Screening for nutrition risk and dysphagia among older adults newly admitted to age related residential care facilities in the Waitemata DHB region.

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ABSTRACT

Background: New Zealand has an ageing population, reflected by an older average population age and reduced mortality. Good nutrition is essential for successful ageing. Many factors are known to influence nutrition risk, and a high prevalence has been observed overseas in people living in age related residential care (ARRC) facilities. In New Zealand, there is limited data on both the prevalence of nutrition risk in ARRC facilities and the health factors that contribute to risk. The changing demographics of the population means that a greater understanding in this area will be important to develop strategies which support the maintenance of good nutrition status for longer, thus potentially reducing health burden. This study aims to determine nutrition risk and the risk of dysphagia (swallowing difficulties) in older adults recently admitted to an ARRC facility in the Waitemata District Health Board (DHB) region.

Methods: Fifty-six individuals aged ≥65 years (or ≥55 years for Māori and Pacific) who were admitted for the first time to an ARRC facility within the Waitemata DHB region were invited to participate in the study. Potential contributors to nutrition risk were explored using a questionnaire that asked about nutritional and non-nutritional risk factors. The Mini Nutritional Assessment®-SF (MNA®-SF) was used to determine level of nutrition risk. Risk of dysphagia was identified using the Eating Assessment Tool (EAT-10). The Montreal Cognitive Assessment (MoCA) was carried out at the end of the interview and was used as a measure of cognitive function.

Results: A total of 53 participants with a mean age of 88 years were included. Overall, 91% of the participants were either malnourished (47%) or at risk of malnutrition (43%). Normal nutritional status was only prevalent in 9% of participants. Fifty-seven percent of participants were widowed, of which, 52% were malnourished. When malnourished participants were compared to those with normal nutritional status, malnourished participants were more likely to be underweight, in hospital level care, have a recent severe decrease in food intake, recent weight loss of greater than 3kg, have poorer mobility, experienced psychological stress or acute disease and have severe dementia or depression. Malnourished participants were more likely to report weight loss of greater than 3 kg than those at risk of malnutrition (56% vs. 13% respectively, $p = 0.03$; Fisher's exact test). Those who were malnourished had poorer mobility ($\chi^2 = 8.592$ $p = 0.003$) and were more likely to be at risk of dysphagia ($\chi^2 = 6.273$ $p = 0.01$) compared to those at risk of malnutrition. Participants in hospital level of care were also more likely to be at risk of dysphagia compared to those in rest home level of care ($\chi^2 = 4.627$ $p = 0.03$).

Conclusions: These findings suggest there may be a high prevalence of nutrition risk among older adults newly admitted to ARRC facilities within New Zealand and that existing poor nutrition may have contributed to the need to move into ARRC. The predisposing factors that affect nutrition status warrant further investigation so initiatives can be undertaken to avoid a change in living situation. The results highlight the need for nutrition screening and early intervention by a dietitian.

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ABBREVIATIONS

Abbreviation	Definition
ARRC	Age related residential care
AD	Alzheimer's Disease
ADL	Activity of daily living
ANSI	Australian Nutrition Screening Initiative
BMI	Body mass index
BMR	Basal metabolic rate
BPSD	Behavioural and psychological symptoms of dementia
BRIGHT	Brief Risk Identification Geriatric Health Tool
CAD	Coronary artery disease
CC	Calf circumference
CHD	Coronary heart disease
COPD	Chronic obstructive pulmonary disorder

CVD	Cardiovascular disease
DALY	Disability-adjusted life year
DHB	District Health Board
DST	Dysphagia Self-Test
EAT-10	10-item Eating Assessment Tool
EAT-20	20-item Eating Assessment Tool
GDP	Gross domestic profit
GDS	Geriatric Depression Scale
GIT	Gastrointestinal tract
GORD	Gastro oesophageal reflux disease
GUSS	Gugging Swallowing Screen
HDEC	Health and Disability Ethics Committee
ICD-10	International Classification of Diseases 10th revision
IHD	Ischaemic heart disease
IU	International Units
MCI	Mild cognitive impairment
MIHL	Minimum income for healthy living
MMSE	Mini Mental State Examination
MNA®	Mini Nutritional Assessment®
MNA®-SF	Mini Nutritional Assessment®-Short Form

MoCA	Montreal Cognitive Assessment
MOW	Meals on Wheels
MST	Malnutrition Screening Tool
MUST	Malnutrition Universal Screening Tool
NASC	Needs Assessment Service Coordination
NCEA	National Certificate of Educational Achievement
NHI	National Health Index
NSTEMI	Non ST segment myocardial infarction
NZBD	New Zealand Burden of Disease, Injuries and Risk Factors Study
OD	Oropharyngeal dysphagia
OTC	Over-the-counter
PEM	Protein-energy malnutrition
ROC	Receiver operating characteristic
SCREEN II	Seniors in the Community: Risk Evaluation for Eating and Nutrition, Version II
SD	Standard deviation
SGA	Subjective Global Assessment
VFS	Videofluoroscopy
WHO	World Health Organization
WI	Weight index
y	years

CHAPTER 1: INTRODUCTION, AIMS AND OBJECTIVES

1.1 Introduction

In New Zealand an older adult is classified as aged 65 years and over, which is consistent with how statistical data is reported (Ministry of Health, 2013a; Statistics New Zealand, 1995). At this age, people are entitled to collect their Superannuation and additional health services, such as a SuperGold card, which offers discounted public transport and local council services (Dixon & Hyslop, 2008; Work and Income, n.d.). For Māori, health disparities, evident by the earlier onset of age-associated illnesses and consequent lower life expectancy, result in a lower older adult age classification of ≥50 years for this ethnic group (Ministry of Health, 2006).

New Zealand is an ageing population, demonstrated by a large projected rise in the number of New Zealanders aged ≥65 years in the future. By the year 2061, a demographic shift is expected where the number of people ≥65 years will more than double, making up 26% of New Zealand residents (Statistics New Zealand, 2012). This increase is already evident, with the 2013 census reporting 14% of the population aged ≥65 years, compared to 12% in 2001 (Statistics New Zealand, 2013b). Age-sex population pyramids and the projected increase in older adults are displayed in Figure 1.

Additionally, a reduction in mortality and an increasing number of people living to an advancing age has led to an older average population age (Ministry of Health, 2013a). The projected rise in the older adult population suggests the need for a focus on optimal health in this age group as it is predicted more will require such health services resulting in greater pressure on the health system (Ministry of Health, 2004).

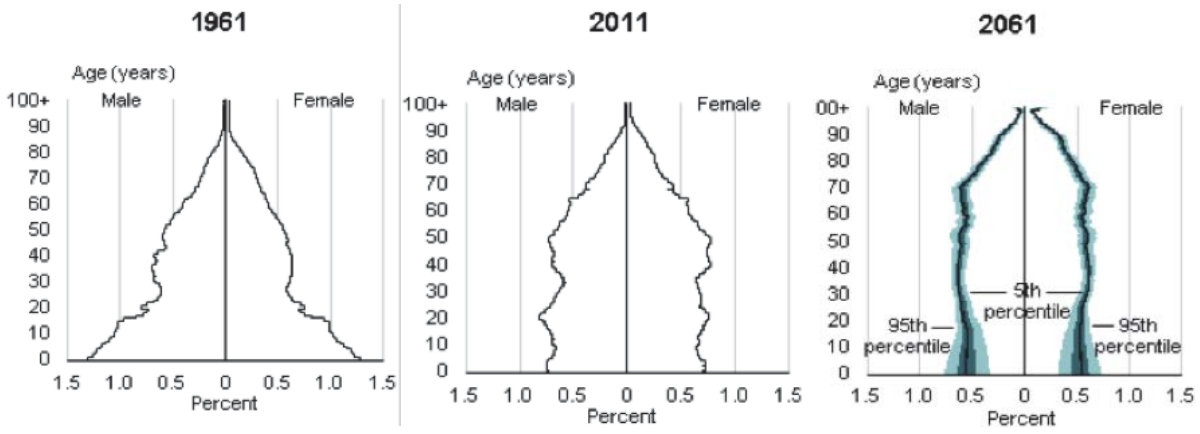

Figure 1: Age-sex population pyramids and projections, 1961 – 2061 (Statistics New Zealand, 2012)

The Government's *New Zealand Positive Ageing Strategy* promotes that older adults should be valued and be able to be active participants in communities, recognising that older people provide a valuable resource to society with their skills, life experience and knowledge (Ministry of Social Policy, 2001). The Strategy acts as a framework to guide policy and service development to promote positive ageing (Ministry of Social Policy, 2001). There are a number of goal areas such as health, transport, housing, cultural diversity and ageing in place, which encourage individuals to participate in their communities, contribute to society and remain in their homes for as long as possible. These goals assess the priority areas as indicated by communities, non-government and government sectors and expert groups and include Māori and Pacific input (Ministry of Social Policy, 2001). As New Zealand's ageing population will place increased pressure on the health system, the *Health of Older People Strategy* acknowledges the need for a strategy that aims to address the reliance on the health system in this population with policies and a system that helps to reduce disability by focusing on prevention (Ministry of Health, 2002b).

Within the older adult population, ethnic diversity is increasing (Ministry of Health, 2002a). The population of older adults in New Zealand ≥65 years differs depending on ethnicity (Ministry of Health, 2006). This is evident by 17% of the total New Zealand European population group aged ≥65 years in 2013, up from 15% in 2006 (Statistics New Zealand, 2013a), compared to a far smaller 5% of the total Māori population within this age group, up from 4% in 2006 (Statistics New Zealand, 2013c). Additionally, the projected population from 2006 - 2026 indicates growth in the number of older adults with differences in growth rates expected between ethnicities (Statistics New Zealand, 2010). The lowest projected average annual increase in adults aged ≥65 years is European/Other at 0.4%, Māori by 1%, Pacific by 2%, and the Asian population having the largest predicted increase of 3% (Statistics New Zealand, 2010). These expected changes in New Zealand's ethnic diversity provides essential information that may contribute to the identification of potential health services that may further promote the health of older people in New Zealand's culturally diverse society.

The New Zealand Government's positive ageing strategy aims to keep people in their own homes for as long as possible. However, when individuals are no longer able to safely live in their own homes as a result of age-related health problems, the need for placement to an age related residential care (ARRC) facility increases (Broad et al., 2011). New Zealand's ageing population reflects the projected increase in demand for ARRC (Cox & Hope, 2006), which also highlights the need for improved understanding of contributors to health loss. Good nutrition is essential for optimal health to support successful ageing in older adults, it impacts on functional capacity, mental health, reduces the risk of chronic disease and improves health-related quality of life, among other benefits (Ministry of Health, 2013a).

Many factors can influence nutrition risk status, although not exhaustive, these may include: social factors, level of support such as home help and meal services, health conditions, polypharmacy, psychological factors and dysphagia (swallowing difficulties) (Ministry of Health, 2013a; Serra-Prat et al., 2012).

Overseas, a high prevalence of nutrition risk, malnutrition and dysphagia has been observed in ARRC facilities. The development of effective nutrition interventions for older adults recently admitted to an ARRC facility requires an understanding of the common nutrition risk factors that affects this group. However, the data available on the prevalence of nutrition risk and dysphagia and the factors associated with these in an ageing population within New Zealand is limited.

Measurement of nutrition risk and dysphagia risk upon admission does not reflect the care provided to the resident by that facility. In fact, as management of dysphagia requires a multi-disciplinary approach, ARRC facilities can improve management due to easier accessibility to the required health professionals. Questions may also be raised as to whether certain preceding factors may have influenced admission into an ARRC facility.

The current prevalence of nutrition risk and dysphagia among older adults newly admitted to an ARRC facility in New Zealand is unknown. Therefore, this study aims to provide a snap shot of the prevalence of nutrition risk and dysphagia in this population of older adults and examine possible relationships that may influence nutrition risk.

1.2 Aims and objectives

1.2.1 Aims

The aim of this research study was to determine the prevalence of nutrition risk in older adults newly admitted to ARRC in the Waitemata DHB region.

1.2.2 Objectives

1. To determine nutrition risk using the Mini Nutritional Assessment®-Short Form (MNA®-SF).

2. To determine risk of dysphagia using the Eating Assessment Tool (EAT-10).

3. To identify demographic, social and health factors associated with nutrition risk.

1.3 Thesis structure

This thesis begins with a review of the literature (Chapter 2) starting with the current understanding of the health of older people. It also describes factors associated with nutrition risk in older adults. Chapter 3 outlines the methods used for this study. Results for the prevalence of nutrition risk and dysphagia and the factors associated with nutrition risk are reported in Chapter 4. Chapter 5 discusses the findings from this study in relation to other research.

CHAPTER 2: LITERATURE REVIEW

2.1 Health of older people

The vision of the *Health of Older People Strategy* is to provide effective health and disability support to enable older adults to be involved to their best ability in decisions affecting their own health, family life and community involvement (Ministry of Health, 2002b). The Strategy is in alignment with the World Health Organization's (WHO) model of 'active ageing' whereby the health, participation and security of older adults is maximised through opportunities that aim to improve quality of life (World Health Organization, 2002a). The WHO describe health not only as referring to physical health but also mental and social wellbeing (World Health Organization, 2002a). Although sufficient health is seen in many people aged ≥65 years, a small proportion have a poor level of health, such as the presence of chronic disease, and require higher levels of care and support (Ministry of Health, 2006).

2.1.1 Ageing in place

Although many people ≥65 years are healthy and independent, a marginal group require additional care and disability support due to reasons such as age-associated illnesses, disability and frailty (Ministry of Health, 2002b). Keeping older adults in their own homes within the community aids self-reliance and independence (Davey, 2006; Ministry of Social Policy, 2001). Older people can miss opportunities to maintain their independence, undergo rehabilitation and receive appropriate health care when the problems they face are deemed an expected part of ageing (Ministry for Disability Issues, 2001). The *New Zealand Disability Strategy* aims to provide services within the community that enable persons with disabilities to remain independent and prevent institutionalisation (Ministry for Disability Issues, 2001).

When individuals are no longer able to live in their own homes as a result of age-related health problems and disability, the need for long-term care in ARRC facilities increases (Broad et al., 2011). In accordance with New Zealand legislation, there are two key levels of ARRC provided. These include hospital level where residents require 24 h nursing and medical services and rest home level where residents are frail and require additional support but do not necessitate 24 h nursing and medical care (Lewis, 2002; New Zealand Legislation, 2001). Both non-profit organisations and private firms own the majority of ARRC facilities in New Zealand (New Zealand Treasury, 2012).

In 1998 in Auckland, New Zealand, 8% of individuals aged ≥65 years lived in an ARRC facility (Bonita, Broad, Thomson, Baskett, & Richmond, 1989). At this time, the population density of older adults in Auckland was similar to New Zealand as a whole (Bonita et al.,

1989). From 1988 to 2008, women were more likely to be in care compared to men (Broad et al., 2011). Furthermore, an increase in the median age of residents upon admission to ARRC facilities was observed from 79 years to 83 years from 1988 to 2008 respectively (Broad et al., 2011). This may indicate a trend whereby individuals of progressively older age are admitted into ARRC facilities (Broad et al., 2011) and also have a potential greater requirement for higher-level care as a result of their advancing age. In 2006, the New Zealand Census indicated that 25,854 individuals were aged ≥65 years and living in ARRC for older adults, which made up 5% of the ≥65 years population. Within this census group, 7,101 (28%) were men and 18,750 (73%) were women (Statistics New Zealand, 2007b). Of the ≥65 years population in ARRC in 2006, 2,769 (11%) were aged 65 – 74 years, 9,234 (36%) and 13,848 (54%) aged 75 – 84 years and ≥85 years respectively (Statistics New Zealand, 2007b).

Hospital level care in New Zealand increased between 1988 and 2008 (Broad et al., 2011), suggestive of an increase in the level of dependency. Over this 10-year period, the number of hospital level of care beds increased by 44% with a decrease in the number of rest home level of care beds by 15% also observed (Broad et al., 2011). However, overall a reduction in the utilisation of ARRC was observed between 1988 and 2008, with the proportion of individuals living in care decreasing from one in 13 to one in 18 over this time period (Broad et al., 2011). This is likely due to Government policies that promote older adults ageing in place within their communities. Despite this, the demand for ARRC in New Zealand is projected to increase as a result of the country's ageing population (Cox & Hope, 2006).

According to the *2002/03 New Zealand Health Survey* (Ministry of Health, 2006), the ethnic majority in ARRC were European/Other at 96%, followed by Māori at 3% and Pacific and Asian residents each making up 0.4% of the population. Similarly, in 2006, 92% of adults with disabilities living in residential facilities were of European ethnicity with Asian/Other groups making up 3% of the ethnic variation (Office for Disability Issues and Statistics New Zealand, 2013).

2.1.2 Cultural influences on ageing in place

Cultural practices and norms surround the decision to place a family member into ARRC and may partly explain the lack of ethnic variation observed in ARRC within New Zealand. Whereas New Zealand European families may be more likely to decide on ARRC placement earlier on when caregiver stress occurs, Asian and Pacific families may not seek assistance from health care workers until the circumstances become exceptionally difficult (McLaughlin & Braun, 1998). For Asian people this may be due to the concept of 'filial piety' which

describes a Chinese concept whereby certain rules guide the way children act towards and treat their elders (Ho, 1996). As a result, children of Asian and Pacific cultures often experience shame and guilt when they are unable to adequately care for older family members (McLaughlin & Braun, 1998).

For New Zealand Māori, whilst kaumātua (Māori elders) have an increasing community obligation at an influential level, reciprocity occurs for the kaumātua whereby their needs are met by younger whānau (family) and hapū (community/tribe) who take the responsibility for their care (Durie, 1999). Some cultures embrace customs such as the preference for the death of a family member to occur at home to support mourning traditions, which can impact on placement of an older family member into ARRC (McLaughlin & Braun, 1998). In contrast, European families are typically more hesitant for death to occur in the home and this may be another reason why they consider earlier ARRC placement in order to avoid this (McLaughlin & Braun, 1998). Therefore, Asian, Pacific and Māori families are more likely to look after their older family members at home and may be less likely to consider ARRC placement as an option.

2.1.3 Health loss and causes of death

'Health loss' measures the amount of "healthy life lost as a result of illness, disability or premature death" (Ministry of Health, 2013b, p. iii). It describes the difference between what an ideal health is for the population and the current health state of the population and is approximated using disability-adjusted life years (DALY) (Ministry of Health, 2013b).

Estimates of population health loss for 2006, both fatal and non-fatal and projections to 2016 can be taken from The New Zealand Burden of Disease, Injuries and Risk Factors Study (NZBD) (Ministry of Health, 2013b). When compared across all ages, older adults in New Zealand made up over 37% of DALYs in 2006 (Ministry of Health, 2013b).

The NZBD study identified the leading groups of disease conditions (those making up at least 5% of the total DALYs) associated with health loss (Ministry of Health, 2013b). Cancers and other neoplasms, vascular and blood disorders, musculoskeletal conditions, respiratory conditions, diabetes and other endocrine and neurological conditions are they key groups in those aged 65 – 74 years (Figure 2) (Ministry of Health, 2013b). For those aged ≥75 years, vascular and blood conditions are the primary cause of health loss, followed by cancers and other neoplasms, neurological conditions, respiratory and musculoskeletal conditions (Figure 2) (Ministry of Health, 2013b).

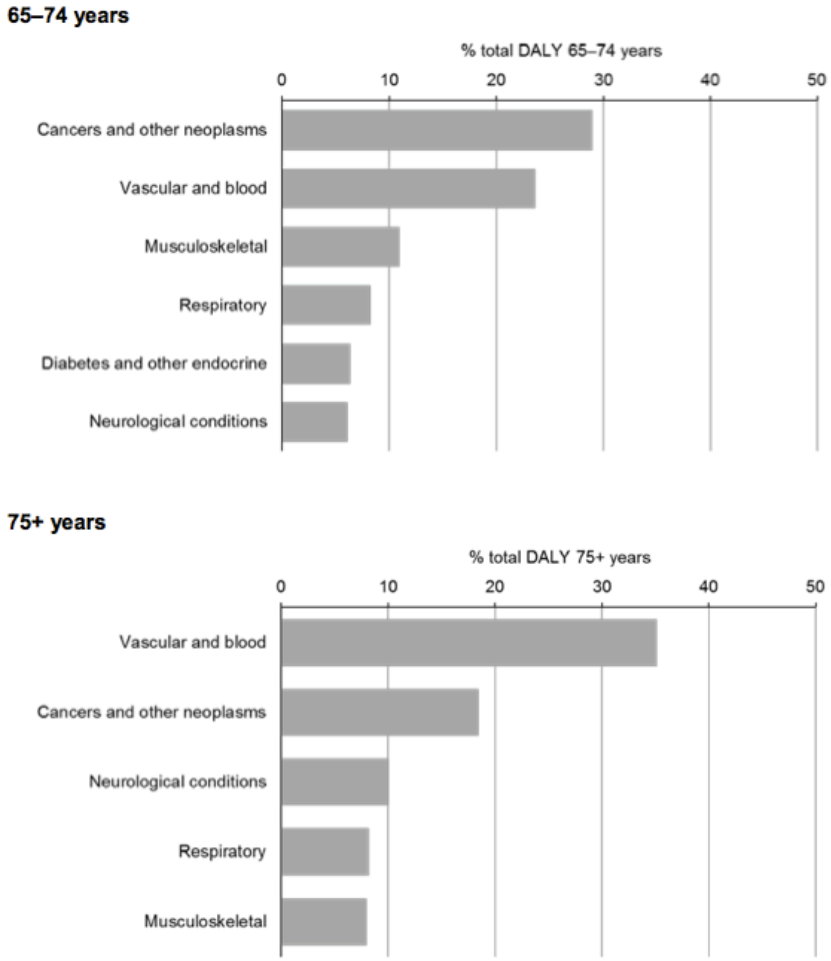

Figure 2: Health loss in relation to leading condition groups measured by disability-adjusted life years (DALYs) (Ministry of Health, 2013b)

Over time, as life expectancy has increased, the main causes of death have moved from infectious diseases to non-communicable diseases (World Health Organization, 2002b). Among 4,126 individuals aged ≥65 years in North Carolina, USA, the impact of chronic comorbidities in relation to mortality was assessed (Fillenbaum, Pieper, Cohen, Cornoni-Huntley, & Guralnik, 2000). Hypertension and diabetes was self-reported by 57% and 20% of people respectively, 15% coronary artery disease (CAD), with cancer and cardiovascular disease (CVD) both reported by 9% of the participants. Significant comorbidity was found in individuals with CAD, CVD, diabetes and hypertension, with risk of mortality high in all of the aforementioned conditions excluding hypertension (Fillenbaum et al., 2000).

Between 2000 and 2002, chronic diseases made up all of the main causes of death with ischaemic heart disease (IHD) the number one cause of death in both men and women aged 65 – 74 years, 75 – 84 years and ≥85 years (Ministry of Health, 2006). Stroke, chronic obstructive pulmonary disorder (COPD) and lung cancer were also highly ranked leading causes of death in those aged ≥65 years (Ministry of Health, 2006). In 2005, the main age-

standardised causes of death were cancer (29%) and IHD (21%) with COPD, cerebrovascular disease and other forms of heart disease accounting for 19% of deaths collectively (Ministry of Health, 2009). The age distribution of the 7,971 deaths from cancer in 2005 was predominantly individuals ≥65 years, with death from cancer fairly rare in those aged ≤45 years (Ministry of Health, 2009).

Health loss is higher in Māori than non-Māori following adjustment for population size (Ministry of Health, 2013b). There are also age disparities which may be a result of Māori having a younger population and having different risk factors compared to non-Māori (Ministry of Health, 2013b). Decreased cancer survival rates have been observed in Māori compared to non-Māori (Jeffreys et al., 2005). Although there were differences in the stages of cancer diagnosed, it was thought differences in health care support also contributed (Jeffreys et al., 2005). Research on cardiovascular health indicated the prevalence of CVD was higher in Māori compared to 'Other' New Zealanders by 67% in 2007 (Chan et al., 2008). Following age-standardisation, Pacific and Indian populations also displayed a higher CVD prevalence than non-Pacific and non-Indian. Despite this, the prevalence in older age categories was in fact lower in both Pacific and Indian populations compared to 'Other' ethnicities. These groups are both more recent migrants, so one possible explanation is that these older adults continued the healthy traditional diet they may have consumed before migration to New Zealand (Chan et al., 2008).

According to the NZBD study, one-third of health loss occurred in non-Māori aged ≥65 years, however for Māori 54% of health loss was evident before middle age (45 – 64 years) was reached (Ministry of Health, 2013b). As a result of Māori being disproportionately represented in younger age groups, the percentage of deaths in the ≥65 years population was nearly 1.5 times greater for non-Māori than Māori (Ministry of Health, 2009).

2.2 Health costs of older adults in age related residential care (ARRC)

Health status across a range of areas is thought to be poorer for individuals in ARRC than that of community dwelling people. This could be as a result of many factors such as loss of independence and reduced physical function that impair their activities of daily living (ADLs).

Data from the *Older People's Health Chart Book 2006* showed self-rated health, which included a number of areas such as physical function, general health, social functioning and mental health, was significantly lower in those aged 65 – 74 years, 75 – 84 years and ≥85 years in ARRC than their equivalents in private dwellings (Ministry of Health, 2006). The prevalence of chronic conditions, for example heart disease, diabetes, cancer and

osteoporosis, was not significantly different between those in ARRC and those in private dwellings (Ministry of Health, 2006).

Risk factors for admission into ARRC in New Zealand were identified in 2,060 older adults aged ≥65 years from August 2001 to August 2002 using the national Support Needs Assessment Form (Weatherall, Slow, & Wiltshire, 2004). Data was retrospective and was collected using an administrative database. Reduced mobility, cognitive impairment, continence problems or being aged >80 years had predictive value for placement into ARRC (Weatherall et al., 2004).

2.2.1 Maintenance of independence

Many individual factors contribute to the ability of older adults to maintain their independence. Factors such as sustaining a healthy lifestyle including good nutrition and physical activity; maintaining social, mental and emotional health; appropriate housing and transport; family support and provision and access to health services (Dwyer, Gray, Renwick, & Ministry of Social Policy, 2000). Some of these factors are more easily modified than others and will be discussed in this report.

The function of older adults and their ability to complete ADLs, thereby maintaining independence, can be improved by moderate physical activity. Physical activity has a positive influence on building muscle and bone, and helps to improve functional outcomes (Dwyer et al., 2000; Wang, van Belle, Kukull, & Larson, 2002). In a population of frail older adults aged ≥75 years, physical activity resulted in lower disability scores and less functional decline (Gill et al., 2002). Although this could have been expected to translate into lower ARRC admission for the intervention group, there was no significant difference compared to the control group, possibly as a result of an insufficient sample size and length of follow up (Gill et al., 2002).

Optimal nutrition is key to good health in older adults, particularly for maintaining physical function and reducing the risk of disability (Ministry of Health, 2013a). Gait speed, calculated in metres per second (m/s), was used as a measure of physical function and was significantly associated with nutrition status in frail older adults undergoing hospital rehabilitation in Canada (Chevalier, Saoud, Gray-Donald, & Morais, 2008). Participants were assessed prior to commencing the rehabilitation programme using the Mini Nutritional Assessment® (MNA®) to ascertain nutrition status and a 15 m timed walk at their typical speed to determine gait speed. Those considered well-nourished according to the MNA®

had a faster gait speed than those who were at risk of malnutrition or malnourished (0.64 m/s vs. 0.53 m/s and 0.56 m/s respectively) (p = 0.031) (Chevalier et al., 2008).

Research in New Zealand has identified a number of factors associated with nutrition risk, one of these being functional status (Wham et al., 2014). Participants were older adults aged ≥75 years or ≥65 years for Māori and were enrolled in the Brief Risk Identification Geriatric Health Tool (BRIGHT Trial). Improved functional status was associated with low nutrition risk in older adults across three DHBs (Wham et al., 2014). These findings, both overseas and within New Zealand, support the need for good nutrition to help maintain the physical function of older adults. The increased muscle strength and balance associated with physical activity may largely explain the role of exercise in preventing falls and maintaining independence.

2.2.2 Loss of independence

Numerous factors can contribute to the loss of independence and changes in functional outcomes such as increasing age, chronic disease, reduced mobility (Barrett, Twitchin, Kletchko, & Ryan, 2006; Ministry of Health, 2013a; Smee, Anson, Waddington, & Berry, 2012). These factors may eventually result in an individual being unable to care for themselves in their own homes and lead to the need for ARRC placement. In relation to loss of independence, three measures of functional capacity: ADLs, instrumental ADLs and physical testing using performance-based measures were utilised by Wang et al. (2002) to assess functional status in non-demented individuals aged ≥65 years in the USA. Hypertension, CVD and coronary heart disease (CHD) as well as diabetes mellitus, arthritis, osteoporosis and cancer were particular health conditions noted to have poor functional outcomes following analysis. Mental health including depression and reduced cognitive function and lifestyle factors such as smoking were also associated with poor functional outcomes (Wang et al., 2002).

Numerous overseas studies document the prevalence of falls in ARRC facilities (Kallin, Lundin-Olsson, Jensen, Nyberg, & Gustafson, 2002; Kron, Loy, Sturm, Th, & Becker, 2003). Falls in ARRC facilities can be the result of dementia, stroke and the progression of chronic disease (Ang, Au, Yap, & Ee, 2006). In one study of 51 older adults living in an ARRC facility in Umeå, Sweden, participants were screened shortly after admission, and data was obtained on fall frequency over a 12-month period (Kallin et al., 2002). More than half (63%) of participants fell on at least one occasion during this period. Both acute illness or disease and drug interactions were suggested as the key precipitating factors of all falls (27% and 9% respectively) (Kallin et al., 2002).

In New Zealand, between 2008 and 2012, falls caused 57%, 67% and 83% of unintentional injuries that required hospitalisation in those aged 65 – 69 years, 70 – 74 years and ≥75 years respectively (Injury Prevention Research Unit & University of Otago, n.d.). Falls, most being preventable, are a significant danger to the health and function of older adults due to their increased vulnerability and recovery time (Accident Compensation Corporation, 2005). As a result, functional decline and its associated decrease in independence can have consequences for both the individual and the health care system.

2.2.3 Declining physical function and health

Functional independence in older adults is an important constituent of quality of life (Wang et al., 2002). Difficulty completing ADLs, resulting in a loss of independence, can occur with ageing and the progression of chronic health conditions (Verbrugge & Rennert, 1997). Function and disability differ and are important to distinguish. Firstly, a reduction in the ability to perform fundamental physical and mental activities, such as walking, dexterity (e.g. clasping objects) and speaking comprehensibly, are deemed functional limitations (Verbrugge & Rennert, 1997). Whereas, disability is classified as a difficulty undertaking social activities such as cleaning and driving a vehicle, which lasts or is expected to last for at least 6 months, and is a result of a long-term health condition which cannot be entirely removed by use of an assistive device (Statistics New Zealand, 2002; Verbrugge & Rennert, 1997). Consequences of poor function are not only physical, emotional wellbeing is also influenced by health status (Bowling & Browne, 1991).

Sarcopenia, the age-related loss of muscle mass is not dependent on disease and develops even in healthy older adults (World Health Organization, 2002b). A reduction in skeletal muscle mass is observed across adulthood, with the loss accelerating after age 80 years in both sexes (World Health Organization, 2002b). This acceleration is likely to be associated with a decrease in physical activity and muscle use (Brownie, 2006). Functional health is influenced by sarcopenia, the potential for falls and frailty are increased due to decreased muscle strength and alteration of gait (World Health Organization, 2002b).

A number of overseas studies assess the prevalence of frailty among individuals living in ARRC. Both prevalence of frailty and its association with mortality and difficulty carrying out basic ADLs were assessed in one study of Spanish older adults living in ARRC (de la Rica-Escuín et al., 2014). Frailty was determined using the Fried criteria (Fried et al., 2001) and comorbidity using the Charlson index (Charlson, Pompei, Ales, & MacKenzie, 1987) which categorises comorbidities and assigns the category a weighting based on one-year mortality risk (de la Rica-Escuín et al., 2014). The prevalence of frailty and high comorbidity (Charlson

index score ≥ 3 points) was 69% and 25% respectively with frail participants showing greater disability in basic ADLs than non-frail participants (de la Rica-Escuín et al., 2014). Disability and mortality were associated with three components of frailty, including low level of physical activity, slowness and exhaustion (de la Rica-Escuín et al., 2014). However, due to the small sample size these results cannot be extrapolated to represent all ARRC facilities both within Spain and overseas.

2.2.4 Frailty and disability within New Zealand

With no single agreed definition of frailty, Fried et al. (2001) developed criteria for defining frailty in which three or more of the following must be present: unintended weight loss, exhaustion, weakness (based on grip strength), slow walking speed and minimal physical activity.

An estimate of the prevalence of frailty in community-dwelling older adults in New Zealand was carried out by Barrett et al. (2006) using information from the 2001 *Living Standards of Older New Zealanders* survey (Fergusson, Hong, & Horwood, 2001). Frailty was identified when the individual had six or more health or mental conditions and difficulty carrying out ADLs. Of the 2,931 participants, 8% were classified as frail with a prevalence of 6% and 20% in those aged 65 – 74 years and 85 – 94 years respectively. More women were considered frail than men and the higher rate of frailty after age 85 years is in accordance with the increased prevalence of ARRC placement in this age group (Barrett et al., 2006).

In 2001, assistance was required by the majority of individuals living in ARRC in New Zealand with severe disability necessitating daily support noted in most residents aged 65 – 74 years and ≥75 years (72% and 84% respectively) (Statistics New Zealand, 2002). The majority (99.7%) of individuals living in residential facilities in 2006 were disabled (Statistics New Zealand, 2007a). Of the disabled adults in care facilities, mobility disability (93%) and/or agility disability (92%) were the key problems in residents, with memory/remembering disability, learning disability and hearing disability present in 55%, 46% and 45% of residents respectively (Office for Disability Issues and Statistics New Zealand, 2013). Disability/illness and ageing were the key causes of the main disabilities in adults living in residential care (53% and 29% respectively) (Office for Disability Issues and Statistics New Zealand, 2013).

