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Evaluation of nutrition risk in older independent living adults within the Waitemata and North Shore community

A thesis presented in partial fulfilment of the requirements for the degree of

Masters of Science
in
Nutrition and Dietetics

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Abstract

Background: Research on the prevalence of nutrition risk in community living adults in New Zealand is limited. With the rise in the proportion of older adults in New Zealand, the assessment of nutrition status of older adults will help to determine those at nutrition risk

Aim: The aim of this study was to determine the prevalence of nutrition risk amongst independent living older adults residing in the Waitemata district health board (DHB) region of New Zealand. The objectives of this study were to determine nutrition risk using the Mini Nutritional Assessment – Short Form (MNA-SF) Tool and to identify any demographic, social or health factors associated with nutrition risk among older community living adults.

Methods: A cross-sectional study of 57 older adults was undertaken. Nutrition risk was assessed using a validated questionnaire, the MNA-SF. Dysphagia risk was determined using the Eating Assessment Tool (EAT-10) and cognitive function was assessed using the Montreal Cognitive Assessment (MoCA). Information on demographic and social information, health status and use of support services was also collected in one-off interviews.

Results: Ninety three percent (n=53) of participants had normal nutrition status (MNA-SF score ≥ 12). Seven percent of participants (n=4) were found to be at-risk of malnutrition (MNA-SF score ≤ 11 ; out of maximum score 14). The majority of participants with normal nutrition status were New Zealand European (58%), living with others (77%), were married (60%), were taking less than five medications (74%), had lower numbers of co-morbidities (70%) and were dentate (42%). Compared to those who were at risk, all participants were women (n=4), three were Maori and Pacific ethnicity, three took ≥ 5 medications and three required support services or daily help. No participants were found to be at-risk of dysphagia in the study.

Conclusion: This study found a low prevalence of nutrition risk in a sample of healthy community-dwelling older adults. Our results contribute to the body of evidence that nutrition screening is important to identify those at nutrition risk. Early identification of nutrition risk can help to prevent nutritional problems in older adults and to help adults to remain active and healthy within the community.

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Table of Contents

Abstract	ii
Acknowledgements	iii
Table of Contents.....	iv
List of Tables.....	viii
List of Figures	ix
Abbreviations	x
Chapter 1. Introduction.....	1
1.1 Background	1
1.2 Statement of the problem	3
1.3 Aim.....	3
1.4 Thesis Structure.....	3
Chapter 2. Literature Review	5
2.1 Ageing in New Zealand	5
2.1.1 The ageing population	5
2.1.2 Health care implications of the ageing population	6
2.1.3 Ageing in place strategy	7
2.2 Health status and successful ageing in older adults.....	9
2.2.1 Cancer.....	11
2.2.2 Cardiovascular disease	11
2.2.3 Neurological disorders	12
2.2.4 Musculoskeletal disorders.....	12
2.2.5 Respiratory disorders.....	12
2.2.6 Diabetes	13
2.2.7 Disability	13
2.2.8 Summary	14
2.3 Nutrient requirements for older people	15
2.3.1 The importance of nutrition in older adults	15
2.3.2 Macronutrients.....	15
2.3.3 Micronutrients	17

2.4 Malnutrition.....	20
2.4.1 Definition of Malnutrition.....	20
2.4.2 Over-nutrition in older adults	20
2.4.3 Malnutrition (Under-nutrition) in older adults.....	21
2.4.4 Nutrition risk in older adults	21
2.4.5 Factors affecting nutrition risk	22
2.4.6 Dysphagia.....	33
2.4.7 Cognition	35
2.4.8 Assessment of nutrition risk	38
Chapter 3. Methods	46
3.1 Study design.....	46
3.2 Participants.....	46
3.2.1 Inclusion Criteria:	46
3.2.2 Exclusion Criteria:	47
3.3 Participant Recruitment	47
3.4 Ethical Approval	47
3.5 Data Collection	48
3.6 Questionnaire	49
3.6.1 Participant Characteristics	49
3.6.2 Health Characteristics	50
3.6.3 Physical Characteristics	50
3.6.4 Nutrition Assessment	52
3.6.5 Dysphagia Assessment.....	54
3.6.6 Cognitive Assessment	54
3.7 Data Interpretation	55
3.7.1 Anthropometric characteristics	55
3.7.2 Health conditions	55
3.7.3 Polypharmacy	56
3.7.4 Nutrition risk status groups.....	56
3.8 Statistical analysis	56
 Chapter 4. Results.....	 58
4.1 Participant Characteristics	58

4.3 Health factors	60
4.3.1 Key Co-morbidities	60
4.3.2 Prescription medications.....	60
4.3.3 Over-the-counter medications.....	61
4.3.4 Nutritional supplements	61
4.3.5 Dental status.....	62
4.3.6 Support services.....	62
4.4 Nutrition status.....	63
4.4.1 Mini Nutrition Assessment – Short Form scores	63
4.4.2 Mini nutritional Assessment item scores	63
4.5 Dysphagia risk	64
4.5.1 EAT-10: Swallowing screening scores	64
4.6 Cognition	65
4.6.1 Montreal Cognitive Assessment Score	65
4.7 Differences between nutrition status and risk factors	65
4.7.1 Marital status	65
4.7.2 Living situation.....	67
4.7.3 Income.....	67
4.7.4 Education	67
4.7.5 BMI.....	67
4.7.6 Key Co-morbidities	68
4.8.7 Medications	68
4.8.8 Nutritional Supplements.....	68
4.8.9 Dental Status.....	68
4.8.10 Support Services	68
4.8.11 EAT-10 scores.....	68
4.8.12 MoCA scores	68
Chapter 5. Discussion	69
5.1 Study outcome: Prevalence of nutrition risk	69
5.2 Characteristics of participants with normal nutrition status	71
5.3 Characteristics of participants at nutrition risk	74
5.4 Strengths	77
5.5 Limitations	78

Chapter 6. Recommendations and conclusions	80
6.1 Recommendations	80
6.2 Conclusions.....	81
6.2.1 Summary of the study	81
6.2.3 Conclusions	81
 References.....	 82
 Appendix 1. Letter of invitation to the study.....	 96
Appendix 2. Waitemata District Health Board Ethics Committee Review	98
Appendix 3. Health and Disability Ethics Committee Review	101
Appendix 4. Maori Research Committee Review	102
Appendix 5. Participant consent form.....	104
Appendix 6. Participant information sheet	108
Appendix 7. Screening questionnaire.....	112
Appendix 8. Letter to General Practitioner	120
Appendix 9. Montreal Cognitive Assessment	121

List of Tables

Table 1: <i>Marital status and living arrangements of older adults in NZ.....</i>	25
Table 2: <i>Nutrition screening and assessment tools for older adults in the community</i>	39
Table 3: <i>Prevalence of nutrition risk in studies undertaken overseas in community living older adults</i>	44
Table 4: <i>Prevalence of nutrition risk in studies undertaken in New Zealand community-living older adults</i>	45
Table 5: <i>Participant characteristics.....</i>	58
Table 6: <i>Anthropometric characteristics of participants¹</i>	59
Table 7: <i>Number of key co-morbidities.....</i>	61
Table 8: <i>Number of prescribed medications.....</i>	61
Table 9: <i>Number of nutritional supplements.....</i>	62
Table 10: <i>Dental status</i>	62
Table 11: <i>Description of support services received by the participants.....</i>	62
Table 12: <i>Nutrition status of participants</i>	63
Table 13: <i>MNA item questionnaire scores.....</i>	64
Table 14: <i>Participants at risk of dysphagia from EAT-10 scores.....</i>	65
Table 15: <i>Participant MoCA scores.....</i>	65
Table 16: <i>Demographic, social and health characteristics by nutrition risk status (MNA score ≤ 11 and >12.....</i>	66

List of Figures

Chapter 2	5
Figure 1: New Zealand population age projection.....	5
Figure 2: Projected growth in the older population groups.....	6
Figure 3: Visited a GP in the past 12 months, by age group and sex.....	7
Figure 4: Causes of health loss in older adults	10

Abbreviations

AD	Alzheimer disease
ADL	Activity of daily living
BMI	Body mass index
CC	Calf Circumference
COPD	Chronic obstructive pulmonary disorder
CVD	Cardiovascular disease
DHB	District health board
EAT-10	Eating Assessment Tool
GP	General Practitioner
HDEC	Health and Disability Ethics Committees
HEI	Healthy Eating Index
IHD	Ischemic heart disease
LiLACS	Life and Living in Advanced Age study
MCI	Mild cognitive impairment
MDADI	M.D. Anderson Dysphagia Inventory
MMSE	Mini-Mental State Examination
MNA	Mini Nutritional Assessment
MNA-SF	Mini Nutritional Assessment-Short form
MoCA	Montreal Cognitive Assessment
MOW	Meals on wheels
NHI	National Health Index
PHO	Primary Health Organisation
SCREEN II	Seniors in the Community: Risk Evaluation for Eating and Nutrition, version II
WHO	World Health Organisation

Chapter 1. Introduction

1.1 Background

As with other countries worldwide, life expectancy and the proportion of older adults is steadily increasing in New Zealand (Statistics New Zealand, 2007; World Health Organization, 2002). Older adults currently make up 14% of New Zealand's total population and is expected to double by 2040 (Statistics New Zealand, 2013a). In the 2006 Census, people aged 65 years and over in Auckland made up 10% of the total population (Auckland Regional Public Health Service, 2008). This number is projected to grow to 15% by 2026 (Auckland Regional Public Health Service, 2008). Auckland is made up of three DHB regions: Waitemata, Auckland and Counties Manukau. The Waitemata DHB has a higher proportion of adults over 65 years (11%) compared to Auckland (9.6%) and Counties Manukau (8.8%) (Auckland Regional Public Health Service, 2008). Waitemata DHB also has the fastest growth in the older adult population compared to other DHB's, with projections showing numbers are likely to increase to 17.3% by 2026 (Auckland Regional Public Health Service, 2008).

Over time the health and wellbeing of our older generation has improved due to a decline in mortality rates and longer life expectancies (Ministry of Health, 2013b). However, it is expected that those who live longer will do so more in poorer health as high rates of chronic conditions will become the drivers of health expenditure (Ministry of Health, 2013a). In the 2011/12 Health Survey, 82% of adults aged 75 years and over reported having excellent, very good or good health, with the remaining 18% rating their health to be fair or poor (Ministry of Health, 2012b). The Ministry of Health recently published the New Zealand Burden of Diseases, Injuries and Risk Factors Study and found one-third of total health loss in New Zealand was attributed to older adults, despite them only making up 12% of New Zealand's total population (Ministry of Health, 2013d).

Currently a large number of older adults live in the community in their own homes (Ministry of Social Policy, 2001). Although a number of these older adults will remain fit and healthy and continue living independently, a small minority may end up with higher levels of disability and increased need of care. This increase in disability occurs as a result of chronic illness and changes in health status which impact on daily functioning (Ministry of Health, 2006c). As the level of disability increases with age, the proportion of older adults living in the community that end up residing in residential care or

hospital will increase (Ministry of Social Development, 2007). Due to the projected rise in the number of older adults and the increasing level of disability and illness, the demand for health care services is set to increase in the coming years to cope with the demand.

There is opportunity to help improve the health status of older people and support those to age successfully. The Health of Older People Strategy was developed in 2001 to encourage and support older adults in the community to remain living independently in their own homes, which is known as 'active ageing' (Ministry of Health, 2001). Active ageing is described by the World Health Organization (WHO) as the continuing participation in all aspects of society, not just being physically active but also remaining active contributors to their families, peers, communities and society (World Health Organization, 2002). The Health of Older People Strategy aims to extend life expectancy for older adults, but also to improve quality of life including those who may be frail and in need of care (Ministry of Health, 2001). Active ageing may help lower the cost and demands on future healthcare, therefore, identifying factors that can help to improve the health of older adults, more may be able to stay healthy and active in the community.

Nutrition is one of the major determinants for successful ageing (Ministry of Health, 2013c). It is not only critical for older adult's physiological wellbeing but also to one's social, cultural and psychological wellbeing (American Dietetic Association, 2005). Nutrition can help to lower risk of disease, disease related disability and aid in mental and physical function (American Dietetic Association, 2005). Impaired nutrition can lead to nutrition risk, a state which precedes malnutrition. Research in older adults has shown that those who are at nutrition risk also have poorer quality of life (Keller, Ostbye, & Goy, 2004; Kvamme, Olsen, Florholmen, & Jacobsen, 2011). There are many factors that can influence nutrition risk. These include changes in body composition causing loss of muscle mass (Janssen, Heymsfield, & Ross, 2002), social factors such as living alone, low income, poor education and requiring support services (Bowman, 2007; Callen & Wells, 2003; Tomstad, Soderhamn, Espnes, & Soderhamn, 2012; Wham, Teh, Robinson, & Kerse, 2011). Polypharmacy, poor dental status and dysphagia have also been linked to adults with higher nutrition risk (Keller et al., 2004; Mann, Heuberger, & Wong, 2013; Saarela et al., 2014). Little research has been undertaken to investigate nutrition risk status in older adults living in New Zealand. Research could help to identify those who are most at risk and areas where changes could be made in order to improve the health status of our older population.

A nutrition screening tool is a valid method to identify those at risk of malnutrition as well as nutrition risk factors of concern in older adults. Screening tools can help to determine the course of action or the type of intervention that may be required. At present, screening studies in New Zealand older adults are limited. In New Zealand, research in community living older adults has found the prevalence of those at any nutrition risk ranges from 23% - 52% and those at high nutrition risk is 32% - 32.8% (McElroy et al., 2012; Watson, Zhongxian, & Wilkinson, 2010; Wham, Carr, & Heller, 2011; Wham, Teh, et al., 2011). These studies highlight that older adults living in the community have a moderately high prevalence of nutrition risk. Early identification of nutrition risk could help to prevent further decline and improve health status.

1.2 Statement of the problem

Nutrition is an essential part to healthy ageing but can be affected by factors such as living situation, income, support services and use of medications. When these factors are compromised in older adults it can lead to nutrition risk, further health problems, loss of independence and poor quality of life. With the rise in the proportion of older adults in New Zealand, the assessment of nutrition status will help to determine those at nutrition risk. This research will also help to inform strategies for the prevention of malnutrition. The purpose of this study is to provide a “snapshot” of the current nutrition status of older adults living in the community in the Waitemata and North Shore region.

1.3 Aim

The aim of this study is to determine the prevalence of nutrition risk amongst independent living older adults residing in the Waitemata DHB region of New Zealand (North Shore and West Auckland).

1.3.1 Objectives:

1. To determine nutrition risk using the Mini Nutritional Assessment – Short Form Tool among older community living adults
2. To identify any demographic, social and health factors associated with nutrition risk among older community living adults

1.4 Thesis Structure

This study is structured into six chapters. The first chapter explores the study and highlights the importance of conducting this research. The literature is then reviewed in Chapter 2 and covers the ageing population in New Zealand, the impact of the growth in the ageing population and the current health status of older adults. The role of nutrition and health in older adults and factors affecting

nutrition risk status will also be reviewed. The last section of the literature review addresses screening for nutrition risk. Chapter 3 details and justifies the methods used to investigate the nutrition risk status of older adults and Chapter 4 reports the results of this study. The findings from this study are discussed in Chapter 5. Finally, Chapter 6 summarises this study outcomes, reflecting on its strengths and limitations and makes conclusions and recommendations for future research.

