one point of time. This might limit the ability to understand why, or when a resident might have developed these conditions. Secondly, several studies have demonstrated that falls are underreported in ARC facilities (Cameron et al., 2018; Murakami & Colombo, 2013; Rapp et al., 2012), therefore the prevalence reported in this study may be an underestimation. Another limitation of this study, and one identified in the literature, was the inconsistent validity and reliability of the interRAI quality indicators within ARC, particularly the prevalence of unintentional weight loss and PI quality indicators. The potential implication to this research is that the difference between datasets, may not be a result of the quality of care provided. As the monitoring and reporting of ARC quality indicators is relatively new within New Zealand, future research could focus on the establishing the validity of a suite of interRAI-LTCF indicators to measure the quality of care in ARC in New Zealand.

There are some factors in this study that might limit the accuracy of this benchmarking approach. Firstly, it was not possible to carry out risk adjustment techniques to enhance the comparison of health outcomes between facilities, because the study used aggregated and deidentified data. In an effort to match the case-mix as closely as possible, all interRAI-LTCF data in this study was gained from hospital-level ARC facilities. Matching facilities by the level of care is the current technique used by TAS in their quarterly reports and publicly available data. However, it is likely that in 2020, TAS will release a suite of risk-adjusted quality indicators (TAS, 2019c), improving the accuracy of benchmarking between facilities. A further limitation is the relatively small sample size of Nurse Maude, which results in increased variability, is likely to be responsible for some of differences noted between Nurse Maude HL and the two other datasets. In the future this can be improved with repeated analysis over time and the use of a data stabilisation technique.

Despite these limitations, this study, and the procedures established in the study, have several strengths and important applications to practice. Firstly, a salient advantage in using the interRAI-LTCF assessment to benchmark across ARC facilities is the standardised definitions and measurements, which ensure consistency and acceptable levels of inter-rater reliability (Hirdes et al., 2008; Kim et al., 2015; Onder, Carpenter, et al., 2012). The main implication of this research is that the benchmarking procedure established in this study provides additional advantages to Nurse Maude, that complement the information provided in the TAS quarterly reports. Equipped with the procedure and baseline data from this study, Nurse Maude can continue tracking indicators (that may or may not be tracked by TAS) over time. In this way, the unique resident population of Nurse Maude, can be followed, in relation to itself, or using comparative data available and accessible through TAS' data visualisation tool.

6 Conclusion

The primary aim of this thesis has been to benchmark Nurse Maude's interRAI-LTCF data with other hospital-level ARC facilities nationwide and in the Canterbury region, targeting three preventable outcomes: falls, unintentional weight loss and PI. In doing so, this research could establish a procedure that could be used by Nurse Maude to carry out benchmarking on a range of health outcomes and indicators, in relation to themselves (over time), as well as comparing their performance to national and Canterbury datasets. A secondary aim of this research was established after TAS introduced individualised quarterly reports for every ARC facility in New Zealand. This study was interested in determining if there were salient advantages in using the benchmarking procedure established in this research that offer Nurse Maude more than what is included in the two quarterly reports produced by TAS.

Consistent with the national and international literature, this study found that some residents within ARC facilities were experiencing or at risk of experiencing three majorly preventable outcomes (falls, unintentional weight loss, and PI). Nurse Maude appeared to perform the same as or better than the national and Canterbury datasets, for the prevalence of pressure injuries and falls. In other areas, such as undernutrition risk and low BMI score, Nurse Maude had slightly lower performance. Some of these patterns can be accounted for by the relatively small sample size of Nurse Maude, which increases the variability in the outcomes. In general, there was less variation between national and Canterbury hospital-level datasets for a majority of the interRAI-LTCF outcomes measured in this study.

As these conditions remain prevalent in ARC facilities throughout New Zealand (Carryer et al., 2017), continued monitoring of these, and other preventable conditions remain an important priority in ARC. The benchmarking procedures established in this research, complement the monitoring and benchmarking currently offered in the TAS quarterly reports. For example, utilising the procedures developed in this research, Nurse Maude have the potential to be reactive to any outcome quality issues that arise, by accessing real-time data and targeting indicators of interest, that may not be provided in the TAS quarterly reports. Nurse Maude are able to benchmark their own health outcomes over time to identify areas where they are doing well, further opportunities for quality-improvement, and to monitor the success of a quality improvement initiatives. Beyond this, Nurse Maude can compare their health outcomes and quality indicators using comparative data available and accessible through TAS' data visualisation tool.

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Appendices

APPENDIX 1: University of Canterbury Human Ethics Approval

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

HUMAN ETHICS COMMITTEE

Secretary, Rebecca Robinson
Telephone: +64 03 369 4588, Extn 94588
Email: human-ethics@canterbury.ac.nz

Ref: HEC 2017/101/LR

6 November 2017

Charlotte Ward
School of Health Sciences
UNIVERSITY OF CANTERBURY

Dear Charlotte

Thank you for submitting your low risk application to the Human Ethics Committee for the research proposal titled "Benchmarking [redacted] Long Term Care Hospital Against Canterbury and National Comprehensive Standardised Long Term Care Data: Targeting Falls, Unintentional Weight Loss and Pressure Injuries".

I am pleased to advise that this application has been reviewed and approved.

With best wishes for your project.

Yours sincerely

pp. R. Robinson

Associate Professor Jane Maidment
Chair, Human Ethics Committee