Falls are common in frail older adults living in ARRC within New Zealand, with consequences such as hip fractures a major concern (Kerse, Butler, Robinson, & Todd, 2004). Across 14 ARRC facilities in Auckland, New Zealand, 547 participants took part in a randomised control trial that implemented and assessed the effectiveness of a fall

prevention program (Kerse et al., 2004). Over a 12-month period, 51% of all participants fell, with the same percentage of participants (51%) experiencing an injury as a result of the fall. The rate of falls within this 12-month time period was reported as 3.3 ± 11.0 falls per resident (Kerse et al., 2004). Nutrition support is particularly important for frail older adults to prevent weight loss and help maintain muscle strength. As a result, optimal nutrition may help with the prevention of falls in older adults.

2.2.5 Impact of ageing on the health system

New Zealand's ageing population reflects the expectation for an increased cost to the health care system and government retirement income contributions (Ministry of Social Policy, 2001). More people living to advancing age means they are more likely to contribute to the workforce and participate in society for a greater period of time than their ancestors, however to do so they are also required to be healthier (Ministry of Social Policy, 2001). This continuing productivity can reduce the burden on the health care system by increasing financial security and independence and promoting positive ageing, whereby older adults are given opportunities to contribute and remain involved in the community (Ministry of Social Policy, 2001).

The high cost of ARRC is well documented both overseas and in New Zealand. In the Netherlands, the financial burden of malnutrition in Dutch nursing homes (equivalent to hospital level care in New Zealand) was assessed by questions that identified malnourished residents requiring further care (resources and additional time), and those at risk of malnutrition (Meijers, Halfens, Wilson, & Schols, 2012). This included nutritional screening, monitoring of weight and nutritional status, prevention, treatment and communication through multidisciplinary meetings. Findings indicated an added cost of 8,000 euro and 10,000 euro per resident at risk of malnutrition or malnourished respectively. Additionally, standard nutritional care in nursing homes totalled 319 million euro with a further 279 million euro per annum for residents at risk of being malnourished and those identified as malnourished (Meijers et al., 2012).

In New Zealand, over the next 50 years, long-term care expenditure is projected to potentially more than double that of the current expenditure (New Zealand Treasury, 2012). Currently, New Zealand's health expenditure for long-term care is approximately 2% of gross domestic profit (GDP) (New Zealand Treasury, 2012). It is the responsibility of the DHBs to provide long-term care in the form of either ARRC or home support for those assessed typically by the Needs Assessment Service Coordination (NASC) organisation, on behalf of the DHB, as requiring these services (New Zealand Treasury, 2012). In 2011, the total cost

of dementia within the New Zealand health care system was $596.3 million, with the cost of dementia in ARRC within New Zealand $371.9 million, 62% of dementia-related health expenditure for that year. This was far greater than for that of dementia-related hospital costs at approximately $139.4 million (21%) (Alzheimers New Zealand, 2012).

Due to the imminent high demand for ARRC in forthcoming decades, particularly for those aged ≥80 years (Cox & Hope, 2006), strategies have been put in place to try and slow the demand, as the sustainability of residential care for the ageing population has been questioned in other countries (Chung et al., 2009; Csesko & Reed, 2009). For example, strategies within New Zealand consist of the inclusion of a compulsory needs assessment prior to admission to ARRC (Weatherall et al., 2004) and the availability of home-based care (New Zealand Treasury, 2012). These strategies aim to promote ageing in place so that older adults can continue contributing to society and help minimise the demand for ARRC.

2.3 Nutrition for healthy ageing

Good health and a variety of food are essential for healthy, successful ageing (Ministry of Health, 2013a; World Health Organization, 2002b). Nutrition can have either a positive or negative impact on the speed of the ageing process, a process which involves change throughout the body (Stanner & Denny, 2009). Successful ageing is defined by Rowe and Kahn (1998) as the ability of an individual to avoid disease, retain high cognitive and physical function and be capable of active involvement with life.

Many age-related changes can influence food intake and nutrition status (within the realms of healthy ageing) including lifestyle and social changes as well as cognitive and physiological changes (Ministry of Health, 2013a). Additionally, the access to and intake of healthy food in older adults is affected by a broader range of determinants which can act both individually or in combinations and include socioeconomic, cultural, environmental, social, community, individual and lifestyle factors (Ministry of Health, 2013a; Figure 3).

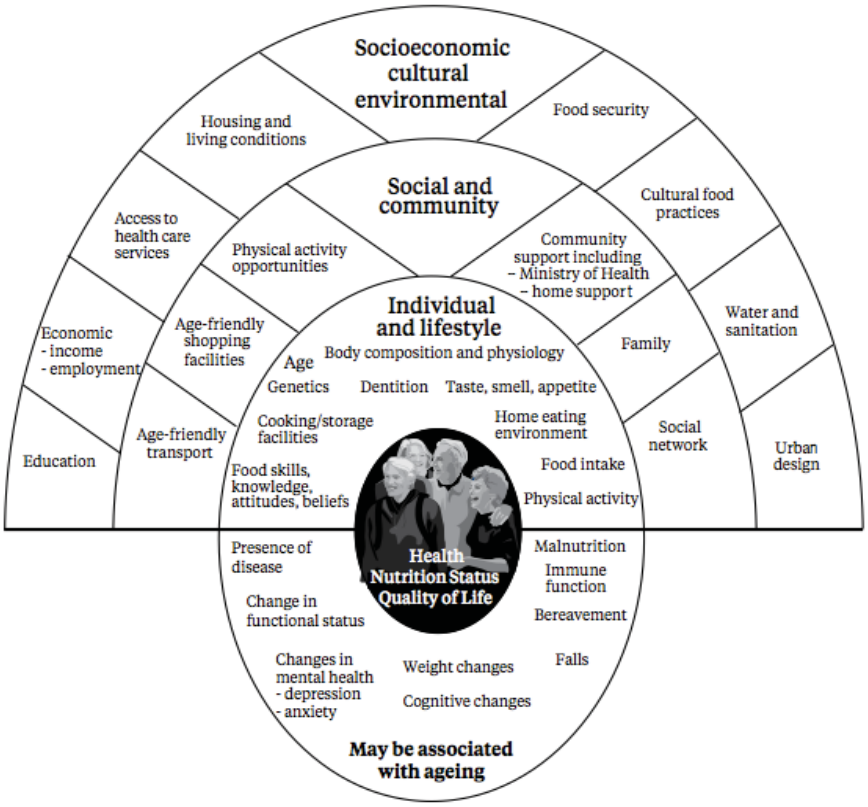

Figure 3: Key determinants of nutrition-related health (Ministry of Health, 2013a)

Some nutrition-related health determinants may differ among ethnicities due to the importance of traditional foods and accessibility and availability. Many traditional foods procured and eaten by New Zealand Māori before European contact, such as kumara and taro, are still eaten today and have many beneficial health properties such as anti-inflammatory and antioxidant functions and can be used to help meet healthy eating guidelines (Cambie & Ferguson, 2003; Wham, Maxted, Dyall, Teh, & Kerse, 2012). Access to and availability of traditional foods was previously ensured by using a whānau approach whereby food was grown, acquired, prepared, eaten and shared as a group (Wham et al., 2012). For Māori aged 75 – 79 years living in Northland and the Bay of Plenty in New Zealand, traditional foods were shown to be important as Māori individuals with regular access to such foods had an improved nutrition status (Wham et al., 2012). Geographic unavailability, lack of others to provide the foods or physical inability for participants to procure traditional foods were the key reasons for the lack of availability (Wham et al., 2012). Therefore, the health of older Māori in ARRC must be considered in relation to the health benefits gained by eating traditional foods and the importance often placed on this. If these foods are not readily available for Māori in this setting their nutritional wellbeing may be compromised.

A healthy lifestyle includes a number of often inter-related factors such as physical activity, refraining from smoking, maintaining a healthy body weight and good nutrition. In a population of 1,894 older New Zealanders aged ≥60 years, individuals who consumed a minimum of five fruit and vegetable serves each day had a far greater chance of being physically active (Mummery, Kolt, Schofield, & McLean, 2007). Also, being overweight or obese, measured using body mass index (BMI) classifications (Table 1), and smoking (defined as reported having smoked at all in the month prior to commencement of data collection) showed a negative correlation with physical activity (Mummery et al., 2007).

The benefits of good nutrition for older adults are widely acknowledged, including the maintenance and support of physical function and mental health (American Dietetic Association, 2005; Ministry of Health, 2013a). Maintenance of both physical and mental function is important for the preservation of independence. Additionally, prevention of malnutrition, disability prevention and decreased chronic disease risk are also related to good nutrition in this age group (Ministry of Health, 2013a). In the case of chronic disease, increasing evidence suggests a healthy lifestyle and good nutrition can help to reduce the risk of some chronic diseases such as CVD, some cancers, osteoporosis and diabetes (Stanner & Denny, 2009).

A combination of risk factors, including high total blood cholesterol, systolic blood pressure, BMI, low physical activity and fruit and vegetable intake, have been estimated to account for at least 70% of mortality associated with stroke and heart disease. For diabetes, a high BMI has been estimated to account for 80% of the associated disease burden (Ministry of Health and the University of Auckland, 2003). Furthermore, the combination of risk factors associated with nutrition was estimated to have led to approximately 40% of all deaths (11,000) in 2007 with an estimated 8,000 – 9,000 and 2,000 – 3,000 reflecting nutrition and lack of physical activity respectively (Ministry of Health and the University of Auckland, 2003).

Nine key guidelines have been developed for food and nutrition in older New Zealanders (Ministry of Health, 2013a). These include incorporation of good nutrition and exercise for maintenance of a healthy body weight and ensuring adequate fluid intake throughout the day (Ministry of Health, 2013a). Daily inclusion of the four key food groups which includes fruit and vegetables, breads and cereals, milk and milk products as well as protein sources such as lean meat, poultry, seafood and meat alternatives is important (Ministry of Health, 2013a). Choosing foods that are low in salt, fat and added sugar is suggested, in addition to the consumption of three healthy meals and snacks each day (Ministry of Health, 2013a). Sharing meals with others, consideration of food safety, limited intake of alcohol, and

moderate-intensity exercise most days of the week for 30 minutes per session is recommended (Ministry of Health, 2013a). It is important to note that these guidelines are recommended for healthy older adults and may not be applicable to those with certain comorbidities.

2.4 Changes in energy and nutrient requirements with age

The ageing process and its associated physiological and body composition changes has a huge impact on nutrition status (Ministry of Health, 2013a). The ability of older adults to select, prepare and eat a diverse range of foods can impact on dietary intake, while alterations can affect the body's ability to absorb, store, use and expel nutrients (Ministry of Health, 2013a). With healthy ageing, while the requirement for energy is decreased, nutrient density becomes more important (World Health Organization, 2014c).

A decline in energy needs per kilogram of body weight is observed in older adults due to the age-related decrease in muscle mass and subsequent reduction in the basal metabolic rate (BMR) where less energy is required for everyday functions (Rowe & Kahn, 1998; World Health Organization, 2014c). Activity level in older adults is often low and also contributes to the decreased energy requirements of this age group compared to younger adults (Rowe & Kahn, 1998). Despite this reduction in BMR, many older adults struggle with maintaining body weight. Undernutrition, which can result from many of the nutrition-related health determinants (Figure 3), and the term 'anorexia of ageing' have been used to explain the physiological reduction in food consumption with age (Ministry of Health, 2013a).

The ageing process, in addition to an increased prevalence of chronic disease and medication usage, is likely to influence nutrient requirements in older adults. In order to manage this, requirements, particularly for protein, vitamin B_{12}, vitamin D and calcium, are increased in older adults compared to younger populations according to the *Nutrient Reference Values for Australia and New Zealand* (NHMRC, 2006). Changes to the gastrointestinal tract (GIT), such as reduced production of gastric acid; and atrophic gastritis, atrophy of the stomach lining, influence the function of the GIT (Phillips, 2003). These functional changes, such as a reduction in gastric motility as a result of structural changes, and decreased secretion of pepsin and intrinsic factor subsequently affect nutrient requirements (Ministry of Health, 2013a; Phillips, 2003). As a result of these changes, the bioavailability of vitamin B_{12}, which requires intrinsic factor, and calcium in addition to some other nutrients is reduced (Phillips, 2003). Digestion of protein and fat, when consumed in large quantities, can also be reduced with age due to the decreased secretion of pancreatic enzyme (Phillips, 2003). In addition to the reduction in production of vitamin D with age,

individuals living in ARRC in Australia and New Zealand are thought to be at a high risk for vitamin D deficiency, particularly those with poor mobility (NHMRC, 2006).

In ARRC, vitamin D supplementation has been suggested to be effective in reducing the rate of falls, which as a result can have a huge impact on morbidity and mortality in older adults (Cameron et al., 2012; Flicker et al., 2005). A Cochrane review by Cameron et al. (2012) included 43 randomised controlled trials in ARRC with 30,373 participants. A decrease in the total number of falls was observed with vitamin D supplementation; this benefit may partly reflect the low baseline vitamin D levels of the participants.

Across multiple ARRC facilities in Australia, 625 participants took part in a two-year randomised, double-blind, placebo-controlled vitamin D supplementation trial (Flicker et al., 2005). Participants were included in the study if their vitamin D level (serum 25-hydroxyvitamin D) was between 25 nmol/L and 90 nmol/L (i.e. classified as having marginal levels of serum 25-hydroxyvitamin D). Individuals with vitamin D deficiency (<25 nmol/L) or sufficient vitamin D levels (>90 nmol/L) were excluded. All participants were given 600 mg of elemental calcium per day and either vitamin D supplementation (ergo-calciferol) or a placebo. The dosage of vitamin D changed from 10,000 IU once weekly, to 1,000 IU once daily due to discontinuation of the higher dose. A reduction in the rate of falls was observed in the vitamin D group compared to the placebo group (665 falls vs. 890 falls respectively) (Flicker et al., 2005). These findings support the possible benefit of supplementation to prevent falls in older adults in ARRC with baseline marginal vitamin D levels. Incorporation of this strategy has the potential to elicit health benefits such as increased independence and decreased risk of injury from falls.

2.5 Factors influencing nutrition risk in older adults

Inadequate nutrition is associated with poor outcomes such as greater risk of hospitalisation, morbidity and reduced independence and quality of life (Jensen, Kita, Fish, Heydt, & Frey, 1997; Mowe, Bohmer, & Kindt, 1994; Patterson, Young, Powers, Brown, & Byles, 2002). Additionally, nutrition risk can be associated with loss of physical function through functional impairment and frailty, as well as social disability where individuals are more dependent on others (Amarantos, Martinez, & Dwyer, 2001; Humphreys et al., 2002; Saka, Kaya, Ozturk, Erten, & Karan, 2010). Nutrition risk precedes malnutrition, which occurs in stages, with poor oral intake one of the first stages followed by changes in biochemistry and body composition (Mummery et al., 2007).

By definition, malnutrition is the condition of being inadequately nourished and is a result of surplus energy and nutrients (over-nutrition) or a deficiency of energy and nutrient/s (undernutrition) (Hickson, 2006). Malnutrition is largely caused by disease in developed

countries (Norman, Pichard, Lochs, & Pirlich, 2008) and is particularly evident in ARRC facilities. Due to functional and physiological changes with ageing such as poor dentition, swallowing problems and altered smell and taste, older adults in ARRC facilities are thought to be at a high risk of malnutrition (Gaskill et al., 2008; Hickson, 2006).

Overseas research notes a high prevalence of nutrition risk in ARRC facilities. In a Dutch study in 2007, 19% of participants were found to be malnourished across multiple ARRC facilities. This was higher than the prevalence in hospitals and home care which was 15% and 14% respectively (Meijers, Halfens, van Bokhorst-de van der Schueren, Dassen, & Schols, 2009). Nutrition risk was identified through use of a questionnaire, which included three key criteria incorporating BMI, recent unintentional weight loss and recent lack of, or reduced nutritional intake. The mean age of participants in hospitals and home care was lower than those in ARRC at 67 years, 78 years and 81 years respectively (Meijers et al., 2009). This suggests the loss of independence, which is often associated with increasing age, may have influenced the need for placement into ARRC. In ARRC facilities in Queensland, Australia, a high prevalence of malnutrition with a median rate of 50% and 49% was observed across multiple centre audits (Banks, Ash, Bauer, & Gaskill, 2007).

Across all the ARRC facilities in Helsinki, Finland, nutrition risk was observed in 60% of residents with 29% considered to be malnourished (Suominen et al., 2005). Nutrition risk was ascertained using the full MNA®, which consists of 18 items with score ranges indicative of malnutrition, nutrition risk (at risk of malnutrition) and normal nutrition status (Guigoz, Vellas, & Garry, 1996). In this population, female gender, impaired ADLs and longer length of stay were associated with malnutrition, with poor nutrition status often prevalent in residents with dementia. At the time of data collection, the mean length of stay in ARRC was 3 years and 3 months (Suominen et al., 2005). The nutrition status of the individuals may in part reflect the care from the facility in which they were living.

Level of ARRC may be influenced by nutrition risk status (Gaskill et al., 2008; Woods, Walker, Iuliano Burns, & Strauss, 2009). Although participants in low-level ARRC in Melbourne, Australia were fairly independent, poor nutrition status was still evident (Woods et al., 2009). This suggests it may be possible to delay transition to high-level ARRC through maintenance of good nutrition status (Woods et al., 2009).

Despite the overseas research, New Zealand data on the prevalence of nutrition risk and dysphagia in ARRC is limited.

2.5.1 Weight change, body mass index and nutrition risk

Two key factors that influence nutrition risk are body weight and weight loss, both of which can be influenced by numerous factors and have many associated health consequences.

A decrease in body weight is typically observed with ageing, particularly after 60 years of age (Dey & Sundh, 1999; Villareal, Apovian, Kushner, & Klein, 2005). Weight loss can increase the risk of adverse health effects in some older adults. In older adults, physical and functional deterioration as well as psychological impairments can arise as a result of being underweight (Sergi et al., 2005). Decreased body weight is associated with increased morbidity, such as having pressure sores (Allman et al., 1986) and higher mortality rates in men (Yaari & Goldbourt, 1998). A positive association between voluntary and involuntary weight loss and mortality in middle-aged and elderly men over a 18 year follow up period was suggested by Yaari and Goldbourt (1998). The greatest rate of mortality, largely due to CHD, was observed in men who lost the largest amount of weight (≥5 kg) and who were considered lean (BMI <22) at baseline (Yaari & Goldbourt, 1998). In older Australian women who lived in low-level ARRC, transition to high-level ARRC was associated with unintentional weight loss (p = 0.02) (Woods, Iuliano-Burns, & Walker, 2011). Maintenance of a healthy weight is supported by good nutrition, such as through adequate energy and dietary protein intake to prevent loss of lean mass.

Body weight, in conjunction with height, can be used to classify adults as underweight, overweight and obese. The outcome of which is deemed a BMI, calculated by taking weight in kilograms and dividing it by height in metres squared (kg/m^2) (World Health Organization, 2000). There is no agreement for a BMI considered ideal for older adults and no older adult-specific BMI reference ranges (Ministry of Health, 2013a). However, the New Zealand BMI cut-offs for the general adult population are displayed in Table 1.

Table 1: Body mass index classification

New Zealand classification	BMI (kg/m^2)	Risk of health problems
Underweight	<18.50	Low
Normal	18.50-24.99	Average
Overweight	25.00-29.99	Increased
Obese	≥ 30.00	Increased
Class I	30.00-34.99	Moderate
Class II	35.00-39.99	Severe
Class III	≥ 40.00	Very severe

BMI = body mass index
Source: Ministry of Health (2013a), adapted from World Health Organization (2000)

Despite no universal agreement, an appropriate BMI threshold to detect underweight older adults was investigated by Sergi et al. (2005). An association between low BMI and short-term mortality prediction was identified in older adults aged 65 – 84 years. A threshold of 20 kg/m^2 was suggested for identification of older adults at increased risk of mortality due to being underweight (Sergi et al., 2005). The risk of mortality as a result of a low BMI was noted as more severe in men than in women (Sergi et al., 2005). However, as previously stated, the median age of admission to ARRC within New Zealand in 2008 was 83 years (Broad et al., 2011), so a threshold of 20 kg/m^2 may not be accurate for those in New Zealand ARRC facilities.

BMI can also be used to indirectly assess body fatness and nutrition status in older adults, yet it only provides a rudimentary measure of body fatness due to its inability to distinguish fat mass, fat distribution or muscle mass (Ministry of Health, 2013a). With age-related body composition changes, there is a clear redistribution of body fat. In particular, the increase in intra-abdominal fat mass is typically larger than that of total body or subcutaneous fat (Borkan, Hults, Gerzof, Robbins, & Silbert, 1983; Quinglong, Hassager, Ravn, Shuling, & Christiansen, 1994). At the same time, lean body mass decreases with loss noted more so in the peripheral tissues compared to centrally due to the reduction in skeletal muscle mass with ageing (Beaufrere & Morio, 2000).

Decreases in height, common within this older population, may lead to incorrect calculation of BMI (Sorkin, Muller, & Andres, 1999; Villareal et al., 2005). Between 70 and 95 years of age there was a significant downward trend in height with a loss of 4 cm in men and 4.9 cm in women (Dey & Sundh, 1999). As a result of age-related physical changes, use of BMI can lead to an underestimation or overestimation of body fatness due to altered body

composition and loss of height respectively (Villareal et al., 2005). Despite BMI being suggested as an inaccurate reflection of health status in older adults due to body composition changes (Ministry of Health, 2013a), it is used due to its cost-effective nature.

Therefore, BMI should be considered among other parameters when assessing the body fatness and nutrition status of individuals. Low BMI may be considered a nutrition risk factor. Increased nutrition risk in relation to reduced dietary variety was observed in women in ARRC facilities with low BMI (p<0.05) (BAPEN, 2011).

The nutrition status of a population of Swedish older adults aged ≥65 years newly admitted within two weeks into an ARRC facility was assessed by Christensson, Unosson, and Ek (1999). Data was collected using structured interviews and the residents' clinical notes. Participants were classified as having or not having protein-energy malnutrition (PEM), defined as a discrepancy between what the body requires and what is consumed leading to a loss of body tissue, particularly muscle (Haute Autorité de Santé, 2007). If the number of nutrition variables below the normal range was two or greater, with one being biochemical and one anthropometric, a participant was identified as having PEM (Christensson et al., 1999). Weight index (WI) was used as a form of nutrition assessment as it indicates how an individual's weight compares to their ideal weight (Christensson et al., 1999). Body weight upon admission was divided by the gender-appropriate reference (ideal) weight to calculate WI. A lower WI was observed in both men and women with PEM compared to those without PEM, with a strong, positive correlation observed between WI and BMI. Furthermore, PEM was evident in 29% and 43% of participants who were admitted from their own homes and the hospital respectively (Christensson et al., 1999).

2.5.2 Ethnicity and nutrition risk

Variation in the health of individuals can be seen between ethnicities, and differences such as social structure, environment and access to services may contribute to ethnic differences observed with nutrition risk status.

A significant difference was noted between ethnicity and nutrition risk among black and white participants in Alabama (p<0.001) (Locher, Robinson, Roth, Ritchie, & Burgio, 2005). Nutrition risk was assessed using an adapted version of the Nutrition Screening Initiative's 10-item DETERMINE checklist (Nutrition Screening Initiative, n.d.). Possible scores ranged from 0 to 21, which represented the lowest and highest risk, with a score of ≥6 indicative of high nutrition risk. Questions related to nutrition risk factors such as poor intake related to illness, irregular meals, income and oral health. The highest prevalence of nutrition risk was

observed in black women (31%) followed by black men (26%) and white women and men at 22% and 7% respectively. For the majority of the nutrition risk factors, the highest or second highest prevalence was noted in black women. Social isolation and the lowest amount of social support was observed in black men and women with lowest level of education reported in black men and lowest income in black women. An association between lower income and nutrition risk was observed in black women as well as white men and women. Nutrition risk was also associated with low social support, however this was only evident for white women (Locher et al., 2005).

Differences between ethnicity and nutrition risk have also been observed among older New Zealanders aged ≥75 years or ≥65 years if Māori (Wham et al., 2014). Nutrition risk was measured using the Australian Nutrition Screening Initiative (ANSI) with the prevalence of low nutrition risk (ANSI score 0 – 3) evident in 39% of Europeans, 33% of New Zealand Māori and 29% of Other ethnicities (Wham et al., 2014). Also, moderate/high nutrition risk (ANSI score 4 – 29) was observed in 62% of Europeans and 67% and 71% of New Zealand Māori and other ethnicities respectively (Wham et al., 2014). Despite the observed differences between ethnicities, the relationship between nutrition risk and ethnicity was not statistically significant ($p = 0.06$) (Wham et al., 2014).

Nutrition risk was over five times more likely to be observed in community-dwelling Māori aged ≥65 years living in Hawke's Bay, New Zealand compared to non-Māori living in the same region ($p = 0.005$) (McElnay et al., 2012). Assessment of nutrition risk was achieved using the Seniors in the Community: Risk Evaluation for Eating and Nutrition, Version II (SCREEN II) tool (Keller, Goy, & Kane, 2005), which grouped individuals into not at risk and at risk with a third category for individuals considered at high risk (McElnay et al., 2012). Nearly two-thirds of Māori were identified as high nutrition risk (63%) compared to nearly a third (30%) of non-Māori who were at high nutrition risk (McElnay et al., 2012).

Different factors influence nutrition risk status depending on ethnicity, therefore it is essential to recognise these factors to prevent poor nutrition, particularly in vulnerable populations. The higher prevalence of nutrition risk in Māori compared to non-Māori in New Zealand may reflect the widely acknowledged health disparities between these groups (Chan et al., 2008; Jeffreys et al., 2005). This highlights the need for further research in identification of obstacles to adequate nutrition and opportunities to improve nutrition risk status of Māori.

2.5.3 Social factors and nutrition risk

2.5.3.1 Marital status

Marital status has been proposed to influence health status, with widows or widowers typically displaying poorer health compared to other groups (Goldman, Korenman, & Weinstein, 1995). Older adults who have been widowed or divorced often experience feelings of loneliness and abandonment (de Jong-Gierveld, 1987) which has the potential to further impact other areas of health. Marital status is a key social circumstance suggested to influence nutrition risk and is indicated by research both overseas and in New Zealand.

Higher dietary risk scores suggesting poor nutrition were noted for Finnish women who were single or widowed compared to women who were married (Haapala et al., 2012). Women were aged 50 – 60 years when baseline measures were taken and were followed up at 10 year and 11 year intervals for a total of three time points over 21 years. Dietary risk scores provided were indicative of change over time and were derived from five multiple-choice questions where the sum of risk points equaled the dietary risk score. The questions incorporated intake of high saturated fat foods, foods that contribute to high cholesterol intake and high sugar foods eaten in the Finnish diet that were considered to increase risk of chronic disease, with one risk point awarded per item. Points were totaled with a possible score range of zero to five with a lower score indicating better dietary habits. A reduction in dietary risk score over the follow up period in married women was steadier and significantly different from women who were widowed before and after 1982 or single before 1982 (Haapala et al., 2012).

Management of nutrition following death of a spouse was investigated in widows who lived within rural communities in North Carolina, USA (Quandt, McDonald, Arcury, Bell, & Vitolins, 2000). Participants were aged 70 – 96 years and interviews consisted of questions related to diet and health, carried out up to five times over a one-year period. Changes in nutritional strategy following loss of a spouse included: food acquisition, such as receiving food parcels; food use, which included, for example, eating out more frequently, skipping and smaller meals; and food security such as preserving less food (Quandt et al., 2000). Additionally, eating less can lead to a decrease in social contacts and integration, further impacting nutrition risk (Quandt et al., 2000). However, important to note, the population of older adults also had a low income, with many below the poverty level, which may have contributed to these study findings.

Marital status was a key factor contributing to nutrition risk in individuals of advancing age living in New Zealand, with a greater likelihood of nutrition risk noted in those who were

widowed compared to all other statuses (Wham, Teh, Robinson, & Kerse, 2011). Participants were aged 75 – 85 years and lived in three areas of the North Island. The SCREEN II tool (Keller et al., 2005) was used to ascertain nutrition risk status and included questions that covered change in food intake, risk factors for food intake and body weight. Widowed participants were over two and a half times more likely to be considered at nutrition risk (SCREEN II <50) compared to other groups (p = 0.015) (Wham et al., 2011). Additionally, a large proportion of those considered not at risk (SCREEN II ≥50) were married (53%), with widowed participants making up 37% of those not at risk and divorced/separated and never married participants making up 6% and 4% respectively (Wham et al., 2011). The high percentage of married/partnered individuals not at nutrition risk suggests that being married/partnered may be a protective factor against nutrition risk.

In New Zealand, differences in nutrition risk status among different marital status groups were evident in community-dwelling older adults aged ≥75 years or ≥65 years for Māori participants (Wham et al., 2014). Nutrition risk was measured using the ANSI (Lipski, 1996) with a score of 0 – 3 indicative of low nutrition risk and a score of 4 – 29 suggestive of moderate/high nutrition risk. Participants were classified as married, single/divorced or widowed. The percentage of married participants at low nutrition risk was 53%, with 61% considered as moderate/high nutrition risk. Furthermore, single/divorced and widowed participants were more likely to be classified as moderate/high nutrition risk than low nutrition risk (81% vs. 19% and 79% vs. 22% respectively) (p<0.0001) (Wham et al., 2014). Change in role within the home following the death of a spouse may partly explain the high prevalence of nutrition risk in widowed participants. Lack of skills required to prepare meals may influence poor nutrition status in widowed individuals, especially if their spouse had previously undertaken this role.

2.5.3.2 Living situation

Alterations in living situation are common in older adults, with many different arrangements possible such as living alone as a result of death of a spouse or moving somewhere in which adequate support is provided (Ministry of Health, 2013a). Many studies support the association between older adults living alone and poor health (O'Sullivan & Ashton, 2012).

Social constructs play a key role in nutritional wellbeing. When company such as family members or caregivers were available to eat meals with homebound older adults in Alabama, USA, an increase in caloric intake was observed (Locher et al., 2005). Participants who lived alone typically ate very few meals in the presence of others, with 72% having consumed every meal unaccompanied (Locher et al., 2005). However, even when

participants lived with others, eating meals in the presence of others was only evident in 58% of participants (Locher et al., 2005). This suggests that living situation does not completely indicate whether meals will be eaten in the company of others.

Using the SCREEN II tool, both Māori and non-Māori individuals living alone in the community in Hawke's Bay, New Zealand were more likely to be at nutrition risk (p<0.001) when compared to those living with others (Keller et al., 2005; McElnay et al., 2012). Of those who lived alone, 46% were considered at high nutrition risk in comparison to 26% of individuals who lived with others. Additionally, those considered not at nutrition risk were more likely to live with others compared to individuals who lived alone (39% vs. 16% respectively) (McElnay et al., 2012). The removal or decline in social interaction and networks in the older population can contribute to nutrition risk through a reduction in motivation to eat (Donini, Savina, & Cannella, 2003). However, in Māori of advanced age, no independent association between living arrangement and quality of life was observed (Dyall et al., 2014). This may suggest a level of support outside of the home. These results could be partly reflected by recent marae visits, with more than half of the Māori participants visiting several times within the previous 12 months or monthly (Dyall et al., 2014).

An increase in nutrition risk, indicated by a lower SCREEN II (Keller et al., 2005) score, was observed in older New Zealand adults aged 75 – 85 years living alone in the community compared to those who live with others (p = 0.002) (Wham et al., 2011). Similarly, moderate/high nutrition risk, measured using the ANSI, was greater in those living alone compared to individuals who lived with their spouse/partner (82% vs. 47% respectively) (p<0.0001) (Wham et al., 2014).

When an individual moves into an ARRC facility, a reduction in food intake is often noted, independent of physical illness (Donini et al., 2003). This decrease in food intake could be the result of emotional stress and loneliness associated with loss of independence when an individual moves from their home to ARRC care. Loneliness has been reported more often in older New Zealanders who moved into ARRC compared to those who stay in their homes (Heppenstall, Keeling, Hanger, & Wilkinson, 2014). The increase in nutrition risk commonly associated with living alone may be a result of eating less when dining alone compared to eating with company, which typically promotes increased food intake through enjoyment and encouragement. In ARRC, this could involve identification of residents who eat in the company of other residents compared to those who eat alone in their room. For those who eat alone, encouragement to share meals with other residents may help promote food intake in this setting.

2.5.3.3 Low income

“Income is the single most important determinant of health” (p.23) with associations between low income and illness noted globally (National Health Committee, 1998). Socioeconomic status plays a key role in terms of nutrition-related health with inadequate income leading to insufficient dietary intake and a higher prevalence of frailty among many older adults (Barrett et al., 2006; Ministry of Health, 2013a; Sharkey et al., 2002).

Overseas, research on low income and nutrition status is well documented. Using 24 h dietary recall data, older adults who self-reported food insufficiency within their households were consuming a mean energy intake at 58% of the recommendation (Rose & Oliveira, 1997). Participants were classified as either food sufficient or food insufficient according to four questions. These included if they had adequate food and whether it was what they wanted to eat or not always what they liked. Questions used to classify food insufficiency were whether food availability was sometimes or often insufficient (Rose & Oliveira, 1997). An association between decreased energy consumption, measured using three-day 24 h dietary recalls, and income at the lowest level was observed in homebound older adults (Sharkey et al., 2002). A relationship was also evident between the lowest income level and inadequate intake of nutrients such as niacin, vitamin B_6 and magnesium (Sharkey et al., 2002). As malnutrition is not only associated with insufficient energy from food but also with a lack of nutrients (Hickson, 2006), these participants are more likely to be at nutrition risk.

Financial strain and risk of malnutrition were associated in community-living older women in Maryland, USA, independent of income (Samuel et al., 2012). Financial strain was determined by whether they had money left at the end of the month and the frequency of insufficient money for food. Financial strain was assessed because income itself may not be an accurate predictor of nutrition risk. Total household income does not predict purchasing power or the portion of income which is available to individuals within the household (Krieger, Williams, & Moss, 1997). Also, regular food availability is not always possible in some older adults, despite their income being above the poverty line (Rose, 1999). Women who reported typically having insufficient money at the end of the month were more than four times more likely to be at risk of malnutrition according to the MNA®-SF when compared to participants who reported having money remaining (Samuel et al., 2012).