Chapter 2. Literature Review

2.1 Ageing in New Zealand

2.1.1 The ageing population

New Zealand has an ageing population. As the baby boomer generation begins to get older the number of people over the age of 65 is steadily rising (Bascand, 2012). Since the early 1980's, the population of adults aged 65 and over has doubled, now making up 14% of the total population, equating to one in eight of all New Zealanders (Figure 1) (Statistics New Zealand, 2013b). According to population estimates this number is expected to double again by 2040 (Statistics New Zealand, 2013b). The number of people aged 65 years is estimated to grow from 1.18 million in 2012 to 1.25 million by 2036 (Figure 2) (Bascand, 2012). Additionally, the average age of our older population is getting older. Current figures show 1 in 8 people are over 85 years, however future predictions show 1 in 4 people aged 65 years and over will be older than 85 years by the year 2061 (Bascand, 2012).

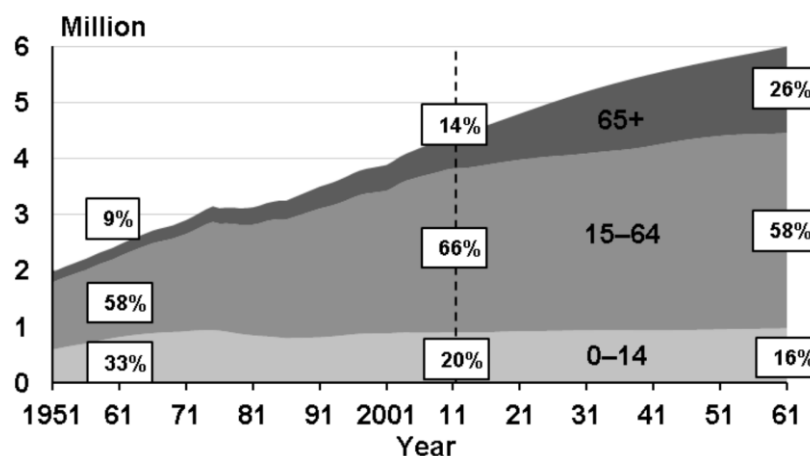


Figure 1: New Zealand population age projection (Bascand, 2012)

People are not only getting older but statistics show the older generation is living longer than ever before. Recent findings suggest this shift is due to improvements in life expectancy as a result of decreased mortality rates within the older population group (Ministry of Health, 2013b). The projected rise in older adults is going to have a considerable impact on our society (Ministry of Health, 2006c). In the coming decades the older population group will make up a large percentage of our country and with it a

diversity of people impacting on different areas of our society, particularly health care and social welfare.

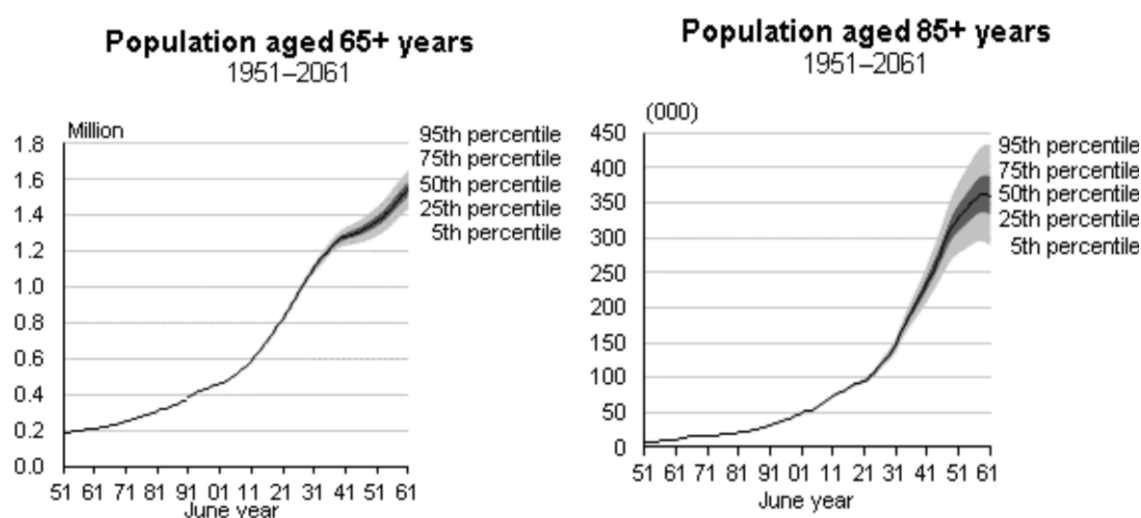


Figure 2: Projected growth in the older population groups (Bascand, 2012)

2.1.2 Health care implications of the ageing population

Older adults are major consumers of our health care system. As the ageing population grows demand for health and disability services within New Zealand is rising. For older adults the primary health sector is likely to be the first point of contact where general practitioners (GP) and practice nurses are usually the first people they encounter (Ministry of Health, 2008). In the Older People's Health Chart Book 2006, adults over the age of 65 years were significantly more likely to have seen their GP compared with younger age groups (Ministry of Health, 2006c). The most recent Health Survey supports this finding, reporting over 90% of adults aged 65 and over had visited their GP in the previous year with rates increasing with age and peaking in the 75 years and older age group (Figure 3) (Ministry of Health, 2012b).

The cost to support and treat older adults is also increasing. A report by Te Pou (2011) highlighted that more than 80% of medical costs are being incurred after people reach 65 years of age (Te Pou, 2011). Higher rates of hospital admissions and increased complexity of treatment and conditions influence the cost of health services for this age group (Ministry of Health, 2002). In New Zealand the average cost of medical treatment for someone who is over the age of 65 is approximately \$1388, compared to \$248 for someone who is under 65 years of age per year. Consequently, the total cost to care for our older generation is likely to rise. Furthermore, in a report by Health

Workforce New Zealand the authors reported that the needs of older people are projected to increase by 100% over the next 25 years (Health Workforce New Zealand, 2011). However, the projected increase in money and labour force to support this will not be enough (Health Workforce New Zealand, 2011). In order to lower the impact of the growing needs of our ageing population, it is important that those individuals already living independently, particularly those in the community are supported to stay healthy and remain living positively.

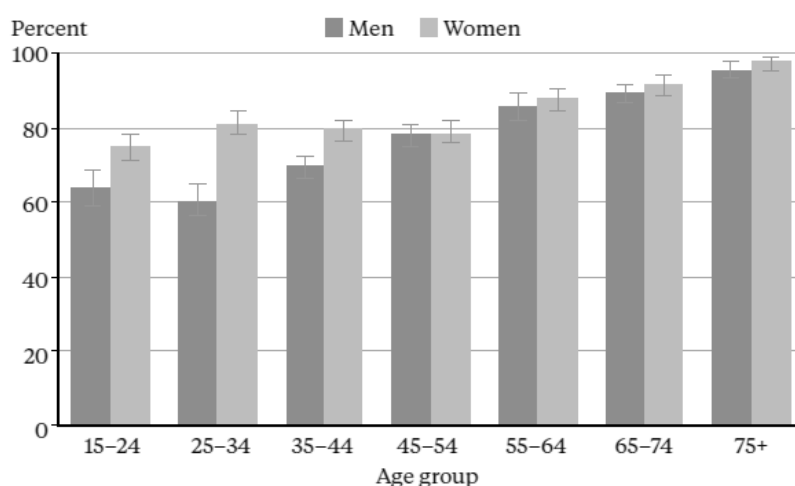


Figure 3 Visited a GP in the past 12 months, by age group and sex

2.1.3 Ageing in place strategy

To help support older people, the New Zealand Health of the Older People Strategy was developed in 2001. This was set out by the Minister of Health to provide future direction for health and support services for older people and for those in future generations. This strategy aims to facilitate the wellbeing of older people through having control over their lives and the ability to participate in and contribute to family, whanau and community life (Ministry of Health, 2001). The strategy helps to encourage an increased focus on the individual as the centre of care across a variety of settings, including hospitals, primary health care services, community health services and disability support services (Ministry of Health, 2006a). It also provides a framework for planning, functioning and providing services for older people's varied and changing needs. This strategy highlights the importance of helping to maintain health in older people in order to improve quality of life and independence within our communities.

This vision to 'positively age' requires a number of factors including: good health, financial security, independence, self-fulfilment, community attitudes, personal safety and the physical environment (Ministry of Social Development, 2001). It is not only about the older individual but also how the younger generation and people around them regard and view older people in a positive and encouraging manner (Ministry of Social Development, 2001). Creating a positive environment can help to increase the likelihood of good health and longer lives as people move into older age.

The majority of older adults live independently in the community throughout New Zealand (Ministry of Social Development, 2007). However, due to age related disability, the number of older adults in hospitals and residential care facilities increases with age (Ministry of Social Development, 2007). Ageing positively benefits both the individual and also society. If health is improved then this increases independence, more older people are then able to contribute to society and overall fewer health care resources will be used (American Dietetic Association, 2005; World Health Organization, 2002). In line with the 'Health of the older people strategy' the major challenge is to keep older adults healthy and remain living independently with a good quality of life. This is also going to help lower costs and demands for health care which is one of the biggest concerns of our ageing population.

2.2 Health status and successful ageing in older adults

Over time the health and wellbeing of our older generation has improved due to a decline in mortality rates and longer life expectancies (Ministry of Health, 2013b). In the 2011/12 Health Survey 82% of adults aged 75 years and over reported having excellent, very good or good health, although 18% of older adults rated their health to be fair or poor (Ministry of Health, 2012b). In addition, according to the most recent annual health report, those who live longer may live in poorer health due to chronic health conditions (Ministry of Health, 2013a). There is opportunity to help improve the health status of older people and support those in the community to age successfully. This will help lead to healthier lives, which is in line with the goals set out by the positive ageing strategy.

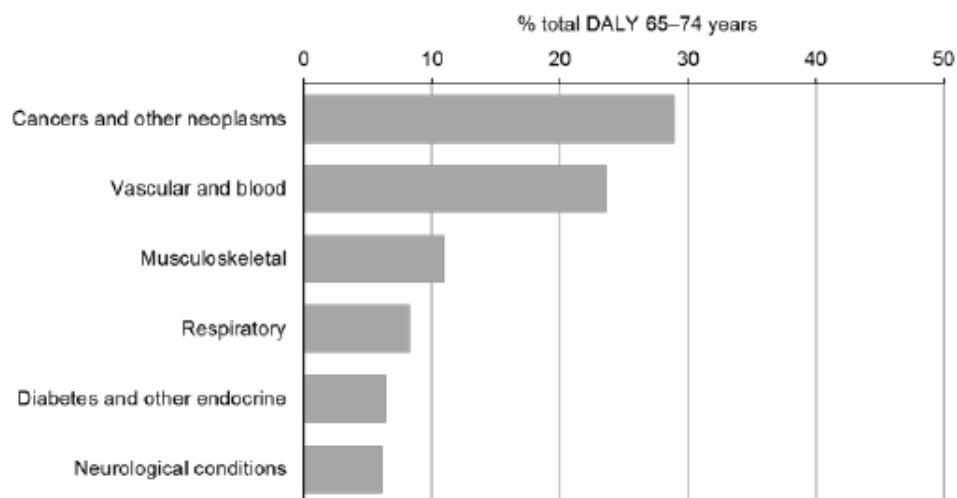
Ageing is associated with many physiological, cognitive, social and lifestyle changes all of which can impact on health status (Ministry of Health, 2013c). Older adults who maintain good health are likely to age successfully as this can help to prevent the onset of chronic and non-communicable diseases (American Dietetic Association, 2005; Koopman & Van Loon, 2009). It is also important for ageing adults to take care of themselves and to have the support to stay healthy. A study by Callen and Wells (2003) reported those people who were well supported by friends, family and the wider community had better self-rated health than those who did not.

The Ministry of Health recently published a report from the New Zealand Burden of Diseases, Injuries and Risk Factors Study highlighting the leading causes of health loss in older adults (Ministry of Health, 2013d). Health loss or burden of disease assesses how much healthy life is lost due to early death, illness or disabilities, such as chronic conditions (Ministry of Health, 2013d). Older adults only make up 12% of New Zealand's total population, however, one-third of total health-loss was contributed by the older population group. The leading causes for health loss in older adults were cardiovascular disorders, cancer, neurological disorders (including dementia), musculoskeletal disorders, respiratory disorders and diabetes (Figure 4) (Ministry of Health, 2013d).

Multiple chronic conditions can lead to poor health status in older adults. As people age, chronic conditions become more prevalent leading to higher hospitalisation rates compared to their younger counterparts (Ministry of Health, 2006c). Co-morbidity can be defined as having multiple chronic conditions (Ministry of Health, 2006c). Chronic

conditions include those such as heart disease, stroke, diabetes, chronic obstructive pulmonary disease (COPD), arthritis, spinal disorders, osteoporosis, cancer. In the 2002/03 New Zealand Health Survey, reported in the Older People's Health Chart Book (2006) found that in those aged 65 years and older, 64% of females and 70% of males had 1-3 chronic conditions (Ministry of Health, 2006c). Therefore it is important to understand the burden these conditions have on older adults as a large proportion live with these chronic conditions which could impact on their nutrition status.

65–74 years



75+ years

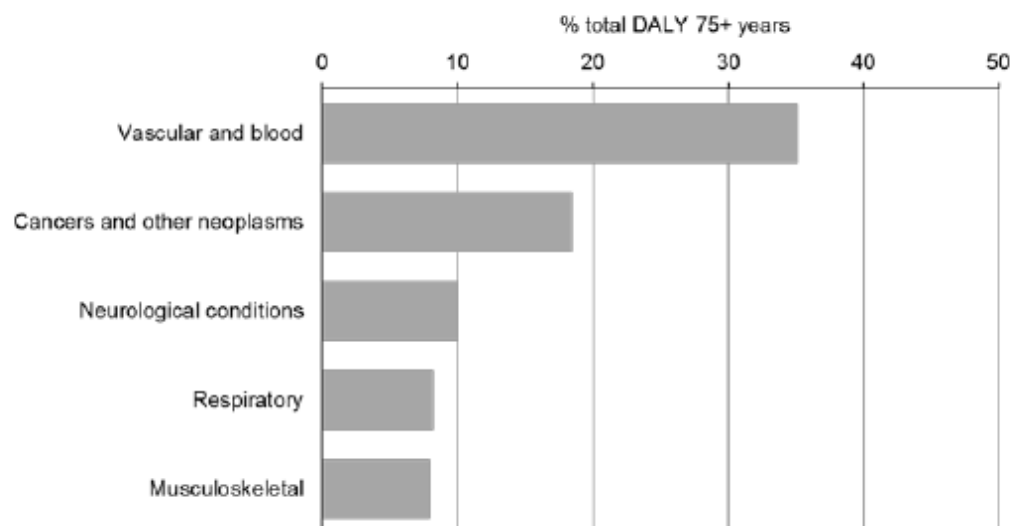


Figure 4 Causes of health loss in older adults (Ministry of Health, 2013d)

2.2.1 Cancer

Cancer is the leading cause of health loss in adults aged between 65-74 years and the second leading cause in adults 75 years and over (Ministry of Health, 2013d). Due to our older population growing in numbers, mortality rates due to cancer are likely to be high as cancer is often a disease of ageing (Ministry of Health, 2013c). Sadly, 72% of deaths in older adults are caused by cancer (Ministry of Health, 2013a). In females aged 85 years and over cancer mortality is seven times higher than those in younger age groups (Ministry of Health, 2006c). In males over 85 years, mortality rates are 12 times higher than those aged 50-64 years (Ministry of Health, 2006c). Lifestyle factors including a balanced diet, low alcohol use, maintaining a healthy weight and regular physical activity may help reduce the chances of developing cancer (Ministry of Health, 2013c).