An estimated minimum income for healthy living (MIHL) was established for community-living adults aged ≥65 years in New Zealand (O'Sullivan & Ashton, 2012). Minimum income was established using the ‘budget standard’ method (O'Sullivan & Ashton, 2012). This method reflects what is required for maintenance of a certain living standard in a specific

household at a certain time (Saunders, Patulny, & Lee, 2004). A discrepancy was observed between the state pension and the MIHL, with the MIHL considerably higher. This suggests that the income many older adults live off is insufficient to promote healthy ageing (O'Sullivan & Ashton, 2012). Consequently, this increases nutrition risk as healthy ageing includes the ability to access sufficient, healthy food on a regular basis (O'Sullivan & Ashton, 2012).

Low income can result in food insecurity. 'Food security' is a widely recognised term that involves access to readily available, safe and nutritionally sufficient food that is accepted by the individual (World Health Organization, 2014a). Findings from the *2008/09 New Zealand Adult Nutrition Survey* indicate that for both men and women aged ≥71 years, more than 92% indicated their household were always able to afford to eat appropriately. This signified a relatively low prevalence of food insecurity within this population (University of Otago and Ministry of Health, 2011).

2.5.3.4 Low education

Health, often a consequence of socioeconomic status, is largely determined by an individual's education with poorer health typically associated with individuals who have a lower education level than those who have achieved a higher level (National Health Committee, 1998).

Overseas, an inverse relationship was noted in women between level of education and prevalence of underweight (Kamal & Islam, 2010). Education was classified as primary level and secondary level, either complete or incomplete, higher education or no education at any level. For women without formal education, nutrition risk was higher, as measured by BMI, with an almost seven-fold greater risk of being underweight than women who had attained a higher education (Kamal & Islam, 2010). For participants with no education, a prevalence of underweight (BMI <18.5) was observed in 37% of the study population, compared to 8% of participants with a higher education (Kamal & Islam, 2010). However, the subjects were of younger age, categorised in 5 year intervals from age 15 – 49 years, therefore these results cannot accurately be extrapolated to the older adult population. Also, a limitation of the study was the use of BMI alone as the key measurement of nutrition risk status. Similarly, in older adults aged ≥65 years living in ARRC in Urmia, Iran, the prevalence of nutrition risk varied according to education (Saeidlou, Merdol, Mikaili, & Bektaş, 2011). Nutrition risk was ascertained by use of the MNA® and education was determined by whether participants were illiterate or literate. Risk of malnutrition was greater in illiterate compared to literate participants (61% vs. 39% respectively) with illiterate participants also more likely to be

malnourished than literate participants (82% vs. 17% respectively) (Saeidlou et al., 2011). The protective factor of education may be indicative of higher income which could contribute to a superior nutrition status (Saeidlou et al., 2011).

Māori and Pacifiic school leavers had the lowest frequency of attainment for the National Certificate of Educational Achievement (NCEA) Level 1, compared to New Zealand European, Asian and total students (Ministry of Education, 2014). No significant differences were found between education level and nutrition risk score in older, community-living adults living in the North Island, New Zealand (Wham et al., 2011). Nutrition risk was determined using the SCREEN II tool (Keller et al., 2005) and education level was defined as primary, secondary or tertiary. When nutrition risk was assessed using ANSI in older New Zealanders living in the community, a significant difference was observed between education level (primary, secondary and tertiary) and nutrition risk (p = 0.01) (Wham et al., 2014). For participants with only primary level of education, 34% were considered as low nutrition risk with 66% at moderate/high nutrition risk (Wham et al., 2014).

2.5.3.5 Support services

Within New Zealand, in support of the ageing in place strategy, support services and care are available to help individuals remain in their own homes (Ministry of Health, 2011). The DHB the individual belongs to funds services to eligible New Zealand citizens or residents following a needs assessment with services offered including, for example, assistance with showering, shopping and meal preparation (Ministry of Health, 2011). Also, home-based meal delivery services, such as Meals on Wheels (MOW), are available to eligible community-living older adults to help promote ageing in place (Wilson & Dennison, 2011).

For older adults living in Germany who received home care, nutrition risk was evident in greater than half of home care recipients (Kiesswetter et al., 2013). Also, use of day-care services in community-living older adults in Japan was assessed according to its associated risk for long-term ARRC placement (Kuzuya, Izawa, Enoki, & Hasegawa, 2012). Over a 36 month follow up period, there was a significantly higher risk of being placed in long-term ARRC in those receiving day-care support in addition to frequency of use compared to nonusers of this service (18% vs. 7% respectively). Despite the goal of ageing in place and delaying placement into ARRC, this was certainly not the case in this study. This relationship was partly explained by the number of comorbidities an individual had, with a greater number, as well as the presence of a depressive mood, associated with more frequent use of the day-care service (Kuzuya et al., 2012).

For New Zealanders aged ≥75 years, the importance of home care support services was highlighted by the need for support in at least one ADL required in 81% of participants (Wilkinson-Meyers, Brown, McLean, & Kerse, 2014). Spouse, family members and friends being the key support providers (Wilkinson-Meyers et al., 2014) brings to light the potential for unmet needs in individuals who may lack this social support. As part of LILACS NZ, a cohort study carried out in New Zealand, cultural and social factors were identified in Māori individuals of advanced age (Dyall et al., 2014). A reduction in health-related quality of life was observed in Māori individuals where the need for practical support was unmet.

The reduction in hand grip strength and fine motor skills, common in healthy ageing can be considered a barrier to good nutrition for some individuals (Dennison, 2014). The ability to open food containers and some food packaging, particularly single portion sizes, can become difficult, and without the help of a support person to open them, some older adults may go without (Dennison, 2014). Consequently, the preparation of meals from scratch in older adults living in the community can prove difficult in regards to opening jars and chopping fresh food. One way to promote the government's ageing in place strategy and prevent older adults from admission to a low level of ARRC is home-delivered meals (Thomas & Mor, 2013). In addition to the provision of a nutritious meal, this style of support service also promotes quality of life and maintenance of independence in community-living older adults (Thomas & Mor, 2013). The MOW service in New Zealand was developed in 1951 where it prepared and delivered a hot meal and dessert to community-dwelling individuals who required support for meal preparation as a result of their age or poor health and disability (Wilson & Dennison, 2011).

2.5.4 Health factors and nutrition risk

Chronic disease is a key cause of health loss and mortality with a higher prevalence of these conditions partly due to greater life expectancy and subsequent increased exposure to risk factors (Ministry of Health, 2013a). Reduced quality of life is often experienced as chronic disease-related health loss can decrease physical function and impact on independence (Ministry of Health, 2013a).

2.5.4.1 Polypharmacy

Polypharmacy is defined as taking five or more medications concomitantly and can increase nutrition risk, partly as a result of the medication side effects and food-drug interactions (Ministry of Health, 2013a). Food-drug interactions have the potential to influence an individual's food consumption and nutrient status, for example, due to competing substances

(Ministry of Health, 2013a). Medication side effects such as dry mouth, taste changes, anorexia, dehydration, cognitive changes and depression all have the potential to negatively impact the nutrition status of older adults (Ministry of Health, 2013a). With numerous comorbidities and consequent medication usage rife in older adults, the increase in polypharmacy with advancing age comes as no surprise.

In Finland, a direct relationship between increased nutrition risk and polypharmacy has been determined. Over a three-year period, a statistically significant relationship was found between excessive polypharmacy (≥10 medications) and an increase in nutrition risk (Jyrkkä, Enlund, Lavikainen, Sulkava, & Hartikainen, 2011). Also, of those that had excessive polypharmacy, the proportion of participants that were malnourished or at risk increased from 31% to 50%.

Moreover, research by Haider, Johnell, Thorslund, and Fastbom (2008) among Swedish older adults indicated a polypharmacy prevalence of 42%, with a significantly higher occurrence seen in ARRC compared to community-living participants. This difference may be the result of poorer health of those in ARRC with an increased need for medications due to a higher number of comorbidities. Additionally, a cross-sectional analysis was carried out on 4,023 ARRC residents in a study collecting data across 56 ARRC facilities over eight countries (Onder et al., 2012). Polypharmacy and excessive polypharmacy were seen in 50% and 24% of participants respectively. Also, direct associations were made between excessive polypharmacy and chronic disease, depression, pain and gastrointestinal symptoms when compared to the non-polypharmacy group. Although direct associations were not drawn between polypharmacy and nutrition (Onder et al., 2012), nutrition risk may occur indirectly through nutrition-related consequences of poor health such as reduced oral intake as a result of pain.

In New Zealand, prescribing rates by general practitioners are high, with older adults frequently prescribed multiple medications (Ministry of Health, 2013a). Computerised records from New Zealand general practice demonstrated a mean of 19.7 medications per year with women aged 65 – 79 years receiving significantly more than men within the same age category (Martin, Hall, & Gardner, 2002).

Polypharmacy in a population of community-living older adults with a mean age of 75.5 years was examined by Heuberger and Caudell (2011). Usage of ≥5 medications was observed in 51% of participants in addition to an inverse relationship between medication number and fibre intake. Although not observed by Heuberger and Caudell (2011), with constipation a fairly common side effect associated with polypharmacy, one might expect an

increase in fibre intake. Additionally, 73% of the participants had received diagnosis of a cardiovascular-related disease (Heuberger & Caudell, 2011). Recommendations have been made to increase intake of cereal fibre in older adults as it has been suggested to reduce the risk of incident cardiovascular disease (Mozaffarian et al., 2003).

2.5.4.2 Dental status

As the mouth is the point where food enters the body, oral health is essential for good nutrition, with factors such as missing teeth and dentures potentially compromising the health status of older adults (Sahyoun, 2004). These effects typically take place by causing dietary restrictions and subsequent diminished nutrition status as a result of difficulty chewing (Marcenes, Steele, Sheiham, & Walls, 2003). With a high prevalence of edentulism (total tooth loss) seen in older adults across the world, ranging from <20% to 60% (Musacchio et al., 2007), this older population is significant in terms of weight loss and malnutrition (Marcenes et al., 2003).

An association was observed between avoidance of difficult to chew foods and the number of teeth present, with harder to chew foods often avoided including nutrient-dense foods such as whole grains, fruit and vegetables (Sahyoun, 2004). Consequently, those with poor dentition consumed less energy, carbohydrate, protein and fat as well as calcium, fibre and vitamin C (Sheiham et al., 2001). Reduced fruit and vegetable intake was seen in those who were edentulous compared to individuals who were dentate (have teeth) (Sheiham & Steele, 2000). Fibre consumption below the recommended intake in older adults has also been observed in edentulous individuals (Walls & Steele, 2004). This may be the result of fibrous foods often being a hard texture, which would prove difficult to chew in the absence of some teeth.

An adequate energy intake as a result of a natural functional dentition suggests the older adult is more likely to have a BMI within the acceptable range (Marcenes et al., 2003). Research by Rauen, Moreira, Calvo, and Lobo (2006) found a statistically significant difference (p = 0.007) between ‘thin’ participants and highly compromised dentition, which suggests poor dentition may indicate inadequate nutrition status. Participants were classified as having either highly compromised dentition or less-compromised dentition and BMI was used as a measure of nutrition status (Rauen et al., 2006). A high risk of undernutrition was also observed in ARRC residents with poor oral health status due to reduced enjoyment from eating and difficulty eating firm foods (Lamy, Mojon, Kalykakis, Legrand, & Butz-Jorgensen, 1999).

Despite dental prostheses (dentures) shown to improve chewing ability compared to edentulous individuals, this improvement is not to the same degree as a dentate individual and may be a result of a poor fitting denture or the decreased maximum bite force (Smith & Parnell, 2008). Although an individual may wear dentures, loss of body weight can lead to the dentures being ill-fitting and loose. This may as a result lead to reduced oral intake and could reduce eating pleasure and cause difficulty chewing some types of food.

2.5.5 Psychological factors, cognition and nutrition risk

2.5.5.1 Depression

The prevalence of depression in advancing age is high and is deemed a public health issue (Ahmadi et al., 2013; Yoshimura, Yamada, Kajiwara, Nishiguchi, & Aoyama, 2013). Loss of social networks is common in those with depression, which may contribute to a lack of motivation to eat and loss of appetite (Donini et al., 2003; Ministry of Health, 2013a).

A significant association (p = 0.006) was observed between nutrition risk and depression in individuals with a mean age of 84.6 years living in ARRC in Berlin, Germany (Smoliner et al., 2009). Nutrition risk was assessed using the MNA® and depression was identified with the Geriatric Depression Scale (GDS). Numerous potential factors such as age, BMI, number of medications and quality of life were analysed as risk factors for nutrition risk; however, the GDS was the only independent risk factor (Smoliner et al., 2009). As the reasons for poor nutrition status are multi-factorial, although depression may have contributed to weight loss, depression treatment may improve nutrition risk status but will not necessarily completely reverse malnutrition (Smoliner et al., 2009)

A relationship between depression, identified using the GDS, and nutrition risk according to the MNA® was also noted by Ahmadi et al. (2013) in an older adult population. Depressed individuals were more likely to be considered higher nutrition risk. Findings indicated 44% of the participants were depressed, with women significantly more depressed than men. Nearly half of depressed older adults (48%) were either malnourished or at risk of malnutrition (Ahmadi et al., 2013). In a population of Japanese older adults, there was no significant difference between depression, measured using the GDS, and nutrition risk according to the MNA®-SF in those aged ≥75 years (Yoshimura et al., 2013). However, a strong association was noted between depression and those at risk of nutrition risk in a younger group aged 65–74 years (Yoshimura et al., 2013).

2.5.5.2 Reduced level of cognition

Complaints regarding worsening memory loss over the years are common in older adults (Jonker, Geerlings, & Schmand, 2000). Older adults can be classed has having a mild cognitive impairment (MCI), and although it differs from dementia, both impact greatly on the health of older people (Ministry of Health, 2013a). MCI is often deemed a precursor to dementia but it is not considered part of normal cognitive ageing, rather it is somewhere in between (Nasreddine et al., 2005). A review by Jonker et al. (2000) suggested that memory changes, particularly mild cognitive impairment, may have a predictive value for dementia after a minimum of two years follow up.

Dementia, with Azheimer's Disease (AD) being the main cause in older people, is described as both an impairment of an individual's memory and decline in intellectual function significant enough that it disturbs the individual's social environment, such as their relationships with others (Ministry of Health, 2013a). Reduction in cognition also has a huge impact on an individual's independence (Stanner & Denny, 2009). In New Zealand, approximately 48,182 individuals (1% of the country's population) had dementia in 2011 (Alzheimers New Zealand, 2012).

Older adults, particularly those diagnosed with advanced dementia, are at risk of malnutrition (Cole, 2012). Of a sample of older adults with dementia living in warden-assisted ARRC, 48% and 33% were deemed at risk of malnutrition and were malnourished respectively (Riches & Jeanes, 2014). However, warden-assisted ARRC differs from that of ARRC facilities in New Zealand and therefore prevalence cannot be directly compared between studies. In agreement, findings by Meijers, Schols, and Halfens (2014) note the prevalence of malnutrition has not declined over time in demented residents and malnutrition occurrence was significantly higher in residents with dementia compared to residents without dementia. Numerous eating difficulties can occur in older adults with dementia, these may include: reduced appetite, inability to recognise food, confusion around when to eat and why it is important, difficulty self-feeding and problems with swallowing and chewing (Asai, 2004; Lin, Watson, & Shiao-Chi, 2010). Reduced food intake and weight loss can occur as a result of these difficulties (Asai, 2004). Extreme wandering can increase energy requirements and if the increased needs are not met, this can also lead to weight loss (Asai, 2004). These eating difficulties and behaviours may worsen with the progression of dementia, and in ARRC the need for feeding assistance may be necessary to increase food intake (Lin et al., 2010).

2.5.5.3 Montreal Cognitive Assessment (MoCA)

The MoCA was first developed to provide a tool for the detection of MCI, with early detection of MCI important as it often precedes AD (Nasreddine et al., 2005). Initially 10 cognitive domains were covered; modification of the tool took place over a 5-year period. The final revised version of the MoCA was developed through administration of the initial version to a number of patients with MCI or AD compared to cognitively healthy controls. Five questionnaire items were replaced due to poor differentiation and the scoring system was modified to give more weight to questions with the strongest discriminatory ability (Nasreddine et al., 2005).

Sensitivity and specificity of the MoCA were tested alongside the Mini Mental State Examination (MMSE) (Folstein, Folstein, & McHugh, 1975) with the standard for cognitive assessment being diagnosis in a memory clinic (Nasreddine et al., 2005). Participants were in three groups, those with MCI, AD, and older adults of normal cognition used as the control. A score of ≥26 points was used as a cut-off as this point produced the greatest sensitivity and specificity. Impaired cognition was suggested in participants with a score of ≤25 points. The MoCA showed greater sensitivity than the MMSE with 90% for MCI and 100% for AD with sensitivity of the MMSE only 18% and 78% for MCI and AD respectively. The percentage of participants with normal cognition (≥26 points) was used to describe specificity. Although 100% of participants with normal cognition were defined using the MMSE, the MoCA still showed good specificity at 87% (Nasreddine et al., 2005).

The MoCA, using a score of 26 points as the cut-off value, showed 83% and 94% sensitivity for MCI and dementia respectively when compared against clinical diagnosis in a memory clinic (Smith, Gildeh, & Holmes, 2007). The MMSE was tested alongside the MoCA and their predictive capacity was tested with a 6-month follow up assessment to investigate the diagnostic outcomes of the participants. Sensitivity of the MoCA was 100% for participants with MCI at baseline being diagnosed with dementia at the 6-month follow up, far greater than the MMSE which showed only 25% specificity. However, while the sensitivity of the MoCA was good, the specificity of the MoCA was unexceptional at 50% compared to the MMSE which had a specificity of 100% (Smith et al., 2007).

2.5.6 Dysphagia and nutrition risk

Changes in the physiology of swallowing can be observed with increasing age as a result of strength losses due to decreased muscle mass and the elasticity of connective tissue (Sura, Madhavan, Carnaby, & Crary, 2012). Age-related changes in swallowing not only increase

the risk of choking and pneumonia but also the risk of malnutrition, seen in 25 – 75% of those suffering from dysphagia (Rofes et al., 2011). Dysphagia is a condition defined as the difficulty or inability to swallow either food or liquids (Forster, Samaras, Gold, & Samaras, 2011). As eating and drinking are typically social, anxiety and panic can occur while eating and can therefore also have harmful social consequences (Forster et al., 2011).

While well older adults are capable of compensating for the normal age-related reduction in swallowing ability due to sufficient functional reserves, changes such as poor neurological health, surgery and illness can cause a drop in functional reserves, consequently impairing oral feeding (Pendergast, Fisher, & Calkins, 1993). With reduction in ability to cope with ADLs potentially contributing to admission into ARRC facilities (Pendergast et al., 1993), negative changes in health status must be considered when considering risk for dysphagia and associated malnutrition.

The prevalence of dysphagia risk is fairly high in ARRC with a prevalence of 24% in participants across ARRC facilities in Japan (Sugiyama et al., 2014). Dysphagia of varying degrees was noted in 55% of the participants who were not eating optimally and lived in ARRC (Kayser-Jones & Pengilly, 1999). Similarly, a dysphagia screen on 395 older adults across two ARRC facilities in South Korea displayed a prevalence of 53% (Park et al., 2013). For these residents, there was a significant association between dementia, poor functional status requiring dependence, delayed feeding time and nutrition issues with dysphagia (Park et al., 2013). To ensure safety of swallow and maintenance of oral intake and hydration, a multi-disciplinary team approach is required (Marik & Kaplan, 2003). Many health care professionals such as a physician, speech and language therapist, clinical dietitian, physiotherapist and occupational therapist can assist with the management of dysphagia (Marik & Kaplan, 2003).

As malnutrition is recognised to further reduce functional capacity, malnutrition associated with dysphagia can hence increase frailty of older adults (Sura et al., 2012), with decreased energy and protein intake a major factor (Forster et al., 2011). Despite detection of dysphagia possible through the use of simple screening tools, under-diagnosis and inappropriate treatment of dysphagia can put these individuals at nutrition risk (Serra-Prat et al., 2012). Individuals with dysphagia may require texture-modified diets for safe oral intake, numerous strategies such as making food appear more attractive visually, dietitian consultation and encouragement of independent feeding are often utitilised to decrease nutrition risk and optimise nutrition in these individuals (Easterling & Robbins, 2008).

In ARRC environments, recognition of dysphagia risk is important for the appropriate care of residents, not only for nutritional adequacy and the prevention of fatal incidents such as aspiration pneumonia but also for quality of life through pleasurable eating experiences.

2.5.6.1 Eating Assessment Tool (EAT-10)

The EAT-10, a dysphagia tool, was developed in order to provide a rapid way of identifying severity of dysphagia and monitoring treatment effectiveness (Belafsky et al., 2008).

Dysphagia is a condition that commonly affects older adults with those affected also at a greater risk of aspiration (Australian and New Zealand Society for Geriatric Medicine, 2011). There are many consequences of dysphagia that are associated with increased morbidity and mortality. These can include: dehydration, choking, increased nutrition risk and malnutrition and aspiration pneumonia (Australian and New Zealand Society for Geriatric Medicine, 2011).

A multi-disciplinary team consisting of experts in dysphagia was asked to contribute 10 questions they felt to be valid to accurately screen for dysphagia (Belafsky et al., 2008). A list of 35 potential questions were voted on which lead to the development of the original dysphagia screen, the 20-item Eating Assessment Tool (EAT-20). The EAT-20 was administered to two groups of people, those with diagnoses of voice or swallow disorders and to normal controls. The 10 least reliable questions were taken out following tests for consistency and reliability to form the EAT-10 questionnaire. Normative data was then gained to set a cut-off score and validity was then analysed (Belafsky et al., 2008).

While the omission of visual analogue scales and formulas makes calculating the final score highly simple and rapid, a limitation of the tool is the lack of specific domains and sub-sections which means it is not possible to group the final result into more categories (Schindler et al., 2013). Also, this tool was validated in participants with a mean age of 62 ± 14 years for those with voice and swallowing disorders and 48 ± 16 years in the normal population. Further evaluation of the tool is necessary in an older age group for the normative data to ensure it is still valid in the older adult population (Belafsky et al., 2008)

Validity and reliability of the tool was assessed using a large number of participants who had problems with their voice and swallowing (Belafsky et al., 2008). Determination of the at-risk cut-off point was suggested by the normative data (Belafsky et al., 2008). Significantly elevated EAT-10 scores were noted in those with a history of head and neck cancer or with oropharyngeal and oesophageal dysphagia when compared to individuals with voice disorders or reflux (Belafsky et al., 2008). When compared to a healthy group of participants

with no voice and swallowing disorders, EAT-10 scores were significantly higher in the group with voice and swallowing disorders (Belafsky et al., 2008).

The EAT-10 tool was tested for its sensitivity and specificity for oropharyngeal dysphagia (OD) and was found to be an effective screen, recommended for use in older adults at risk for OD and poor nutrition that would benefit from further testing (Rofes, Arreola, Mukherjee, & Clavé, 2014). Mean age of the participants was 74.4 ± 12.4 years and many were at a high risk of malnutrition in accordance with the MNA®-SF (Rofes et al., 2014). When the accuracy of the EAT-10 was compared against videofluoroscopy (VFS) for detection of OD, sensitivity and specificity was 0.89 and 0.82 respectively (Rofes et al., 2014). This was determined using a receiver operating characteristic (ROC) curve with a normative cut-off point of ≥3 points used (Rofes et al., 2014). Increased sensitivity of the EAT-10 was observed when the cut-off was reduced from 3 points to 2 points, with specificity unaffected (Rofes et al., 2014). As this led to a reduced number of false-negative results, further assessment is indicated with an EAT-10 score of ≥2 points (Rofes et al., 2014).

2.6 Screening for nutrition risk in older adults

Assessment of nutrition risk is carried out in order to ascertain features and characteristics of individuals that may be associated with nutrition risk status. Unfortunately, changes in the nutrition status of older adults are often subtle initially which means they are sometimes not recognised until they are more severe and physical differences are clear (Brownie, 2006). Many studies indicate individuals in ARRC are at a high risk of malnutrition (Banks et al., 2007). This suggests the importance of screening for nutrition risk in order to identify those at risk of poor nutrition earlier on, before malnutrition occurs.

There are a variety of screening tools with different assessment parameters used to assess nutrition risk, however not all are specific to ARRC. Some examples of the numerous tools include: the Subjective Global Assessment (SGA) which uses an individual's medical history and a physical examination to determine their level of nutrition risk (Detsky et al., 1987). The SGA was found to be effective in the nutrition assessment of older adults in ARRC (Sacks et al., 2000). Although it is cost-effective and non-invasive, use of this tool requires specific training to administer (Sacks et al., 2000). The Malnutrition Screening Tool (MST) uses two questions related to recent oral intake and recent weight loss as a means to assess nutrition risk status (Ferguson, Capra, Bauer, & Banks, 1999). The tool is simple, valid and reliable (Ferguson et al., 1999) and can be used in ARRC for fast identification of nutrition risk (Isenring, Bauer, Banks, & Gaskill, 2009). However, as only two questions are used, it does not incorporate other areas that may contribute to nutrition risk. The Malnutrition Universal

Screening Tool (MUST) assesses nutrition risk using BMI, weight loss and acute disease (BAPEN, 2011). Although the MUST is fast and easy to use with good internal consistency, it was developed in the hospital and in the community with only poor to fair validity in ARRC (BAPEN, 2011; Guaitoli, Jansma, & de Vet, 2014). The Mini Nutritional Assessment® (MNA®) includes a number of different nutrition assessment parameters known to contribute to nutrition risk (Guigoz, 2006). The tool has been used across a wide range of settings, with reliability shown in ARRC (Bleda, Bolibar, Pares, & Salva, 2002). However, the MNA® is very lengthy and takes time to administer which may prove difficult with some older adults, especially those with cognitive impairment. Also, the anthropometric data required to calculate BMI may be hard to obtain in some individuals, such as in those who are bed bound.

The Mini Nutritional Assessment®-Short Form (MNA®-SF) uses a large number of assessment parameters to ascertain nutrition risk status (Rubenstein, Harker, Salva, Guigoz, & Vellas, 2001), As nutrition risk is not one-dimensional, the inclusion of risk factors such as poor mobility, psychological stress and cognitive impairment is a strength of this tool. Although the MNA®-SF is longer than other tools such as the MST and MUST, it is still fast and easy to administer, and is used in the ARRC setting (Kaiser et al., 2011; Young, Kidston, Banks, Mudge, & Isenring, 2013).

2.6.1 Mini Nutritional Assessment®-Short Form (MNA®-SF)

The Mini Nutritional Assessment® (MNA®) consists of an 18-item questionnaire with four groups of questions which include anthropometry, general health assessment, dietary assessment and ending with a subjective assessment (Guigoz, 2006). The screen takes <15 minutes to complete, has a maximum score of 30 points and is a three classification scoring system. A score of ≥24 points for well-nourished, 17 – 23.5 points is considered at risk of malnutrition and <17 points is suggestive of malnutrition (Guigoz, 2006).

The original MNA®-SF was developed by Rubenstein et al. (2001) as it was thought the full MNA® was potentially too extensive for regular nutrition screening. It consisted of six items taken from the full MNA® with the predictive value and sensitivity of questions considered during development. Good predictors of nutrition status were weight loss and illness/stress with poor predictive value associated with mid-arm circumference, institutionalisation and intake of more than 3 medications (Rubenstein et al., 2001). The original MNA®-SF was a two-step process, with only a two classification system used with ≤12 points suggestive of ‘satisfactory’ nutrition status and ≤11 points indicative of risk of malnutrition (Guigoz, 2006).

For individuals classified as being at risk of malnutrition, a second step, the completion of the full MNA®, was needed for confirmation of the final score category (Guigoz, 2006).

The revised version of the MNA®-SF was developed in 2009 and included a three classification scoring system, the same as in the full MNA® (Kaiser, Bauer, et al., 2009). The option of calf circumference (CC) was included in the revised version where calculation of BMI was not possible due to missing body weight or height information such as in bedridden participants or in geographical areas that lacked the appropriate resources.. The use of CC was deemed a more useful parameter than mid-arm circumference (Kaiser, Bauer, et al., 2009). The revised MNA®-SF can be used as a stand-alone tool for nutrition risk screening in older adults with the changes making it more appropriate for use as a routine screening tool (Kaiser, Bauer, et al., 2009).

The six questions from the full MNA® that were used for the MNA®-SF were chosen due to their superior sensitivity and specificity, association with the final score from the full MNA®, and their greater internal consistency (Rubenstein et al., 2001). Their correlation with clinical nutrition status and administration simplicity was also considered (Rubenstein et al., 2001).

Validation of the revised MNA®-SF was carried out against a standard nutrition assessment tool, the full MNA® (Kaiser, Bauer, et al., 2009). Validity, sensitivity and specificity of the original MNA®-SF were demonstrated across various countries using older adults in different settings (Kaiser, Bauer, et al., 2009). The validity and precision of the full MNA® was maintained in the MNA®-SF. The revised MNA®-SF includes a three-category scoring system as per the full MNA® and has the option of using CC in the event that BMI cannot be determined (Kaiser, Bauer, et al., 2009). Analysis showed that the MNA®-SF classified 80% of participants correctly in comparison to the full MNA®. However, when the full MNA® classed a case as normal nutritional status, there were no times where the MNA®-SF classed the same case as malnourished and vice versa (Kaiser, Bauer, et al., 2009). Across all cases, 20% were misclassified by one category when comparing the MNA®-SF to the full MNA®, i.e. at risk versus malnourished (Kaiser, Bauer, et al., 2009). Despite this, misclassification by two categories has greater potential harm in terms of identification of nutrition risk than compared to misclassification by one category.

The high prevalence of cognitive impairment in ARRC must be considered in relation to the reliability of the information if the MNA® is carried out by a one-on-one interview with the resident (Kaiser, Winning, et al., 2009). In this case, completion of the nutrition screening should be carried out with assistance of nursing staff (Kaiser, Winning, et al., 2009). The

MNA®-SF is suggested to be appropriate for use in almost all older adults, including those who are bedridden or cognitively impaired (Kaiser, Bauer, et al., 2009).

2.7 Summary

Numerous factors may play a role in the nutrition risk status of older adults recently admitted to ARRC. Personal and health characteristics, such as gender, BMI, comorbidities, polypharmacy and poor dentition among others, may have some influence on the health of older adults.

Of particular importance is dysphagia, as it can compromise food intake and lead to unintentional weight loss. These factors do not necessarily stand alone, and may be interrelated with other risk factors.

Nutrition screening upon admission to ARRC may help in early detection of those at risk of poor nutrition and dysphagia. This can assist in the development and implementation of appropriate nutrition and swallowing interventions and strategies. Therefore, the aim of this study was to determine the prevalence of nutrition risk in older adults newly admitted to an ARRC facility in the Waitemata DHB region.

CHAPTER 3: METHODS

3.1 Participants

Participants were enrolled into this observational study having recently been admitted into an ARRC facility in the Waitemata DHB region from the hospital or the community.

3.2 Participant recruitment

Participants were recruited through two methods, the NASC service at Waitemata DHB and manual communication via telephone by the researcher with ARRC facilities across the Waitemata DHB region. NASC help to identify support services for individuals with impaired functional capacity in order to promote independent living where possible (Ministry of Health, 2014). This allowed for identification of recent admissions and their viability as possible participants. A flow chart that describes the recruitment process is outlined in Figure 4.

Participants were enrolled between 13 June 2014 and 19 August 2014. Prior to commencement of data collection, meetings were held with the Waitemata DHB NASC team, at both the North Shore Hospital and Waitakere Hospital sites. The study was outlined and NASC agreed to gain consent through either the individuals soon to be placed into an ARRC facility or through their Legal Representative. Following the NASC assessment, the study was described to the individual, an information sheet (Appendix 1) was provided, and they were asked whether they would like to participate. Their family was also provided with an information sheet if they requested one. For Waitemata DHB inpatients, the consent form (Appendix 2a, 2b) was sent to the ARRC facility with the individuals' clinical notes. For those within the community, the consent form was made available for pick up from the NASC office located at the Community Health Office at North Shore Hospital. An email was sent to the Massey University interviewer detailing the participant's National Health Index (NHI) number, the name of the ARRC facility and their date of ARRC admission.

Manual communication with individual ARRC facilities was the second method of data collection. A flyer (Appendix 3) that described the study and included contact details of the researchers was emailed out to all ARRC facilities in the Waitemata DHB region. Facilities were called on a weekly basis to ascertain new admissions that met the criteria for the research study. Written consent was gained from the participant upon arrival following explanation of the study procedure, provision of the information sheet and discussion of the consent form.

3.3 Inclusion and exclusion criteria

Depending on the method of recruitment by which participants were enrolled into the study, eligibility of participants was determined either through NASC screening or through contact with the ARRC facility.

Initially the inclusion criteria required participants to have been admitted to an ARRC facility within 5 days. However, due to recruitment strain this was adjusted to include individuals within 14 days of admission. Participants were required to be first time admissions into ARRC and aged ≥65 years or ≥55 years if Māori or Pacific. Those admitted for short-term respite care were excluded. The lower age criteria for Māori and Pacific were in light of the well-recognised health disparities between these two groups compared to other ethnicities. Participants were required to be able to understand and give consent to take part in the research and be capable of completing a self-assessment questionnaire. Screening also involved checking participants were willing to undergo anthropomorphic measurements including body weight, height and CC. Exclusion criteria included:

1. Age <65 y (or <55 y for Māori and Pacific)
2. Inability to give reasonable informed consent
3. Tumour in the voicebox
4. Pyschiatric illness that affects nutrition (e.g. Anorexia Nervosa)
5. Zenker Diverticulum
6. Malabsorption syndromes or metabolic syndromes affecting digestion
7. Presence of an orocutaneous or pharyngocutaneous fistulae

Palliative care was also stated as an exclusion criterion to prevent undue burden on sick patients. However, where participation appealed to a resident and they were willing to take part they were included in the study.