2.2.2 Cardiovascular disease

Cardiovascular disease (CVD) is the second leading cause of health loss in older adults in New Zealand (Ministry of Health, 2013d). Vascular disorders make up 24% of health loss in adults aged between 65-74 years and 35% in adults aged 75 years and over (Ministry of Health, 2013d). Cardiovascular disease includes a number of diseases affecting heart and blood vessel function and contributes significantly to health loss in older adults (Ministry of Health, 2013b). The two most common types being ischemic heart disease (IHD) and stroke (Ministry of Health, 2012a, 2013a).

Ischaemic heart disease, one of the most common forms of heart disease can lead to heart attacks, angina and can cause heart failure (Ministry of Health, 2012a). The highest prevalence of IHD occurs in adults aged 65 years and older. The 2011/12 Health Survey found 30% of adults 75 years and over had been diagnosed with IHD (Ministry of Health, 2012b). Stroke is also very common among the older population with a “spike” in the occurrence after the age of 65 years (Ministry of Health, 2012a). The 2011/12 Health Survey found 8% of people aged 75 years and over reported having had a stroke.

Ischaemic heart disease and stroke are very serious health conditions. However a range of lifestyle factors can contribute to these disorders including: high blood pressure, high cholesterol, smoking, obesity, physical inactivity, unhealthy diets and excessive alcohol consumption (Ministry of Health, 2012a). In the most recent New Zealand health survey of adults, 50% of the older age group (≥ 65 years) were taking

medication for high blood pressure (Ministry of Health, 2012a). In addition, nearly one in three people over 65 years were taking medication for high cholesterol.

Fortunately, risk factors for CVD are modifiable and can be improved to reduce the likelihood of early death and illness. It is important that early intervention and management is carried out to help tackle this growing health problem but also to promote a healthy lifestyle in older adults.

2.2.3 Neurological disorders

Neurological disorders are the third leading cause of health loss in older adults in New Zealand and affect the brain and nervous system function (Ministry of Health, 2013b). It incorporates disorders such as dementia, epilepsy, Parkinson's disease, multiple sclerosis, motor neuron disease, muscular dystrophy, migraine, intellectual impairment and insomnia (Ministry of Health, 2013a). The main neurological cause of health loss is dementia. Dementia is more common in adults over 65 years old and includes Alzheimer's diseases and vascular dementia (Ministry of Health, 2013a). Given that our older population is increasing it is likely that the rates of dementia will increase putting older people at risk of health loss due to this.

2.2.4 Musculoskeletal disorders

Musculoskeletal disorders are the fourth leading cause of health loss in New Zealand older adults (Ministry of Health, 2013d). Arthritis, the inflammation of joints causing pain, heat, redness and swelling is the most common form of musculoskeletal disorder in older adults (Ministry of Health, 2012b). The most common types of arthritis are: osteoarthritis, rheumatoid arthritis and gout (Ministry of Health, 2013b). The 2011/12 Adult Health Survey found that half of all women over 65 years had been diagnosed with arthritis and one third of men (Ministry of Health, 2012a). Arthritis is a chronic condition and can cause deformity and increase disability (Ministry of Health, 2012b). Unfortunately Arthritis can be quite painful and burdensome. Due to the commonality of Arthritis many people in the community are likely to be affected by it which could impact on their health status.

2.2.5 Respiratory disorders

In older adults, the two most common respiratory disorders are asthma and COPD (Ministry of Health, 2013b). Respiratory conditions can contribute to a decline in health loss in older adults (Ministry of Health, 2013a). In adults aged 65-74 years, COPD contributed to 6.3% of health loss and in adults 75 years and over COPD contributed 6.7% to health loss. Chronic obstructive pulmonary disease is a lung disorder affecting

the ability to breath (Ministry of Health, 2013a) affecting 10% of older adults aged over 75 years (Ministry of Health, 2008). Asthma causes people to have oversensitive airways reacting to triggers that do not affect other people, and is commonly treated with medication (Ministry of Health, 2012a). The proportion of adults taking medication is similar across age groups, however significantly more females have medicated asthma (Ministry of Health, 2012a). Both respiratory diseases can affect an individual's ability to breathe normally, which can result in shortness of breath (Ministry of Health, 2012a). This in turn could make it difficult for carrying out activities of daily living (ADL's) impacting on health status.

2.2.6 Diabetes

Diabetes is the fifth most common cause of health loss in adults aged 65-74 years (Ministry of Health, 2013d). It is a disease where the body cannot control its blood sugar (glucose) levels properly; the body either does not make enough insulin to clear the glucose (due to the body's cells becoming resistant to the insulin) or the body cannot make any insulin at all (Ministry of Health, 2012a). Diabetes is a chronic condition and if not controlled can lead to heart disease, stroke, blindness, kidney disease, nerve damage and/or limb amputation (Ministry of Health, 2012a). There are two main types of diabetes: Type-one and Type-two diabetes. Treatment of Type-one diabetes requires insulin to be injected as the body no longer produces it. Type one diabetes is less common than type-two and develops mainly in childhood (Ministry of Health, 2012a).

Type-two diabetes usually develops as a result of being overweight or obese as the body's cells become resistant to insulin. The prevalence of Type 2 diabetes has increased in older adults over time. In the 2011/12 Health Survey the number of those diagnosed with Type 2 diabetes peaked in adults aged 65-74 years old, occurring in approximately 16% of men and 12% in women (Ministry of Health, 2012b). Fortunately type two diabetes can be controlled through weight loss, physical activity and if necessary, medication and insulin (Ministry of Health, 2013c). In order to prevent long term complications in those with diabetes it is important to manage it well, but establishing good lifestyle behaviours may help to reduce the chances of developing complications of this disorder in the future.

2.2.7 Disability

One of the overriding factors affecting health status is the level of disability that an individual may have. Research has shown that the prevalence of disability increases

with age (Ministry of Social Development, 2007). Disability refers to “an impairment or limitation that could be physical, sensory, neurological, psychiatric or intellectual” (Ministry of Health, 2013b, p. 155). As a consequence of increasing disability with age, the number of older people residing in hospital and residential care facilities increases (Ministry of Social Development, 2007). In the most recent Disability Survey 59% of older adults reported having a disability (Statistics New Zealand, 2014). Physical impairment was the most common type of disability and was prevalent in 49% of adults over 65 years with hearing coming in second. According to the 2006 disability survey, 82% of people who had a disability were living in households in the community (Statistics New Zealand, 2006a). Individuals living in the community may be more at risk of poor health status if they have a disability that may limit their ability to take care of themselves. Having a disability, particularly a physical disability might mean people may require the need for more assistance and support. Evidence has shown that those who receive help can experience greater wellbeing (Ministry of Health, 2013a). If older adults can get adequate home support and help with personal care it may not only help improve their health status but also help them to stay living within the community.

2.2.8 Summary

Older adults in the community are likely to have multiple health conditions which may impact on their health and also the ability to function independently. Many of these conditions are life long and can cause further complications if not managed well. Lifestyle factors such as regular exercise, low alcohol intake, maintaining a healthy weight and most importantly eating a balanced diet can help to manage many of these chronic conditions and potentially reduce the chances of developing them.

2.3 Nutrient requirements for older people

2.3.1 The importance of nutrition in older adults

Good health and also nutritional wellbeing is important in older adults in order to remain independent and active. Having good nutrition is one of the major determinants for successful ageing and can help lower risk of diseases, disease related disability and aid in mental and physical function (American Dietetic Association, 2005). Nutrition is not only critical for older adult's physiological wellbeing but also to one's social, cultural and psychological wellbeing (American Dietetic Association, 2005). Good nutrition can also help to prevent disease and assist recovery if ill. It is essential that older adults are meeting their dietary recommendations for the benefit of their health and help to support them as they get older.

2.3.2 Macronutrients

As adults age it is important that the foods they eat are providing them with the right nutrients. The following section discusses important nutrients in order to promote good health for older adults.

2.3.2.1 Energy

Older adults generally have lower energy requirements than the average adult. The amount of energy that one individual needs is determined by gender, body size and physical activity, therefore, each individual's energy requirements will be different (Ministry of Health, 2013c). Older adults need energy to maintain metabolic processes, physiological functions, muscular activity, heat production, growth and synthesis of new tissues (Ministry of Health, 2013c). However as people age, body composition changes; older people are more likely to have increased fat mass due to a decline in muscle mass (Stanner, Thompson, & Buttriss, 2009). This is due to a reduction in basal metabolic rate affected by a reduction in muscle mass (Ministry of Health, 2013c; Roberts & Dallal, 2005).

A sufficient energy intake is important to ensure an adequate intake of a variety of foods and nutrients. Energy comes from all foods which are broken up into macronutrient groups: carbohydrates, protein and fat. Older adults tend to have lower energy intakes, sometimes making it difficult to meet all their nutrient requirements. This can be compensated by eating nutrient dense foods but this does not always happen (Stanner et al., 2009). Consuming a variety of foods from each of the foods groups helps to meet nutrient requirements (Ministry of Health, 2013c). Older adults

who have inadequate energy intakes may be at risk of becoming underweight which can affect health status and functionality (Ministry of Health, 2013c). It is important for older adults to ensure they meet their energy needs by consuming a variety of foods which are also nutrient dense in order to maintain functioning in a positive manor.

2.3.2.2 Carbohydrate

Carbohydrates are the main energy providing food group and when broken down provides fuel for the brain in order to function (Ministry of Health, 2006b, 2013c). It is important for older adults to get enough energy dense foods to provide them with the energy and fuel they need to function on a daily basis.

There is currently only a recommended acceptable range (45-65% of total daily energy intake) for carbohydrate intake in New Zealand adults (Ministry of Health, 2006b). However, this does not reduce the value of carbohydrate as a key component in the diet (Ministry of Health, 2006b). Carbohydrate foods provide an important source of energy, sugars and fibre. Good sources of carbohydrates include bread, fruit, potatoes, taro and kumara. However, other good sources include: cereal grains, legume and seeds (Ministry of Health, 2013c). As long as older adults are eating a variety of carbohydrates and choosing good sources it should be providing adequate energy.

2.3.2.3 Protein

Researchers have suggested a need for higher intakes of protein in older adults (Campbell, Trappe, Wolfe, & Evans, 2001). Protein is an essential part of our bodies and is used for a number of functions including: building and repair of tissues, hormone, enzyme and antibody synthesis and many more (Ministry of Health, 2013c). Protein also helps maintain muscle mass (fat free mass) and as adults get older muscle mass can decline (Campbell et al., 2001; Koopman & Van Loon, 2009). Muscle mass is particularly important for older adults as it helps to support strength, functioning and maintaining a healthy weight (Ministry of Health, 2006b). Therefore the need for protein increases with age.

For those living in the community, being able to function independently is important to ageing well. Inadequate protein intakes can lead to skin fragility, reduced immune function, poor wound healing and longer recovery times (Ministry of Health, 2013c). The current recommendation in New Zealand for protein intake for older adults is 25% more than younger adults. This is to meet the increased need for protein that people have as they get older. Good sources of protein include: eggs, milk products, legumes,

cereals and cereal-based foods, nuts and meat alternatives (Ministry of Health, 2013c). By eating a variety of high protein containing foods every day older adults will be able to meet the recommended intake and prevent side effects of low protein intakes.

2.3.2.4 Fat

There is no set recommendation for dietary fat intake in older adults as the focus is on the types of fats in the diet. Fats are the highest energy containing sources of food for the body and should make up approximately 20-35% of total daily energy intake (Ministry of Health, 2006b). This is enough to help sustain body weight and also to reduce the risk of obesity and cardiovascular disease which is important as people get older (Ministry of Health, 2006b). The three main dietary fats include: saturated fatty acids, monounsaturated and polyunsaturated fats. Saturated fats are found mainly in animal-based foods and polyunsaturated and monounsaturated fats are found mainly in plant-based foods (Ministry of Health, 2006b). *Trans*-fats are another form of saturated fats and are produced in food processing but can be found naturally in ruminant animal foods (Ministry of Health, 2006b).

Dietary fats, mainly saturated and *trans*-fats can increase the risk of cardiovascular disease and some chronic conditions (Ministry of Health, 2006b), which is why it is important for older adults to consider the types of fats that they consume in their diets. Having a diet which includes foods such as nuts, seeds, legumes, oily fish, oils and margarines higher in unsaturated fats will help lower saturated fats (Ministry of Health, 2013c). Older adults will benefit from eating fewer foods high in saturated and *trans*-fats ensuring adequate intakes of unsaturated fats to lower risk of CVD.

2.3.3 Micronutrients

There are many different nutrients that are important for the health of older adults. However, calcium and vitamin D are two key nutrients that have higher requirements for older adults. This is to maintain bone health as there is an increased risk of osteoporosis and also reduced production of vitamin D with ageing Ministry of Health (2006b); (World Health Organization, 2014).

2.3.3.1 Calcium

Calcium is an important nutrient for older adults as it is needed for the development and maintenance of the skeleton (Ministry of Health, 2006b). Calcium also plays a role in neuromuscular and cardiac function and is stored in our bones and teeth to help strength and structure (Ministry of Health, 2006b). Older adults who have low intakes

of calcium are at risk of developing low bone mineral density causing osteoporosis and increasing the risk of bone fractures (Ministry of Health, 2006b). This is particularly common in older women as rates of osteoporosis increase post menopause, which is one of the major causes of morbidity in New Zealand (Ministry of Health, 2006b). As a result of this women have increased calcium requirements as they reach menopause. It is necessary for older adults, particularly women to have an adequate diet including rich calcium sources to prevent poor bone health. Good sources of calcium include milk, bread, cheese, dairy products and vegetables. Other good sources include: canned fish with bones, legumes, nuts, leafy vegetables, dried fruit and tofu. Eating a variety of these foods should be sufficient to meet the recommended intake.

2.3.3.2 Vitamin D

Vitamin D is another important nutrient for older adults. The primary role of vitamin D is to maintain serum calcium concentrations which helps to optimise bone health and muscle function (Ministry of Health, 2006b, 2013c). As people get older the ability to synthesise vitamin D reduces. Low vitamin D status can lead to an increase in bone turnover, which can lead to osteoporosis (Ministry of Health, 2006b). People get most of their vitamin D from sunlight exposure (Ministry of Health, 2006b). However older people are more at risk of having a vitamin D deficiency due to spending less time exposed to the sun. Older adults tend to spend more time indoors due to being house bound, having poor mobility, or always covering themselves up, limiting the ability to produce vitamin D from the sun (Ministry of Health, 2013c).

Vitamin D can be found in some foods but only in small amounts. Foods such as fatty fish (e.g. salmon, herring and mackerel), liver, eggs, some fortified foods such as margarine and low-fat dairy products all contain small quantities of vitamin D (Ministry of Health, 2013c). As a result of foods containing only small amounts of vitamin D, it is important that older adults are getting vitamin D from other sources such as sun exposure or vitamin D supplementation.

Vitamin D supplementation may be considered if someone has suboptimal vitamin D status or they are unable to be exposed to sunlight (Ministry of Health, 2013c). The consensus statement on vitamin D and sun exposure in New Zealand supports supplementation in those in at-risk groups. These are people who have poor mobility, are frail, housebound, people who are bed-ridden or chair-bound (Ministry of Health and Cancer Society of New Zealand, 2012). Vitamin D supplementation may be less

common in community living adults as they are more inclined to spend time outdoors. However, it is still important to ensure they are meeting the recommended amount. Nutrition plays an essential part in ageing.

2.3.3.3 Summary

A diet that incorporates variety and is rich in nutrients is important for older adults to help prevent diseases and maintain health. If nutrition is compromised then older adults may experience a negative effect on health.

2.4 Malnutrition

2.4.1 Definition of Malnutrition

Malnutrition can be defined as “a state of nutrition in which deficiency or excess (or imbalance) of energy, protein, and other nutrients causes measurable adverse effects on body form (body shape, size and composition), body function, and clinical outcome (British Association for Parenteral and Enteral Nutrition, 2012, p. 1). The term malnutrition can encompass both under-nutrition and over-nutrition (obesity).

2.4.2 Over-nutrition in older adults

The term over-nutrition can also be referred to as being overweight or obese.

Alarming, obesity rates have been steadily increasing in older adults. In the New Zealand Health Survey 2011/12, obesity rates peak in adults aged 64-74 years but trend downwards as people reach 75 years and older (Ministry of Health, 2012a).

Over time, people who are obese are at increased risk of developing chronic diseases such as heart disease, Type 2 diabetes, and some cancers (World Health Organization, 2004). Many factors contribute to obesity including poor nutrition, lack of physical activity, cultural factors, psychological factors, personal attitudes and social factors such as income and living situation (Ministry of Health, 2013c). Many of these factors are modifiable; meaning if altered can reduce the chances of developing these chronic diseases helping to positively impact health.

Nutrition can play a role in the development of obesity. Obesity is commonly caused by an excessive intake of energy dense, low-nutrient containing foods which can lead to malnutrition due to inadequate nutrient intakes (Nowson, 2007). Obesity levels in New Zealand have shown to increase with age (Ministry of Health, 2013e). As people get older they are also more likely to develop sedentary behaviours which can promote weight gain (Harvey, Chastin, & Skelton, 2013; World Health Organization, 2004). Older adults who have a diet high in energy dense foods combined with sedentary behaviour are likely to become overweight. This in turn can reduce mobility (physical function) and could lead to frailty (Nowson, 2007). However this can be modified through healthy eating and increased physical activity (Villareal, Banks, Sinacore, Siener, & Klein, 2006). Factors associated with malnutrition in obese adults, such as poor nutrition and decreased mobility and frailty are similar to those who are underweight. The importance of a healthy diet is crucial to the wellbeing of obese individuals and also those who are underweight.

2.4.3 Malnutrition (Under-nutrition) in older adults

Ageing is a natural process and can cause changes in physiological functioning, strength and body composition (Phillips, 2003). These changes in older adults are often related to factors such as reduced appetite, increased frailty, poor cognitive function and poor dental status which may cause a decrease in food intake as people get older. A decline in food intake may result in a reduction in energy intake which can affect nutrient intake (Ministry of Health, 2013c). When nutrient requirements are not met a loss of weight and a decline in health status may occur. This is known as malnutrition.

Malnutrition has been associated with a reduced quality of life and may predispose to disease, poor recovery from illness, and negatively affect physical function, wellbeing and clinical outcomes (Keller et al., 2004; Sergi et al., 2005; Stanner et al., 2009). Malnutrition in older adults is also related to increased risk of frailty and fall related fractures (Sergi et al., 2005; Vellas et al., 1997). Older adults living in the community who are malnourished are also more likely to be admitted to hospital and have a prolonged hospitalisation than those who are well nourished (Sergi et al., 2005; Visvanathan, Newbury, & Chapman, 2004). It is important that the factors associated with poor nutritional status are identified and modified to prevent malnutrition from occurring.

2.4.4 Nutrition risk in older adults

Nutrition risk precedes malnutrition, and is the state in which older adults living in the community may find themselves due to a number of influencing factors. These are known as determinants of health which can be modified to improve health status. Determinants of health include: social factors such as income and living situation, support services, health status, changes in physical functioning and body composition and dental status (Figure 5). Prevention of malnutrition is essential which is why identifying those at nutrition risk is important. If people are identified as 'at risk', interventions can be put in place to improve their health. This is especially important for those living in the community as it can help them to remain living independently.

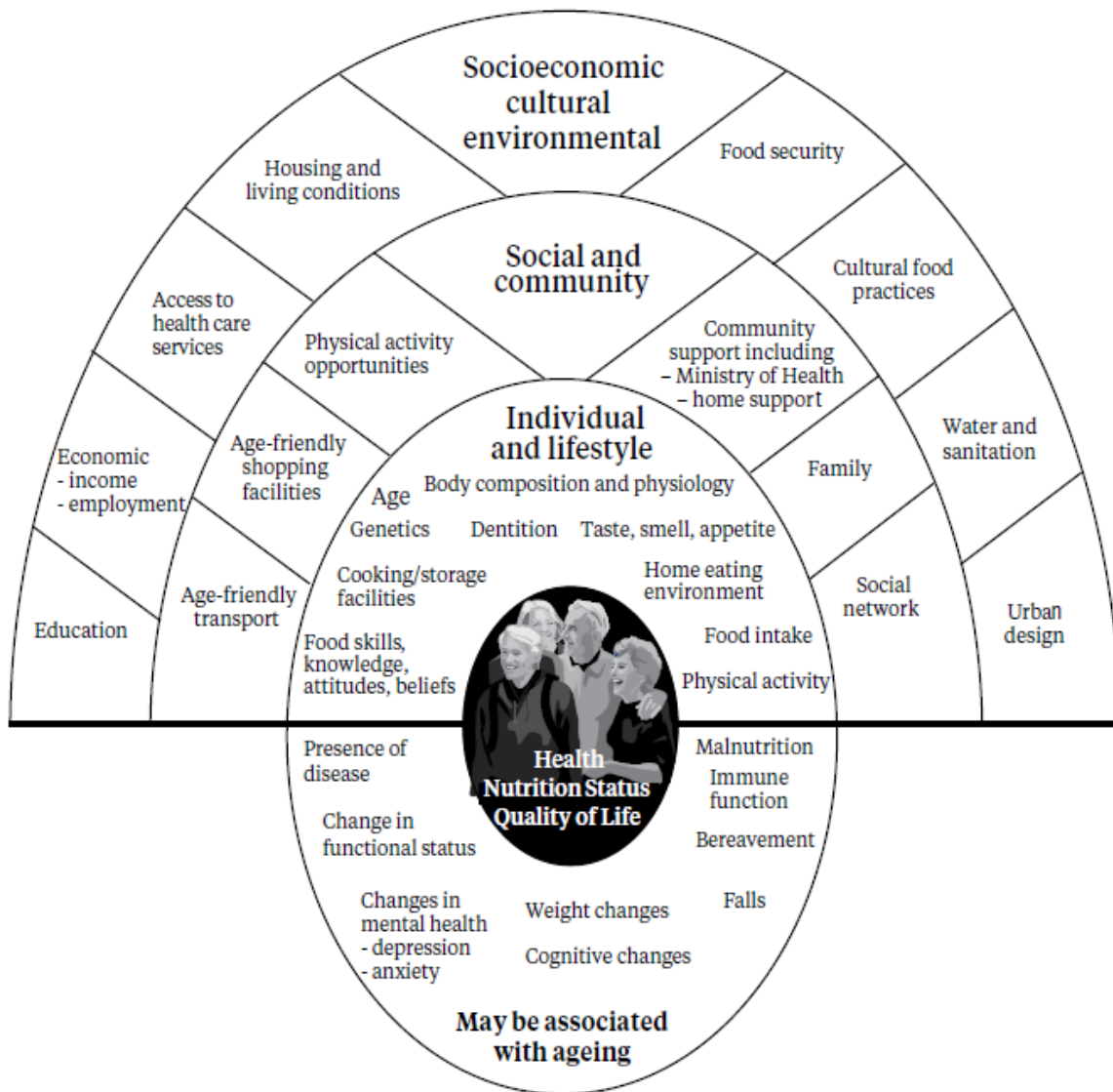


Figure 5: Factors affecting nutrition related health (Ministry of Health, 2013c)

2.4.5 Factors affecting nutrition risk

2.4.5.1 Change in body composition

One of the most apparent physical changes that occurs in older adults is the decline in lean body mass, caused mainly by a reduction in skeletal muscle mass (Rolland et al., 2008). This change in body composition can have an effect on an adult's strength and balance, predisposing them to an increased risk of falls and injury (Chien & Guo, 2014; Janssen et al., 2002). Age associated loss of muscle mass and loss of muscle function is commonly recognized as sarcopenia (Rolland et al., 2008). Nutrition plays an important role in maintaining body composition. Inadequate nutrition can have a

negative effect, leading to the development of severe loss of muscle mass (sarcopenia) (Volkert, 2011). Sarcopenia is a common problem in older adults and tends to increase with age (American Dietetic Association, 2005). The effects of sarcopenia have been linked with increased risk of disability and frailty, increasing risk of falls and loss of independence (Volkert, 2011). Maintaining physical functioning is an important aspect to healthy ageing, especially for those wanting to live well in the community.

Sarcopenia and other physical changes in body composition are associated with nutrition risk. A study conducted by Wham, Teh, et al. (2011) looked at the factors that affect nutrition risk in community living adults. They found that participants who had a low level of body fat were at higher nutrition risk. In comparison, those who had higher grip strength, higher muscle mass and lower body fat were more likely to be at lower nutrition risk. These results clearly demonstrate that having good nutrition status can help to maintain functional ability. In a more recent study by Kiesswetter et al. (2013) similar results were found. A decline in functionality was found with deteriorating nutrition status. Also, the number of participants who were physically unable to perform the test was highest in the malnourished group.

The importance of maintaining muscle mass and strength is essential to wellbeing. Data from the Australian Longitudinal Study of Ageing looked at body function and mobility and compared this to anthropometric data in adults over the age of 70 years (Bannerman et al., 2002). Results found older adults who had lost >10% of body weight over two years had increased limitation in physical function compared to those whose weight remained stable. Similarly, Janssen et al. (2002) supports the view that a decline in muscle mass is associated with functional impairment and disability. Janssen et al. (2002) found that the likelihood of functional impairment was two times greater in men and three times greater in women who had a severe loss of muscle mass. It is clear from this research that a loss of muscle mass can have a significant impact on older adults physical functioning.

Nutrition and physical functioning are closely linked. Inadequate nutrition may exacerbate the development of sarcopenia and on the other hand sarcopenia can affect nutrition status. This can have a large impact on people living in the community. Loss of physical function due to loss of muscle mass or sarcopenia in older community living adults could not only affect their ability to prepare, cook and eat meals, but also impair their ability to undertake activities of daily living.

One of the contributing factors for nutrition risk is a low body weight. A method for assessing a healthy body weight is to measure body mass index (BMI). Body mass index is a measurement used to assess body mass using height and weight (weight/height^2) (Stanner et al., 2009). In the most recent New Zealand Health Survey a BMI of 30 or over was classified as being obese, a BMI of 25.0-29.9 was considered overweight, normal range was a BMI of 18.5-24.9 and underweight was a BMI of less than 18.5. These are based on the WHO's BMI cut-off points for adults (World Health Organization, 2007).

Previous health surveys in New Zealand have found a small percentage of adults who are classified as underweight. The 2011/12 Health Survey showed 1% of the total adult population was classified as underweight (Ministry of Health, 2012b). In the 2002/03 Health Survey the prevalence of underweight women was found to be 1.8% in the 65-74 age group and 4.6% in those aged over 85 years. A low BMI puts someone at risk of poor health status, increasing risk of mortality (Sergi et al., 2005). Using BMI can be useful to identify those people or populations that may be at risk of health conditions associated with impaired nutrition status. Body mass index is therefore important for the assessment of nutrition risk.

In addition to this, the loss of lean body mass can sometimes be accompanied by an increase in body fat (Brownie, 2006). This is reflected in the current statistics showing older adults between 65-74 having higher rates of obesity compared to adults under 65 years (Ministry of Health, 2012a). However, the BMI values show a trend downwards as people move into the over 75 age bracket. This decline in BMI could be influenced by this loss of muscle mass commonly seen in older adults. Interestingly, Martyn, Winter, Coles, and Edington (1998) found that mortality risk was twice as high in subjects whose BMI was less than 20 than in those whose BMI's were greater than 20. This study highlights the importance of maintaining lean body mass in older adults to remain independent and reduce their risk of mortality.

2.4.5.2 Social Factors

There are a number of social factors that may also influence nutrition status in older adults. These factors include: living situation, income level and education.

2.4.5.2.1 Living situation

Living arrangements can have an effect on diet quality and can be a major barrier to maintaining nutrition status (American Dietetic Association, 2005). It can be quite

common for elderly to be living either on their own or with a partner or spouse. According to the living standards of older adults in New Zealand, of those that were single, 82% lived alone, 16% lived with relatives and of those single 76% were widowed (Ministry of Social Policy, 2001). By comparison, 97% of couples that were married, 90% lived alone and 9% lived with relatives (Table 1). Living alone may cause lack of motivation to prepare and cook food which might mean that some people in the community may have to depend on family or arranged help for meals. Callen and Wells (2003), identified that one of top aids to nutritional health was the assistance of family and friends which helped people to remain in the community when they may have needed to move to an assisted living situation.

Table 1 Marital status and living arrangements of older adults in NZ

	Single	Couples
Marital status	76% widowed 13% separated or divorced 11% were never married	97% married 3% in de facto unions
Living Arrangements	82% lived alone 16% lived with relatives	90% lived alone 9% lived with relatives

(Ministry of Social Policy, 2001)

Loneliness or bereavement can also have a negative effect on food intake. Callen and Wells (2003), found that people who were widowed cooked less balanced meals and some participants felt cooking for one was hard. In contrast, people who went to community meal sites or had friends or family to have meals with found this to be really helpful to maintain nutritional health. The sharing of meals and having others present when eating has been shown to help improve meal consumption, resulting in higher intake of calories (Locher, Robinson, Roth, Ritchie, & Burgio, 2005). Eating alone has been found to be a key nutrition risk factor for older adults in the community.

Three studies conducted in New Zealand in elderly populations have looked at the prevalence of nutrition risk and relating factors (McElnay et al., 2012; Watson et al., 2010; Wham, Carr, et al., 2011). Watson et al. (2010), conducted a nutrition risk screening study based in Christchurch in adults aged 70 years and older living independently in the community. A total of 152 participants were included in this study. Participants that were 'at risk' or at 'high risk' were more likely to be living alone. In

addition to this, eating alone was the most frequently occurring risk factor for nutrition risk in those 'not at risk', 'at risk' and those at 'high risk'.