3.4 Ethics

Ethical approval for the present study was granted by the Northern A Health and Disability Ethics Committee (HDEC) and Waitemata DHB (Reference 14/NTA/70; Appendix 4). The study underwent Māori Research Review to ensure responsiveness to Māori (Appendix 5). All parties signed a letter of understanding which outlined the agreement and responsibilities shared by Waitemata DHB, Massey University and the ARRC facilities. Participants took part on a voluntary basis following provision of information about the study's requirements, risks, benefits and their rights in taking part. The interviewer discussed the consent form with the participant, provided an information sheet and assessed their understanding of the

study. The consent form included information on the following: why the study was being done, inclusion and exclusion criteria, the content and length of the interview, risks and benefits, confidentiality, cost and compensation as well as 24 h contact details of the Principle Investigator. Either written or verbal consent was gained. Written consent was gained using a standard consent form signed by the participant or a consent form for vulnerable participants (Appendix 2b), such as those with dementia, signed by the participant's Legal Representative. The participant/Legal Representative and interviewer signed the consent form prior to commencement of the interview. The participant or Legal Representative signed to indicate agreement to participate in the study, that they had read and understood the consent form, would be given a signed and dated copy of the consent form and that the interviewer had provided the participant with the appropriate information.

All participants were informed that participation was voluntary; they could withdraw from the study at any time if they wished without question, and that choosing to withdraw or not take part would not affect their care. Participants were assured their medical information would be kept private by way of storage of research data in a locked file with electronic files password protected and accessible only by the principle and co-researchers. It was explained that removal of all personal identification would take place if the study was published or presented but that if required by law, personal information may be given out.

3.5 Questionnaire

The study involved a personal interview with a questionnaire (Appendix 6) to identify nutritional and non-nutritional factors that may increase nutrition risk.

The questionnaire included a range of questions finishing with the Mini Nutritional Assessment®-Short Form (MNA®-SF; Nestlé 1994, Revision 2009; Appendix 7), and 10-item Eating Assessment Tool to assess dysphagia risk (EAT-10; Nestlé; Appendix 8). Following completion of the questionnaire, the MoCA (Version 7.0; Appendix 9) was carried out. Every interview was completed in the same order, each by a trained interviewer. The questionnaire included 46 questions consisting of eight parts:

1. Personal characteristics
2. Demographics
3. ARRC
4. Health
5. Support services
6. MNA®-SF
7. EAT-10

8. Interviewer assessed respondent reliability

3.5.1 Pilot questionnaire

Feedback on the questionnaire was obtained through piloting the questions on friends and family of the researchers. The aim was to ascertain whether changes needed to be made to the questionnaire and the length of time it would take to carry out before it was used in the study.

Findings from the pilot study reiterated the importance of a clear introduction of the study and the reasons for the questionnaire, as well as the main objectives of the research. Pilot participants reported that no question was too sensitive or personal and importantly that they felt comfortable answering all questions. With most questions easily understood, any confusion was quickly nullified when answer options were provided. Time taken to complete the questionnaire was estimated at between 30 – 45 minutes, which excluded the time to complete the consent process, and an additional 5 – 15 minutes was estimated to explain the study and gain informed consent. The timeframe was dependent on the assumption that participants would have a varied level of understanding.

Changes were made to the questionnaire as a result of the findings from the pilot questionnaire. These changes removed repetitive questions and clarified wording of others to prevent confusion.

A major limitation of the pilot interviews was that participants were typically aged <65 years hence they were not representative of the study population.

3.5.2 Participant characteristics

The first part of the questionnaire comprised personal and demographic questions, which included: age, gender, ethnicity, marital status, living situation, income and education. A range of possible answers to each question was read out to the participants.

Weight, height, demispan, and CC were measured and BMI calculated. Participants' weight was taken from the weight recorded in the participants' notes upon admission to the ARRC facility. If weight had not yet been taken, the nurse measured and recorded it following the interview. Demispan or CC were not measured for all participants, they were taken when either weight or height was unavailable.

Demispan was measured as per the user guide for the MNA®-SF (Nestle Nutrition Institute, 2004) which used measurement guidelines from BAPEN (2011). The mid-point of the sternal

notch was marked with a pen. The participant was then asked to hold their left arm out, parallel with the floor and inline with the shoulders. With the arm held flat and straight, the distance between the mark on the sternal notch to the web between the middle finger and ring finger was measured to the nearest 0.5 cm. To calculate height from demispan, the following formula was used.

Men:
Height (cm) = (1.40 x demispan in cm) + 57.8

Women:
Height (cm) = (1.35 x demispan in cm) + 60.1

Measurement of CC was in accordance with instructions in the MNA®-SF user guide (Nestle Nutrition Institute, 2004). The left leg was used and subjects were required to be seated with their leg uncovered and hanging loose (non-weight bearing). A tape measure (Lufkin Executive Thinline, 2m W606PM) was wrapped around the calf at the widest point and at a right angle to the calf length. Measurements were also taken above and below this point to guarantee the widest point and were recorded to the closest 0.1 cm. For bed-bound participants, CC was measured with the left leg bent at a 90º angle with the person lying in the supine position. Measurement was taken at the widest point with the tape snug around the calf and measured to the nearest 0.1 cm.

There were five demographic questions: ethnicity, marital status, living situation, income and education. Two questions asked about: setting prior to ARRC admission (community or hospital) and level of ARRC (rest home or hospital level of care). In relation to support services, two questions asked whether participants received any subsidised support service and whether they required assistance with ADLs.

3.5.3 Health characteristics

Six health-related questions asked the following: key comorbidities, other health problems, regular medications, regular over-the-counter (OTC) medications, regular nutrition supplements (e.g. Complan or vitamin and mineral supplements) and dental status. The majority of this information was taken from the participants' clinical notes.

3.5.4 Nutrition risk (Mini Nutritional Assessment®-Short Form)

This questionnaire was used to identify nutrition status of participants and classify them as normal nutrition status, at risk of malnutrition or malnourished. It is quick to complete, takes

less than 5 minutes and does not require training to complete. Question answers were derived from the patient, their clinical notes and in some cases, a close family member or the nursing staff at the ARRC facility.

The MNA®-SF comprises six questions (A to F) with multiple-choice answers as shown in Appendix 7. The questions include: food intake over the past 3 months, weight loss over the past 3 months, mobility, psychological stress or acute disease, neuropsychological problems, and anthropometry. For neuropsychological problems, participants with a medical diagnosis of MCI were classified as mild dementia according to the MNA®-SF due to the association between nutrition risk and cognitive impairment in older adults (Patterson et al., 2002). A maximum of 14 points are available, scoring is as follows: 12 - 14 points (normal nutritional status), 8 - 11 points (at risk of malnutrition) and 0 - 7 points (malnourished). Where BMI was unavailable, the question was replaced with CC.

3.5.5 Dysphagia (Eating Assessment Tool, EAT-10)

This swallowing screen questionnaire was used to identify older adults who are at risk of dysphagia. Those at risk may as a result, also be considered at nutrition risk.

The tool is comprised of 10 questions (Table 2, Appendix 8), and can be simply administered and scored with a completion time of under two minutes (Schindler et al., 2013). Points are assigned based on the score for each question and are accumulative. If the sum of the EAT-10 score is ≥3, the participant may have problems with swallowing and it is recommended they speak to a doctor about their results (Schindler et al., 2013). The questions ask each participant to rate the extent they experience each problem on a scale from zero being no problem to four being a severe problem.

Table 2: Questions in the EAT-10

Question item
1. My swallowing problem has caused me to lose weight
2. My swallowing problem interferes with my ability to go out for meals
3. Swallowing liquids takes extra effort
4. Swallowing solids takes extra effort
5. Swallowing pills takes extra effort
6. Swallowing is painful
7. The pleasure of eating is affected by my swallowing
8. When I swallow food sticks in my throat
9. I cough when I eat
10. Swallowing is stressful

Eating Assessment Tool (EAT-10) (Belafsky et al., 2008)

For this present study, an EAT-10 cut-off point of ≥3 points was used for detection of dysphagia risk.

3.5.6 Assessment of respondent reliability

The interviewer recorded the reliability of the participants' answers and reliability of questions using their own judgment. Responses were ranked from one being very poor to five being very good for both reliability of responses and participants' understanding.

3.5.7 Montreal Cognitive Assessment (MoCA)

The MoCA was used to determine whether participants had normal or abnormal cognitive function. The assessment takes 10 minutes to complete, is made up of eight sections and has a total of 30 points available (Nasreddine et al., 2005).

Visuospatial/executive skills asked participants to draw a clock and three-dimensional cube as well as an alternation task where participants were required to connect letters and numbers in the correct order. Short-term memory was assessed by the interviewer reading the participant five nouns, with participants reading back the five nouns after they were read by the interviewer followed by a recall five minutes later. Repetition of a list of numbers forwards and in reverse, a prolonged attention task and serial number subtraction were used to assess attention. Language was tested by asking participants to repeat two sentences accurately, name the maximum number of words they could that started with the letter F,

and through a naming task that tested the ability of participants to identify pictures of three unfamiliar animals. Abstraction was evaluated by asking the participant to recognise the similarity between two items. Lastly, orientation to time and place was assessed (Nasreddine et al., 2005).

For this present study, a cut-off score of ≥26 points was used with a score of ≤25 points indicating some form of cognitive impairment. Each question had a different score value as questions were weighted differently depending on its ability to distinguish certain features. The MoCA administration and scoring instructions (Nasreddine, 2010) were used to ensure consistency across assessments. These gave directions on the wording the interviewer was to use to ask each question and acceptable answers to the questions.

For participants who scored ≤25 on the MoCA, results from the questionnaire were checked with a family member or nurse closely familiar with their background to ensure reliable data. Acceptable agreement between responses from a participant with below normal cognitive function and responses from their caregiver has been shown in a previous study (World Health Organization, 2014b). This ensured subjects with cognitive impairment did not have to be excluded from this research.

3.5.8 Questionnaire completion

Upon completion of the interview, participants were asked if they would like to know the answers of the questionnaires and if so the results were discussed. Documentation was completed in the participants' clinical notes at the ARRC facility and outlined consent gained, the questionnaire results and where appropriate, recommendations for referrals. Nutrition risk and dysphagia risk were documented in the participants' clinical notes. Where identified as being at risk of malnutrition, a written recommendation was made for the resident's nutrition and body weight to be monitored. For those identified as malnourished, a written recommendation was made for the resident to be seen for a nutrition assessment by a New Zealand Registered Dietitian. For participants considered at risk of dysphagia, a written recommendation was made for completion of a swallowing assessment. A copy of the signed consent form was included in the participants' clinical notes.

3.6 Data handling and statistical analysis

Data was coded and entered into Microsoft Excel Version 12.3.6 for Mac. It was then transferred for analysis into IBM SPSS Statistics Version 21 for Mac, a statistical analysis

programme. Once data was transferred, participants were categorised by age, and comorbidities and medications were grouped accordingly.

Participants were categorised as 65 – 74 years, 75 – 84 years, and ≥85 years, the same groups used by the WHO**.** Classification of BMI was underweight (<18.5 kg/m^2), normal (18.50 – 24.99 kg/m^2) and overweight/obese (≥25 kg/m^2), which was in accordance with the New Zealand Ministry of Health BMI cut-off values (Ministry of Health, 2013a), adapted from those of the WHO (World Health Organization, 2000).

Comorbidities were grouped as per the NZBD study for the key health conditions experienced by older adults in New Zealand (Ministry of Health, 2013b). Condition groups in this report were also selected according to their prevalence in this study population. These groups consisted of: cancers and other neoplasms, vascular and blood disorders, musculoskeletal and connective tissue, respiratory, diabetes and endocrine, neurological, gastrointestinal, mental and behavioural disorders and other. Comorbidities identified in the clinical notes were categorised using the International Classification of Diseases 10th revision (ICD-10) codes (World Health Organization, 2014b). Examples of comorbidities and their condition groups are shown in Appendix 10. One exception to the ICD-10 codes was the classification of dementia. Whereas Alzheimer's Disease and Parkinson's Disease are classified as neurological conditions according to ICD-10, vascular dementia is classified as a mental and behavioural disorder. Although many participants were diagnosed with dementia, the type was often unspecified. Therefore, all forms of dementia were classified as a neurological condition, which is also in line with the classification used for dementia by the NZBD study (Ministry of Health, 2013b). A full list of comorbidities according to participant identification number is shown in Appendix 11.

Regular medications were categorised as <5 medications and ≥5 medications according to polypharmacy, the concurrent intake of ≥5 medications (Ministry of Health, 2013a).

Descriptive statistics were used to describe the following variables:

1. Participant characteristics
2. Demographic characteristics
3. Recruitment type
4. Setting prior to admission
5. Level of care
6. Anthropometry
7. Comorbidities
8. Dental status

9. Support services
10. Nutrition risk
11. Dysphagia risk
12. Number of medications
13. Cognition

The data was then processed with BMI categories (underweight, normal, overweight/obese), MoCA final score categories, support services, MNA®-SF final score and breakdown, EAT-10 final score categories, ARRC questions and other selected health questions compared against gender.

BMI categories, MNA®-SF final score categories, demographic, health and selected personal characteristics, ARRC, support services, EAT-10 final score categories and MoCA final score categories were compared against the level of care.

Demographic, health and selected ARRC, support services, setting prior to admission, EAT-10 final score categories, MoCA final score categories and MNA®-SF breakdown were compared against nutrition risk status in accordance with the MNA®-SF final score categories.

Data was tested for normality using Kolmogorov-Smirnov and Shapiro-Wilk tests and normality plots were explored. Non-normally distributed data was tested for homogeneity of variance using the Levene's test. No variables were non-parametric. Normally distributed data was summarised as the mean ± standard deviation (SD). Categorical data was reported as frequencies and percentages.

For parametric data (weight, height, CC, demispan and overall BMI), the Independent Samples *t*-test was used to draw comparisons between variables.

Where there were multiple levels of a categorical variable, such as with marital status and level of mobility, each individual variable was compared separately to a chosen, fixed variable.

Categorical data was compared using Pearson's chi-square test or Fisher's exact test. Assumptions of the test including: independency, non-overlapping categories and expected counts greater than 5 were met. Where expected counts were <5, the assumption for Pearson's chi-square test was violated and Fisher's exact test was used to compare groups. Differences were considered significant at $p<0.05$.

CHAPTER 4: RESULTS

4.1 Recruitment

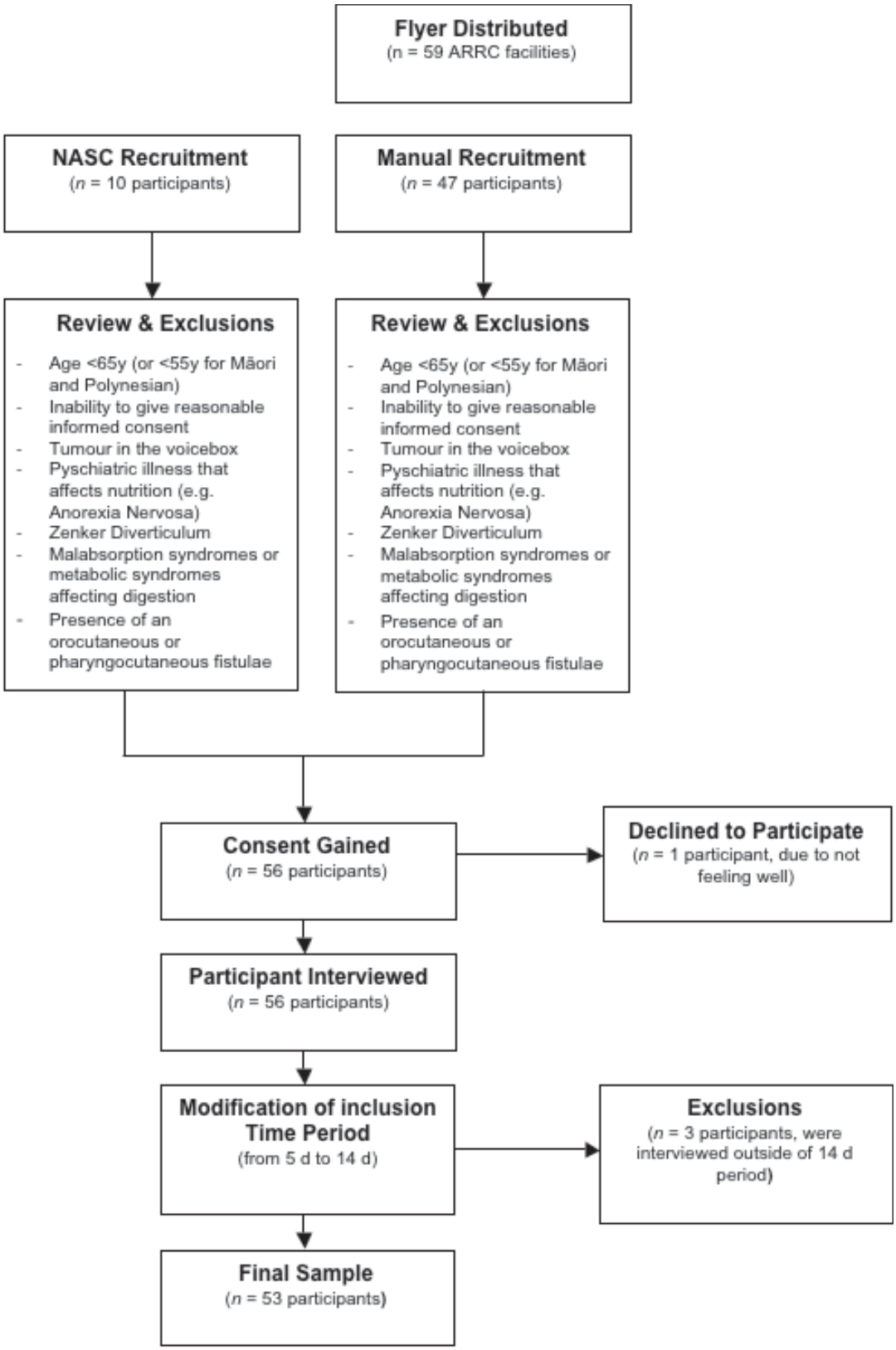

Figure 4: Study flow

The sample enrolled into the study included 53 residents aged 65 to 103 years newly admitted into an ARRC facility in the Waitemata DHB region. Thirty participants (57%) were rest home level and 23 participants (43%) were hospital level of care. There were 59 ARRC facilities in the Waitemata DHB region at the time of data collection. Participants were from 28 different facilities. Three facilities refused to take part and another three were not visited due to outbreaks of norovirus or scabies. The remaining 25 facilities did not have any residents eligible for the study during the data collection period.

The majority of the participants (81%) were recruited manually through communication with the ARRC facilities in the Waitemata DHB region. The remaining 10 participants (19% of the study population) were recruited through NASC. Prior to admission to an ARRC facility, 42% of participants were living in the community and 59% were in hospital.

4.2 Participant characteristics

The personal and demographic characteristics of the 53 participants are shown in Table 3. The age of participants ranged from 65 years to 103 years, with a mean (±SD) of 88.0 (±6.7) years. The majority (70%) were aged ≥85 years, with 25% and 6% aged 75 – 84 years and 65 – 74 years respectively. The gender distribution was relatively even with 57% women and 43% men.

Ethnicity however, had a very unequal distribution with 83% New Zealand European and the remaining 17% stating Other. Of the participants that stated Other, five of the nine were European, two were African, one was Asian and another was European Asian.

Most of the participants (57%) were widowed, with a further 32% married/partnered. This made up the clear majority of participants, with only a small percentage either divorced/separated or never married.

As participants were living in ARRC, all were recorded as living with others.

Thirty-three participants (62%) reported their only income to be a pension, with the remaining 20 participants (38%) stating they had a supplementary income to their pension.

There was a wide variation in the education level noted among participants, from a participant who left school at the age of 12 years to a Master Mariner and a trained medical practitioner who was a neuroradiographer. The majority attended secondary school (51%), with a further 28% having attended a tertiary education institution.

Table 3: Participant characteristics

	Total
Age (years), mean ± SD	88.0 ± 6.65, Range: 65 - 103
65 – 74 y	3 (5.7)
75 – 84 y	13 (24.5)
≥85 y	37 (69.8)
Gender	
Female	30 (56.6)
Male	23 (43.4)
Ethnicity	
New Zealand European	44 (83.0)
New Zealand Māori	0
Pacific Islander	0
Other	9 (17.0)
Marital status	
Married/partnered	17 (32.1)
Widowed	30 (56.6)
Divorced/separated	4 (7.5)
Never married	2 (3.8)
Living situation	
Living with others	53 (100)
Income	
Pension only income	33 (62.3)
Pension plus other income	20 (37.7)
Education	
Primary	11 (20.8)
Secondary	27 (50.9)
Tertiary	15 (28.3)

Values are frequency (percentage) unless otherwise indicated, n = 53
SD = standard deviation

As shown in Table 4, the mean BMI for participants was 21.3 ± 3.9 kg/m^2 with only a slight variance seen between genders. Men had a slightly higher mean BMI than women, which coincides with the fact that men also had a higher mean weight at 66.7 ± 11.8 kg compared with 52.8 ± 13.4 kg for women. Both weight and height were statistically significant when compared with gender (Independent Samples t-test, p <0.001).

Despite a difference in the mean height between the two genders of over 10 cm, the mean demispan of both men and women were similar, only differing by approximately 1-2 cm. The mean demispan for men was 80.1 ± 4.5 cm, and for women it was 78.5 ± 3.0 cm. The mean CC was also similar for both genders, with only 0.57 cm separating them. For both demispan and CC there was a small sample size, with only 10 and 12 participants respectively, as measurements were not taken for every participant as per the MNA®SF. The differences in both demispan and CC between genders were not statistically significant.

Twelve participants (23%) were classified as underweight according to BMI, 33 (62%) were of normal weight and 8 (15%) were overweight/obese. Whilst the gender breakdown of those classified as normal was relatively even (17 men vs. 16 women), there were three times more women than men for underweight participants (9 vs. 3 participants). No statistically significant differences were noted between mean BMI, BMI categories and gender.

Table 4: Anthropometry and gender comparisons

	Total	**Men**	**Women**	***p*-value**
Weight (kg) (*n* = 53)	58.8 ± 14.4	66.7 ± 11.8 *n* = 23	52.8 ± 13.4 *n* = 30	<0.001 *****
Height (cm) (*n* = 53)	165.5 ± 9.8	173.3 ± 6.0 *n* = 23	159.58 ± 7.8 ***** *n* = 30	<0.001 *****
Demispan (cm) (*n* = 10)	79.7 ± 4.0	80.1 ± 4.5 *n* = 7	78.5 ± 3.0 *n* = 3	
Calf circumference (cm) (*n* = 12)	30.8 ± 3.7	31.1 ± 3.6 *n* = 7	30.5 ± 4.3 *n* = 5	
BMI (kg/m^2) (*n* = 53)	21.3 ± 3.9	22.2 ± 3.5 *n* = 23	20.6 ± 4.2 *n* = 30	
Underweight (<18.50) *n* (%)	12 (22.6)	3 (13.0)	9 (30.0)	
Normal (18.50 – 24.99) *n* (%)	33 (62.3)	17 (73.9)	16 (53.3)	
Overweight/obese (>25.0) *n* (%)	8 (15.1)	3 (13.0)	5 (16.7)	

*****Significant differences between men and women ($p<0.05$) (Independent Samples *t*-test)
Values are mean ± SD unless otherwise indicated, *n* = 53
BMI = body mass index; SD = standard deviation
Body mass index and calf circumference were cut-offs as per Kaiser, Bauer, et al. (2009)

As shown in Table 5, of the 30 participants living in rest home level of care, the large majority were ≥85 years or older (83%), with zero participants between the ages of 65 and 74 years. Whilst the majority of participants that required hospital level of care were also

aged ≥85 years, the percentage was much smaller at 52%, with 35% of patients aged 75 – 84 years and 13% aged 65 – 74 years.

More women were in rest home level of care than men (63% vs. 11%) with a similar distribution for hospital level of care (Table 5). The difference in level of care between genders was not statistically significant.

As shown in Table 5, the majority of participants in rest home level of care were widowed (67%) with only 20% married/partnered. In hospital level of care, 48% of participants were married/partnered and 44% were widowed. The difference between rest home and hospital level of care was statistically significant for married/partnered vs. widowed ($\chi^2 = 4.321$ $p = 0.04$). Widowed participants were more likely to be rest home level of care (67%) compared to hospital level of care (44%).

The majority of both rest home level and hospital level of care participants relied on the pension as their sole source of income and had a secondary level of education respectively. No significant differences were observed between level of care and income or level of education.

Overall, 22% of participants were underweight. The majority of participants (62%) were deemed to be within the normal range for BMI, and 15% were classed as underweight.

Thirty-percent of participants in hospital level of care were underweight compared to 17% of those in rest home level of care (Table 5). The relationship between level of care and BMI was not statistically significant for any of the BMI categories.

Table 5: Demographic, health and social characteristics by level of ARRC status

	Rest home	Hospital	*p*-value
Age			
65 – 74 y	0	3 (13.0)	
75 – 84 y	5 (16.7)	8 (34.8)	
≥85 y	25 (83.3)	12 (52.2)	
Gender			
Female	19 (63.3)	11 (47.8)	
Male	11 (36.7)	12 (52.2)	
Ethnicity			
New Zealand European	26 (86.7)	18 (78.3)	
Other	4 (13.3)	5 (21.7)	
Marital Status			
Married/partnered	6 (20.0)	11 (47.8)	0.04 *
Widowed	20 (66.7)	10 (43.5)	
Divorced/separated	2 (6.7)	2 (8.7)	
Never married	2 (6.7)	0	
Living Situation			
Living with others	30 (100)	23 (100)	
Income			
Pension only income	17 (56.7)	16 (69.6)	
Pension plus other income	13 (43.3)	7 (30.4)	
Education			
Primary	7 (23.3)	4 (17.4)	
Secondary	15 (50.0)	12 (52.2)	
Tertiary	8 (26.7)	7 (30.4)	
BMI (kg/m^2)			
Underweight (<18.50)	5 (16.7)	7 (30.4)	
Normal (18.50 – 24.99)	21 (70.0)	12 (52.2)	
Overweight/obese (≥25.00)	4 (13.3)	4 (17.4)	
Regular Prescribed Medications			
Less than five medications	6 (20.0)	5 (21.7)	
Five or more medications	24 (80.0)	18 (78.3)	
Dental Status			
Dentate	10 (33.3)	13 (56.5)	0.04 *
Dental Appliance	20 (66.7)	8 (34.8)	
Edentulous	0	2 (8.7)	

Support Service			
Not receiving support service	30 (100)	23 (100)	
Need daily help	29 (96.7)	22 (95.7)	
Does not need daily help	1 (3.3)	1 (4.3)	
Dysphagia (Eating Assessment Tool, EAT-10)			
Not 'at risk' of dysphagia (<3 points)	24 (80.0)	12 (52.2)	0.03 *
'At risk' of dysphagia (≥3 points)	6 (20.0)	11 (47.8)	
Cognition (Montreal Cognitive Assessment, MoCA)			
Normal cognitive function (≥26/30)	1 (3.3)	1 (4.3)	
Below normal cognitive function (<26/30)	29 (96.7)	22 (95.7)	

*Significant differences between rest home and hospital (p<0.05) (Pearson's chi-square test)
Values are frequency (percentage) unless otherwise indicated, n = 53
ARRC = age related residential care; BMI = body mass index
Body mass index cut-offs as per the Ministry of Health (2013a), adapted from World Health Organization (2000)
Eating Assessment Tool (EAT-10) (Nestle Nutrition Institute, n.d.)
Montreal Cognitive Assessment (MoCA) (Nasreddine, 2005)

4.3 Health characteristics

4.3.1 Comorbidities

The amount of times different conditions occurred under each comorbidity group heading is shown in Table 6, with numerous conditions under one comorbidity group possible for one participant. The comorbidities that occurred most frequently were vascular and blood disorders (89), musculoskeletal and connective tissue conditions (44) and neurological conditions (40). Participants had a mean of 6.5 ± 2.7 comorbidities each, with a range between 2 and 13. The complete list of key comorbidities for each participant is shown in Appendix 11.

Table 6: Frequency of comorbidity/disease occurrence

	Total
Cancer and other neoplasms	12 (3.5)
Vascular and blood disorders	89 (26.0)
Musculoskeletal and connective tissue	44 (12.9)
Respiratory	20 (5.9)
Diabetes and endocrine	16 (4.7)
Neurological	40 (11.7)
Gastrointestinal	31 (9.1)
Mental and behavioural disorders	12 (3.5)
Other	79 (23.1)
Total	**342 comorbidities**

Values are frequency (percentage) unless otherwise indicated, n = 53
Health loss categories as per the New Zealand Burden of Disease, Injuries and Risk Factors Study (NZBD) (Ministry of Health, 2013b)

The number (percentage) of participants diagnosed with a condition that fell within each comorbidity are outlined in Table 7. Some participants had more than one comorbidity that fell within the same category.

Men tended to have a lower percentage of each comorbidity, with the exception of cancer, gastrointestinal and other. For neurological conditions, the incidence was less common in men (48%) than in women (80%) (χ^2 = 6.009 p = 0.01). No other significant differences were observed between comorbidity and gender.

Table 7: Comorbidities and gender comparisons

	Total	Men	Women	*p*-value
Cancer and neoplasms	11 (20.8)	6 (26.1)	5 (16.7)	
Vascular and blood disorders	45 (84.9)	18 (78.3)	27 (90.0)	
Musculoskeletal and connective tissue	30 (56.6)	12 (52.2)	18 (60.0)	
Respiratory	15 (28.3)	6 (26.1)	9 (30.0)	
Diabetes and endocrine	16 (30.2)	5 (21.7)	11 (36.7)	
Neurological	35 (66.0)	11 (47.8)	24 (80.0)	0.01 *
Gastrointestinal	23 (43.4)	11 (47.8)	12 (40.0)	
Mental and behavioural disorders	9 (17.0)	3 (13.0)	6 (20.0)	
Other	42 (79.2)	20 (87.0)	22 (73.3)	

*Significant differences between men and women ($p<0.05$) (Pearson's chi-square test)
Values are frequency (percentage) unless otherwise indicated, $n = 53$
Health loss categories as per the New Zealand Burden of Disease, Injuries and Risk Factors Study (NZBD) (Ministry of Health, 2013b)

4.3.2 Medications

Polypharmacy was prevalent in this study population with 79% of participants taking ≥5 medications regularly and 21% taking <5 (Table 8). The mean number of regular prescribed medications was 7 ± 3.4, with a range of 0 – 14.

Only one participant reported taking OTC medication, which was Metamucil. One participant took regular nutrition supplementation, a men's multivitamin.

Whilst the majority (42 participants, 79%) took ≥5 medications, there was no significant difference between gender and the number of regular prescribed medications (Table 8).

Table 8: Regular prescribed medications and gender comparison

	Total	Men	Women
Less than five medications	11 (20.8)	2 (8.7)	9 (30.0)
Five or more medications	42 (79.2)	21 (91.3)	21 (70.0)

Values are frequency (percentage) unless otherwise indicated, $n = 53$
Polypharmacy classified as ≥5 concurrent medications

The most common regularly prescribed medications and their possible side effects are shown in Table 9. Aspirin featured highly at 43%, with cholecalciferol (40%) also prevalent having been prescribed to over a third of all participants. Paracetamol and omeprazole were also common, making up 32% and 26% respectively of the regularly prescribed medications.

Table 9: Five most common regular prescribed medications and their possible side effects

Medication name	Total	Possible side effects
Aspirin	23 (43.4)	Nausea, vomiting, stomach pain, heartburn
Cholecalciferol	21 (39.6)	Nausea, vomiting, constipation, poor appetite
Paracetamol	17 (32.1)	Side effects rare (e.g. rash, hives, itching)
Laxsol	17 (32.1)	Stomach cramps, nausea
Omeprazole	14 (26.4)	Nausea, vomiting, constipation

Values are frequency (percentage) unless otherwise indicated, *n* = 53
Side effects as per the U.S. National Library of Medicine (2014)

As shown in Table 5 (p. 55), polypharmacy was predominant in both rest home level of care and hospital level of care with 80% and 78% of participants taking ≥5 regular prescribed medications respectively. No significant differences were observed between level of care and the number of regular prescribed medications.

4.3.3 Dental status

The majority of participants wore a dental appliance (53%, Table 10). Although men were more likely to wear a dental appliance than be dentate (35%) or edentulous (4%), women were more likely to be dentate (50%) than wear a dental appliance (47%) or be edentulous (3%). No significant differences were observed between dental status and gender in this study population.

Table 10: Dental status and gender comparisons

	Total	Men	Women
Dentate	23 (43.4)	8 (34.8)	15 (50.0)
Dental appliance	28 (52.8)	14 (60.9)	14 (46.7)
Edentulous	2 (3.8)	1 (4.3)	1 (3.3)

Values are frequency (percentage) unless otherwise indicated, *n* = 53

In relation to dental status, only two participants across rest home and hospital level of care were edentulous (Table 5, p. 55). In rest home level of care, two-thirds (67%) had a dental appliance, compared to only 35% of hospital level participants. Whereas the majority (57%) of hospital level care participants were dentate, only one-third of rest home level participants were dentate. The relationship between dentate participants vs. those with a dental appliance was statistically significant when compared to level of care ($\chi^2 = 4.073$ $p = 0.04$).

4.3.4 Support services

No participants received a support service due to living in an ARRC. Fifty-one participants (96%) required daily help, with two participants (4%) not needing daily help. For one of the two participants who did not require daily help with ADLs, the clinical manager stated she needed "reminding" to complete tasks but was otherwise independent with her ADLs.

4.3.5 Cognition

4.3.5.1 Montreal Cognitive Assessment (MoCA)

Of the 53 participants, all but two (one in each level of care) were classified as having below normal cognitive function (Table 5, p. 55).

With a maximum score of 30 points available on the MoCA, a score of ≥26 indicates normal cognitive function and a score of <26 is suggestive of below normal cognitive function. The mean score was 15 ± 6 points. The majority of participants were classified as having below normal cognitive function (96%), with only two participants considered to have normal cognitive function (Table 11).

The level of cognitive function was similar between men and women with 96% of men and 97% of women showing below normal cognitive function as per the MoCA. There was no statistically significant association between MoCA score and gender.

Table 11: Cognition (MoCA) and gender comparison

	Total	**Men**	**Women**
Normal cognitive function (MoCA ≥26/30)	2 (3.8)	1 (4.3)	1 (3.3)
Below normal cognitive function (MoCA <26/30)	51 (96.2)	22 (95.7)	29 (96.7)

Values are frequency (percentage) unless otherwise indicated, *n* = 53
Montreal Cognitive Assessment (MoCA) (Nasreddine, 2005)

4.3.5.2 Assessment of respondent reliability and understanding

The mean score for both interviewer assessed reliability of respondents' answers and their understanding of the questions was 4 (good) ± 1.0. The majority of reliability and understanding was considered very good (40% and 42% respectively). Twenty-eight percent were considered to have good reliability, 28% neither good nor poor, 2% poor and 2% were very poor. Similar results were observed with the participants' understanding of questions with 28% considered good, 26% neither good nor poor, 2% poor and another 2% thought to have a very poor understanding.

4.3.6 Nutrition risk using the Mini Nutritional Assessment®-Short Form

Overall, 91% of participants were either malnourished or at risk of malnutrition. Both men and women had a high percentage of participants who were at risk of malnutrition and malnourished (Table 12). Women had a slightly higher percentage of malnourished participants compared to men (50% vs. 44% respectively). However, no statistically significant difference was found between nutrition risk status and gender.

Table 12: MNA®-SF final score breakdown and gender comparison

	Total	**Men**	**Women**
Normal nutritional status (12 – 14 points)	5 (9.4)	3 (13.0)	2 (6.7)
At risk of malnutrition (8 – 11 points)	23 (43.4)	10 (43.5)	13 (43.3)
Malnourished (0 – 7 points)	25 (47.2)	10 (43.5)	15 (50.0)

Values are frequency (percentage) unless otherwise indicated, *n* = 53
Mini Nutritional Assessment®-Short Form (MNA®-SF) (Nestle Nutrition Institute, 2009)

A severe decrease in food intake was reported by 23% of participants. Very little difference was observed between men and women when evaluating food intake and recent weight loss (Table 13). Sixty percent of participants reported weight loss in the previous 3 months, and of these participants, 32% reported a weight loss of more than 3 kg. For one participant, a BMI of 12.8 kg/m^2 was calculated, the lowest value of the study population, however weight loss of only 1 – 3 kg in the last three months was reported. Despite the participant's very low BMI, her daughter stated her mother had always been very small and a low body weight.

The MNA®-SF showed one of the greatest differences between genders, albeit still limited, was neuropsychological problems. Women were more likely to have psychological problems

than men (53% vs. 35% respectively). No significant differences were observed between all questions of the MNA®-SF and gender.

Table 13: MNA®-SF questionnaire breakdown and gender comparison

	Total	**Men**	**Women**
Food intake			
Severe decrease	12 (22.6)	5 (21.7)	7 (23.3)
Moderate decrease	21 (39.6)	9 (39.1)	12 (40.0)
No decrease	20 (37.7)	9 (39.1)	11 (36.7)
Weight loss			
Weight loss greater than 3 kg	17 (32.1)	9 (39.1)	8 (26.7)
Weight loss between 1 to 3 kg	15 (28.3)	5 (21.7)	10 (33.3)
No weight loss	16 (30.2)	8 (34.8)	8 (26.7)
Does not know	5 (9.4)	1 (4.3)	4 (13.3)
Mobility			
Bed or chair bound	5 (9.4)	3 (13.0)	2 (6.7)
Able to get out of bed/chair but does not go out	28 (52.8)	11 (47.8)	17 (56.7)
Goes out	20 (37.7)	9 (39.1)	11 (36.7)
Psychological stress or acute disease			
Yes	30 (56.6)	16 (69.6)	14 (46.7)
No	23 (43.4)	7 (30.4)	16 (53.3)
Neuropsychological problem			
Severe dementia or depression	8 (15.1)	3 (13.0)	5 (16.7)
Mild dementia	24 (45.3)	8 (34.8)	16 (53.3)
No psychological problems	21 (39.6)	12 (52.2)	9 (30.0)
BMI (kg/m^2) (*n* = 43)		(*n* = 16)	(*n* = 27)
BMI less than 19	12 (27.9)	3 (18.8)	9 (33.3)
BMI 19 to less than 21	7 (16.3)	0	7 (25.9)
BMI 21 to less than 23	10 (23.3)	6 (37.5)	4 (14.8)
BMI 23 or greater	14 (26.4)	7 (43.8)	7 (23.3)
Calf circumference (cm) (*n* = 10)		(*n* = 7)	(*n* = 3)
CC less than 31	5 (50.0)	3 (42.9)	2 (66.7)
CC 31 or greater	5 (50.0)	4 (57.1)	1 (33.3)

Values are frequency (percentage) unless otherwise indicated, *n* = 53
BMI = body mass index; CC = calf circumference
Mini Nutritional Assessment®-Short Form (MNA®-SF) (Kaiser, Bauer, et al., 2009)
Body mass index and calf circumference were cut-offs as per Kaiser, Bauer, et al. (2009)

4.4 Dysphagia (Eating Assessment Tool, EAT-10)

Overall, the EAT-10 evaluated 32% of participants to be at risk of dysphagia. Men were more likely to be at risk of dysphagia than women (44% vs. 23% respectively, Table 14). Despite the differences between gender, they were not statistically significant.

Table 14: EAT-10 and gender comparison

	Total	**Men**	**Women**
Not at risk of dysphagia (<3 points)	36 (67.9)	13 (56.5)	23 (76.7)
At risk of dysphagia (≥3 points)	17 (32.1)	10 (43.5)	7 (23.3)

Values are frequency (percentage) unless otherwise indicated, *n* = 53
Eating Assessment Tool (EAT-10) (Nestle Nutrition Institute, n.d.)

As shown in Table 5 (p. 55), participants living in hospital level of care were more likely than those in rest home level to be at risk of dysphagia (48% vs. 20% respectively). This result was statistically significant ($\chi^2 = 4.627$ $p = 0.03$). For rest home level of care, the majority of participants were not at risk of dysphagia (80%).

4.5 Nutrition risk (Mini Nutritional Assessment®-Short Form, MNA®-SF) by level of age related residential care (ARRC)

Participants in hospital level of care were more likely to be malnourished (61%) than those in rest home level of care (37%) (Table 15). A low percentage of participants were deemed as having a normal nutritional status for both levels of care (13% for rest home vs. 4% for hospital). There was no significant difference observed between nutrition risk score and level of care in this study population.

Table 15: MNA®-SF final score and level of ARRC comparison

	Total	**Rest home**	**Hospital**
Normal nutritional status (12 – 14 points)	5 (9.4)	4 (13.3)	1 (4.3)
At risk of malnutrition (8 – 11 points)	23 (43.4)	15 (50.0)	8 (34.8)
Malnourished (0 – 7 points)	25 (47.2)	11 (36.7)	14 (60.9)

Values are frequency (percentage) unless otherwise indicated, *n* = 53
ARRC = age related residential care
Mini Nutritional Assessment®-Short Form (MNA®-SF) (Nestle Nutrition Institute, 2009)

4.5.1 Mini Nutritional Assessment®-Short Form (MNA®-SF) questionnaire breakdown

A severe decrease in food intake was more likely in hospital level of care (30%) than in rest home level (17%). A fairly even distribution was noted for participants who described a moderate decrease in food intake (40% for rest home level and 39% for hospital level, Table 16). Participants in hospital level of care were also more likely to have weight loss greater than 3 kg compared to rest home level (44% vs. 23%, Table 16). In contrast, for those in rest home level of care, the majority of participants reported no weight loss (37%).

Mobility varied between the different levels of care with 61% in hospital care able to get out of their bed/chair but did not go out, compared to 50% in rest home level that reported they did go out. Poorer mobility was noted in hospital level of care with 17% of participants bed bound compared to only 3% of participants bed bound in rest home level (Table 16). Also, those in rest home level of care were more likely to go out compared to hospital level (50% vs. 22% respectively); this difference was statistically significant ($\chi^2 = 4.425$ $p = 0.04$).

Whereas 50% of rest home level participants had mild dementia with 37% reporting no psychological problems, this differed from hospital level participants where 44% reported no problems and 40% had mild dementia. Equally, both levels of care had four participants each that reported severe dementia or depression.

Table 16: MNA®-SF questionnaire breakdown and level of ARRC comparison

	Total	**Rest home**	**Hospital**	***p*-value**
Food intake				
Severe decrease	12 (22.6)	5 (16.7)	7 (30.4)	
Moderate decrease	21 (39.6)	12 (40.0)	9 (39.1)	
No decrease	20 (37.7)	13 (43.3)	7 (30.4)	
Weight loss				
Weight loss greater than 3 kg	17 (32.1)	7 (23.3)	10 (43.5)	
Weight loss between 1 to 3 kg	15 (28.3)	10 (33.3)	5 (21.7)	
No weight loss	16 (30.2)	11 (36.7)	5 (21.7)	
Does not know	5 (9.4)	2 (6.7)	3 (13.0)	
Mobility				
Bed or chair bound	5 (9.4)	1 (3.3)	4 (17.4)	
Able to get out of bed/chair but does not go out	28 (52.8)	14 (46.7)	14 (60.9)	

Goes out	20 (37.7)	15 (50.0)	5 (21.7)	0.04 *
Psychological stress or acute disease				
Yes	30 (56.6)	14 (46.7)	16 (69.6)	
No	23 (43.4)	16 (53.3)	7 (30.4)	
Neuropsychological problem				
Severe dementia or depression	8 (15.1)	4 (13.3)	4 (17.4)	
Mild dementia	24 (45.3)	15 (50.0)	9 (39.1)	
No psychological problems	21 (39.6)	11 (36.7)	10 (43.5)	
BMI (kg/m^2) (*n* = 43)		(*n* = 24)	(*n* = 19)	
BMI less than 19	12 (27.9)	5 (20.8)	7 (36.8)	
BMI 19 to less than 21	7 (16.3)	5 (20.8)	2 (10.5)	
BMI 21 to less than 23	10 (23.3)	8 (33.3)	2 (10.5)	
BMI 23 or greater	14 (26.4)	6 (25.0)	8 (42.1)	
Calf circumference (cm) (*n* = 10)		(*n* = 6)	(*n* = 4)	
CC less than 31	5 (50.0)	1 (16.7)	4 (100)	
CC 31 or greater	5 (50.0)	5 (83.3)	0	

*Significant differences between rest home and hospital ($p<0.05$) (Pearson's chi-square test)
Values are frequency (percentage) unless otherwise indicated, $n = 53$
BMI = body mass index; CC = calf circumference
Mini Nutritional Assessment®-Short Form (MNA®-SF) (Nestle Nutrition Institute, 2009)
Body mass index and calf circumference were cut-offs as per Kaiser, Bauer, et al. (2009)

4.6 Nutrition risk status

4.6.1 Demographic, health and social characteristics

Demographic, health and social characteristics were tested for association with nutrition risk status as determined by the MNA®-SF final score. Comparisons were drawn according to malnourished vs. at risk of malnutrition, malnourished vs. normal nutritional status and normal nutritional status vs. at risk of malnutrition. Due to the small group size for participants with normal nutrition status, comparisons using Pearson's chi-square test were used between malnourished and at risk participants only.

When malnourished vs. at risk of malnutrition were compared, as nutrition risk increased, the risk of dysphagia also increased, with the association statistically significant ($\chi^2 = 6.273$ $p = 0.01$). Of the malnourished participants, 52% were at risk of dysphagia, compared to 17% of

those at risk of malnutrition. Additionally, all five participants who were classified as normal nutritional status were not at risk of dysphagia (Table 17).

Malnourished and at risk participants had a higher mean (±SD) number of comorbidities per participant than those with normal nutritional status (6.5 (±2.8) and 7 (±2.6) respectively).

Table 17: Demographic, health and social characteristics by MNA®-SF nutrition risk status

	Malnourished (0 – 7 points)	**At risk of malnutrition (8 – 11 points)**	**Normal nutrition (12 – 14 points)**	***p*-value**
Age				
65 – 74 y	1 (4.0)	2 (8.7)	0	
75 – 84 y	8 (32.0)	4 (17.4)	1 (20.0)	
≥85 y	16 (64.0)	17 (73.9)	4 (80.0)	
Gender				
Female	15 (60.0)	13 (56.5)	2 (40.0)	
Male	10 (40.0)	10 (43.5)	3 (60.0)	
Ethnicity				
New Zealand European	20 (80.0)	20 (87.0)	4 (80.0)	
Other	5 (20.0)	3 (13.0)	1 (20.0)	
Marital Status				
Married/partnered	9 (36.0)	6 (26.1)	2 (40.0)	
Widowed	13 (52.0)	14 (60.9)	3 (60.0)	
Divorced/separated	2 (8.0)	2 (8.7)	0	
Never married	1 (4.0)	1 (4.3)	0	
Living Situation				
Living with others	25 (100)	23 (100)	5 (100)	
Income				
Pension only income	15 (60.0)	15 (65.2)	3 (60.0)	
Pension plus other income	10 (40.0)	8 (34.8)	2 (40.0)	
Education				
Primary	5 (20.0)	6 (26.1)	0	
Secondary	13 (52.0)	11 (47.8)	3 (60.0)	
Tertiary	7 (28.0)	6 (26.1)	2 (40.0)	
Setting prior to admission				
Community	8 (36.4)	11 (50.0)	3 (13.6)	
Hospital	17 (54.8)	12 (38.7)	2 (6.5)	

BMI (kg/m^2)				
Underweight (<18.50)	8 (32.0)	4 (17.4)	0	
Normal (18.50 – 24.99)	15 (60.0)	13 (56.5)	5 (100)	
Overweight/obese (≥25.00)	2 (8.0)	6 (26.1)	0	
Regular Prescribed Medications				
Less than five medications	6 (24.0)	3 (13.0)	2 (40.0)	
Five or more medications	19 (76.0)	20 (87.0)	3 (60.0)	
Dental Status				
Dentate	10 (40.0)	11 (47.8)	2 (40.0)	
Dental Appliance	13 (52.0)	12 (52.2)	3 (60.0)	
Edentulous	2 (8.0)	0	0	
Support Service				
Not receiving support service	25 (100)	23 (100)	5 (100)	
Need daily help	25 (100)	22 (95.7)	4 (80.0)	
Does not need daily help	0	1 (4.3)	1 (20.0)	
Dysphagia (Eating Assessment Tool, EAT-10)				
'Not at risk' of dysphagia (<3 points)	12 (48.0)	19 (82.6)	5 (100)	0.01 *
'At risk' of dysphagia (3 points)	13 (52.0)	4 (17.4)	0	
Cognition (Montreal Cognitive Assessment, MoCA)				
Normal cognitive function (≥26/30)	0	1 (4.3)	1 (20.0)	
Below normal cognitive function (<26/30)	25 (100)	22 (95.7)	4 (80.0)	

*Significant differences between malnourished and at risk of malnutrition (p<0.05) (Pearson's chi-square test)
Values are frequency (percentage) unless otherwise indicated, n = 53
BMI = body mass index
Mini Nutritional Assessment®-Short Form (MNA®-SF) (Nestle Nutrition Institute, 2009)
Eating Assessment Tool (EAT-10) (Nestle Nutrition Institute, n.d.)
Body mass index cut-offs as per Ministry of Health (2013a)
Montreal Cognitive Assessment (MoCA) (Nasreddine, 2005)

4.6.2 Nutrition status according to the Mini Nutritional Assessment®-Short Form (MNA®-SF) final score

The components of the MNA®-SF were tested for association with the MNA®-SF final score. Pearson's chi-square test and Fisher's exact test for expected cell counts <5 were used. Due to the small group size for participants with normal nutritional status, comparisons using Pearson's chi-square test were used between malnourished and at risk participants only.

When malnourished vs. at risk of malnutrition were compared, two associations were found (Table 18). Malnourished participants were more likely to report weight loss of greater than 3 kg than those at risk of malnutrition (56% vs. 13% respectively) with the association statistically significant (p = 0.03; Fisher's exact test). Those who were malnourished had poorer mobility than those at risk of malnutrition (χ^2 = 8.592 p = 0.003). The majority of malnourished participants were able to get out of bed/chair but not go out (72%), this was higher than those that were at risk of malnutrition (35%) where most participants were able to go out (57%).

Table 18: Nutrition status according to the MNA®-SF final score

	Malnourished (0 – 7 points)	**At risk of malnutrition (8 – 11 points)**	**Normal nutrition (12 – 14 points)**	***p*-value**
Food intake				
Severe decrease	12 (48.0)	0	0	
Moderate decrease	11 (44.0)	10 (43.5)	0	
No decrease	2 (8.0)	13 (56.5)	5 (100)	
Weight loss				
Weight loss greater than 3 kg	14 (56.0)	3 (13.0)	0	0.03 **
Weight loss between 1 to 3 kg	6 (24.0)	9 (39.1)	0	
No weight loss	1 (4.0)	10 (43.5)	5 (100)	
Does not know	4 (16.0)	1 (4.3)	0	
Mobility				
Bed or chair bound	3 (12.0)	2 (8.7)	0	
Able to get out of bed/chair but does not go out	18 (72.0)	8 (34.8)	2 (40.0)	0.003 *
Goes out	4 (16.0)	13 (56.5)	3 (60.0)	
Psychological stress or acute disease				

Yes	17 (68.0)	13 (56.5)	0
No	8 (32.0)	10 (43.5)	5 (100)
Neuropsychological problem			
Severe dementia or depression	6 (24.0)	2 (8.7)	0
Mild dementia	10 (40.0)	12 (52.2)	2 (40.0)
No psychological problems	9 (36.0)	9 (39.1)	3 (60.0)
BMI (kg/m^2) (*n* = 43)	(*n* = 19)	(*n* = 19)	(*n* = 5)
BMI less than 19	8 (42.1)	4 (21.1)	0
BMI 19 to less than 21	5 (26.3)	2 (10.5)	0
BMI 21 to less than 23	2 (10.5)	5 (26.3)	3 (60.0)
BMI 23 or greater	4 (21.1)	8 (42.1)	2 (40.0)
Calf circumference (cm) (*n* = 10)	(*n* = 6)	(*n* = 4)	(*n* = 0)
CC less than 31	5 (83.3)	4 (100.0)	0
CC 31 or greater	1 (16.7)	0	0

*Significant differences between malnourished and at risk of malnutrition ($p<0.05$) (Pearson's chi-square test)
**Significant differences between malnourished and at risk of malnutrition ($p<0.05$) (Fisher's exact test)
Values are frequency (percentage) unless otherwise indicated, *n* = 53
BMI = body mass index; CC = calf circumference
Mini Nutritional Assessment®-Short Form (MNA®-SF) (Nestle Nutrition Institute, 2009)
Body mass index and calf circumference were cut-offs as per Kaiser, Bauer, et al. (2009)

CHAPTER 5: DISCUSSION

5.1 Introduction

Overall, 91% of the participants in this study were either malnourished (47%) or at risk of malnutrition (43%). Normal nutritional status was only prevalent in 9% of all participants. As good nutrition is an important determinant of successful ageing, it appears the nutrition status of this population is severely compromised. Poor nutrition status in ARRC residents is widely acknowledged. Findings from this study are consistent with those in a study of older people with a mean age of 82 years living in ARRC in Helsinki, Finland (Suominen et al., 2005). Using the MNA®, 89% of the ARRC participants were malnourished or at risk of malnutrition (Suominen et al., 2005). Similarly, in Japan, 83% of participants across selected ARRC facilities were classified as either malnourished or at risk of malnutrition when screened using the MNA®-SF (Hirose et al., 2014). A high prevalence of nutrition risk was also noted in older adults living in ARRC in Urmia, Iran with 88% malnourished and at risk of malnutrition according to the MNA® (Saeidlou et al., 2011). There are a number of factors that affect the nutrition status of older people.

In this study, most participants were admitted from hospital care (59%) with the remainder (42%) of participants admitted from the community. As the majority of participants were malnourished or at risk of malnutrition on admission, this raises the question of whether their compromised nutrition status impacted on their requirement for admission into ARRC.

Personal, demographic and health characteristics may exacerbate the nutrition problems and further increase nutrition risk. Age related functional decline is thought to increase nutrition risk in those who live in ARRC (Zuliani et al., 2001).

5.1.1 Characteristics of participants who were malnourished, at risk and with normal nutritional status

The majority of malnourished participants (64%) in this study were aged ≥85 years and more than half (60%) were women. These malnourished participants were typically widowed (52%), had a pension only income (60%) and had attended secondary (52%). Although most malnourished participants had a normal BMI (60%), 32% were still underweight and 83% had a CC less than 31 cm. The majority was taking ≥5 regular prescribed medications, possibly reflected by a mean of 6.5 comorbidities per person. Malnourished participants were more likely to wear a dental appliance (52%) than be dentate or edentulous (40% and 8% respectively). All malnourished participants were classified as below normal cognitive function according to the MoCA. Malnourished participants were more likely to be in hospital

level of care than rest home level (56% vs. 44% respectively). Almost half (48%) reported a severe decrease in food intake in the previous 3 months, with a moderate decrease in food intake and no decrease reported in 44% and 8% of the participants respectively. This reduction in food intake may be reflected by 56% of malnourished participants who reported a recent weight loss of more than 3 kg. Reduced functional capacity was evident in the malnourished group, with 72% of these participants able to get out of their bed or chair but did not go out. Recent psychological stress or acute disease was described by 68% of malnourished participants. According to the MNA®-SF, the majority of malnourished participants had mild dementia (40%) with severe dementia or depression evident in 24% of this group.

For participants at risk of malnutrition, most were ≥85 years (74%) and were largely women (57%). The majority of at risk participants were widowed (61%), had a pension only income (65%) and had attended secondary school (48%). Eighty-three percent had a BMI classification of either normal or overweight/obese, 17% of participants at risk of malnutrition were underweight and four participants had a CC of less than 31 cm. Most of those at risk of malnutrition took ≥5 regular prescribed medications (87%) with a mean of 7 comorbidities per person. While 52% of this group wore a dental appliance, many of the at risk participants were dentate (48%). Among those at risk, most had below normal cognitive function (98%) with only one participant with normal cognitive function according to the MoCA. Those at risk of malnutrition were more likely to be lower level of care with 65% rest home level and 35% hospital level. Although no decrease in food intake in the past 3 months was reported by 57% of at risk participants, a moderate decrease was described by 44%, with no participants having reported a severe decrease in food intake. This could be reflected by no recent weight loss in most of this group (44%). More than half of the at risk participants had good mobility where they were able to go out (57%) with only two participants bed or chair bound. Although psychological stress and acute disease was still prevalent (57%) in this group, 44% of the at risk participants had not experienced this in the last 3 months. Despite the fact more than half of those at risk had mild dementia (52%), only two participants had severe dementia or depression according to the MNA®-SF.

As there was only a small group of participants with normal nutritional status, these results should be viewed with caution. However, they may suggest some trends. Those with normal nutritional status were mainly men (60%) who were aged ≥85 years (80%). Although 60% were widowed, 40% of those with normalal nutrition status were married/partnered. More than half had a pension only income (60%), 40% had attended a tertiary institution and all had a normal BMI. Forty-percent of those with normal nutritional status took <5 regular

prescribed medications with a mean of 4 comorbidities per person. While 60% wore a dental appliance, 40% of participants with normal nutritional status were dentate. Below normal cognitive function was observed in 80% of the group with one participant classified as normal cognitive function. Participants with normal nutritional status were more likely to be rest home level of care than hospital level (80% vs. 20% respectively). All participants with normal nutritional status reported no recent decrease in food intake and no weight loss over the past 3 months. Although reduced mobility was reported in 40% of the participants with normal nutritional status, 60% stated they were able to go out. According to the MNA®-SF, all participants considered as having a normal nutritional status reported no recent psychological stress or acute disease and no neuropsychological problems.

Therefore, based on findings from this present study, a high prevalence of a number of nutrition risk factors were observed in malnourished individuals compared to those at risk or with normal nutritional status. When those who were malnourished were compared with those with normal nutritional status, malnourished participants were more likely to be underweight, in hospital level care, have a recent severe decrease in food intake, recent weight loss of greater than 3 kg, have poorer mobility, experienced psychological stress or acute disease and have severe dementia or depression.

The high prevalence of nutrition risk in the current study may reflect that the majority of participants (70%) were of advanced age (≥85 years). New Zealand data from the 2006 Census indicates only 54% of the ARRC population ≥65 years were aged ≥85 years (Statistics New Zealand, 2007b). Advanced age is a risk factor for malnutrition. Individuals in ARRC facilities in Queensland, Australia, aged over 90 years have an increased likelihood of malnutrition compared to older adults aged 71 – 90 years (69% vs. 50% respectively) (Gaskill et al., 2008). Many physiological changes which occur with ageing such as reduced function and changes in taste and smell, contribute to this higher prevalence of malnutrition in the older age categories (Gaskill et al., 2008). However, as all three categories for nutrition risk (malnourished, at risk and normal nutritional status) in this present study were largely participants aged ≥85 years, it is possible that other risk factors in addition to nutrition status may have influenced the need for ARRC admission.

In this study, women were more likely to be either malnourished or at risk of malnutrition than have a normal nutritional status (60% vs. 57% vs. 40% respectively). Similarly, for individuals across ARRC facilities in Helsinki, Finland, an association (p<0.001) was found between female gender and malnutrition (Suominen et al., 2005). Women were more likely to be malnourished than be at risk of malnutrition or have a normal nutrition status (Suominen et al., 2005). However, participants had lived in ARRC facilities for a mean of 3

years and 3 months when they were assessed. Therefore, these findings cannot be directly compared to this present study where participants were assessed within 14 days of admission. Assessment of participants upon admission removed the possible variability in quality of care across ARRC facilities and its potential effect on the nutrition risk factors.

New Zealand Europeans made up the majority of the participants (83%) in this study, and the nutrition risk status did not differ according to ethnicity. Of the other ethnicities, two-thirds were of European descent, which signals the potential for an even further skew in the ethnic distribution of participants in this study. These findings are largely in agreement with the *2002/2003 New Zealand Health Survey* where the majority of individuals in ARRC were defined as New Zealand European (96%) (Ministry of Health, 2006). However, whereas this survey noted 3% of ARRC residents were Māori and 0.4% Pacific and Asian (Ministry of Health, 2006), this present study did not include any Māori or Pacific participants. The low prevalence of Māori, Pacific and Asian participants may partly be explained by the tendency for these populations to look after sick, older family members in their homes. They may delay or not consider admission to ARRC as a result of the shame and guilt often experienced when the provision of adequate care to sick family members proves difficult to manage (McLaughlin & Braun, 1998). For older Māori living in New Zealand, traditional Māori foods were considered important by 88% of participants with improved nutrition status in those who had regular access to these foods (p = 0.01) (Wham et al., 2012). The low prevalence of Māori in ARRC facilities may also be associated with the importance of traditional foods to many Māori people and the potential of reduced accessibility of these foods within ARRC.

Fifty-seven percent of participants in this present study were widowed and of these, 52% were malnourished. This is consistent with findings from a study in community-living individuals in the North Island, New Zealand, where a high prevalence (53%) of participants were widowed and nutrition risk was evident in the majority (66%) of these individuals (Wham et al., 2011). Poorer health status, such as increased nutrition risk, is widely acknowledged in those who have been widowed (Haapala et al., 2012; Wham et al., 2011). Widowed individuals were less likely to enjoy meals and were more likely to report a poor appetite compared to participants who were married (Rosenbloom & Whittington, 1993). Additionally, 92% of widowed individuals were reported to eat meals alone (Rosenbloom & Whittington, 1993). Following loss of a spouse, companionship can prove an effective means to prevent increased nutrition risk (Wham et al., 2014). In this present study, the prevalence of widowhood was fairly similar across those of malnourished, at risk of malnutrition and normal nutritional status. Widowhood may contribute to the need to move into ARRC. The change in role within the home environment and potential lack of skills

required to prepare meals due to no partner contribution may increase nutrition risk. Once these individuals move into ARRC and have their meals prepared for them by the facility, the influence of bereavement and lack of interest in eating may have more of an impact on nutrition risk in this population.

Eating in the presence of others can improve nutrition risk status by encouraging increased food consumption (Locher et al., 2005). In this study, as participants were in ARRC all were classified as living with others. However, as participants were new admissions they may have had minimal interaction with the other residents. Reduction in food intake is often described when an individual is admitted to ARRC, reduced social interaction may contribute to nutrition risk as individuals might have less motivation to eat (Donini et al., 2003). Individuals may also choose to eat alone in their bedroom instead of choosing to join others for meal times in the dining area. Lower nutrition risk was observed in ARRC participants who ate meals in the public dining area at the facility instead of in their bedrooms (Reed, Zimmerman, Sloane, Williams, & Boustani, 2005). Living situation, such as living alone prior to ARRC placement, may be influential in the requirement for admission to an ARRC facility.

Sixty-two percent of participants received a pension only income, while 38% received income in addition to their pension. The prevalence of pension only income was similar between participants who were malnourished, at risk of malnutrition and with normal nutritional status. Similarly, the New Zealand Superannuation was the only source of income for almost half of 417 older Māori in New Zealand (Dyall et al., 2014). However, with the majority of this present study being New Zealand European, direct comparisons cannot be made due to the over-representation of Māori in relation to lower socioeconomic status (Peterson & Williams, 2000) and poorer health outcomes (Ministry of Health, 2013b). Despite this, low income is recognised as a factor for increased nutrition risk in older adults (Sharkey et al., 2002) as financial strain can result in insufficient money for food (Samuel et al., 2012). For this present study, income may have been of greater importance prior to admission to ARRC due to the provision of meals by the facilities once in ARRC. This suggests the potential for individuals with lower income to be at a higher risk for admission into care possibly due to the influence of low income on increased nutrition risk.

The majority of all participants attended secondary school (51%) and 21% attended primary school. Those with normal nutritional status were more likely to have attended a tertiary institution compared to the other groups. A low level of education (i.e. primary school) is largely influenced by socioeconomic status and can be associated with poor health, and as a result, nutrition risk (National Health Committee, 1998; Saeidlou et al., 2011). In ARRC, education level may impact the understanding of nutrition advice provided by health

professionals. It may also have influenced the dietary habits of the individual before admission to ARRC and as a result may have affected the need for the placement.

Overall, 23% of participants were underweight (BMI <18.5 kg/m^2) with malnourished participants more likely to be underweight than those at risk or of normal nutritional status (32% vs. 17% vs. 0% respectively). This is consistent with other research within ARRC in Copenhagen, Denmark, where 22% of participants were underweight using the same BMI cut-off value of <18.5 kg/m^2 (Beck & Ovesen, 2002). Poor nutritional reserves may reduce the body's ability to withstand illness. Low BMI increases risk of mortality in individuals in ARRC and may be considered an indicator for nutrition support (Cereda et al., 2011). Conversely, in ARRC, higher BMI was associated with a deterioration of nutrition status over a 2 year period (Bolmsjö, Jakobsson, Mölstad, Östgren, & Midlöv, 2014). Nutrition risk can still occur in an older adult with a high BMI, for example a sudden drop in food intake or stopping eating as a result of a health condition. Low BMI may increase risk for ARRC admission with a BMI within the normal range considered protective (Kendig, Browning, Pedlow, Wells, & Thomas, 2010).

Participants in hospital level of care were more likely to be malnourished compared to those in rest home level (61% vs. 37% respectively). These findings were consistent with Gaskill et al. (2008) who observed a higher incidence of malnutrition according to the SGA in participants who were higher level of care compared to those with a lower care need. For older Australian women classified as low level of care, unintentional weight loss was a good predictor for the need for transfer to higher level care (Woods et al., 2011). As individuals who are a higher level of care require more assistance with their ADLs, these findings could support the impact of poor nutrition status on reduced functional capacity in relation to higher care requirements.

Participants in this present study had a mean of 6.5 comorbidities each, with a range of 2 – 13. This is higher than the range of 0 – 5 comorbidities for new admissions to ARRC in Sweden (Christensson et al., 1999). Participants who were malnourished or at risk of malnutrition had a higher mean number of comorbidities than those with normal nutritional status (6.5 vs. 7 vs. 4 respectively). In this present study, 85% of participants were diagnosed with vascular and blood disorders. Similarly, findings by Christensson et al. (1999) indicate the most common conditions were vascular, these being symptomatic heart failure, cerebrovascular disease and IHD. A high prevalence of nutrition risk (between 50% and 83%) was observed in those with CVD, COPD, cancers, depression and neurological conditions (Brantervik, Jacobsson, Grimby, Wallén, & Bosaeus, 2005). Numerous comorbidities can result in poor quality of life. These individuals may therefore be at risk for

anorexia of ageing which commonly occurs with ageing and is linked with a decrease in appetite and subsequent food consumption (Chapman, MacIntosh, Morley, & Horowitz, 2002). The physiological changes associated with chronic disease may further increase this (Brownie, 2006). Multiple comorbidities may lead to a change in an individual's food choices and eating habits through a range of factors, which often then compound to further increase nutrition risk. This highlights the need for earlier nutrition risk screening and intervention in this older ARRC population.

Polypharmacy, the concurrent intake of ≥5 medications, is widely acknowledged to increase nutrition risk (Ministry of Health, 2013a). In this present study, a higher prevalence of polypharmacy was reported in malnourished individuals compared to those with normal nutritional status (76% vs. 60% respectively). The mean number of regular prescribed medications was seven, similar to research by Williams et al. (1999) who noted an average of five medications per individual in ARRC in Los Angeles, USA. Findings in this study were consistent with research, where a high prevalence of polypharmacy (91%) was found in a population of older adults with dementia within ARRC in Australia (Somers et al., 2010). The increased nutrition risk with polypharmacy may partly be due to possible interactions and the side effects from certain medications (Ministry of Health, 2013a). However, excessive polypharmacy (≥10 medications) is associated with poor nutrition status independent of health status (Jyrkkä et al., 2011). Many medications are likely to impact nutrition status (Heuberger, 2012). Common side effects from medications can include dry mouth, nausea, taste changes, anorexia and depression which can as a result, increase nutrition risk (Ministry of Health, 2013a). In this present study, nausea was a side effect of four of the five most commonly prescribed medications (Table 12; p. 59). Polypharmacy reflects numerous comorbidities and increases the risk of multiple medication side effects. This highlights a major barrier to optimal nutrition in this population.