A similar study by Wham, Carr, et al. (2011) based in Auckland, conducted a nutrition risk screening questionnaire (SREEN II) in 51 community living adults. It was found that 82% of participants lived alone. In those who lived alone, nutrition risk was higher and all participants reported feelings of loneliness. In another New Zealand study, based in Hawkes Bay, McElroy et al. (2012) found that participants living alone was significantly associated ($p < 0.001$) with nutrition risk. Those who lived alone were 3.5 times likely to be at nutritional risk than those living with others. Older adults who live in the community on their own may benefit from sharing meals or having a companion to eat with to maintain nutrition status.

People who live alone may be widowed. Prior to being widowed their partner may have done all the cooking for them, so when they find that they are on their own it can be difficult to motivate themselves to cook or they may not have cooking skills. Those who live alone have been shown to have poor nutrition intake as a result of forgetting to eat, lack of motivation to prepare meals and not wanting to eat the food once it is cooked (Watson et al., 2010; Wylie, Copeman, & Kirk, 1999). Older adults who live in the community on their own may be more at risk of having poor nutrition status.

2.4.5.2.2 Income

In recent years, the number of New Zealanders working beyond the age of their entitlement for superannuation has steadily risen (Statistics New Zealand, 2007). Changes in the age for superannuation from 60-65 years and the demographic shift of our ageing population are contributing factors. Older adults working beyond retirement age could be seen as a positive factor as they are remaining active within the community, however, for some working beyond the superannuation age may be a necessity. In 1999 the compulsory retirement age was stopped, resulting in a rise in service jobs and part-time and casual work opportunities (Statistics New Zealand, 2007). In the 2006 census the number of people aged 65 years and over working both part time and full time has more than doubled since 1991 (Statistics New Zealand, 2006b).

Older adults are now working for longer and this is likely to increase as this generation grows. For a vast majority of older adults in the community, the New Zealand superannuation is still the main source of income (Statistics New Zealand, 2007).

Annual incomes in those 65 years and older are much lower compared to those in middle aged groups. In the 2006 census, the groups with the lowest median annual income was in those aged 70 to 74 years with an annual income of \$14,800 (Statistics New Zealand, 2006c).

Income level is an important economic factor that can affect nutritional status in older adults. It can impact on food choices and the ability to purchase foods to maintain a healthy diet. Older adults who have low incomes have been shown to consume less total daily energy than those who are in the medium and high income groups (Bowman, 2007). Bowman (2007) found that adults who had low incomes were also less likely to meet recommended intakes for micronutrients including fibre, calcium and potassium. Adults also ate less wholegrains, vegetables, meat, fish and poultry compared to adults with medium and higher incomes. In this particular study, lower incomes groups also had more adults who were over the age of 70 years or older. Given that a large portion of older adults already live on their own (Ministry of Social Policy, 2001) and have poorer dietary intake due to low income, this particular group of older adults could be more vulnerable to nutrition risk.

Income level can also influence the types of food purchased. Wylie et al. (1999) found that some people considered they had insufficient money to spend on food, therefore were less likely to purchase foods such as chicken, fish and fruit. Foods such as meat and fish are good sources of protein. In addition to this, older adults have higher dietary needs for protein (Ministry of Health, 2006b), therefore if people do not have money to buy foods such as these then this may put them at nutrition risk as they might not be meeting nutrition requirements.

2.4.5.2.3 Education and dietary related knowledge

Elderly may benefit from education to understand the importance of good nutrition as eating the right foods can have significant impact on health in older adults. Having dietary related knowledge may help to make better decisions about food but also healthier behaviours. Well-educated people have been shown to have good knowledge in nutritional health (Callen & Wells, 2003). These factors were noted in a study by Callen and Wells (2003), who found participants demonstrated healthy behaviours such as cutting down on fats, using lean meats and healthy methods of cooking and also trying to include whole foods in their diet rather than processed foods. Nutritional knowledge was assessed in a study by McElnay et al. (2012). McElnay et al. (2012) found a lack of age-related dietary knowledge within their 473 participant group. For

example, only 36% of all participants knew that older adults have higher protein dietary requirements than younger adults. These studies suggest that education can play a significant part in the development of lifelong healthy eating habits.

2.4.5.2.4 Support services

The New Zealand government has the ageing in place strategy to help people age well within our communities. To support older adults living within their home, some may require support services to help with daily living and to remain independent. Whether this is through private services or government funded services, older people who need extra support in the community may be eligible to receive it (Ministry of Health, 2011). The purpose of these support services is to help older adults maintain independence and their quality of life. Help can range from grocery shopping, housework and transport to personal care such as showering, dressing, bathing and toileting to meals-on-wheels (MOW) (Ministry of Health, 2011). Having help can ensure someone is still getting the food they need, having meals cooked for them and to help with everyday living. This provides independence and the ability to remain in their homes. This type of support also provides social connectedness with other people in the community which can help to maintain nutritional health (Callen & Wells, 2003).

However, one study by Wylie et al. (1999) found that people who did receive home help did not feel that it was enough for what they needed. They therefore had to prioritise jobs resulting in other daily tasks like grocery shopping not being done. Given that these individuals may already be in a fragile state, inadequate support could put these people at nutrition risk. In addition, some participants explained that they did not know how to access home help. Although this study found that some participants were unhappy with the home help they received, this was a small study with only 15 participants and may not be a very good representation of home help on a larger scale.

Research has shown a relationship between nutrition risk and older adults receiving home-help (Tomstad et al., 2012). In a sample of 158 Norwegian older home-dwelling adults aged 65 years and older, 20.3% (n=32) were found to be at nutritional risk. Tomstad et al (2012), found factors such as living alone and receiving help regularly were predictors for being at nutrition risk. Furthermore Wham, Carr, et al. (2011), identified risk factors associated with nutrition risk in a group of independently living older adults aged 80-85 years. It was found that 67% (n=34) of participants had some disability which was indicated by the need for assistance with housework, meal preparation, shopping, paying the bills and help dressing and feeding. A linear

relationship between the disability score and nutrition risk screening score was found. The higher the disability scores the lower the nutrition risk score putting more participants at nutrition risk. Given that people who receive home help may be less independent and unable to carry out normal activities of daily living it's not surprising that they may be more at nutrition risk. It is important to consider that if people are receiving home help that it is adequate for their needs and people are satisfied with the help that they are receiving.

Meals-on-wheels (MOW's) are another type of community support service that older adults can receive. Pre-made meals are nutritionally complete and home delivered hot, and can be provided for as long as people require them (Wilson & Dennison, 2011). Meals-on-wheels are particularly helpful for those with disabilities or who are unable to prepare meals themselves (Wilson & Dennison, 2011). In their study, Johansson, Sidenvall, Malmberg, and Christensson (2009) found that MOW's was a key nutrition risk factor, as people at nutrition risk were more frequent users of this service. The guidelines for MOW state: one MOW meal should provide one-third of the dietary requirement for energy and one-half of the recommended intake of protein (Wilson & Dennison, 2011). However, some older adults may not eat the whole meal at once, therefore not receiving all the nutrition the meal provides, which could put them at greater nutrition risk. In addition, Johansson et al. (2009) found that those who were well-nourished also used home help services and over time the use of this increased as disability may have increased. Meals on Wheels can be very useful to individuals who are currently unable to cook for themselves particularly if eaten as part of healthy balanced diet.

The presence of others when eating has been found to increase caloric intake as it promotes an enhanced social environment (Locher et al., 2005). Although home help or meals-on-wheels has been found to be a predictor for nutrition risk in some studies (Johansson et al., 2009; Tomstad et al., 2012), a study by Keller (2006) looked at the impact of receiving MOW's on nutrition risk in older adults. A total of 263 older adults completed a nutrition risk screening questionnaire at baseline and then again at 18-month follow-up to compare any association with nutrition risk. Results found those participants who received MOW had higher follow up scores than those who were not in these meal programs from the nutrition screening questionnaire. This research shows that MOW can help maintain nutrition status in those who require additional support in the home.

A study by Frongillo, Isaacman, Horan, Wethington, and Pillemer (2010), looked at the satisfaction of people receiving MOW, and found that three quarters of participants report overall satisfaction with the meals. It might be important to determine what else older adults are eating in their diet in combination with the MOW or other factors which can influence nutrition status. Some studies have found that those who are at nutrition risk also have low intakes of dairy, and fruits and vegetables (Margetts, Thompson, Elia, & Jackson, 2003; Watson et al., 2010). It may be that MOW meal is the only meal they eat throughout the day which would result in a decreased nutrition status. Although MOW meals are nutritionally complete it is important that any other foods they are eating throughout the day can contribute to the overall recommended intake for the day.

2.4.5.3 Health factors

2.4.5.3.1 Polypharmacy

The definition of polypharmacy is the use of five or more medications concurrently (Heuberger, 2012; Ministry of Health, 2013c). In older adults prescribing rates are high and continue to rise with age (Martyn et al., 1998; Ministry of Health, 2013c). According to New Zealand statistics 36% of adults between the ages of 65 – 74 had 10 or more prescriptions in 12 months, this increased to 43% in adults aged 75 years and over, and each prescription could have up to 20 medications (Statistics New Zealand, 2004). The impact of being on five or more prescription medications can increase individual's risk of food drug interactions, which can affect food intake and also nutrition status. Polypharmacy effects can include: loss of appetite, change in oral health, reduced mobility, change in metabolism of nutrients and can sometimes alter digestion, absorption and utilization of nutrients (Heuberger, 2012).

A study conducted by Keller (2006) found those at high nutrition risk used more medications and had more medical problems than those who were not at high nutritional risk. Nearly 40% of men and 45% of women reported using ≥ 3 prescription drugs, over the counter medications, or vitamin-mineral supplements each day. High nutrition risk is usually associated with a low body weight or low BMI. Martyn et al. (1998) found that in those with a BMI $< 20 \text{ kg/m}^2$, prescription rates were higher than in those who had BMI within the healthy range of $20\text{--}25 \text{ kg/m}^2$. Heuberger (2012) also describes the association between the impact of prescription drugs and the effect on weight management, recommending proper management of drug regimens and nutritional care in order to prevent the negative effects of polypharmacy occurring.

2.4.5.3.2 Dental status

Older adults are at risk of developing chewing difficulties leading to altered eating habits, which in turn affects dietary intake leading to nutrition risk. As adults get older, dental status may worsen. Loss of teeth and dentures, both commonly seen in older adults can contribute to chewing difficulties, as chewing food requires adequate teeth or dentures (Lamy, Mojon, Kalykakis, Legrand, & Butz-Jorgensen, 1999). According to the most recent Oral Health Survey, almost one third of the older adult population group (65-75 years) were edentulous (the total loss of natural teeth) (Ministry of Health, 2010).

Sheiham and Steele (2001) assessed the dental status of older adults and how it affected their ability to eat certain foods. Those who were edentulous (little natural teeth) had difficulty eating or could not eat a range of foods including: apples (50%), nuts (42%), raw carrots (41%), steak (33%), tomatoes (20%), lettuce (17%) and toast (2%). Compared to those who were dentate (had natural teeth), edentulous adults had significantly greater difficulty in eating foods. Of those who had teeth, the ability to eat foods was based on the number of teeth they had. People with one to ten teeth tended to have the most difficulty. Another concern found in this study was the decrease in nutrient intakes in those who were edentulous. Edentulous adults had lower intakes of fibre ($P<0.001$), protein, calcium, vitamin C ($P<0.01$) and non-haem iron ($P<0.05$) compared to individuals who had natural teeth. Similar findings were found in a recent study by Mann et al. (2013). Individuals with chewing difficulties as a result of missing teeth were on average 44.9% below the recommended nutrient intakes for their age.

Adults who have lost teeth may replace them with dentures. Findings from the Life and Living in Advanced Age study (LiLACS), a cohort study conducted in New Zealand adults aged from 80-90 years reported dentures were worn in 76% of people (Kerse, 2014). However, dentures can also cause chewing problems. The LiLACS study found that poorly fitting dentures and missing teeth contributed to chewing difficulties in 24% of participants. Other reasons found for chewing difficulties were painful teeth, gum disease or other pain in the mouth. Findings from these studies emphasise that those with poor dental status are at risk of dietary restriction and nutrient deficiencies. Older adults are already vulnerable to dietary restriction due to disabilities, social factors and health. If older adults have poor dental status as well, this is likely to further increase their chance of nutrition risk.

Nutrition risk has been associated with poor dental status. A study looking at the association between nutritional status and dental status in adults over 50 years old found those participants who had dentures or who had fewer than five pairs of posterior teeth was significantly associated with a lower Healthy Eating Index (HEI) score (Andrieu et al., 2001). Those with poor HEI scores had lower intakes of fruit and poor diet variety in those with fewer teeth.

Similarly Kikutani et al. (2013) assessed whether nutrition risk might be influenced by dental status in older community living adults (mean age 83.2 ± 8.6 years). Dental status was classified according to one of three groups; Group A, natural dentition with adequate function; Group B, partially or fully edentulous, but maintaining functional occlusion with dentures in either or both jaws and Group C, functionally inadequate occlusion with no dentures. Results found that 17.9% of participants were well nourished, 14.0% were at risk and 28.6% were malnourished. The relationship between dental status (Group C) and nutrition risk was found to be statistically significant ($P < 0.05$). The participants found to be malnourished, had more poor functioning occlusions and were more likely to have no dentures than those participants not at nutrition risk.

More recently, Saarela et al. (2014) assessed dentition and its association with nutritional status in older adults over 65 years living in independent residential care. In this study nutritional status was significantly associated with dentition status ($P = 0.014$). Participants who were edentulous without dentures had the highest prevalence of malnutrition and at risk individuals (23.4% and 62.8% respectively) compared to those with dentures (12.2% and 63.8%) and natural teeth (12.1% and 65.5%). Chewing problems were prevalent in 55.3% of adults who were edentulous without dentures. These individuals were also more likely to consume pureed or soft meals.

Based on the results of these studies dental status is an important factor to consider when assessing for nutrition risk. Dental status not only affects chewing capabilities but also the types of foods that someone may be able to consume. In addition, if individuals regularly eat pureed and smooth diets this can make swallowing muscles weaker which could lead to a loss of ability to swallow certain textures even if the person has good dentures (Sura, Madhavan, Carnaby, & Crary, 2012).

2.4.6 Dysphagia

2.4.6.1 Definition of dysphagia

As people age changes in swallowing can occur resulting in a slower process, negatively impacting the flow of food and liquid down the oesophagus (Sura et al., 2012). Dysphagia can be defined as difficulty in swallowing during the oropharyngeal or the esophageal phase of swallowing (Forster, Samaras, Gold, & Samaras, 2011). Globus sensation is the sensation of an ingested food or liquid sticking or pooling at a point above the stomach (Katzka & Kochman, 2004). Dysphagia is made up of four subgroups: anatomic disorders of the upper oesophagus, motility disorders of the upper oesophagus, anatomic disorders of the lower oesophagus and motility disorders of the lower oesophagus (Katzka & Kochman, 2004). This includes oropharyngeal dysphagia, one of the most common motility disorders in older adults and one of the main causes of aspiration pneumonia (Forster et al., 2011). Dysphagia can be accompanied by pain when swallowing known as odynophagia, coughing, regurgitation, and the need for liquid to wash the food down or have difficulty clearing saliva (Katzka & Kochman, 2004). This may cause discomfort and difficulty eating particular foods which could impact on nutrition intake.