As the mouth is the first point of digestion, poor oral health such as missing teeth can impact on nutrition risk. In this study, over half of the participants wore a dental appliance (53%) and of the participants classified as malnourished, 52% wore a dental appliance. Compared to this present study, dental appliances were more prevalent in ARRC in Istanbul, Turkey, where 80% of participants wore either complete or partial dentures (Bekiroglu, Çiftçi, Bayraktar, Yavuz, & Kargul, 2012). For these participants, in those aged >70 years, 65% reported a change in eating habits, 65% also reported difficulty biting and chewing foods and 64% reported food falls out of the mouth due to ill-fitting dentures (Bekiroglu et al., 2012). Increased nutrition risk in relation to decreased energy and nutrient intake was observed in those with poor dentition (Sheiham et al., 2001). Complaints such as difficulty eating certain

foods that often surround the wearing of dentures suggest the potential for a high prevalence of nutrition risk in those who wear ill-fitting dentures.

Overall, a moderate decrease in food intake due to loss of appetite, digestive problems, or chewing and swallowing problems over the previous 3 months was noted in 40% of participants in this present study. Malnourished participants were the only group to report a severe decrease in food intake. This was slightly higher than findings by Vandewoude and Gossum (2013) who used the MNA®-SF to identify loss of appetite in 29% of participants aged >90 years, across 70 ARRC facilities in Belgium. Consistent with findings from this present study, low food intake was noted in over half of participants across selected ARRC facilities in the USA with increased food consumption in those who ate with others compared to alone in their rooms (Reed et al., 2005). Again, this supports the importance of social interaction in maintenance of nutrition status in this older ARRC population.

Reduced food intake typically leads to weight loss, and has many potential causes (Bales & Ritchie, 2002). Overall, in this study 60% of participants experienced weight loss in the 3 months prior to ARRC admission. Malnourished participants were more likely to report weight loss of greater than 3 kg (56%) than those at risk of malnutrition (13%) (p = 0.03). These findings were higher than weight loss observed in overseas research within ARRC that used the MNA® and MNA®-SF (Grieger, Nowson, & Ackland, 2009; Vandewoude & Gossum, 2013). Weight loss in this present study was more than 50% greater than participants in Belgium, where only 26% lost weight (Vandewoude & Gossum, 2013). Similarly, in Australia, 28% of participants across selected ARRC facilities reported recent weight loss (Grieger et al., 2009). Weight loss may result from inadequate dietary intake, catabolism, or loss of muscle mass and can present as wasting, cachexia or sarcopenia (Roubenoff, Heymsfield, Kehayias, Cannon, & Rosenberg, 1997). As weight lost in older adults (typically lean mass) takes longer to re-gain, the risk for malnutrition and its associated consequences increases in older adults (Hickson, 2006).

Poor mobility can result from an age-related reduction in muscle mass due to decreased muscle strength and power (Lauretani et al., 2003). In this present study, those who were malnourished had poorer mobility than those at risk of malnutrition (p = 0.003). High levels of functional impairment were identified using the MNA®-SF in ARRC facilities in Belgium where reduced mobility was prevalent in 81% and 72% of participants with a BMI <20 and ≥20 respectively (Vandewoude & Gossum, 2013). Optimal nutrition, such as adequate dietary protein, can help to maintain the physical function of older adults (Ministry of Health, 2013a). Increased functional capacity was associated with low nutrition risk in a New Zealand study of older adults across three DHBs (Wham et al., 2014). Therefore, a decline

in mobility, particularly in older adults, may have nutritional consequences with these individuals more likely to be at risk of poor nutrition.

Fifty-seven percent of participants in this present study had experienced psychological stress or acute disease in the 3 months prior to admission into ARRC. Those who were malnourished were more likely to experience this compared to at risk or normal nutritional status participants (68% vs. 56% vs. 0% respectively). In Finland, psychological stress was prevalent in 36% of participants and was associated with nutrition risk according to the MNA® (Soini, Routasalo, & Lagström, 2004). Increased stress levels are suggested to influence nutrition risk in older adults with lower protein intake associated with stressful life events (Payette, Gray-Donald, Cyr, & Boutier, 1995). Metabolic changes occur in the presence of acute illness and as a result can lead to a reduction in appetite and subsequent food intake (Omran & Morley, 2000).

Reduced cognitive function can be caused by or may occur as a consequence of poor nutrition (Omran & Morley, 2000). In this present study, severe dementia or depression was more prevalent in malnourished participants compared to those at risk or of normal nutritional status (24% vs. 9% vs. 0% respectively). Also, 92% were assessed as below normal cognitive function according to the MoCA. These findings are consistent with research by Vandewoude and Gossum (2013) where neuropsychological problems were present in 59% of ARRC participants in Belgium. A review of psychiatric disorders in ARRC showed a prevalence of 58% across 74 studies (Seitz, Purandare, & Conn, 2010). Difficulties can often occur with dementia that increase nutrition risk, these can include: loss of appetite, excessive wandering and pacing, increased need for feeding assistance and changes in eating habits such as eating with hands, increased time to eat meals and preference for eating the same foods (Ikeda, Brown, Holland, Fukuhara, & Hodges, 2002; Lin et al., 2010). Depression, a key form of psychological stress common in adults, can decrease appetite and as a result increase nutrition risk (Ahmadi et al., 2013). Dementia-related nutrition risk factors such as forgetting to eat meals and loss of ability to cook foods may become less important due to the increased level of care and provision of meals by an ARRC facility. However, changes such as: reduced appetite, excessive wandering and preference for the same foods highlights the increased risk of inadequate nutrition in older adults with cognitive impairment. This reflects the potential difficulty in application of nutrition interventions and strategies within this population.

5.2 Dysphagia

Overall, in this present study 32% of the participants were at risk of dysphagia. Malnourished individuals were more likely to be at risk of dysphagia compared to those at risk and of normal nutritional status (52% vs. 17% vs. 0% respectively). The overall prevalence was consistent with research by Lin, Wu, Chen, Wang, and Chen (2002) who noted 32% of non-tube fed ARRC participants in Taiwan had impaired swallowing. Swallowing was assessed using a swallowing questionnaire and neurological assessment, self-reported swallowing impairment and a timed swallowing test (Lin et al., 2002). Similarly, 40% of ARRC participants in Portugal were at risk of dysphagia, assessed using the Dysphagia Self-Test (DST). Of this study population, nearly half of the participants (49%) reported they often choked or coughed when eating or drinking, 45% stated difficulty clearing their mouth of food in one swallow, and 24% reported frequent respiratory conditions (Nogueira & Reis, 2013). The reliability of a subjective dysphagia assessment may be questioned in this older population due to the potential for cognitive impairment. However, subjective assessments can be useful as how an individual perceives their level of impairment may influence their ability to carry out specific functions (Nogueira & Reis, 2013).

Over half of ARRC participants, with a mean age of 83 years, had dysphagia (55%), evaluated using a bedside dysphagia screen (Kayser-Jones & Pengilly, 1999). In agreement, in older adults across eight ARRC facilities in South Korea, dysphagia risk was prevalent in 53% of the study population, assessed using a Gugging Swallowing Screen (GUSS) test (Park et al., 2013). Of these individuals, 41% were classified as high risk of dysphagia (Park et al., 2013).

A number of health conditions such as dementia, Parkinson's disease and cerebral vascular accidents can contribute to dysphagia (Kayser-Jones & Pengilly, 1999). Consequences can occur with inappropriate dysphagia management such as: dehydration, respiratory infections, malnutrition and death (Ekberg, Hamdy, Woisard, Wuttge-Hannig, & Ortega, 2002). Aspiration pneumonia is prevalent in older adults and the incidence increases with age (Cabre et al., 2010). Of ARRC residents in Mataró, Spain, admitted to hospital with pneumonia, 42% had OD, assessed using a clinical bedside water swallow assessment (Cabre et al., 2010).

In light of New Zealand's ageing population and the projected increase in demand for ARRC, the high prevalence of dysphagia in this population, both in this study and overseas, highlights the importance of dysphagia screening and evaluation.

5.3 Association between dysphagia and nutrition risk

Malnourished participants were more likely to be at risk of dysphagia compared to those at risk of malnutrition (52% vs. 17%, $p = 0.01$). All participants classified as normal nutritional status were not at risk of dysphagia. These findings are consistent with Suominen et al. (2005) who noted ARRC participants in Finland with dysphagia were more likely to be malnourished than the other participants ($p<0.001$). Similarly, in South Korean ARRC participants, dysphagia was associated with high nutrition risk ($p<0.001$) (Park et al., 2013). Within this study, 47% of participants with dysphagia were considered high nutrition risk compared to 29% of individuals without dysphagia. Also, 66% of participants with dysphagia had a BMI classification of underweight compared to 27% of participants without dysphagia ($p<0.001$) (Park et al., 2013).

Although many physical consequences are associated with dysphagia, there are also many social and psychological burdens that may increase nutrition risk (Ekberg et al., 2002). Across four European countries, in those with dysphagia, anxiety and panic during meals was reported by 41% of participants, and 36% reported they avoided eating with others (Ekberg et al., 2002). For ARRC participants in Portugal, 32% reported unintentional weight loss as a result of impaired swallowing and 37% described reduced enjoyment from eating (Nogueira & Reis, 2013).

In this present study, participants in hospital level of care had an increased risk of dysphagia compared to those in rest homes (48% vs. 20%, $p = 0.03$). This could be associated with the increased level of malnutrition observed in higher level of care facilities where participants had significantly reduced functional capacity (Gaskill et al., 2008). The occurrence of dysphagia after stroke is very common (64% to 78% using instrumental testing) (Martino et al., 2005). This may explain the increased level of malnutrition in higher level of care, as such individuals often require greater assistance following a stroke. As nutrition risk is higher in individuals with dysphagia they may be more likely to be classified as hospital level of care as opposed to rest home level.

Appropriate management of dysphagia can improve swallowing function and as a result may lower nutrition risk (Elmstahl, Bulow, Ekberg, Petersson, & Tegner, 1999). For older adults with, or at risk of dysphagia, nutrition status should be monitored to evaluate effectiveness of nutrition and swallowing intervention strategies (Elmstahl et al., 1999).

5.4 Summary

This study found 91% percent of participants were either malnourished or at risk of malnutrition. There were several key risk factors that distinguished malnourished participants from those with normal nutritional status.

Fifty-two percent of widowed participants were malnourished. Those who were malnourished or at risk of malnutrition had a higher mean number of comorbidities compared to those with normal nutritional status. This is reflected by the high occurrence of polypharmacy in the study population (79%). Polypharmacy was more prevalent in malnourished individuals than those with normal nutritional status (76% vs. 60% respectively).

There was a significantly higher prevalence of weight loss greater than 3 kg and poorer mobility in malnourished participants compared to those at risk.

Thirty-two percent were at risk of dysphagia and malnourished participants were more likely to be at risk of dysphagia than those at risk of malnutrition. Furthermore, those in hospital level of care had an increased risk of dysphagia compared to rest home level of care.

These findings suggest nutrition risk and dysphagia may be prevalent among older adults in ARRC in New Zealand. The high occurrence of these nutrition risk factors could have contributed to the need for increased level of care and admission to an ARRC facility. Nutrition screening for individuals newly admitted into ARRC may help with early detection of nutrition risk and dysphagia. This can assist with implementation of nutrition and swallowing interventions and strategies.

5.5 Limitations

New Zealand Europeans were over-represented in this sample, however this was consistent with New Zealand data on the ethnic makeup of individuals in ARRC.

Body weight was taken from clinical notes upon admission instead of residents being individually weighed during the interview. As the same calibrated scales were not used across the facilities, there may be some variability in accuracy of weights between participants. Although some heights were taken from the clinical notes and others calculated from demispan, a number of height measurements were self-reported. As a result, some may be inaccurate due to the age-related decrease in height (Sorkin et al., 1999) which could lead to inaccuracy in BMI when calculated from self-reported height.

Vision impairments and difficulty writing and using a pen led to some MoCA scores not being reflective of the participants' cognitive function. Also, the MoCA does not have subsections

for respondents who score <26 points (below normal cognitive function), which does not allow further classification of cognition.

The small sample size can be considered a limitation in relation to the difficulty drawing numerous associations with nutrition risk. Due to the particularly small number of participants in the normal nutritional status group, trends reported were only suggestive. The study aimed to take a snap shot of the current prevalence of nutrition risk and dysphagia in this population in New Zealand. In order to fully understand associations and where the relationship lies between factors that may influence nutrition risk, a larger sample size would be necessary. Accordingly, due to the small sample size, these results cannot be extrapolated across the wider ARRC population in New Zealand.

The sample size was restricted due to the short timeframe available for the recruitment period and the number of newly admitted individuals that did not meet the inclusion criteria. The catchment area of the Waitemata DHB region also limits the representativeness of the sample as it represents only a small proportion of older adults across New Zealand.

A further limitation of the study was that the tools used for identification of nutrition risk and dysphagia were developed and validated overseas and not in a New Zealand population.

5.6 Strengths

Firstly, participants were recruited from ARRC facilities in the Waitemata DHB region. As a result, participants were of varied socioeconomic status based on facility locations.

Secondly, data from the participant interviews was collected on a wide range of factors that could influence nutrition risk. The reliability of the data gathered was strengthened by ensuring all the responses provided by the participant were checked with either a relative, the ARRC clinical manager or a nurse familiar with the participants' history.

This study provides a snapshot of data that can be used to compare findings of the prevalence of nutrition risk and dysphagia in other settings, and in future studies there may be opportunities for trends to be observed.

As the participants enrolled into the current study were recent, first time admissions their nutrition status was reflective of their health prior to admission. This avoided any blame being placed on the facilities. However, this could also be a limitation as the small recruitment window affected comparisons with overseas studies where participants may have been living in an ARRC facility for a longer period of time.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

This study has investigated nutrition risk and dysphagia in 53 older adults aged between 65 and 103 years newly admitted to ARRC in the Waitemata DHB region. The gender distribution was fairly even with 57% women and 43% men. Thirty participants (57%) were rest home level of care and 25 (43%) were hospital level.

Nutrition risk was assessed using the MNA®-SF, which asked six questions and was validated in the older adult population, including for individuals who were bedridden or with cognitive impairment. Forty-seven percent were malnourished, 43% at risk of malnutrition and only 9% of participants were classified as having a normal nutritional status. Findings were consistent with overseas research and the high level of nutrition risk suggests these participants have an increased risk of health loss and mortality.

In this present study, many factors, which can be personal, demographic, social and health-related, suggest an increase in nutrition risk. This increase in risk was observed with widowhood, the high number of comorbidities, polypharmacy, severe decrease in food intake, recent weight loss, poor mobility, psychological stress and acute disease and neuropsychological problems.

Dysphagia, assessed using the EAT-10 tool, is another key nutrition risk factor and can lead to reduced food intake and weight loss, and as a result, increased nutrition risk. In this study, compared to at risk participants, those who were malnourished were more likely to be at risk of dysphagia. Also, participants in hospital level of care were more likely to be at risk of dysphagia than their counterparts in rest home level of care.

These risk factors are perhaps indicative of a change in health status, which is likely to have increased their nutrition risk. As a result, this could have precipitated the need for increased level of care and admission to an ARRC facility.

As mentioned, many factors can contribute to poor health and nutrition status of older adults admitted to ARRC. These individuals could have been exposed to a number of nutrition risk factors prior to admission. Within the ARRC environment, residents have increased access to regular support and services. This can include support across multiple health aspects meaning they may be in a better position to work towards their individual health goals.

Recommendations

These results highlight the need for screening and early nutrition intervention by a dietitian. Screening for dysphagia risk upon admission is also important as the potential reduction in food intake and weight loss as a result of dysphagia will impact on nutrition risk.

Future studies could further investigate nutrition risk in this population in a large cohort to further identify risk factors for nutrition and where they may lie. Also, investigation into the prevalence of ARRC residents who eat alone compared to those who eat in the public dining area may indicate further areas for nutrition intervention.

CHAPTER 7: APPENDICES

Appendix 1: Patient information sheet

PATIENT INFORMATION SHEET

Research Title:

Multidimensional Nutritional Assessment in an Elderly Urban Population

Primary / Principal Researcher:

Dr Jacqui Allen, FRACS
Otolaryngologist, Waitemata District Health Board
University of Auckland
Mobile: 021 897 444

Co-Investigators:

Dr Carol Wham, PhD
Dr Carol Wham, PhD, NZ Registered Dietitian
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ljohnson@waitematapho.health.nz

Waitemata
District Health Board
Te Wai Awhina

Making a healthy difference to the community

Dr Cheryl Johnson, MBChB
Geriatrician
Waitemata District Health Board
Takapuna, Auckland 0740
Phone 021 393 860
c.johnson@waitematadhb.govt.nz

Rebecca Watkin
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Julia Buhs-Catterall
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jules_b-c@hotmail.com

Emily Fraser
Masters Student
Fraseremily8@gmail.com

Lynelle Dagley MN
Gerontology Nurse Specialist - Nga Kaitiaki Kaumatua
Comprehensive Care Ltd
Building B, 42 Tawa Drive, Albany, Auckland 0632
PO Box 302-163, North Harbour, Auckland 0751
MOB: 021 689-131
DDI: +64 9 414-6732

Tanya Bish
Quality and Professional Development Nurse Leader for ARRC I, WDHB
Level 1, 15 Shea Terrace
Private Bag 93503
Takapuna
Ph: 4868920 ext 3746 M: 0212464125 F: 441 8957

Introduction and aims of the project:

You are invited to participate in a research project that will evaluate the nutritional status of persons over 65 years of age in the Waitemata District Health Board regions. You have the right not to participate in the study, or subsequently withdraw from this study at any time. Any decision not to participate will not affect your current, continuing or future health care at this or any other health care facility.

Waitemata
District Health Board
Te Wai Awhina
Making a healthy difference to the community

People who are older adults may encounter unique nutritional challenges. Living circumstances may affect what and how we eat. Nutrition also affects overall health and susceptibility to illness. Understanding differences in nutrition associated with home situations will help inform health policy and community interventions.

The aim of this project is to evaluate nutritional status in older adults living in three different situations – independently in their own home, in the hospital rehabilitation ward and in a residential care facility. This will be performed by interviews and body measurements.

Participant selection:

You have been identified as a potential participant for this study because you are in the correct age group. Upon your consent, you will be selected for this study. The study will include a total of 750 participants. We acknowledge that you may wish to discuss this project with your whanau before consenting.

The research procedure:

If you agree to participate in the study, the following will occur:

1. Once you have signed the consent form to participate in the study, you will be enrolled in the study.
2. We will then schedule a time for a researcher to meet with you to complete further interviews and to perform body measurements including your weight, height, forearm length and arm circumference. This interview will take approximately 30-60 minutes and be performed at a place convenient for you.
3. You may withdraw from the study at any time.

Risks and Benefits:

It is possible that the interviews and measures may detect a nutritional problem. If this happens you will be offered appropriate intervention and management by the Hospital team.

Side effects may occur although this is extremely unlikely. We do not know all side effects that may happen.

Participation:

If you do agree to take part in this study, you are free to withdraw at any time, without having to give a reason. This will in no way affect any future care or treatment. Your participation in the study will be stopped should any harmful effects appear or if you feel it is not in your best interest to continue.

Inclusion and Exclusion Criteria:

The following criteria will be used to determine who should be invited to participate in this study. Inclusion criteria are those things that should be present in order to be invited to participate. Exclusion criteria are those things that should be absent in order to be invited to participate. If all inclusion criteria are met and no exclusion criteria are present then you will be invited to participate in the study.

Inclusion criteria

1. Sixty-five years of age or older (or 55yrs if Māori or Pacific)
2. Ability to understand and give consent for the study
3. Ability to complete self-assessment questionnaire
4. Willing to undergo anthropomorphic measures (these measure body dimensions such as weight, height and arm circumference)
5. Admitted to a ward or residential care facility no more than five days previously

Exclusion criteria

1. Age less than 65 years old (or 55 yrs for Māori and Pacific)
2. Inability to give reasonable informed consent
3. Any tumour in the voicebox
4. Anyone with psychiatric illness affecting nutrition eg. Anorexia nervosa

5. Anyone with a Zenker diverticulum – this is a pocket in the throat that collects food and causes swallow problems
6. Anyone with malabsorption syndromes or metabolic syndromes affecting digestion
7. Anyone with a leak between the throat and the skin (a fistula)
8. Anyone in palliative care

These criteria may be discussed with the investigator

Confidentiality:

Research findings will be presented at international research meetings and submitted for publication in peer-reviewed journals. Additionally, research findings will be made available to the local medical community through research presentations and regional forums. However, no material that could personally identify you will be used in any reports on this study. Consent forms will be kept in a locked filing cabinet in the Department of Otolaryngology at the hospital or will be stored on password-protected computers. Research data will be stored for a period of ten years after data collection is complete (as required by New Zealand law), at which time they will be destroyed. With your permission, de-identified data from this study may be used in future related studies, which have been given ethical approval from the Ethics Committee.

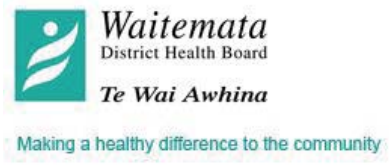
Results:

If requested, you will be offered copies of the publications that arise from this research. However, you should be aware that a significant delay may occur between completion of data collection and completion of the final report. Alternatively, or in addition, you can choose to have the results of the study discussed with you personally by the lead investigator.

Questions:

You may have a friend or whanau support to help you understand the risks and/or benefits of this study and any other explanation you may require.

Please contact Dr Allen if you require any further information about the study.



If you need an interpreter, this can be provided.

To ensure ongoing cultural safety Nga Kai Tataki - Māori Research Review Committee Waitemata DHB encourage those who identify themselves as Māori and who are participating in health research or clinical trials to seek cultural support and advice from either Mo Wai Te Ora – Māori Health Services or their own Kaumatua or Whaea. For assistance please contact the Services Clinical Leader for Mo Wai Te Ora – Māori Health on 09 486 1491 ext: 2324 or the Māori Research Advisor on 09 486 1491 ext: 2553.

If you have any queries or concerns about your rights as a participant in this study, you may wish to contact a Health and Disability Advocate, telephone: Auckland Central: 09 525 2700 or 0800 555 050. Free Fax (NZ wide): 0800 2787 7678 (08002SUPPORT). Email (NZ wide): advocacy@hdc.org.nz.

Appendix 2a: Informed consent form

INFORMED CONSENT FORM
WAITEMATA DHB
CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Investigator's Name: Dr Jacqui Allen, FRACS

Department: Department of Otolaryngology/Head and Neck Surgery

STUDY TITLE: Multidimensional Nutritional Assessment in an Elderly Urban Population

INTRODUCTION

This is a research study. Research studies only include subjects who choose to participate. As a study participant you have the right to know about the procedures that will be used in this research study so that you can make the decision whether or not to participate. The information presented here is to make you better informed so that you may give or withhold your consent to participate in this research study. Please take your time to make your decision and discuss it with your family and friends.

You are being asked to take part in this study because you are older than 65 years (or older than 55 years if you are Maori or Pacifica). We wish to evaluate nutritional status in older adults living in the Waitemata District Health Board region.

In order to participate in this study, it will be necessary to give your written consent.

WHY IS THIS STUDY BEING DONE?

The purpose of this study is to evaluate nutritional status in persons over 65 years old (or over 55 yrs if you are Maori or Pacific Islander) who live in different domestic situations. These are adults living independently in their own homes, those in the hospital rehabilitation ward and those living in a residential care facility. The evaluation will be performed by questionnaires and body measurements at a single visit. Different nutritional profiles will help us understand whether nutrition contributes to a person's living situation.

HOW MANY PEOPLE WILL TAKE PART IN THE STUDY?

750 people will take part in this study.

BEFORE YOU BEGIN THE STUDY

You will need to meet certain eligibility criteria for participation. You must be over 65 years old, or 55 years if you are Maori or Polynesian. No testing is required before participating in the study.

INCLUSION AND EXCLUSION CRITERIA

Inclusion criteria are things that should be present before or at the time that you are invited to participate in the study. Exclusion criteria are things that should be absent before or at the time that you are invited to participate in the study.

Inclusion criteria

1. Sixty-five years of age or older (or 55yrs if Maori or Polynesian)
2. Ability to understand and give consent for the study
3. Ability to complete self-assessment questionnaire
4. Willing to undergo anthropomorphic measures (these measure body dimensions such as weight, height and arm circumference)
5. Admitted to a ward or residential care facility no more than five days previously

Exclusion criteria

1. Age less than 65 years old (or 55 yrs for Maori and Polynesian)
2. Inability to give reasonable informed consent

3. Any tumour in the voicebox
4. Anyone with psychiatric illness affecting nutrition eg. Anorexia nervosa
5. Anyone with a Zenker diverticulum – this is a pocket in the throat that collects food and causes swallow problems
6. Anyone with malabsorption syndromes or metabolic syndromes affecting digestion
7. Anyone with a leak between the throat and the skin (a fistula)
8. Anyone in palliative care

These criteria may be discussed with the investigator

WHAT WILL HAPPEN IF I TAKE PART IN THIS RESEARCH STUDY?

If you decide to participate in this study, you will be asked to do the following: Complete a survey about your swallowing, the 10-item Eating Assessment Tool (EAT-10). This takes approximately five minutes. A single visit will be scheduled with you, at your convenience, to complete several further surveys and take body measurements including your weight, height, arm circumference and forearm length. The total time expected for the visit is 60-90 minutes. A researcher will perform all measurements. We will also request permission to review your medical charts to see what medication you are taking and what illnesses you may have. At this time, the study will be complete.

The following procedures are part of regular care and may be done even if you do not join the study:

None of this investigation is part of routine patient care. If you decide not to participate your care will not in any way be affected.

HOW LONG WILL I BE IN THE STUDY?

You will be asked to participate in the study for a single visit lasting approximately 30-60 minutes.

CAN I STOP BEING IN THE STUDY?

You can decide to stop at any time. Tell the study doctor if you are thinking about stopping or decide to stop. You may complete any aspect of the study and you may stop participating at any time.

WHAT SIDE EFFECTS OR RISKS CAN I EXPECT FROM BEING IN THE STUDY?

It is extremely unlikely that you would experience side effects from participation in this study. All body measurements are non invasive. Everyone taking part in the study will be watched carefully for any side effects. However, the study doctor does not know all the side effects that may happen.

You should talk to your study doctor about any side effects that you have while taking part in the study.

ARE THERE BENEFITS TO TAKING PART IN THE STUDY?

The benefits to science and humankind that might result from this study are to learn more nutrition in older adults and how living arrangements might affect that. You may directly benefit from having nutritional problems indentified. The improvement may be mild or significant. You may not benefit from taking part in this study.

WHAT OTHER CHOICES DO I HAVE IF I DO NOT TAKE PART IN THIS STUDY?

Your alternative is not to take part in this study. Talk with your doctor about your choices before you decide if you will take part in this study. If you choose not to take part in this study, your future care will not in any way be affected.

WILL MY MEDICAL INFORMATION BE KEPT PRIVATE?

We will do our best to make sure that the personal information in your medical record will be kept private. However, we cannot guarantee total privacy. Your personal information may be given out if required by law.

If information from the study is published or presented at scientific meetings, your name and other personal information will not be used. All personal identifying information will be removed and the research data will be coded and stored in a locked file that is accessible only by the primary and co-investigators.

The Ethics Committee has the authority to review your research and medical records.
All information will be stored for 10 years in accordance with New Zealand law then destroyed.

WHAT HAPPENS IF I AM INJURED BECAUSE I TOOK PART IN THIS STUDY?

If you are injured as a direct result of research procedures, you will receive reasonably necessary medical treatment at no cost. Waitemata DHB does not provide any other form of compensation for injury. In the case of injury resulting from this study, you do not lose any of your legal rights to seek payment by signing this form.

WHAT ARE THE COSTS OF TAKING PART IN THIS STUDY?

The researcher will come to you to perform the interview at your convenience. There will be no costs incurred for actual patient care if required.

WILL I BE COMPENSATED FOR BEING IN THIS STUDY?

You will not be compensated for participation in this study.

WHAT ARE MY RIGHTS IF I TAKE PART IN THIS STUDY?

Taking part in this study is your choice. You may choose either to take part or not to take part in the study. If you decide to take part in this study, you may leave the study at any time. No matter what decision you make, there will be no penalty to you and you will not lose any of your regular benefits. Leaving the study will not affect your medical care. You can still get your medical care from our institution.

We will tell you about new information or changes in the study that may affect your health or willingness to continue in the study.

If you require Māori cultural support, talk to your whānau in the first instance. Alternatively you may contact the administrator for He Kamaka Waiora (Māori Health Team) by telephoning 09 486 8324 ext 2324.

If you have any questions or complaints about the study you may contact the Auckland and Waitematā District Health Boards Maori Research Committee or Maori Research Advisor by telephoning 09 4868920 ext 3204.

DOES THE RESEARCHER HAVE A FINANCIAL INTEREST IN THIS RESEARCH STUDY?

The Principle Investigator (Dr Allen) has no financial interest in the study. The co- Investigators have no financial interest in this study.

WHO CAN ANSWER MY QUESTIONS ABOUT THE STUDY?

If you have questions, please ask us. You can talk to the Investigator about any questions or concerns you have about this study.

Dr. Jacqui Allen at phone number 021 897 444

24-hour emergency at phone number 021 897 444

My signature below will indicate that I have decided to participate in this study as a research subject. I have read and understand the information above. I understand that I will be given a signed and dated copy of this consent form.

Signature of Subject or Legal Representative	Print Name
Date	Time
Signature of Investigator	Print Name
Date	Time

Appendix 2b: Informed consent form – Vulnerable participants

INFORMED CONSENT FORM – VULNERABLE PARTICIPANTS
WAITEMATA DHB
CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Investigator's Name: Dr Jacqui Allen, FRACS

Department: Department of Otolaryngology/Head and Neck Surgery

STUDY TITLE: Multidimensional Nutritional Assessment in an Elderly Urban Population

INTRODUCTION

This is a research study. Research studies only include subjects who choose to participate. Study participants have the right to know about the procedures that will be used in this research study so that you can make the decision whether or not to participate. The information presented here is to make you better informed so that you may give or withhold your consent for your family member, spouse or charge to participate in this research study. Please take your time to make your decision and discuss it with your family and friends.

Your family member, spouse or charge is being asked to take part in this study because they are older than 65 years (or older than 55 years if Maori or Pacifica). We wish to evaluate nutritional status in older adults living in the Waitemata District Health Board region.

In order for them to participate in this study, it will be necessary to give your written consent.

WHY IS THIS STUDY BEING DONE?

The purpose of this study is to evaluate nutritional status in persons over 65 years old (or over 55 yrs if you are Maori or Pacific Islander) who live in different domestic situations. These are adults living independently in their own homes, those in the hospital rehabilitation ward and those living in a residential care facility. The evaluation will be performed by questionnaires and body measurements at a single visit. Different nutritional profiles will help us understand whether nutrition contributes to a person's living situation.

HOW MANY PEOPLE WILL TAKE PART IN THE STUDY?

750 people will take part in this study.

BEFORE THEY BEGIN THE STUDY

Your family member, spouse or charge will need to meet certain eligibility criteria for participation. They must be over 65 years old, or 55 years if Maori or Polynesian. No testing is required before participating in the study.

INCLUSION AND EXCLUSION CRITERIA

Inclusion criteria are things that should be present before or at the time that invitation to participate in the study occurs. Exclusion criteria are things that should be absent before or at the time that invitation to participate in the study occurs.

Inclusion criteria

1. Sixty-five years of age or older (or 55yrs if Maori or Polynesian)
2. Ability to understand and give consent for the study
3. Ability to complete self-assessment questionnaire
4. Willing to undergo anthropomorphic measures (these measure body dimensions such as weight, height and arm circumference)
5. Admitted to a ward or residential care facility no more than five days previously

Exclusion criteria

1. Age less than 65 years old (or 55 yrs for Maori and Polynesian)
2. Inability to give reasonable informed consent

3. Any tumour in the voicebox
4. Anyone with psychiatric illness affecting nutrition eg. Anorexia nervosa
5. Anyone with a Zenker diverticulum – this is a pocket in the throat that collects food and causes swallow problems
6. Anyone with malabsorption syndromes or metabolic syndromes affecting digestion
7. Anyone with a leak between the throat and the skin (a fistula)
8. Anyone in palliative care

These criteria may be discussed with the investigator

WHAT WILL HAPPEN IF THEY TAKE PART IN THIS RESEARCH STUDY?

If you decide your family member, spouse or charge can participate in this study, they will be asked to do the following: Complete a survey about swallowing, the 10-item Eating Assessment Tool (EAT-10). This takes approximately five minutes. A single visit will be scheduled with them, at their convenience, to complete further surveys and take body measurements including your weight, height, arm circumference and forearm length. The total time expected for the visit is 60-90 minutes. A researcher will perform all measurements. We will also request permission to review medical charts to see what medication are being taken and what illnesses they may have. At this time, the study will be complete.

The following procedures are part of regular care and may be done even if you do not join the study:

None of this investigation is part of routine patient care. If you decide you do not want your family member, spouse or charge to participate their care will not in any way be affected.

HOW LONG WILL THEY BE IN THE STUDY?

They will be asked to participate in the study for a single visit lasting approximately 30-60 minutes.

CAN THEY STOP BEING IN THE STUDY?

You can decide to stop at any time and remove your family member, spouse or charge. Tell the study doctor if you are thinking about stopping or decide to stop. You may complete any aspect of the study and you may stop participating at any time.

WHAT SIDE EFFECTS OR RISKS CAN I EXPECT FROM BEING IN THE STUDY?

It is extremely unlikely that your family member, spouse or charge would experience side effects from participation in this study. All body measurements are non invasive. Everyone taking part in the study will be watched carefully for any side effects. However, the study doctor does not know all the side effects that may happen.

You should talk to your study doctor about any side effects that you have while taking part in the study.

ARE THERE BENEFITS TO TAKING PART IN THE STUDY?

The benefits to science and humankind that might result from this study are to learn more nutrition in older adults and how living arrangements might affect that. Your family member, spouse or charge may directly benefit from

having nutritional problems indentified. The improvement may be mild or significant. They may not benefit from taking part in this study.

WHAT OTHER CHOICES DO I HAVE IF THEY DO NOT TAKE PART IN THIS STUDY?

Your alternative is not to have your family member, spouse or charge take part in this study. Talk with your doctor about your choices before you decide if they will take part in this study. If you choose not to take part in this study, their future care will not in any way be affected.

WILL MEDICAL INFORMATION BE KEPT PRIVATE?

We will do our best to make sure that the personal information in their medical record will be kept private. However, we cannot guarantee total privacy. Personal information may be given out if required by law.

If information from the study is published or presented at scientific meetings, your family member, spouse or charge's name and other personal information will not be used. All personal identifying information will be removed and the research data will be coded and stored in a locked file that is accessible only by the primary and co-investigators.

The Ethics Committee has the authority to review your research and medical records.
All information will be stored for 10 years in accordance with New Zealand law then destroyed.

WHAT HAPPENS IF THEY ARE INJURED BECAUSE THEY TOOK PART IN THIS STUDY?

If your family member, spouse or charge are injured as a direct result of research procedures, you will receive reasonably necessary medical treatment at no cost. Waitemata DHB does not provide any other form of compensation for injury. In the case of injury resulting from this study, you do not lose any of your legal rights to seek payment by signing this form.

WHAT ARE THE COSTS OF TAKING PART IN THIS STUDY?

The researcher will come to you to perform the interview at your convenience. There will be no costs incurred for actual patient care if required.

WILL THEY BE COMPENSATED FOR BEING IN THIS STUDY?

Your family member, spouse or charge will not be compensated for participation in this study.

WHAT ARE MY RIGHTS IF THEY TAKE PART IN THIS STUDY?

Your family member, spouse or charge taking part in this study is your choice. You may choose either to take part or not to take part in the study. If you decide that your family member, spouse or charge can take part in this study, they may leave the study at any time. No matter what decision you make, there will be no penalty to you. Leaving the study will not affect their medical care. You can still get their medical care from our institution.

We will tell you about new information or changes in the study that may affect your family member, spouse or charge's health or willingness to continue in the study.

If you require Māori cultural support, talk to your whānau in the first instance. Alternatively you may contact the administrator for He Kamaka Waiora (Māori Health Team) by telephoning 09 486 8324 ext 2324.

VERSION DATE: 22/04/14

(12/2013)

If you have any questions or complaints about the study you may contact the Auckland and Waitematā District Health Boards Maori Research Committee or Maori Research Advisor by telephoning 09 4868920 ext 3204.

DOES THE RESEARCHER HAVE A FINANCIAL INTEREST IN THIS RESEARCH STUDY?

The Principle Investigator (Dr Allen) has no financial interest in the study. The co- Investigators have no financial interest in this study.

WHO CAN ANSWER MY QUESTIONS ABOUT THE STUDY?

If you have questions, please ask us. You can talk to the Investigator about any questions or concerns you have about this study.

Dr. Jacqui Allen at phone number 021 897 444

24-hour emergency at phone number 021 897 444

My signature below will indicate that I have decided to participate in this study as a research subject. I have read and understand the information above. I understand that I will be given a signed and dated copy of this consent form.

Signature of Subject or Legal Representative	Print Name
Date	Time
Signature of Investigator	Print Name
Date	Time

VERSION DATE: 22/04/14

(12/2013)

Appendix 3: Subject recruitment flyer

Waitemata District Health Board
Te Wai Awhina
Making a healthy difference to the community

Massey University

RECRUITING FOR NUTRITION STUDY

Older adults may encounter unique nutritional challenges. Nutrition affects overall health and susceptibility to illness. Understanding differences in nutrition associated with home situations will help inform health policy and community interventions. This study is being carried out for the completion of a Masters' thesis in collaboration with Waitemata DHB and Massey University.

Who can take part?

We are looking for participants 65 years of age or older admitted to residential care within the last week willing to take part in a study about nutrition.

What does the study involve?

A researcher will visit you for a one-off visit where a questionnaire will be completed and simple body measurements recorded. This is estimated to take 30-60 minutes to complete.

Participants must be prepared to:

- Answer questions about their eating and swallowing
- Have their weight and height measured

What will participants gain?

It is possible that interviews and measures may detect a nutritional problem. If this happens recommendations will be made for you to contact the Dietitian contracted to your facility for further assessment and intervention.

Ethics

This study has been reviewed and approved by the Health and Disability Ethics Committees (HDEC) and has received Waitemata DHB locality.

Contact

Please contact us to become part of the study:

Dr Jacqui Allen, FRACS (Principal Researcher): 021 897 444
jacqueline.allen@waitematadhb.govt.nz

Rebecca Watkin (Masters student): 021 033 4604
rebecca.watkin@hotmail.co.nz

Appendix 4: Ethics documents (Health and Disabilities Ethics Committee and Waitemata DHB)

Health and Disability Ethics Committees

Authorisation report

Study ref:	**14/NTA/70**
Study title:	Multidimensional Nutritional Analysis in an Elderly Urban Population
Status:	Application decision given - Decision: decision of "approved" 27/06/2014 05:31:00

This authorisation report was generated by DHB Waitemata District Health Board on 01 Jul 2014 at 11:47 AM

Authorisation Type	Authorisor	Date and time	Lead Investigator(s) at locality
Co-ordinating Investigator	Jacqueline Allen	19 Apr 2014, 03:05 PM	Jacqueline Allen
Primary Contact Person	Jacqueline Allen	19 Apr 2014, 03:15 PM	Jacqueline Allen
Sponsor	cath cronin WDHB	30 Apr 2014, 09:55 AM	
Locality	Waitemata DHB	01 Jul 2014, 11:42 AM	Jacqui Allen

Electronic Authorisations History

Date	Authorisation Type	Action
01 Jul 2014, 11:42 AM	Locality	Authorisation given by DHB Waitemata District Health Board
15 May 2014, 12:00 PM	Locality	Request for authorisation accepted by DHB Waitemata District Health Board
30 Apr 2014, 09:55 AM	Sponsor	Authorisation given by Ms Cath Cronin
30 Apr 2014, 09:50 AM	Sponsor	Request for authorisation accepted by Ms Cath Cronin
29 Apr 2014, 09:23 PM	Sponsor	Request for authorisation sent by Dr Jacqueline Allen to Ms Cath Cronin
29 Apr 2014, 09:22 PM	Sponsor	Request for authorisation recalled by Dr Jacqueline Allen
19 Apr 2014, 03:18 PM	Sponsor	Request for authorisation sent by Dr Jacqueline Allen to DHB Waitemata District Health Board
19 Apr 2014, 03:16 PM	Locality	Request for authorisation sent by Dr Jacqueline Allen to DHB Waitemata District Health Board
19 Apr 2014, 03:15 PM	Primary Contact Person	Authorisation given by Dr Jacqueline Allen
19 Apr 2014, 03:05 PM	Co-ordinating Investigator	Authorisation given by Dr Jacqueline Allen

Health and Disability Ethics Committees
Ministry of Health
C/- MEDSAFE, Level 6, Deloitte House
10 Brandon Street
PO Box 5013
Wellington
6011

0800 4 ETHICS
hdecs@moh.govt.nz

30 June 2014

Dr Jacqueline Allen
PO Box 99743
Newmarket
Auckland
Auckland 1149

Dear Dr Allen

Re:	**Ethics ref:**	**14/NTA/70**
	Study title:	Multidimensional Nutritional Analysis of Waitemata DHB Elderly Population

I am pleased to advise that this application has been *approved* by the Northern A Health and Disability Ethics Committee. This decision was made through the HDEC-Expedited Review pathway.

Conditions of HDEC approval

HDEC approval for this study is subject to the following conditions being met prior to the commencement of the study in New Zealand. It is your responsibility, and that of the study's sponsor, to ensure that these conditions are met. No further review by the Northern A Health and Disability Ethics Committee is required.

Standard conditions:

1. Before the study commences at *any* locality in New Zealand, all relevant regulatory approvals must be obtained.

2. Before the study commences at *a given* locality in New Zealand, it must be authorised by that locality in Online Forms. Locality authorisation confirms that the locality is suitable for the safe and effective conduct of the study, and that local research governance issues have been addressed.

After HDEC review

Please refer to the *Standard Operating Procedures for Health and Disability Ethics Committees* (available on www.ethics.health.govt.nz) for HDEC requirements relating to amendments and other post-approval processes.

Your **next progress report** is due by 27 June 2015.

Please don't hesitate to contact the HDEC secretariat for further information. We wish you all the best for your study.

Yours sincerely,

Dr Brian Fergus
Chairperson
Northern A Health and Disability Ethics Committee

Encl: appendix A: documents submitted
appendix B: statement of compliance and list of members

Appendix A
Documents submitted

Document	*Version*	*Date*
CV for CI: CV Dr Allen	1.0	17 February 2014
PIS/CF: Patient Information Sheet	1.0	17 February 2014
Survey/questionnaire: MNA Tool	1.0	17 February 2014
Survey/questionnaire: Eating Assessment Tool-10	1.0	25 February 2014
Survey/questionnaire: Montreal Cognitive Assessment	1.0	25 February 2014
Covering Letter: Covering letter	1.1	19 April 2014
CVs for other Investigators: CV Wham	1.0	19 April 2014
Evidence of scientific review: Peer Review	1.0	19 April 2014
CVs for other Investigators: CV Johnston	1.0	19 April 2014
CVs for other Investigators: CV Watkins	1.0	19 April 2014
CVs for other Investigators: CV Dennison	1.0	19 April 2014
CVs for other Investigators: CV Dagley	1.0	19 April 2014
CVs for other Investigators: CV Fraser	1.0	19 April 2014
CVs for other Investigators: CV Buhs-Catterall	1.0	19 April 2014
CVs for other Investigators: CV Johnston C	1.0	19 April 2014
CVs for other Investigators: CV Bish	1.0	19 April 2014
Invitation letter	1.0	19 April 2014
PIS/CF: Consent Form (inclusion and exclusion criteria included)	1.0	19 April 2014
Protocol: Study Protocol	1.0	19 April 2014
PIS/CF for persons interested in welfare of non-consenting participant: Consent for vulnerable people	1.0	19 April 2014
Application		10 May 2014
Covering Letter: HDEC response letter June 2014.docx		04 June 2014
Survey/questionnaire: MNA study ID.pdf		04 June 2014
Survey/questionnaire: MOCA study ID.pdf		04 June 2014
PIS/CF: Patient Information Sheet Nutrition-1.4. May 2014.docx	1.4	04 June 2014
PIS/CF: Study Consent I&E BW JA revision .doc		04 June 2014
PIS/CF: Study Consent I&E for vulnerable participants .doc		04 June 2014
Response to Request for Further Information		05 June 2014
Covering Letter: HDEC response letter 2 June 2014 - .docx		02 June 2014
PIS/CF: Patient Information Sheet Nutrition-1.5. June 2014.docx	1.5	04 June 2014
PIS/CF: Study Consent I&E JA revision version 1.5 June 14.doc	1.5	04 June 2014

Appendix B
Statement of compliance and list of members

Statement of compliance

The Northern A Health and Disability Ethics Committee:

- is constituted in accordance with its Terms of Reference
- operates in accordance with the *Standard Operating Procedures for Health and Disability Ethics Committees*, and with the principles of international good clinical practice (GCP)
- is approved by the Health Research Council of New Zealand's Ethics Committee for the purposes of section 25(1)(c) of the Health Research Council Act 1990
- is registered (number 00008714) with the US Department of Health and Human Services' Office for Human Research Protection (OHRP).

List of members

Name	*Category*	*Appointed*	*Term Expires*
Dr Brian Fergus	Lay (consumer/community perspectives)	01/07/2012	01/07/2015
Dr Karen Bartholomew	Non-lay (intervention studies)	01/07/2013	01/07/2016
Ms Susan Buckland	Lay (consumer/community perspectives)	01/07/2012	01/07/2015
Ms Shamim Chagani	Non-lay (health/disability service provision)	01/07/2012	01/07/2014
Dr Christine Crooks	Non-lay (intervention studies)	01/07/2013	01/07/2015
Mr Kerry Hlini	Lay (consumer/community perspectives)	01/07/2012	01/07/2014
Ms Michele Stanton	Lay (the law)	01/07/2012	01/07/2014

http://www.ethics.health.govt.nz

Appendix 5: Māori Research Review

26 March 2014

Dr Jacqui Allen FRACS
Senior Lecturer
University of Auckland
New Zealand

Re: Multidimensional Nutritional Assessment in an Elderly Urban Population

Tēnā koe Jacqui

As a reminder the Maori Research Review critiques research proposals for responsiveness to Maori. Ethical, scientific and clinical rigour is reviewed by the respective bodies at each District Health Board.

Thank you for providing the study protocol. Overall I think it was thoughtful and well written. The study seeks to explore nutritional status in an elderly urban population at a single point in time and compare elderly subjects living in three different contexts. The study is being powered to allow for subgroup analysis, including ethnicity subgroups. Powering for ethnic analysis will ensure Māori experiences are reflected in the study findings and interventions. To ensure this happens 750 participants will be recruited.

Consent will be discussed in person and written information given. Face to face consenting increases the likelihood of Māori participation. Subjects will be given time to read information, ask questions and decide on whether to participate. Giving Māori time to respond will enable them to discuss the matter with their whānau. Appropriate interpreting services will be available if needed. Provision of interpreter services will also increase Māori participation as some Māori feel more comfortable using their own language, particularly kaumātua.

In the rationale the investigator notes:

> The New Zealand adult nutrition survey (2008) identified 0.5-2.5% of older people (71 years+) as clinically underweight[13]

Was there any information related to Māori kaumātua in the survey?

As you probably know one way in which research can address tikanga Māori in research practice is to ensure Māori are part of the research team. Are there any Māori researchers on this study?

Please provide the Māori Research Committee what a copy of the final report.

If you have not done so already please add the following to the information and or consent form.

- If you require Māori cultural support talk to your whānau in the first instance. Alternatively you may contact the administrator for He Kamaka Waiora (Māori Health Team) by telephoning 09 486 8324 ext 2324
- If you have any questions or complaints about the study you may contact the Auckland and Waitematā District Health Boards Maori Research Committee or Maori Research Advisor by telephoning 09 4868920 ext 3204

On behalf of the Maori Research Committee at the Waitematā and Auckland District Health Boards the application has been approved.

Heio ano

H.A Wihongi

Dr Helen Wihongi
Maori Research Advisor
He Kamaka Waiora (Maori Health)
Waitematā and Auckland DHB's,
Private Bag 93 503,
Takapuna, Auckland
Ph + 64 9 4868920 ext 3204
Cell 021 0203 1167
Email helen.wihongi@waitematadhb.govt.nz

Tereki Stewart
Chairperson
Māori Research Committee
Waitematā and Auckland DHB's
PO Box 108040
Symond Street
Ph +64 09 366 1993
email tstewart@tihiora.co.nz

Appendix 6: Questionnaire

Older Adults Nutrition Risk and Dysphagia Screening

Student Dietitian Interviewer:……
Interview Date: / /
Setting prior to residential care admission:…
Level of residential care:……

Personal

1. ID number:……
2. Last name:……
3. First name: ……
4. NHI number:……..
5. DOB: ……...../...../.....
6. Age:…….. (years) ……....(months)
7. Gender:…….. (M=1, F=2)
8. Weight: ……kg
9. Height:……..cm
10. Demispan……..…cm
11. Calf circumference: ……....cm
12. BMI: …….....

Height (cm) from demispan:
Females=(1.35 x demispan in cm)+60.1
Males=(1.40 x demispan in cm+57.8

Demographic

13. Which of these best describes your ethnicity?

1 = New Zealand European
2 = New Zealand Māori
3 = Pacific Islander
4 = Other, please specify_____

Comments:

_____

_____

14. What is your current marital status?

Married/partnered	Widowed	Divorced/separated	Never married
1	2	3	4

Comments:

_____

_____

15. Who lives in your house/unit/apartment with you most of the time?

Living alone	Living with spouse only	Living with others
1	2	3

Comments:

_____

_____

16. Do you receive any income in addition to your pension?

Pension only income	Pension plus other income
1	2

Comments:

_____

_____

17. What is your highest level of education?

Primary	Secondary	Tertiary
1	2	3

Comments:

_____

_____

Health

18. Have you been told by your doctor that you have any health issues?

Yes	No
1	2

Key co-morbidities: (ICD 10 code)	Comments:

19. Do you have any other health problems?

Yes	No
1	2

Other health problems	Comments:

20. What medications, prescribed by the doctor, are you regularly taking?
Number of medications:

Medication	Comment (i.e. dose etc)
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	
14.	
15.	
16.	
17.	
18.	
19.	
20.	
21.	
22.	
23.	
24.	
25.	

21. What over-the-counter medications are you regularly taking?
Number of medications:

Medication	Comment
1.	
2.	
3.	
4.	

5.	
6.	
7.	
8.	
9.	
10.	

22. What, if any, nutrition supplements eg. Complan or vitamin and mineral supplements are you regularly taking?

Number of supplements:

Nutrition Supplement	Comment
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

23. What is your dental status?

Dentate	Edentulous	Dental Appliance
1	2	3

Comments:

Support Services

24. Do you receive any regular subsidised support service?

Yes	No
1	2

Comments (i.e. Hours, frequency etc):

25. Do you usually need help with daily tasks like shopping, cleaning, cooking?

Yes	No
1	2

Comments:

Mini Nutritional Assessment (Nestlé Nutrition Institute)

26. Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties?

severe decrease in food intake	moderate decrease in food intake	no decrease in food intake	
0	1	2	

27. Weight loss during the last 3 months

weight loss greater than 3 kg	does not know	weight loss between 1 and 3 kg	no weight loss	
0	1	2	3	

28. Mobility

Bed or chair bound	Able to get out of bed/chair but does not go out	Goes out	
0	1	2	

29. Has suffered psychological stress or acute disease in the past 3 months?

Yes	No	
O	2	

30. Neuropsychological problems

severe dementia or depression	mild dementia	no psychological problems	
0	1	2	

If BMI is not available, replace BMI with calf circumference

31. Body Mass Index (BMI) (weight in kg) / (height in m2)

BMI less than 19	BMI 19 to less than 21	BMI 21 to less than 23	BMI 23 or greater	
0	1	2	3	

32. Calf circumference (CC) in cm

CC less than 31	CC 31 or greater	
0	3	

Comments:

_____

_____

33. Final MNA® Score

Final MNA® Score: _____	Normal nutritional status (12-14 points)	At risk of malnutrition (8-11 points)	Malnourished (0-7 points)
	1	2	3

EAT-10: A Swallowing Screening Tool (Nestle Nutrition Institution)

To what extent do you experience the following problems? Rate from 1-4

34. My swallowing problem has caused me to lose weight

0 No problem	1	2	3	4 Severe problem	

35. My swallowing problem interferes with my ability to go out for meals

0 No problem	1	2	3	4 Severe problem	

36. Swallowing liquids takes extra effort

0 No problem	1	2	3	4 Severe problem	

37. Swallowing solids takes extra effort

0 No problem	1	2	3	4 Severe problem	

38. Swallowing pills takes extra effort

0 No problem	1	2	3	4 Severe problem	

39. Swallowing is painful

0 No problem	1	2	3	4 Severe problem	

40. The pleasure of eating is affected by my swallowing

0 No problem	1	2	3	4 Severe problem	

41. When I swallow food sticks in my throat

0 No problem	1	2	3	4 Severe problem	

42. I cough when I eat

0 No problem	1	2	3	4 Severe problem	

43. Swallowing is stressful

0	1	2	3	4	

No problem				Severe problem	

Comments:

_____

_____

44. Final EAT-10 Score

Final EAT-10 Score: _____	Not at risk (less than 3 points)	At risk (3 points or higher)
	1	2

Montreal Cognitive Assessment (MoCA)

45. Final MoCA score____/30 (≥26 is considered normal).

Interviewer to answer the following

How well do you rate:

	Very poor	Poor	Neither good nor poor	Good	Very good
46. The reliability of the respondent's responses?	1	2	3	4	5
47. The participant's understanding of the questions	1	2	3	4	5

Comments (required if answer is 1 or 2):

_____

_____

Appendix 7: Mini Nutritional Assessment®-Short Form (MNA®-SF)

Mini Nutritional Assessment

MNA®

Nestlé Nutrition Institute

Last name: First name:

Sex: Age: Weight, kg: Height, cm: Date:

Complete the screen by filling in the boxes with the appropriate numbers. Total the numbers for the final screening score.

Screening

A Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties?
0 = severe decrease in food intake
1 = moderate decrease in food intake
2 = no decrease in food intake ☐

B Weight loss during the last 3 months
0 = weight loss greater than 3 kg (6.6 lbs)
1 = does not know
2 = weight loss between 1 and 3 kg (2.2 and 6.6 lbs)
3 = no weight loss ☐

C Mobility
0 = bed or chair bound
1 = able to get out of bed / chair but does not go out
2 = goes out ☐

D Has suffered psychological stress or acute disease in the past 3 months?
0 = yes 2 = no ☐

E Neuropsychological problems
0 = severe dementia or depression
1 = mild dementia
2 = no psychological problems ☐

F1 Body Mass Index (BMI) (weight in kg) / (height in m^2)
0 = BMI less than 19
1 = BMI 19 to less than 21
2 = BMI 21 to less than 23
3 = BMI 23 or greater ☐

IF BMI IS NOT AVAILABLE, REPLACE QUESTION F1 WITH QUESTION F2.
DO NOT ANSWER QUESTION F2 IF QUESTION F1 IS ALREADY COMPLETED.

F2 Calf circumference (CC) in cm
0 = CC less than 31
3 = CC 31 or greater ☐

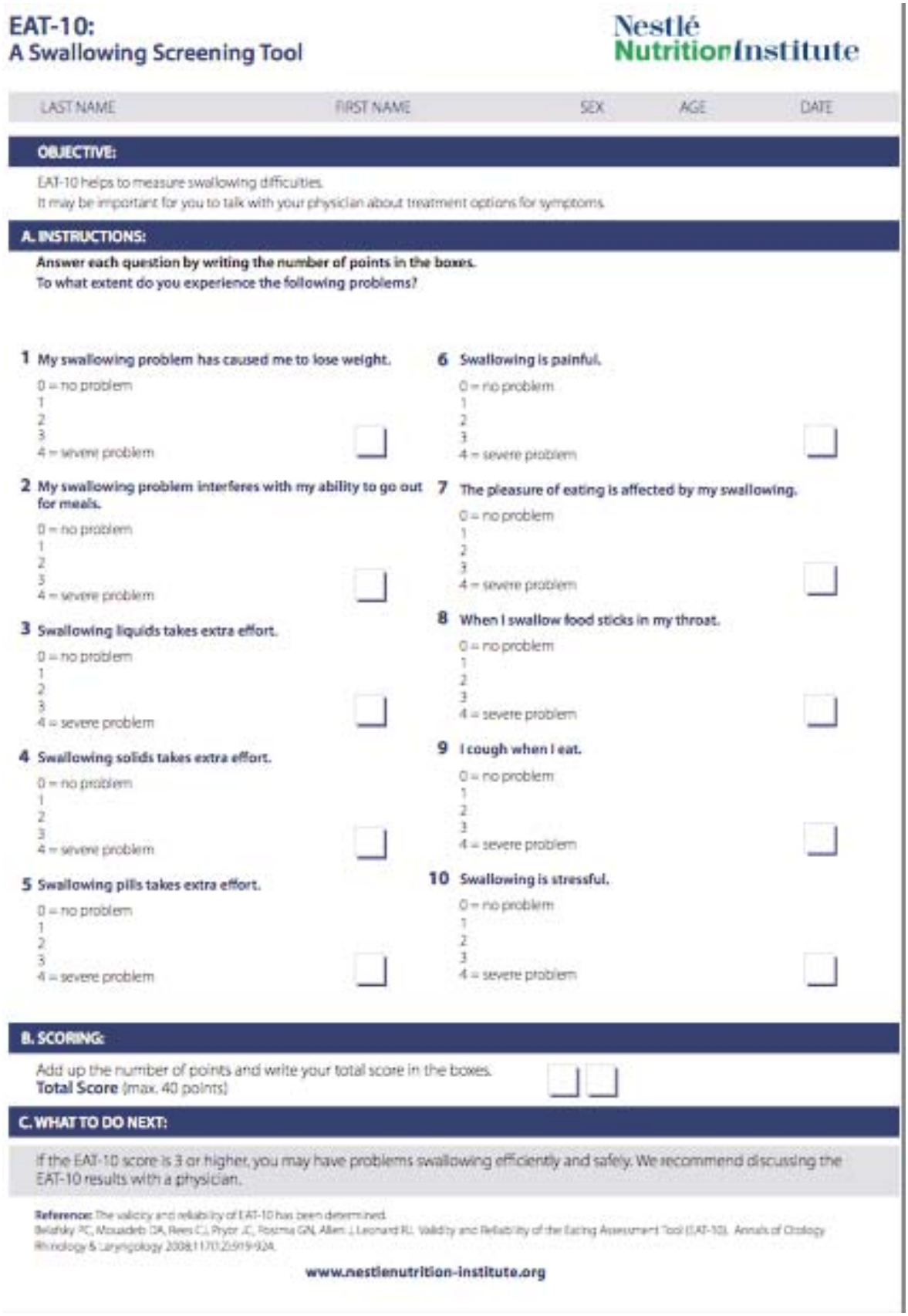
Screening score ☐☐
(max. 14 points)

12-14 points: Normal nutritional status
8-11 points: At risk of malnutrition
0-7 points: Malnourished

Ref. Vellas B, Villars H, Abellan G, et al. *Overview of the MNA® - Its History and Challenges.* J Nutr Health Aging 2006;10:456-465.
Rubenstein LZ, Harker JO, Salva A, Guigoz Y, Vellas B. *Screening for Undernutrition in Geriatric Practice: Developing the Short-Form Mini Nutritional Assessment (MNA-SF).* J. Geront 2001;56A: M366-377.
Guigoz Y. *The Mini-Nutritional Assessment (MNA®) Review of the Literature - What does it tell us?* J Nutr Health Aging 2006; 10:466-487.
Kaiser MJ, Bauer JM, Ramsch C, et al. *Validation of the Mini Nutritional Assessment Short-Form (MNA®-SF): A practical tool for identification of nutritional status.* J Nutr Health Aging 2009; 13:782-788.

For more information: www.mna-elderly.com

Appendix 8: Eating Assessment Tool (EAT-10)



EAT-10:
A Swallowing Screening Tool

Nestlé Nutrition Institute

LAST NAME | FIRST NAME | SEX | AGE | DATE

OBJECTIVE:

EAT-10 helps to measure swallowing difficulties.
It may be important for you to talk with your physician about treatment options for symptoms.

A. INSTRUCTIONS:

Answer each question by writing the number of points in the boxes.
To what extent do you experience the following problems?

1 My swallowing problem has caused me to lose weight.
0 = no problem
1
2
3
4 = severe problem

2 My swallowing problem interferes with my ability to go out for meals.
0 = no problem
1
2
3
4 = severe problem

3 Swallowing liquids takes extra effort.
0 = no problem
1
2
3
4 = severe problem

4 Swallowing solids takes extra effort.
0 = no problem
1
2
3
4 = severe problem

5 Swallowing pills takes extra effort.
0 = no problem
1
2
3
4 = severe problem

6 Swallowing is painful.
0 = no problem
1
2
3
4 = severe problem

7 The pleasure of eating is affected by my swallowing.
0 = no problem
1
2
3
4 = severe problem

8 When I swallow food sticks in my throat.
0 = no problem
1
2
3
4 = severe problem

9 I cough when I eat.
0 = no problem
1
2
3
4 = severe problem

10 Swallowing is stressful.
0 = no problem
1
2
3
4 = severe problem

B. SCORING:

Add up the number of points and write your total score in the boxes.
Total Score (max. 40 points)

C. WHAT TO DO NEXT:

If the EAT-10 score is 3 or higher, you may have problems swallowing efficiently and safely. We recommend discussing the EAT-10 results with a physician.

Reference: The validity and reliability of EAT-10 has been determined.
Belafsky PC, Mouadeb DA, Rees CJ, Pryor JC, Postma GN, Allen J, Leonard RJ. Validity and Reliability of the Eating Assessment Tool (EAT-10). Annals of Otology Rhinology & Laryngology 2008;117(12):919-924.

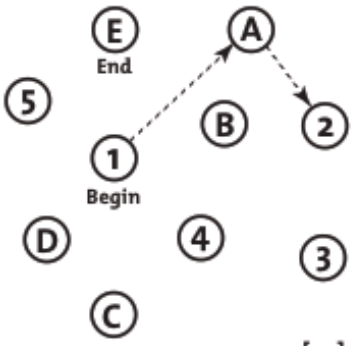
www.nestlenutrition-institute.org

Appendix 9: Montreal Cognitive Assessment (MoCA)

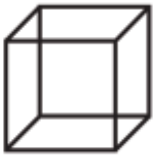
MONTREAL COGNITIVE ASSESSMENT (MOCA)

NAME :
Education : Date of birth :
Sex : DATE :

VISUOSPATIAL / EXECUTIVE — POINTS



Copy cube



[ ] [ ]

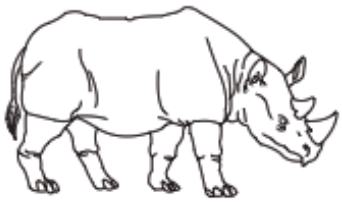
Draw CLOCK (Ten past eleven) (3 points)

[ ] Contour [ ] Numbers [ ] Hands

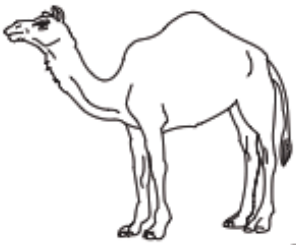
__/5

NAMING

[ ]



[ ]



[ ]

__/3

MEMORY — Read list of words, subject must repeat them. Do 2 trials. Do a recall after 5 minutes.

	FACE	VELVET	CHURCH	DAISY	RED
1st trial					
2nd trial					

No points

ATTENTION — Read list of digits (1 digit/ sec.).