Dysphagia impacts adversely on an older adult's health and wellbeing due to its effects on individuals' swallowing abilities. People with dysphagia will often compensate and change their way of eating. People will often have to eat slowly and carefully and only small amounts at a time (Katzka & Kochman, 2004). Dysphagia can also cause embarrassment leading to social withdrawal and eating out publicly and it can also cause restricted eating habits as certain foods exacerbate the swallowing difficulty and cause coughing (Katzka & Kochman, 2004). These effects of dysphagia may lead to inadequate dietary intake, and also impact on social connectedness with people in the community which could potentially put individuals at nutrition risk.

2.4.6.2 Prevalence of dysphagia

The prevalence of dysphagia is higher in older adults and increases with age (Eslick & Talley, 2008; Kawashima, Motohashi, & Fujishima, 2004; Mann et al., 2013; Roy, Stemple, Merrill, & Thomas, 2007). Within the community, the prevalence of dysphagia has been shown to range from 5% - 33% (Mann et al., 2013; Roy et al., 2007). Prevalence of dysphagia can also be higher in older adults with oesophageal reflux, stroke, dementia, COPD, or those with severe neck, back or head injuries (Kawashima et al., 2004; Roy et al., 2007; Sura et al., 2012). Those with dysphagia may also have a

poorer quality of life, which could be associated with anxiety and depression (Eslick & Talley, 2008; Roy et al., 2007). This evidence suggests that dysphagia is a common problem with community living older adults and certain risk factors can predispose those who may already have other complications.

2.4.6.3 Dysphagia and nutrition risk

As a result of dysphagia and the changes in eating habits, older adults are at risk of developing poor nutrition status. Dysphagia may cause restriction of foods or food groups and modification of the consistency of liquids and foods may be necessary. However this may have a low acceptability and poor adherence resulting in inadequate nutritional intake (Sura et al., 2012). Serra-Prat et al. (2012) assessed whether dysphagia was a risk factor for malnutrition in independent living older adults. Nutrition status and dysphagia were assessed at baseline and then again one year later. It was found that the prevalence of malnutrition and nutrition risk among participants was significantly associated with dysphagia ($P=0.010$) and impaired efficiency of swallowing ($P=0.015$).

Another study looking at the association of swallowing difficulties and nutritional status in community living adults found that 51 participants (5%) had swallowing difficulties (Mann et al., 2013). Of those with swallowing difficulties, participants were deficient in a number of nutrients including fibre, potassium, calcium, magnesium, vitamin D and folate. Findings from this study suggest that swallowing difficulties may place individuals at nutrition risk due to inadequate nutrient intake.

A recent study by Takeuchi et al. (2014) which investigated the association between malnutrition and dysphagia risk in community-dwelling frail older adults found 25% of participants were malnourished, 67% were at nutrition risk and 8% were well nourished. Those at risk of dysphagia had a significantly higher prevalence of malnutrition ($P=0.02$) than those not at risk. These studies highlight that dysphagia is not only highly prevalent in community living adults but is also closely linked with nutrition status.

2.4.6.4 Screening for dysphagia

Screening for dysphagia is useful to identify those with swallowing difficulties as dysphagia may signal underlying disease which may be impacting on nutrition status. If individuals are found to be at risk then follow up treatment can be put into place. There are currently three main screening tools that have been validated for the use in dysphagia. These include the SWAL-QOL, a symptom-specific outcome questionnaire,

the M.D. Anderson Dysphagia Inventory (MDADI) and the Eating Assessment Tool (EAT-10).

The SWAL-QOL consists of 44 items and is used to assess the severity of dysphagia (McHorney et al., 2002). Unfortunately, because of the length of the questionnaire it has not been widely accepted in clinical practice (Belafsky et al., 2008). The MDADI is designed specifically for head and neck cancer patients and consists of twenty questions. However the scoring can be complicated and also due to its specificity for cancer patients it would not be applicable for the general population (Chen et al., 2001). One screening tool that has been deemed appropriate for the use in older adults is the Eating Assessment Tool (EAT-10). The Eating Assessment Tool (EAT-10) is a validated tool and has been found to be reliable and with good reproducibility for identifying those at risk of dysphagia (Belafsky et al., 2008).

2.4.6.4.1 The Eating Assessment Tool (EAT-10)

The EAT-10 is designed to be a rapid screening tool that can be applicable to a wide range of individuals including older adults. It is a self-administered survey which can determine the severity of the individuals swallowing problem and can be completed in two minutes (Belafsky et al., 2008). The tool consists of ten questions and is scored out of 40; those who score three or greater are considered to be at risk of dysphagia and require further follow up support. Those who score less than three are considered not at risk. Due to its simple design and ease of use the EAT-10 tool is considered appropriate for the use in older adults within the community (Belafsky et al., 2008).

2.4.7 Cognition

2.4.7.1 Dementia

Dementia is a term describing a group of conditions that can lead to impairment of mental function (National Institute for Health and Care Excellence, 2006). It is often related to symptoms such as loss of memory, language difficulties, altered judgement, confusion and sometimes changes in mood and personality (Ragdale, 2014).

Dementia is a progressive disease and the chances of developing dementia increases with age (Alzheimer's Disease International, 2009). Alzheimer's disease (AD) is the most common form of dementia and accounts for approximately 60% of those who are diagnosed (Williams & Weatherhead, 2013). According to the most recent statistics, in New Zealand, approximately 48,000 people have dementia with around 45,000 of those in people aged over 65 years (Deloitte Access Economics, 2012).

Mild cognitive impairment (MCI) is a condition that precedes dementia and is the state between normal cognitive ageing and dementia (Nasreddine et al., 2005). Mild cognitive impairment may develop into more severe cognitive decline such as AD, however, the speed at which cognition declines will vary from person to person (Ragdale, 2014). Due to the growing number of older adults in New Zealand, the number of people affected by MCI and dementia is likely to increase.

2.4.7.2 Cognition and nutrition risk

One of the biggest concerns regarding older adults and cognitive decline is poor dietary intake leading to nutrition risk. The risk of malnutrition has shown to be prevalent in older adults within the community (Guigoz, 2006). The prevalence of nutrition risk in cognitively impaired older adults has also been previously reported. In a review, nutrition risk was assessed in cognitively impaired older adults living at home and in institutions using the MNA screening tool (Guigoz, 2006). Of the participants (11 studies, n=2051) it was found that 44% (range 19-87%) were at nutrition risk and 15% (range 0-62%) were malnourished. Changes in nutrition status have also been associated with MCI and dementia, further increasing nutrition risk in older adults (Galesi, Leandro-Merhi, & De Oliveira, 2013; Orsitto, 2012).

Galesi et al. (2013) assessed the association between nutrition status and dementia in a sample of 150 adults aged over 60 years living in a long-stay institution. Results of the study found 64% were considered nourished and 36% were considered malnourished, while 48% of participants had dementia. Data analysis found that the nutrition status of participants was significantly different in those with and those without dementia ($P<0.001$) indicating that dementia may increase nutrition risk in older adults.

Another recent study evaluated nutrition status in a group of 560 elderly subjects admitted to an acute geriatric unit in Italy with cognitive decline (Orsitto, 2012). Participants were characterized into three groups including: those with dementia, those with MCI and those with no cognitive impairment. Results found in those with dementia and MCI the frequency of malnutrition was significantly higher ($P<0.001$ and $P<0.001$ respectively) than that of those with no cognitive impairment. The frequency of participants at-risk was also significantly higher in those with dementia and MCI ($P<0.001$ and $P<0.05$ respectively) compared to those with no cognitive impairment.

As a result of cognitive decline, older adult's nutrition status may become compromised due to changes in eating habits. Some of the common issues around eating habits in

older people with declining cognition include: forgetting to eat, some individuals may forget whether they ate or what it was they ate which can lead to misreporting. Some individuals may also develop the inability to cook, some may lose interest in eating and sometimes may refuse to eat (Stanner, 2007). These factors can also contribute to weight loss, a key risk factor for malnutrition (Guigoz, Vellas, & Garry, 1996; Miyamoto, Higashino, Mochizuki, Goda, & Koyama, 2011).

Research has shown how changes in eating behaviours and food intake can cause nutritional problems in those with early stages of AD. In a longitudinal study of 94 community-living older adults aged 65 years and older, nutrition status and dietary intakes were assessed at baseline and twelve months later (Shatenstein, Kergoat, & Reid, 2007). Of the participants, 36 had early stages of AD and 58 had no cognitive decline. Results found at the end of the 12-month period that those with normal cognition had greater intakes of key nutrients including: calcium, B-vitamins, vitamin D, vitamin C, folate, iron and zinc. There was also a higher prevalence of those with AD at moderate and high nutrition risk at baseline and after 12 months compared to those with no cognitive impairment.

These studies have shown that nutrition problems can develop in older adults as a result of cognitive decline. If cognitive decline is not monitored carefully then individuals affected by this disease may become at risk for malnutrition if not already presenting with impaired nutrition status. Early nutritional intervention can be beneficial for these older adults to enable them to live well.

2.4.7.3 Screening for mild cognitive impairment

2.4.7.3.1 Montreal Cognitive Assessment (MoCA)

Cognitive impairment is associated with nutrition risk. The MoCA was developed as a screening tool used to detect mild cognitive impairment (MCI) or the early stages of dementia. Screening tools such as the Mini-Mental State Examination (MMSE) is used to detect dementia, however it is difficult to detect MCI as most individuals with MCI score above 26 on the MMSE, which is considered normal cognition (Nasreddine et al., 2005). The validation study for the MoCA found that it had excellent sensitivity, reliability and was sensitive enough to identify those with MCI. The benefit of the MoCA is that it is a stand-alone cognitive tool and can be administered in 10 minutes making it easy to apply in a clinical setting (Nasreddine et al., 2005).

2.4.8 Assessment of nutrition risk

A valid method to identify risk of malnutrition or characteristics of concern in older adults is to use a nutrition screening tool. Detecting nutrition risk in older adults through screening is a simple and valid way to assess whether they are at high risk for poor nutrition or people who may have impaired nutritional status (McElnay et al., 2012). Screening will determine the course of action as to the type of nutrition intervention that may be required in order to prevent further progression into a malnourished state (Rubenstein, Harker, Salva, Guigoz, & Vellas, 2001).

2.4.8.1 Malnutrition screening tools

In a literature review of nutrition screening tools, Green and Watson (2006) found twenty one tools that are designed to assess nutrition status in older adults. However, many of these tools had limited evidence which demonstrated their validity, sensitivity and specificity. Some tools were only designed for the use in hospitals, residential care and outpatient settings, making them inappropriate for a community setting. In a more recent review of screening tools, Phillips, Foley, Barnard, Isenring, and Miller (2010) identified ten screening tools suitable for use in community dwelling older adults.

Green and Watson (2006) and Phillips et al. (2010) both described one tool that had been extensively evaluated and validated for the use in older adults living in the community. This was the MNA and its abbreviated form the MNA-SF. Two other screening tools including the Seniors in the community: Risk Evaluation for Eating and Nutrition (SCREEN II) and DETERMINE checklist showed validity and reliability, however they had not been extensively used within community dwelling populations. A summary of the current screening tools can be found in Table 2. The MNA-SF tool was deemed most appropriate for the use in this research.

2.4.8.2 The Mini Nutritional Assessment

The MNA was developed to provide a rapid and simple evaluation of older adults nutrition status in outpatient clinics, hospitals and nursing homes in order to facilitate nutrition intervention (Guigoz, Vallas, & Garry, 1994). It has been widely validated for the use in elderly populations from the very frail to the healthy older person (Guigoz et al., 1994; Vellas et al., 1999).

Table 2: *Nutrition screening and assessment tools for older adults in the community*

Tool	Country of origin	Population group	Areas covered	Risk categories identified	Evidence of usability
Mini Nutritional Assessment-short form (MNA-SF) ¹	Switzerland	Older adults	6-item questionnaire Anthropometry, access to food, clinical condition	Maximum score 14 12-14: well nourished 8-11: at risk <7: Malnourished	Rasheed and Woods (2013); Rubenstein et al. (2001)
Mini Nutritional Assessment (MNA) ²	Switzerland	Older adults	18-item questionnaire Anthropometry, social factors, self-perception, lifestyle, medication, mobility, dietary assessment, subjective assessment	Total of screening score (14 points) and assessment (16 point) 24-30: normal nutrition status 17-23.5: At risk of malnutrition <17: Malnourished	Guigoz et al. (1996)
Seniors in the Community: Risk Evaluation for Eating and Nutrition (SCREEN I) ³	Canada	Older adults	15-item questionnaire Anthropometry, dietary intake, factors affecting food intake, access to food, social factors,	Those who have a nutritional problem At risk of developing a nutrition problem Those who need further nutrition assessment and treatment	Keller et al. (2000)
Seniors in the Community: Risk Evaluation for Eating and Nutrition (SCREEN II) ⁴	Canada	Older adults	14-item questionnaire Anthropometry, dietary intake, factors affecting food intake, access to food, social factors,	Those who have a nutritional problem At risk of developing a nutrition problem Those who need further nutrition assessment and treatment	Keller et al. (2005)

¹ (Rubenstein et al., 2001)

² (Guigoz et al., 1994)

³ (Keller, Hedley, & Wong Brownlee, 2000)

⁴ (Keller, Goy, & Kane, 2005)

Tool	Country of origin	Population group	Areas covered	Risk categories identified	Evidence of usability
DETERMINE checklist Nutrition Screening Initiative ⁵	USA	Older adults	10-Item questionnaire Anthropometry, dietary intake, factors affecting food intake, access to food, clinical condition, social factors	0-2: Good 3-5: Moderate nutrition risk 6 or more: High nutrition risk	Barrocas, White, Gomez, and Smithwick (1996)
Malnutrition Universal Screening Tool (MUST) ⁶	UK	Older adults in hospital	Anthropometry and clinical condition	0: Low risk 1: Medium risk 2: High risk	Stratton et al. (2004)
Short Nutritional Assessment Questionnaire (SNAQ) ⁷	Netherlands	Older adults in hospital	4-item questionnaire Anthropometry, factors affecting food intake, dietary intake	1: Well nourished 2: Moderately nourished 3: Severely malnourished	Kruizenga et al. (2003)
Australian Nutrition Screening Initiative (ANSI) ⁸	Australia	Older adults	12-item questionnaire Anthropometry, dietary intake, factors affecting food intake, access to food, clinical condition, social factors	Range 0-29 0-3: Low risk 3-5: Moderate risk ≥6: High risk	Patterson, Young, Powers, Brown, and Byles (2002)

⁵ (White, 1996)

⁶ (Elia, 2003)

⁷ (Kruizenga, Seidell, De Vet, Wierdsma, & Van Bokhorst-de van der Schueren, 2003)

⁸ (Cobiac, 1995)

The MNA identifies those at nutrition risk and also the information needed for intervention planning and does not require laboratory data (Guigoz et al., 1996). However, due to its complexity and the time it takes to administer (approximately 10 to 15 minutes) this affects its use as a brief screening tool (Rubenstein et al., 2001). A shorter version of the MNA was then developed which still retains the validity and usefulness of the original questionnaire (Rubenstein et al., 2001). Two independent samples of older adults from a variety of settings were used to test the MNA-SF against the full MNA to validate the questionnaire. The MNA-SF showed high diagnostic accuracy in relation to nutrition status and high correlation with the MNA (Rubenstein et al., 2001).

The MNA-SF contains six questions and can be administered in approximately three minutes. The sum of the MNA-SF questions places individuals into three categories, those who have normal nutritional status (score of ≥ 12), those who are at nutrition risk (score of 8-11) and those who are malnourished (score of ≤ 7). Scores that are ≥ 12 indicate satisfactory nutrition status, with no follow-up required. A score ≤ 11 suggests nutrition risk and is confirmed by completing the MNA questionnaire.

2.4.8.3 The prevalence of nutrition risk

The prevalence of malnutrition has been widely researched internationally. In a review of the literature, Guigoz (2006) found in community living older adults the prevalence of malnutrition was relatively low (2-10%) compared to those older adults in hospital and institutionalized settings (30-60%). Guigoz (2006) went on to describe the prevalence rates of malnutrition found in 23 studies in community-dwelling older adults using the MNA to assess nutrition status, a highly validated screening tool. Of the 14,149 participants across the 23 studies, the prevalence of malnutrition was only $2 \pm 0.1\%$ (mean \pm SE, range 0-8%), and those at risk of malnutrition was $24 \pm 0.4\%$ (range 8-76%). Of these subjects, $74 \pm 0.4\%$ (range 16-100%) were well-nourished. According to this literature review Guigoz (2006) prevalence rates in community living adults are low compared to those in other settings such as those in hospital where malnutrition rates and those at risk are $23 \pm 0.5\%$ and $46 \pm 0.5\%$ respectively. However, rates of at-risk older adults in the community are still relatively high.

Other studies have reported similar findings, with lower rates of malnourished older adults and higher rates of those who have normal nutrition status. Studies have been summarised in Table 3. Those who were malnourished ranged from 0 - 24.6%, those at-risk ranged from 3.9% - 67.4% and those well-nourished ranged from 8.0 – 96.1%.

These studies also used different screening tools which may have affected the prevalence rates. If older adults are identified as at-risk, this is important as simple corrective measures can be put into place to prevent further decline in nutrition status.

2.4.8.4 Prevalence of nutrition risk in New Zealand

There is limited evidence reporting the prevalence of malnutrition in community living older adults in New Zealand. There have only been four studies in recent years looking at nutrition status in different groups of older adults. Studies have been summarised in Table 4. The first study by Watson et al. (2010), identified the prevalence of nutrition risk in a sample of 152 community living older adults aged 70 years and older living in Christchurch. Participants were either living alone or with one other person. Nutrition risk was assessed using SCREEN (Seniors in the Community Risk Evaluation for Eating and Nutrition), a valid and reliable questionnaire for the identification of nutrition risk in community-living older adults (Keller et al., 2005). SCREEN has scores that range from 0 to 64, a score of ≥ 54 was considered not at risk, a score of 50-53 was considered at risk and a score of ≤ 49 was considered high risk. Of the participants, 31% were at high nutrition risk, 23% were at nutrition risk, and 46% were not at-risk.

In a second study Wham, Carr, et al. (2011), assessed the nutrition risk status of 51 independently living older adults aged 80-85 years living in Auckland. Participants were either living alone or with a spouse or partner. Nutrition risk was also assessed using the SCREEN II questionnaire. In this study, those who scored < 50 were considered to be at significant nutrition risk. This study found 31% of participants were at nutrition risk, with majority (69%) of participants identified as not at risk. The participant's scores ranged from 38 to 61. This study supports findings from other studies, that the majority of independent living adults in the community are not at-risk for malnutrition (Guigoz, 2006).

In a third study by the same author Wham, Teh, et al. (2011) looked at the nutrition risk status of community-living older adults aged between 75 and 85 years old living in three North Island locations. Again the SCREEN II questionnaire was used. A score of less than 50 was deemed to identify significant nutrition risk. A total of 112 participants were recruited for the study, of these, 52% were found to be at nutrition risk with participant's scores ranging from 29-58, similar to that found in Watson et al. (2010).

In the fourth study McElroy et al. (2012), looked at nutrition risk amongst community living older people in Hawkes Bay. This study was conducted in 473 older adults aged

65 years and older. Similar to other studies, the SCREEN II questionnaire was used to assess nutrition risk. Of the participants, 32.8% were at high risk, 23.7% were at risk, 30.7% were not at risk and 12.9% of participants had missing data therefore a score was not calculated. Findings from this study were similar to those found in New Zealand studies by Watson et al. (2010) and Wham, Teh, et al. (2011) but also internationally, as reported by Guigoz (2006) with a high proportion of older adults at nutrition risk.

In summary these studies highlight that nutrition risk is prevalent in community living adults in New Zealand with a small minority who are at high risk or malnourished. These studies have also shown that a large number of adults within the community have normal nutrition status. However, there is still limited research on the wider older adult New Zealand population. There is opportunity to add to this research and to look at the nutrition status of another group of community living adults in New Zealand.

Table 3: *Prevalence of nutrition risk in studies undertaken overseas in community living older adults*

Authors	(n)	Mean age (years)	Not at risk (%)	At risk (%)	Malnourished (%)	Screening tool
Takeuchi et al. (2014), Japan	874	81.8	8.0	67.4	24.6	MNA-SF
Winter, Flanagan, McNaughton, and Nowson (2013), Australia	225	81.3	83.1	16.4	n = 1	MNA-SF
Isenring, Baker, and Kerr (2013), Australia	254	74.3	96.1	3.9	0	MNA-SF
Nykanen, Lonnroos, Kautiainen, Sulkava, and Hartikainen (2012), Finland	696	81	84.8	14.2	1.0	MNA-SF
Ulger et al. (2010), Turkey	2327	72.1	72.0	28.0		MNA-SF
Wyka, Biernat, Mikolajczak, and Piotrowska (2012), Poland	238	60+	87.0	16	0	MNA
Johansson et al. (2009), Sweden	258	74.2	83.7	15.9	0.4	MNA
Chien and Guo (2014), Taiwan	4378	69.5	88.1	9.2	1.3	MNA-T2
Schilp et al. (2012), Amsterdam	1267	77.3	81.7	7.7	10.7	SNAQ ⁶⁵⁺
Kvamme et al. (2011), Norway	3286	71.7	92.0	4.7	2.8	MUST
Yap, Niti, and Ng (2007), Singapore	2605	66	69.9	4.6	25.5	DETERMINE checklist

Table 4: *Prevalence of nutrition risk in studies undertaken in New Zealand community-living older adults*

Authors	(n)	Mean age (years)	Not at risk (%)	At risk (%)	Malnourished (%)	Screening tool
Watson et al (2010) Christchurch	152	79.5	46	23	31	SCREEN
Wham et al (2011) Northland	108	80.9	48	52	NA	SCREEN II
Wham et al (2011) North Shore, Auckland	51	82.4	69	31	NA	SCREEN II
McElnay et al. (2012) Hawkes Bay	473	74	43.5	23.7	32.8	SCREEN II

Chapter 3. Methods

3.1 Study design

The study was designed as a cross-sectional study to determine the prevalence of nutrition risk and dysphagia in older independent living adults within the Waitemata and North Shore community. This observational study was conducted between May and July 2014.

3.2 Participants

This study was conducted within the Waitemata DHB area in older adults living independently in the community (see age criteria below). Waitemata DHB provides services to the largest DHB population in the country with more than 560,000 people (Ministry of Health, 2014). It is also the second fastest growing of the twenty DHB's around New Zealand. Waitemata DHB is made up of North Shore City, Waitakere City and the Rodney district (Ministry of Health, 2014). The Waitemata DHB funds two Primary Health Organisations (PHO's) which provide healthcare services to those enrolled within their geographic location.

One of these PHO's is Comprehensive Care. Comprehensive Care supports 50 general practices across the north and west of Auckland and from Devonport to Rodney. Practices are located in both urban and rural settings. These general practices were approached by a member of Comprehensive Care and asked to agree to participate in this study. By participating in the study, the member of Comprehensive Care then identified patients enrolled within the general practice who met the eligibility criteria for age group and ethnicity.

Suitable individuals who fit the following criteria were then sent out a letter of invitation (Appendix 1).

3.2.1 Inclusion Criteria:

- 1) Age greater than 65 years (European ethnicity), age greater than 55 years (Maori and Pacific Island ethnicity)
- 2) Able to understand and give consent for the study
- 3) Able to complete self-assessment questionnaire
- 4) Willing to undergo anthropometric measures (weight and height)

3.2.2 Exclusion Criteria:

- 1) Age less than 65 years (European ethnicity), age less than 55 years (Maori and Pacific Island ethnicity)
- 2) Inability to give reasonable informed consent
- 3) Any tumour in the voicebox
- 4) Anyone with psychiatric illness affecting nutrition e.g. Anorexia nervosa
- 5) Anyone with a Zenker diverticulum (this is a pocket in the throat that collects food and causes swallowing 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 who may not survive two years

3.3 Participant Recruitment

A total of 368 invitation letters were sent out to eligible patients on two separate occasions. The invitation letter contained an opt-off option and ten days were allowed for the patient to respond back to the practice. Those who did not respond were then contacted by phone by the researcher (MSc Nutrition and dietetics student). For patients who verbally agreed to take part in the study, a one-off interview time was organised for a face-to-face interview in their home at a time of convenience. Those who disagreed to participate were noted and advised they would not be contacted any further. The recruitment of older adults for this study and the final number of participants is shown in Figure 6.

3.4 Ethical Approval

Ethical approval for this study was obtained from the Waitemata DHB ethics committee (Appendix 2) and the Health and Disability Ethics Committee (HDEC) (Application 14/NTA/70) (Appendix 3). The study was also reviewed and approved by the Maori Research Committee for the Waitemata and Auckland DHB's (Appendix 4).

Participants were advised that all information gathered would be completely confidential and no material would be able to identify them personally in any research reports. Participants were informed that all forms would be stored in a locked cupboard and information stored on password-protected computers.

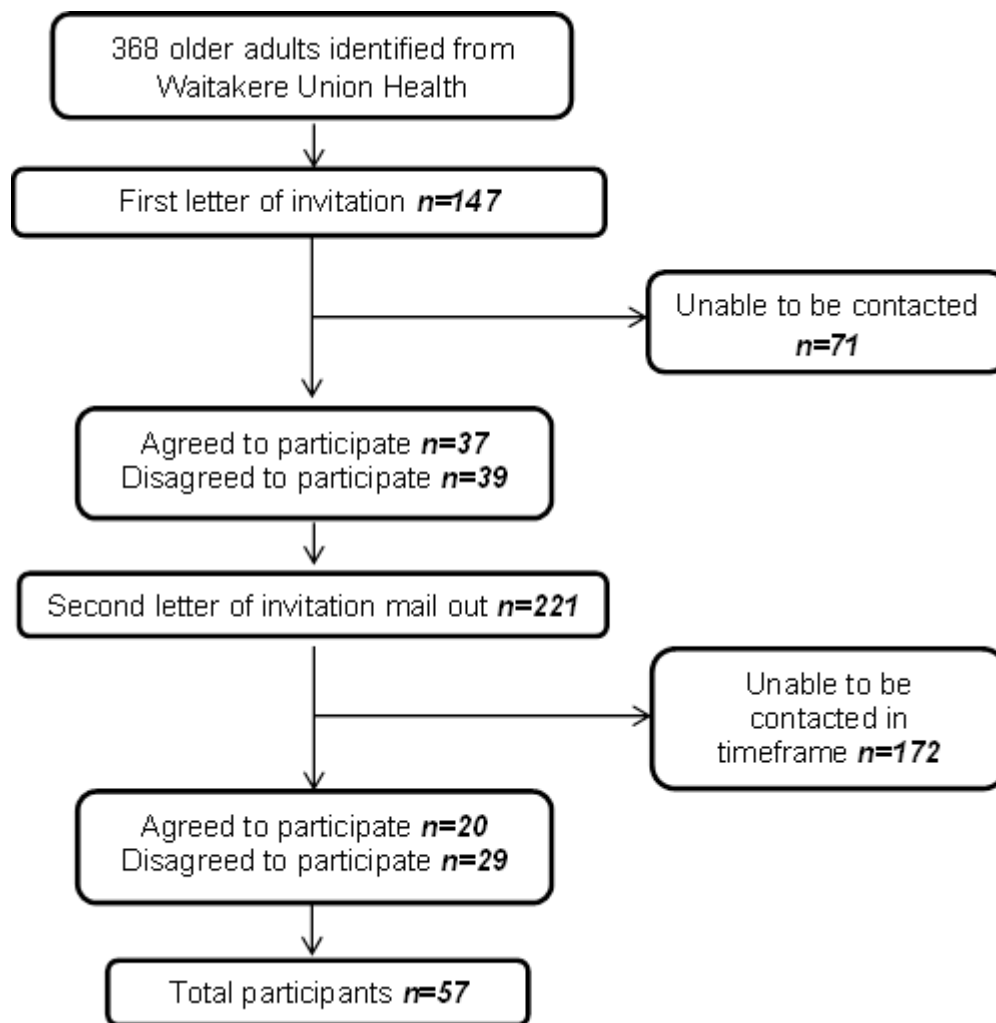


Figure 6: Flow diagram detailing recruitment and final number of participants

3.5 Data Collection

Before beginning each interview, participants were taken through a consent form (Appendix 5) which was signed upon agreement. Participants were also provided an information sheet complementary to this (Appendix 6). Participants were encouraged to raise any questions throughout this process and these were answered as needed. Participants were advised the interview would take 45 minutes to an hour and details of the questionnaire were explained. Participants were advised if at any time should they wish to stop or were uncomfortable with any question they could choose to do so. One researcher (MSc Nutrition and dietetics student) completed all interviews and data collection to reduce inter-individual variability.

3.6 Questionnaire

The questionnaire was developed to determine nutrition risk and those at risk of dysphagia (Appendix 7). The questionnaire also looked at factors associated with nutrition risk. The questionnaire was then piloted on a number of random subjects. This was to gather feedback on whether the instructions, content, layout, and wording of questions were clear but also whether the questions meant the same thing to all respondents. The length of time taken for data collection also needed to be ascertained. As a result of the pilot questionnaire there were three main findings; the first finding was that the questionnaire would take approximately 45-60 minutes in total including the consent process. Secondly, some wording of questions needed to be changed as some of the subjects expressed confusion around this. For example the question stating; who do you live with most of the time? The third option for this question was "With spouse, child and/or other". This was deemed too hard to understand and was changed to "Living with others". Finally, the last change was to include a question regarding education level as research has suggested that education may influence nutrition status (Callen & Wells, 2003).

The first section of the questionnaire includes information about participant characteristics including demographic and social information and also participant health status and the use of support services. The second section is the validated MNA-SF (Rubenstein et al., 2001) to determine nutrition risk and in addition to this the validated EAT-10 tool (Belafsky et al., 2008) to determine dysphagia risk. The last section of the questionnaire is the MoCA to assess cognition status.

3.6.1 Participant Characteristics

Demographic information was collected at the beginning of the interview. The first questions were to ascertain background information of the participants including date of birth and NHI (National Health Index) number. The participants were also asked to choose which ethnic group they belonged to. The different ethnic groups were taken from statistics New Zealand and were used in the New Zealand National Nutrition survey (University of Otago and Ministry of Health, 2011). Participants were asked to choose which their ethnic group was; New Zealand European, New Zealand Maori, Pacific Islander or other. If other was chosen, they were asked which 'other' ethnic group they belonged to.