Subject has to repeat them in the forward order [ ] 2 1 8 5 4

Subject has to repeat them in the backward order [ ] 7 4 2

__/2

Read list of letters. The subject must tap with his hand at each letter A. No points if ≥ 2 errors

[ ] F B A C M N A A J K L B A F A K D E A A A J A M O F A A B

__/1

Serial 7 subtraction starting at 100 [ ] 93 [ ] 86 [ ] 79 [ ] 72 [ ] 65

4 or 5 correct subtractions: **3 pts**, 2 or 3 correct: **2 pts**, 1 correct: **1 pt**, 0 correct: **0 pt**

__/3

LANGUAGE — Repeat : I only know that John is the one to help today. [ ]
The cat always hid under the couch when dogs were in the room. [ ]

__/2

Fluency / Name maximum number of words in one minute that begin with the letter F [ ] _____ (N ≥ 11 words)

__/1

ABSTRACTION — Similarity between e.g. banana - orange = fruit [ ] train – bicycle [ ] watch - ruler

__/2

DELAYED RECALL

	Has to recall words WITH NO CUE	FACE [ ]	VELVET [ ]	CHURCH [ ]	DAISY [ ]	RED [ ]	Points for UNCUED recall only
Optional	Category cue						
	Multiple choice cue						

__/5

ORIENTATION — [ ] Date [ ] Month [ ] Year [ ] Day [ ] Place [ ] City

__/6

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Normal ≥ 26 / 30

TOTAL __/30

Add 1 point if ≤ 12 yr edu

Administered by: _____

Appendix 10: Comorbidity examples and their relevant condition group

Health Loss Category	ICD-10 Code Example
Cancers and other neoplasms	**C00-D48**
Lung	
Colorectal	
Polycythaemia vera	
Vascular and blood disorders	**D50-D89 & I00-I99**
Hypertension	
Atrial fibrillation	
Ischaemic heart disease	
Musculoskeletal and connective tissue	**M00-M99**
Osteoporosis	
Arthritis (e.g. Rheumatoid, Osteoarthritis, Gout)	
Spondylosis	
Respiratory	**J00-J99**
Chronic obstructive pulmonary disease	
Asthma	
Pneumonia	
Diabetes and endocrine	**E00-E90**
Type 2 diabetes mellitus	
Hypothyroidism	
Neurological	**G00-G99**
Neuropathy	
Hemiplegia	
Dementia (all forms)	
Gastrointestinal	**K00-K93**
Chronic constipation	
Gastro oesophageal reflux disease	
Mental and behavioural disorders	**F00-F99**
Depression	
Anxiety	
Other	

Urinary tract infection	
Glaucoma	
Human immunodeficiency virus (HIV)	

Health loss categories as per the New Zealand Burden of Disease, Injuries and Risk Factors Study (NZBD) (Ministry of Health, 2013b)
International Classification of Diseases 10th revision (ICD-10) codes (World Health Organization, 2014b)

Appendix 11: Comorbidities according to participant identification number

ID number	Key comorbidities	ID number	Key comorbidities	ID number	Key comorbidities
3001	Congestive cardiomyopathy Ischaemic heart disease Atrial fibrillation Paget's disease of bone Congestive cardiac failure Chronic leg ulcers	3003	Vascular dementia Hypertension Solarkeratosis Aortic valve replacement + coronary artery bypass graft (2013) Atrial fibrillation Bradycardia Bronchiectasis Osteoporosis	3004	Hypertension Macular degeneration Osteoarthritis spine
3005	Bilateral foot drop Myeopathy Peripheral neuropathy	3006	Supranuclear palsy COPD Anaemia Left adrenal mass Constipation	3008	Felty's syndrome Rheumatoid arthritis Postural hypotension
3009	GORD Hypertension Postural hypotension Dyslipidaemia R) Posterior circulation infarct and L) dense hemiparesis Dysphagia secondary to stroke Cognitive impairment Chronic hyponatraemia L) lower lung pneumonia Insomnia	3010	Metastatic bowel cancer Cerebrovascular accident (2014) Right hemiparesis Metastatic adenocarcinoma Brain cancer (frontopanetal tumour) Deep vein thrombosis	3011	Adenocarcinoma R) upper left lung GORD Glaucoma
3012	Hypothyroidism Osteoporosis Parkinson's disease Ischaemic heart disease COPD Renal impairment (eGFR 37)	3013	Cerebrovascular accident Glaucoma Cognitive impairment Dyslipidaemia Primary hyperparathyroidism C4/C5 spondylosis	3014	Cognitive impairment (likely Alzheimers) Emphysema Hypothryroidism Osteoporosis Polycythemia vera

3015	Angina Anxiety and panic attacks Depression Dyslipidaemia Glaucoma Vasovagal syncope Hearing impairment	3016	Dementia Delirium 2^0 dementia Anaemia of chronic disease Cardiac conduction disease with atrial flutter Chronic renal failure Ischaemic cardiomyopathy Type 2 diabetes mellitus	3017	Osteoarthritis Cerebrovascular disease Hypothyroidism GORD Age-related macular degeneration Dyslipidaemia Hypertension
3018	Paroxysmal atrial fibrillation with intermittent brachycardia Cavernous haemangioma Mild aortic sclerosis Embolic stroke Hyponatraemia Macular degeneration Previous retinal vein occlusion R) eye blind Urinary tract infection Dyspnoea	3019	Macular degeneration Asthma Bilateral pitting oedema of ankles Hypertension Hypothyroidism	3020	Cognitive impairment Angina Chronic atrial fibrillation Hypertension Spondylosis Osteoarthritis
3021	Hypertension Colon cancer Confusion - cognitive impairment Type 2 diabetes mellitus Glaucoma Stroke	3022	Biventricular heart failure Hypertension Type 2 diabetes mellitus Chronic kidney disease Glaucoma (blind in left eye) COPD Reflux Dyspnoea	3023	Dementia GORD Hypertension Hypercholesterolemia Prostate cancer R) cerebellar cerebrovascular accident Depression Chronic kidney disease Osteoarthritis Recurrent urinary tract infections
3024	Otogenic vertigo (Meniere's disease) Hypertension Hearing loss	3025	Dementia Prolapsed vagina Cystocoele Hypertension Macular degeneration Osteoarthritis Asthma	3027	Dementia Uterovaginal prolapse

3028	Peripheral vertigo Bronchial asthma Effort dyspnoea Familial tremor Hypertension Type 2 diabetes mellitus	3029	Irritable bowel syndrome Hereditary macular degeneration Cognitive decline Osteoarthritis Osteoporosis Diverticulosis Hypertension	3030	Hiatus hernia L) homonymous hemianopia Gastritis Cognitive impairment Spinal compression fracture Cerebrovascular accident Hearing impairment (wears heading aids) Constipation
3031	Parkinson's disease - Ataxia syndrome Postural hypotension Bilateral cataracts Hallucinations Chronic constipation R) eye partially blind Hypertension Cognitive decline Previous esotropia w/ corrective surgery ((L) extropia + hypermetropia) Episodes of palpitations Anxiety disorder Osteoarthritis Fragile X syndrome	3032	Staphlococcus aureus septicaemia Progressive metastatic urothelial cancer - metastatic to stomach, lymph nodes, liver, possibly pelvis Progressive liver disease Lower limb oedema Hearing loss Impaired vision	3033	Atrial fibrillation COPD Osteoarthritis (left knee) Benign prostate hypertrophy GORD Osteoporosis Hearing impairment Bilateral pseudophakia Asthma Hypertension Left dacryoadenitis Bilateral cataract extraction Impaired vision
3034	Atrial fibrillation Vascular dementia Anxiety Depression Dyslipidaemia Asthma GORD Streptococcal bacteraemia infection Impaired vision	3035	Right middle cerebral artery infarct L) hemiplegia and L) homonymous hemianopia Hypertension Right internal carotid artery stenosis 50-69% Sensorineural hearing loss	3036	Gout Osteoarthritis Impaired vision Impaired hearing

3037	Human immunodeficiency virus positive Alzheimer's disease Depression Peripheral neuropathy from D40 Mixed lipodystrophy pattern Benign prostatic hypertrophy	3038	Cognitive impairment Dyslipidaemia Hypertension Type 2 diabetes mellitus Metastatic colon cancer Atrial fibrillation Glaucoma Arthritis R) hemicolectomy Hepatic lesions	3039	L) ankle infected chronic ulcer 2^0 venous insufficiency Mild cognitive impairment Osteoporosis Polycythaemia vera Urinary tract infection Cataracts Hyponatraemia Hearing impairment
3040	Moderate dementia Hypertension	3041	Pneumonia COPD Type 2 diabetes mellitus Abdominal aortic aneurysm Benign prostatic hyperplasia Gout Chronic renal impairment	3042	Aortic disease Metastatic prostate cancer Osteoarthritis
3043	Type 2 diabetes mellitus Dyslipidemia Hypertension Osteoporosis Osteoarthritis Dementia Cholelithiasis cervical + lumbar spondylosis Retinopathy Neuropathy	3044	Parkinson's disease Anxiety Constipation Acute myocardial infarct	3045	Bilateral foot gout Progressive cognitive impairment (dementia) Myocardial infarction Acute or chronic renal failure
3046	Diverticulitis GORD Haematemesis Hiatus hernia Oesophagitis Scoliosis of lumbar spine Blind right eye Dementia Stroke	3047	Multilobar community acquired pneumonia NSTEMI COPD Bilateral macular degeneration Chronic renal impairment Haemorrhoids with grade 3 prolapse and obstructed defecation	3048	Dementia Congestive heart failure COPD Hypertension Oesophageal reflux Osteoarthritis Rheumatoid arthritis
3049	Hypothyroidism Hypertension Depression	3050	Diverticulitis Dyslipidaemia Hypothroidism Osteoporosis Percutaneous myocardial revascularisation Psoriatic arthritis Short term memory loss/cognitive impairment	3051	Memory loss Urinary tract infection Constipation Hypertension Osteoarthritis Left hemiarthroplasty

3052	Mild dementia Hypothyroidism Diverticulitis Stroke Dyslipidaemia Intermittent BPSD/aggression	3053	Hypothyroidism Osteoarthritis Sensorineural deafness Dementia Osteoporosis Dysphagia	3054	Delirium Vascular dementia Systemic lupus erythematosis Ischaemic heart disease (NSTEMI 2013) Atrioventricular block Hypertension Benign prostatic hyperplasia Osteoporosis Osteoarthritis Senile macular degeneration COPD Lung cancer Interstitial lung disease
3055	Anxiety disorder Chronic constipation Hypertension Lung cancer Varicose veins Uterine fibroids	3056	Large bowel obstruction Stroke Aspiration pneumonia Atrial fibrillation COPD Hypertension R) + L) hemicolectemy + ileostomy for sigmoid volvulus/ischaemic bowel Very poor swallow ESBL enterobacter cloacae Benign prostatic hyperplasia		

Comorbidities recorded as per diagnoses in participants' clinical notes
BPSD = behavioural and psychological symptoms of dementia
GORD = gastro oesophageal reflux disease
COPD = chronic obstructive pulmonary disorder
NSTEMI = Non ST segment myocardial infarction

Appendix 12: Study protocol

Study Protocol – Multidimensional Nutritional Assessment in an Elderly Urban Population

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Conflict of Interests: We declare that we have no conflict of interests, commercial involvement or financial gain from this research or in relation to any products used in this research.

Funding: Funding is sought by grant application.

Study Design:
Prospective non-randomized cross-sectional observational human study

Setting:
Tertiary Care, Waitemata District Health Board
Primary Care, Waitemata Primary Health Care Organisation
Residential Aged Care Facilities, Waitemata District

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Study Aims:

Hypothesis: That nutritional status and anthropomorphic measures will differ between three elderly populations – independently-living, well elderly, hospital in-patients and residential care residents.

Primary Objectives:

i) To describe and document the nutritional status and anthropomorphic measurements of the elderly population in Waitemata District Health Board catchment
ii) To compare and contrast nutritional status in three subgroups of elderly subjects

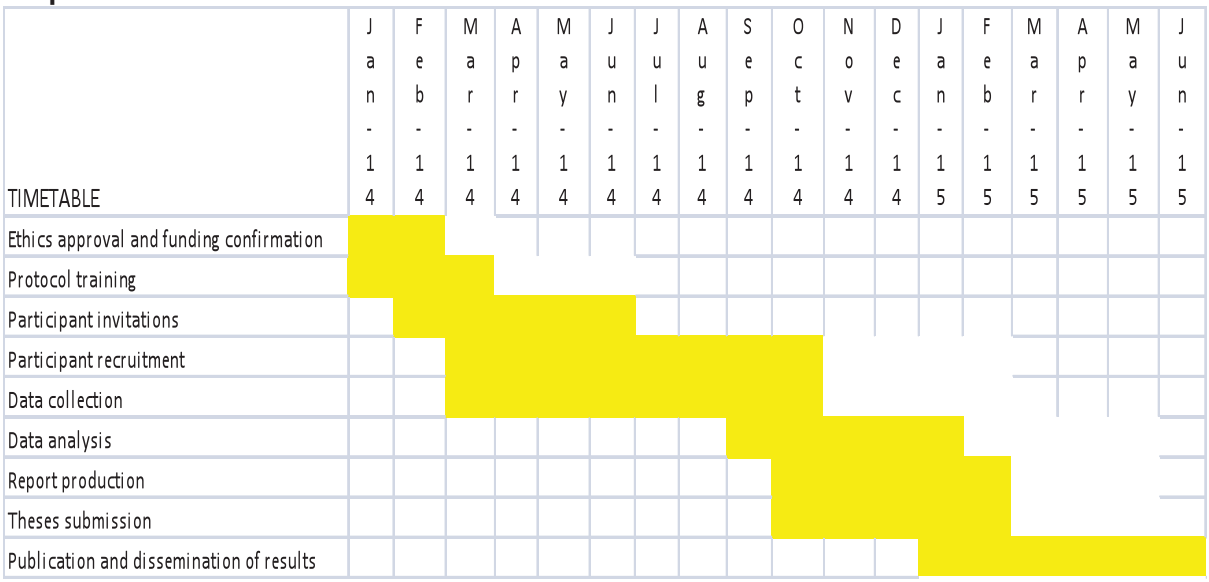
Secondary Objectives:

i) Identify predictive factors associated with nutrition risk
ii) Categorise dental status
iii) Identify modifiable factors associated with nutrition risk.
iv) Measure dysphagia specific quality of life using the EAT-10 score

Number of Participants:

750

Proposed Timeframe:



Jan 2014 – February 2014	Ethics approval and funding confirmation, protocol training
February 2014 – June 2014	Participant invitations
March 2014 – October 2014	Participant recruitment and data collection
September 2014 – January 2014	Data analysis, preliminary report production and presentation (publication), theses submission
October 2014 – April 2015	Report production and results publication and dissemination

Rationale and Literature Review:

Nutrition is a key determinant of successful ageing as food is not only critical to physiological wellbeing but also contributes to social, cultural and psychological quality of life (American Dietetic Association 2005). Clinical malnutrition is preceded by a state of nutritional risk and screening can identify older people at risk of poor nutrition or who currently have impaired nutritional status. Previous studies of older people have shown a relationship between nutrition risk and health related QOL[1-4]. Changes in nutritional status and physical health are well established; higher patterns of morbidity occur in malnourished older people[5]. Social factors play an important role in promoting the maintenance of adequate food intake. Living alone may contribute to under-eating[6]. Having someone else in the household increases the opportunity to share meal preparation and dining[7]. Meal sharing increases food intake which is positively correlated with nutritional quality as well as health outcomes[8]. In living alone people have higher levels of weight loss (American Dietetic Association 2005) decreased energy intake and poorer dietary variety perhaps resulting from decreased interaction at meal times[7]. Women who lose their spouse report higher levels of food insecurity and difficulty accessing food due to transport difficulties[6].

Screening studies in New Zealand adults have suggested that a third of community living older adults show high nutritional risk[9-13]. Among community living adults of advanced age, more than half have

been identified at high nutrition risk[12]. The New Zealand adult nutrition survey (2008) identified 0.5-2.5% of older people (71 years+) as clinically underweight[13]. Nutritional status has impact on multiple organ systems and systemic disease. Being either overweight (obese) or underweight can have negative health impact. Although obesity is at epidemic proportions, among older people, weight loss and undernutrition are prevalent, sinister and result in reduced quality of life. Good nutrition is vital to maintain functional capability; conversely poor nutrition increases the risk of hospitalisation, disability and mortality. Health problems arise as a result of inadequate food and nutrition intake[14].

Older people demonstrate increasing frequency of swallowing difficulty (dysphagia) and increased prevalence of diseases that can affect swallowing ability, cognition, manual dexterity and metabolism – all of which may give rise to precarious nutritional intake or malnutrition. Illness, cognitive impairment, loss of a spouse or injury may make purchasing food, preparing a meal and monitoring personal nutrition more difficult. High risk populations include those with neurological disease including stroke, where dysphagia is the most common persistent sequelae, Parkinson's disease (almost 80% demonstrate dysphagia), dementia, and head and neck cancer survivors. Natural age-related changes also increase the work of eating. Muscle loss, de-conditioning, medication effects and comorbid disease affect swallow function with weaker pharyngeal function and slower food transit times. If these physiological changes are coupled with psychosocial changes such as dementia, depression, isolation, loss of spouse and living alone then real nutritional deficit may occur.

Our understanding of older people's nutritional status in New Zealand is incomplete. Social setting has been demonstrated to affect nutritional status eg. Decile living ratings associated with obesity. We believe that personal living arrangements are correlated with nutritional status. Adults living independently manage their own diets and calorific intake. Once individuals translocate to residential care the question is whether their ability to be nutritionally replete is already lost and has led to the need to move, or whether other concomitant factors that mandate the change in living situation also impact nutrition. Typically admission to hospital results from an acute insult and frequently this creates a hypermetabolic state which incurs increased nutritional requirements. Additional protein is needed to prevent protein malnutrition that is often seen on surgical wards. Hospital diets should accommodate calorific demands but often food is unappetizing and unfamiliar, feeding ability may be affected by disease, medications or instrumentation such as IV lines and cannulae, and patients do not maintain appropriate intake. Our hypothesis is that there will be significant nutritional differences between older population groups comparing healthy, independently living adults (PHO cohort) to in-patient rehabilitation ward patients to residential care residents within the Waitemata DHB catchment.

Impact of Nutritional Status on Quality of Life and health risk

Adequate food intake is critical to physiological wellbeing and psychological quality of life. The impact of poor nutrition is pervasive. Low energy reduces further the ability to prepare food and maintain diet. Food intake, including protein amount, type and timing is essential in maintaining skeletal muscle strength and mass and thus functional status. Age related decline in muscle mass and function leads to loss of mobility, one of the primary determinants of both quality of life (QOL) and the need for residential care. This further depletes energy. Immune surveillance is reduced and ability to fight infection or disease will be affected. If poor nutrition is the result of or associated with dysphagia then effect on

quality of life, morbidity, mortality, and health care expenditure is significant. Aspiration pneumonia is one of the most common causes of death after stroke and is the

most common cause of death in persons with Parkinson's disease[15,16]. Of the 77 million hospitalizations in the U.S. in 2004-2005, the adjusted mortality rate associated with dysphagia was 13.7, and hospital stays associated with dysphagia were twice as long as those for non-dysphagic patients, representing a cost per year in the U.S. of $547 billion[17]. Dysphagia is a symptom and no matter what the underlying aetiology is, the common denominator is reduced nutrition. We need to understand the factors that are associated with declining nutritional status and which may be modified before significant impairment is established.

This population study will provide a snapshot of elderly in our community and how they are faring from a nutritional standpoint. It will provide insight into differences and areas of need, as well as informing strategies for prevention of malnutrition. Identifying predictive factors for nutritional impairment will enable targeted intervention to be developed right from a primary care level. The simple study design and cross-collaboration of several disciplines means that the study has a high likelihood of successful completion and of acceptance of results and recommendations. The researchers involved all work in the area of older adult care and will drive change as a result of the study's findings.

Study Design:

A prospective, non-randomized, observational, cross-sectional human cohort study

Methods and Subjects:

Subjects meeting inclusion criteria and nil exclusion criteria will be invited to participate in the study. Consent will be discussed in person and written information given. Subjects will be given time to read information, ask questions and decide on whether to participate. Appropriate interpreting services will be available if needed.

Inclusion criteria

1. Sixty-five years of age or older (or 55yrs if Māori or Pacific)
2. Ability to understand and give consent for the study
3. Ability to complete self-assessment questionnaire
4. Willing to undergo anthropomorphic measures (these measure body dimensions such as weight, height and arm circumference)
5. Admitted to a ward or residential care facility no more than five days previously

Exclusion criteria

1. Age less than 65 years old (or 55 yrs for Māori and Pacific)
2. Inability to give reasonable informed consent
3. Any tumour in the voicebox

4. Anyone with psychiatric illness affecting nutrition eg. Anorexia nervosa
5. Anyone with a Zenker diverticulum – this is a pocket in the throat that collects food and causes swallow problems
6. Anyone with malabsorption syndromes or metabolic syndromes affecting digestion
7. Anyone with a leak between the throat and the skin (a fistula)
8. Anyone in palliative care

STUDY PROTOCOL

Subjects will be invited to participate in the study by letter of invitation (primary health care organisations) or face-to-face interview (in-patients and residential residents). Interviews will take place in the subject's residence, ward or other site deemed most convenient for the patient. Investigators will travel to the site to meet the subject.

After appropriate consent is received subjects will be enrolled into the study. An interview will then be performed which will consist of a structured interview (the Mini Nutritional Assessment [MNA])[18,19] [Appendix] and anthropomorphic measurements (Body mass index [kg/m^2], calf circumference [cm], dental assessment (dentate, edentulous, dental appliance) and completion of self assessment questionnaire (the Eating Assessment Tool, EAT-10)[20] [Appendix]. A simple screen for cognitive impairment will also be performed (Montreal Cognitive Assessment)[21]. Estimated time for completion of whole interview is approximately 60 minutes. All information gathering from the subject will occur at first visit. No further interaction is required. Information will be entered into Excel spreadsheets on personal computers accessible only by password known to the Investigators. Additional demographic information may be recovered from the patient notes by the study investigators (with consent).

Nutritional status will be measured using the Mini Nutritional Assessment, a validated instrument for assessment of nutritional risk. This tool has been rated as the most effective and appropriate for assessing nutrition in the elderly[22]. Dysphagia specific quality of life will be assessed with the Eating Assessment Tool (EAT-10). The EAT-10 is a validated self-administered disease specific quality of life instrument for dysphagia[20]. This questionnaire typically takes five minutes to complete.

Subjects that are detected as having nutritional risk or needing intervention will be referred to the appropriate Service for review and management. This will not affect study participation.

Information Collection

All information will be stored in password protected computers accessible only by the Investigators. Only the Primary investigators will have access to the complete data set. Investigators are aware and will comply with all Privacy Act tenets and requirements. Information will only be reported in de-identified groups with no individual information reported.

Ethics Information

This study has been entered into the HDEC system and is deemed NOT to require full HDEC review (see attached Waitemata District Health Board letter and HDEC transcript). District Health Board Ethics committee review has been performed and approved.

Adverse Events

As the primary objective of the study is to assess nutrition at a single time point there are unlikely to be adverse events related to study participation. Possible adverse events may be psychological in creating stress for the patient questioned about their nutritional status.

Subjects are free to withdraw from the study at any time. This will not adversely affect their ongoing care.

Study Data

The primary objectives of the study are to ascertain nutritional status in an elderly urban population at a single point in time and compare elderly subjects living in three different contexts. Study data will be collected and analyzed as a group, and no individual data will be identifiable.

The secondary objectives of the study are to identify factors that are predictive of poor nutrition, identify which factors are modifiable, to categorize dental status by a forced choice, three item scale (dentate, edentulous, dental appliance) and measure dysphagia-specific quality of life (EAT-10).

The study will be completed at this time.

Analyses

Power calculation has been completed. Estimating an effect size of 10%, that is that there will be a 10% difference in average weight between best and worst categories, and to achieve 80% power with a significance level of 0.05, the number of subjects required per group is 33. However, estimating a larger standard deviation and smaller effect size with the same power and significance level suggests that 142-175 subjects would be required per group depending on SD.

We are interested in detecting differences between ethnic groups and considering that the proportion in the cohort will be smaller, we are aiming for 250 participants per group.

Descriptive statistics will be used to report group findings including inter-quartile ranges, standard deviation and relative risk. Odds ratios will be used for factors identified to be associated with worse nutrition. Confounding factors and comorbidity groups will be analyzed by analysis of variance. All tests will be two-sided; tests will be at level 0.05, with Bonferroni correction for multiple comparison.

Impact of Research

In support of the government's 'Ageing in Place' policy (Ministry of Social Policy 2001) there is a need to identify the prevalence and factors that could lead to malnutrition and intervene accordingly.

This study focuses on older adults, gathering baseline data on their nutritional status which can be used to monitor changes in health status in potential future studies. Nutrition underpins much of this vulnerable age-group's health profile and ability to deal with comorbid disease. Factors contributing to nutrition are both psychosocial and physical. It is critical to understand what the current state of nutritional compromise is in our older population. Advancing knowledge in this area will inform health policy and strategy particularly at a primary intervention level to reduce long term consequences of nutritional depletion in an aging population. This study will encompass diverse ethnicities due to geographic and socioeconomic spread within Waitemata DHB and three key living situations that we believe have a major impact on nutrition in older people. Our collaboration with primary care and expert researchers in this field will enhance our ability to apply the knowledge obtained and implement effective prevention strategies and provide education to patients and caregivers. Interventions will be developed with end-users but may include meal support, in-home nutritional assessment as routine, dietary advice and social eating groups. Knowledge gained from the study can be transferred to GP's, community health nurses, dietitians and clients through written and web-based platforms.

Responsiveness to Māori

Māori will be well represented in this observational study by virtue of inclusion of catchment areas with good population representation in West Auckland. Key researchers in this study have already focused previous research on ethnic inequalities and published in this area. The study is powered to enable subgroup analysis with a particular aim of clarifying differentiating factors between Māori and non-Māori participants. Cultural considerations have been adopted in developing the study protocol and are approved by the Organisation's Māori research adviser.

Research Team Expertise

The study will be coordinated via WDHB Otolaryngology, Dietetics and Gerontology Services. Ethics approval is not required from HDEC (confirmation letter available). Locality agreement in progress. Staff will provide expertise free and students are funded by Massey University.

Dr Allen is a practicing Otolaryngologist with extensive research experience in New Zealand and the United States of America. She is grant-funded for current research and is an Honorary Senior Lecturer in the University of Auckland. She is able to coordinate the research, provide analysis and deliver study goals.

Kaye Dennison is the former Professional leader for Dietitians at WDHB with many years experience in Nutrition with older people in community settings. She has supervised many postgraduate students focused on research related to Nutrition and Older people. Currently she is an independent Dietitian consultant. She will also coordinate the research, analyse and disseminate data.

Dr Carol Wham is a Massey University Senior Lecturer overseeing all Masters Students in Nutrition and Dietetics. Carol is an experienced gerontology dietitian and has published in this area specifically regarding ethnic inequities and will coordinate research, supervise students, provide analysis and deliver study goals.

Dr Lannes Johnson is the Clinical Lead of Waitemata PHO, a large primary healthcare organisation. Dr Johnson has extensive clinical research experience, including in older adult care. He will coordinate the PHO cohort, provide analysis and deliver study goals.

Dr Cheryl Johnson is a Gerontologist at WDHB and will coordinate the in-patient hospitalized elderly cohort. Dr Johnson has expertise in elderly care and nutritional disorders and will also provide analysis.

Tanya Bish is a Residential Aged Care Nurse Consultant for WDHB. Ms Bish has a Masters in Gerontology Nursing (Hons) and has worked as a Residential Facility Manager, Gerontology Nurse Specialist and professional development nurse leader. She will provide Aged Care advice to the team and help coordinate residential care cohort.

Julia Buhs-Catterall, Emily Fraser and Rebecca Watkin are Masters Students in Nutrition and Dietetics under supervision of Dr Wham and will complete the data collection as Masters projects. All have completed undergraduate Bachelor degrees in Human Nutrition.

Funding

Funding will be provided by Massey University and is also sought from the Auckland Medical Research Foundation and other grant funders.

Expected Benefit and Research Impact

There may be direct benefit to the patient for study participation. They may directly benefit from being identified as having nutritional risk and being referred to appropriate services. The improvement may be mild or significant. For Society as a whole there will be great value in understanding nutritional differences between groups in the cohort. In particular, whether there are factors associated with nutrition that may lead to deterioration in living circumstances and loss of independence. Detection of factors associated with risk of nutritional deterioration will allow policy decisions and intervention to be directed at those risk groups at a primary intervention level. Enhanced awareness of nutritional risk alone may benefit subjects and the community as a whole.

There may be no benefit from participation in the study.

Presentation and publication

All published or presented data from the study will be presented in a de-identified manner, protecting patient confidentiality. Data will be presented locally and internationally at appropriate Scientific Conferences. Publication in peer-reviewed journals will be sought. Participants will be provided with data or manuscripts if requested. Personal information will only be available to the PI and co-investigator.

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Appendix
Mini Nutritional Assessment® (MNA®)

Nestlé Nutrition Institute

Mini Nutritional Assessment MNA®

Last name: First name:

Sex: Age: Weight, kg: Height, cm: Date:

Complete the screen by filling in the boxes with the appropriate numbers. Total the numbers for the final screening score.

Screening

A Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties?
0 = severe decrease in food intake
1 = moderate decrease in food intake
2 = no decrease in food intake ☐

B Weight loss during the last 3 months
0 = weight loss greater than 3 kg (6.6 lbs)
1 = does not know
2 = weight loss between 1 and 3 kg (2.2 and 6.6 lbs)
3 = no weight loss ☐

C Mobility
0 = bed or chair bound
1 = able to get out of bed / chair but does not go out
2 = goes out ☐

D Has suffered psychological stress or acute disease in the past 3 months?
0 = yes 2 = no ☐

E Neuropsychological problems
0 = severe dementia or depression
1 = mild dementia
2 = no psychological problems ☐

F1 Body Mass Index (BMI) (weight in kg) / (height in m²)
0 = BMI less than 19
1 = BMI 19 to less than 21
2 = BMI 21 to less than 23
3 = BMI 23 or greater ☐

IF BMI IS NOT AVAILABLE, REPLACE QUESTION F1 WITH QUESTION F2.
DO NOT ANSWER QUESTION F2 IF QUESTION F1 IS ALREADY COMPLETED.

F2 Calf circumference (CC) in cm
0 = CC less than 31
3 = CC 31 or greater ☐

Screening score ☐☐
(max. 14 points)

12-14 points:	Normal nutritional status
8-11 points:	At risk of malnutrition
0-7 points:	Malnourished

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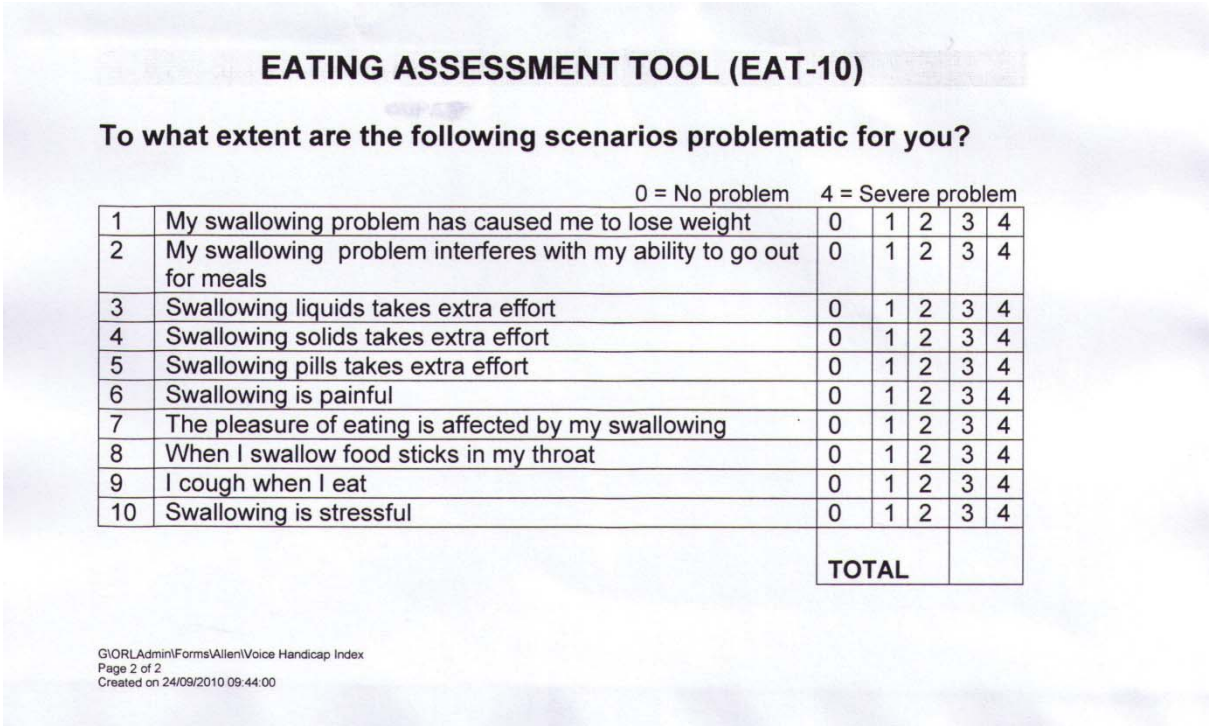
For more information: www.mna-elderly.com

Eating Assessment Tool (EAT-10)



EATING ASSESSMENT TOOL (EAT-10)

To what extent are the following scenarios problematic for you?

		0 = No problem				4 = Severe problem
1	My swallowing problem has caused me to lose weight	0	1	2	3	4
2	My swallowing problem interferes with my ability to go out for meals	0	1	2	3	4
3	Swallowing liquids takes extra effort	0	1	2	3	4
4	Swallowing solids takes extra effort	0	1	2	3	4
5	Swallowing pills takes extra effort	0	1	2	3	4
6	Swallowing is painful	0	1	2	3	4
7	The pleasure of eating is affected by my swallowing	0	1	2	3	4
8	When I swallow food sticks in my throat	0	1	2	3	4
9	I cough when I eat	0	1	2	3	4
10	Swallowing is stressful	0	1	2	3	4
		TOTAL				

G\ORLAdmin\Forms\Allen\Voice Handicap Index
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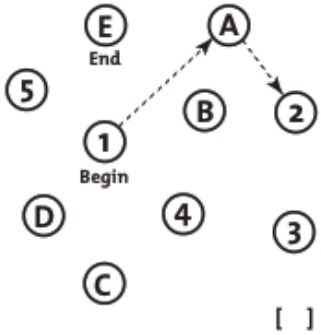
Montreal Cognitive Assessment (MoCA)

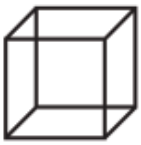
MONTREAL COGNITIVE ASSESSMENT (MOCA)

NAME :
Education : Date of birth :
Sex : DATE :

VISUOSPATIAL / EXECUTIVE — POINTS



Copy cube

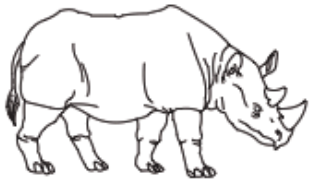
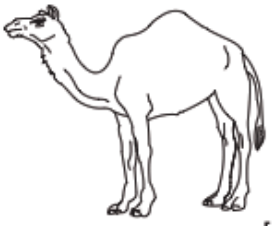


[ ] [ ]

Draw CLOCK (Ten past eleven) (3 points)

[ ] Contour [ ] Numbers [ ] Hands __/5

NAMING

[ ] [ ] [ ] __/3

MEMORY — Read list of words, subject must repeat them. Do 2 trials. Do a recall after 5 minutes.

	FACE	VELVET	CHURCH	DAISY	RED
1st trial					
2nd trial					

No points

ATTENTION — Read list of digits (1 digit/ sec.).
Subject has to repeat them in the forward order [ ] 2 1 8 5 4
Subject has to repeat them in the backward order [ ] 7 4 2 __/2

Read list of letters. The subject must tap with his hand at each letter A. No points if ≥ 2 errors
[ ] F B A C M N A A J K L B A F A K D E A A A J A M O F A A B __/1

Serial 7 subtraction starting at 100 [ ] 93 [ ] 86 [ ] 79 [ ] 72 [ ] 65
4 or 5 correct subtractions: **3 pts**, 2 or 3 correct: **2 pts**, 1 correct: **1 pt**, 0 correct: **0 pt** __/3

LANGUAGE — Repeat : I only know that John is the one to help today. [ ]
The cat always hid under the couch when dogs were in the room. [ ] __/2

Fluency / Name maximum number of words in one minute that begin with the letter F [ ] ____ (N ≥ 11 words) __/1

ABSTRACTION — Similarity between e.g. banana - orange = fruit [ ] train – bicycle [ ] watch - ruler __/2

DELAYED RECALL

	FACE	VELVET	CHURCH	DAISY	RED	
Has to recall words WITH NO CUE	[ ]	[ ]	[ ]	[ ]	[ ]	Points for UNCUED recall only
Optional: Category cue						
Optional: Multiple choice cue						

__/5

ORIENTATION [ ] Date [ ] Month [ ] Year [ ] Day [ ] Place [ ] City __/6

© Z.Nasreddine MD Version 7.0 www.mocatest.org Normal ≥ 26 / 30

TOTAL __/30
Add 1 point if ≤ 12 yr edu

Administered by: _____

Table 1. FTE commitments of study personnel

Member	FTE for project	Funding requested
Dr Jacqueline Allen	0.1	No
Dr Carol Wham	0.1	No
Dr Lannes Johnson	0.1	No
Elle Dagley	0.1	Yes
Kaye Dennison	0.1	No
Julia Buhs-Catterall	0.4	No
Emily Fraser	0.4	No
Rebecca Watkin	0.4	No
Tanya Bish	0.1	No

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