Participants were also asked what their current marital status was; were they currently married, widowed, divorced, separated or never married. Participants were asked

about their financial income and whether or not they received any income in addition to their pension. The last question was about the participant's level of education.

Participants were asked to define whether their highest level of education was primary, secondary or tertiary.

3.6.2 Health Characteristics

The second part of the questionnaire was about the participant's current health status.

3.6.2.1 Health problems

Participants were asked if they had any current health problems which they had been told by their doctor. If the answer was yes then participants were asked to list these and conditions were noted. Any other health problems were also noted if they were ongoing.

3.6.2.2 Medications and supplements

Participants were asked if they were on any prescription medications, and if so details of these were taken. In addition to this participants were asked if they take any over-the-counter medications or nutrition supplements as some people may not always be taking prescribed medications.

3.6.2.3 Dental

Participants were asked about their dentition and rated as dentate, edentulous or any form of dental appliance.

3.6.2.4 Support Services

Participants were asked if they receive any regular subsidised support service such as MOW's or if they needed help with daily tasks like shopping, cleaning and cooking. If participants did receive any support services, details of what they were and how often were recorded.

3.6.3 Physical Characteristics

3.6.3.1 Weight

Weight was collected using calibrated automated Wedderburn scales (model 1609N). Scales were set on a hard surface and tarred/zeroed prior to the participant standing on them. Scales were set down with a support surface close by so that participants

were able to support themselves if needed. The participant was then asked to step onto the scales, arms at their sides and head facing directly forward at a 90 degree angle. Weight was taken when the value stabilised. Participants were asked to take off any heavy clothing items and shoes before stepping onto the scales which may have influenced the reading.

3.6.3.2 Height

Participants were first asked if they knew their height. If participants did not know their height then a demi-span measurement was done. Then using a calculation the demi-span was converted into a height measurement (Nestle Nutrition Institute, 2002). Height was needed to calculate participant's BMI.

3.6.3.3 Demi-span

The demi-span measurement is one of the alternative indirect methods for measuring height according to the MNA guide when standing height cannot be measured (Nestle Nutrition Institute, 2002). Demi-span can be defined as the distance between the mid-point of the sternal notch and the finger roots when the arm is outstretched laterally (Hirani & Mindell, 2008). The demi-span measurement can also be done easily and without causing discomfort or distress to the participant (Hirani & Mindell, 2008).

The demi-span measurement was taken by a trained researcher and measured using a Lufkin Executive thin line 2m measuring tape on each participant. The participant was asked to stand and place the left arm in a horizontal position which is line with the shoulders. Using the measuring tape the distance was measured from the midpoint at the sternal notch to the web between the middle and ring fingers. The participants arm was flat and wrist was straight. The demi-span measurement was taken in cm and measured to the nearest mm and then converted into height using a standardised formula from the MNA guide (Nestle Nutrition Institute, 2002).

3.6.3.4 Calf circumference (CC)

In line with the MNA guide, when standing height cannot be physically measured a CC measurement needs to be completed (Nestle Nutrition Institute, 2002). To carry out the measurement participants were asked to sit comfortably with their left leg hanging loosely. Participants were then asked to roll up the left trouser leg. Using the measuring tape it was wrapped around the participant's calf and the measurement was taken at the widest part. To ensure an accurate measurement, additional

measurements were taken above and below to ensure the widest part of the calf was measured (Nestle Nutrition Institute, 2002).

3.6.4 Nutrition Assessment

3.6.4.1 The Mini Nutritional Assessment (MNA) – short form questionnaire

The MNA-SF questionnaire was used to determine nutrition risk. This was to allow future comparison with ongoing assessment of nutrition risk in hospital and rest home settings within the WDHB. This is a validated questionnaire for use in older adults (Rubenstein et al., 2001) and has been rated as one of the most effective and appropriate for assessing nutrition in the elderly (Guigoz, 2006; Phillips et al., 2010). The short-form questionnaire has seven questions, each one related to nutrition status. Participants are asked the question and then given options to rate their answer and are given a score. At the end of the questionnaire the numbers are then added up to determine their nutritional status.

The first question asks about whether the participant's food intake has declined over the past three months which could have been due to a loss of appetite, digestive problems and/or chewing or swallowing difficulties. Participants have to rate whether there has been a severe, moderate or no decrease in food intake.

The second question is whether the participant has experienced any unintentional weight loss during the last three months. Participants have to choose between; a weight loss greater than 3kg, they do not know, weight loss between 1 and 3 kg or have experienced no weight loss.

The third question is about the participant's mobility. Participants are asked how their mobility is and rate it as either; bed or chair bound, able to get out of bed/chair but does not go out or goes out.

The fourth question asks whether participants have suffered any psychological stress or acute disease in the past 3 months. Participants have to answer either yes or no.

The fifth question asks about neuropsychological problems. Participants are asked if they have dementia or have had any prolonged or severe sadness. Participants are rated as either having; severe dementia or depression, mild dementia or no psychological problems.

The last section of the MNA-SF is in regards to the height and calf circumference measurement. If BMI cannot be determined using standing height then a CC must be used. Participants are put into either, BMI less than 19, BMI 19 to less than 21, BMI 21 to less than 23 or BMI 23 or greater. Calf circumference measurements are either, CC less than 31 or CC 31 or greater.

3.6.4.2 Results of the MNA

When the questionnaire is completed the scores are added up to the final MNA-SF score. Subjects are scored as either having normal nutritional status (12-14 points), at risk of malnutrition (8-11 points) or malnourished (0-7 points).

3.6.4.3 Participants with normal nutrition status

Those participants who were identified as having normal nutritional status were given the New Zealand 'Eating for Older People' pamphlet (Ministry of Health, 2012c). This was to provide them with basic information on nutrition which they could choose to read at their leisure.

3.6.4.4 Participants at risk

Those who were identified at risk of malnutrition received education regarding diet modification. This included education on high energy/high protein diets, food fortification and high energy/high protein drinks. The education was supported by giving participants the Ministry of health "Eating for older people" booklet (Ministry of Health, 2012c), and the "Good Food/Safe Food for Older People" pamphlet (New Zealand Nutrition Foundation and Ministry for Primary Industries, 2010).

At risk participants were also asked to give consent for the researcher to notify their GP of the results from the study. A letter (Appendix 8) was then sent out with the study information and the result from the questionnaire to the participants GP to enable any follow up support service as required.

3.6.4.5 Participants malnourished

The participants found to be malnourished were also asked to give consent to notify their GP's using the letter above. This was for follow up support and a community dietetic referral in order to be monitored more closely and to have a further in-depth nutrition assessment.

3.6.5 Dysphagia Assessment

3.6.5.1 The Eating Assessment Tool (EAT-10)

The EAT-10 questionnaire is a validated disease specific quality of life tool for dysphagia (Belafsky et al., 2008). It is used to determine initial severity of dysphagia and to monitor the treatment response within a variety of swallowing disorders (Belafsky et al., 2008). The EAT-10 swallowing screening tool has ten questions. Each participant was required to answer each question as to the extent that they experience the problems in the questions. Participants were required to rate the problem from 0 being no problem to 4 being a severe problem.

The first question asked about whether a swallowing problem had caused them to lose weight. The second questions asked whether the swallowing problem interfered with their ability to go out for meals, the third questions asked if swallowing liquids took extra effort, the fourth questions asked if swallowing solids took extra effort, the fifth question asked if swallowing pills took extra effort, the sixth question asked if swallowing was painful, the seventh questions asked if the pleasure of eating was affected by their swallowing, the eighth questions asked if when they swallowed did food stick in their throat, the ninth question asked if they coughed when they ate and the tenth question asked if they found swallowing stressful at all.

3.6.5.2 Results of EAT-10

When the questionnaire was completed the scores were added up to the final EAT-10 score. Subjects were scored as either not at risk (less than 3 points) or at risk (3 points or higher).

Those who were identified as not at risk did not require any follow up support and were advised of their result. Those who were found to be at risk were asked to give consent for the researcher to notify their GP of the results. A letter (Appendix 8) was then sent to enable any follow up service as required due to a potential swallowing disorder.

3.6.6 Cognitive Assessment

3.6.6.1 Montreal Cognitive Assessment (MoCA)

The MoCA is a rapid screening tool to assess for mild cognitive function (Nasreddine et al., 2005) (Appendix 9). It assesses a variety of cognitive domains including; attention and concentration, executive functions, memory, language, visuoconstructional skills,

conceptual thinking, calculations and orientation (Nasreddine et al., 2005). The questionnaire takes approximately 10 minutes to complete and each question is scored differently. The highest score an individual can get is a total of 30, someone who scores 26 or above is considered to have normal cognitive function.

3.6.6.2 Results of MoCA

The total MoCA scores were added up and scores were recorded in the questionnaire. Those who score 26 or greater are considered to have normal cognition and those who score less than 26 are considered to have cognitive impairment. Results of the MoCA will be used for further analysis when looking at factors affecting nutrition risk.

3.7 Data Interpretation

3.7.1 Anthropometric characteristics

Participants BMI measurements were grouped according to the New Zealand Food and Nutrition Guidelines for older adults (Ministry of Health, 2013c). The three groups included: underweight ($\text{BMI} \leq 18.5 \text{ kg/m}^2$), normal ($\text{BMI} 18.5\text{-}24.99 \text{ kg/m}^2$) and overweight/obese ($\geq 25 \text{ kg/m}^2$). To get BMI measurements participants' height and weight had to be measured. If height could not be measured then a demi-span or calf circumference measurement was taken as per the MNA-SF protocol (Nestle Nutrition Institute, 2002). If a demi-span measurement was taken, then using the following calculation was converted to height (Females height in cm = $(1.35 \times \text{demi-span in cm}) + 60.1$ and males height in cm = $(1.40 \times \text{demi-span in cm}) + 57.8$). A calf-circumference measurement can be used in place of height when height cannot be measured as per the MNA instructions (Nestle Nutrition Institute, 2002).

One participant was bed bound due to illness, therefore a weight was unable to be completed and BMI calculated. A second participant was unable to bend their arm for the demi-span measurement and was unsure of their height, therefore a BMI measurement was unable to be completed.

3.7.2 Health conditions

Participant's key-comorbidities were recorded during data collection. In order to analyse this data co-morbidities were then broken down into groups. The groups represent the leading causes of health loss in people aged 65 years and over (Ministry of Health, 2013d). These include; cancer, vascular and blood disorders, musculoskeletal disorders, respiratory diseases, diabetes and endocrine disorders, neurological disorders and gastrointestinal disorders. An 'other' category was

introduced due to a number of conditions falling into this group. This also allowed further comparisons to be done. The total number of co-morbidities within each health condition was analysed and was compared between men and women.

Participants with one to three or four or more key co-morbidities were compared to those in the normal nutrition status group and those who were in the at-risk group. This criteria was based on the 2002/03 New Zealand Health Survey which assessed the number of chronic conditions among older adults and was reported in the Older People's Health Chart Book, 2006 (Ministry of Health, 2006c).

3.7.3 Polypharmacy

The number and types of prescription medications was recorded during data collection. According to the Ministry of Health Food and Nutrition Guidelines for older adults, the use of five or more prescribed medications is considered polypharmacy (Ministry of Health, 2013c). Therefore, for data analysis participants were split into two groups. The first group were those taking five or more prescription medications and the second group were those taking less than five. Medications were then further analysed to determine the most commonly used.

3.7.4 Nutrition risk status groups

Due to small grouping numbers it was decided that the single participant within the malnourished group would be combined with the at-risk group. Demographic, social and health characteristics were then compared to the two groups; normal nutrition status and at-risk for data analysis.

3.8 Statistical analysis

Data was first entered into the computer program Excel. All data was coded and then imported into SPSS version 21 (IBM Corporation, Released 2012) for statistical analysis. Descriptive statistics were completed for study variables: demographic; gender, ethnicity and marital status; social; living situation, income and education; anthropometric; height, weight, BMI, calf-circumference and demi-span; key Co-morbidities; cancer, vascular and blood disorders, musculoskeletal, respiratory, diabetes and endocrine, neurological, gastrointestinal and other; health status: prescribed medications, over-the-counter medications, nutritional supplements, dental status and support services.

Descriptive statistics were carried out and the mean plus standard deviation or median plus 25th and 75th percentile documented. Comparisons between groups were

performed using appropriate non-parametric tests. Normality of distribution was tested using the Kolmogorov-Smirnov tests, Shapiro-Wilk tests and normality plots. Mann-Whitney and Chi-square tests were performed in the case of non-parametric data being collected. The primary outcome was nutrition status and this was compared to factors affecting nutrition status. Chi-square tests were performed to ascertain differences between normal nutrition status groups and at-risk groups. Fishers exact test was used on data when the Pearson Chi-Square was invalid. To interpret if there was a difference between groups p -value of <0.05 was considered statistically significant.

Chapter 4. Results

4.1 Participant Characteristics

The participant characteristics are summarised in Table 5. The participants comprised of 57 older adults aged between 65 and 93 years. The participants had a median [25th, 75th percentile] age of 72 years [68, 76]. The majority of adults were aged between 65-74 years making up 70.2% of the total participants. Those aged between 75-84 years made up 26.3% of the group while there were only two participants that were aged over 85 years.

Table 5: *Participant characteristics*

	Total n (%) n=57	Men n (%) n=31	Women n (%) n=26
Age (years) Median [25 th , 75 th]	72 [68, 76]	73 [68, 76]	71 [68, 74]
Range	65 - 93	65-84	65-93
Age categories			
Age 65-74 years	40 (70.2)	20 (64.5)	20 (76.9)
Age 75-84 years	15 (26.3)	11 (35.5)	4 (15.4)
Age 85+	2 (3.5)	N/A	2 (7.7)
Ethnicity			
New Zealand European	33 (57.9)	18 (58.1)	15 (57.7)
New Zealand Maori	8 (14.0)	5 (16.1)	3 (11.5)
Pacific Islander	7 (12.3)	3 (9.7)	4 (15.4)
Other	9 (15.8)	5 (16.1)	4 (15.4)
Marital Status			
Married/partnered	34 (59.6)	21 (67.7)	13 (50.0)
Widowed	15 (26.3)	8 (25.8)	7 (26.9)
Divorced/separated	6 (10.5)	1 (3.2)	5 (19.2)
Never married	2 (3.5)	1 (3.2)	1 (3.8)
Living Situation			
Living alone	13 (22.8)	7 (22.6)	6 (23.1)
Living with spouse only	23 (40.4)	13 (41.9)	10 (38.5)
Living with others	21 (36.8)	11 (35.5)	10 (38.5)
Income			
Pension only income	37 (64.9)	19 (61.3)	18 (69.2)
Pension plus other income	20 (35.1)	12 (38.7)	8 (30.8)
Education			
Primary	8 (14.0)	7 (22.6)	1 (3.8)
Secondary	33 (57.9)	16 (51.6)	17 (65.4)
Tertiary	16 (28.1)	8 (25.8)	8 (30.8)

The majority of participants were of New Zealand European descent (57.9%), although Maori participants made up 14%, Pacific Islander participants made up 12.3% and participants from other ethnicities made up 15.8%. Ethnicities from the 'other' group included British (n=5), Nepalese (n=1), Chinese (n=1), South East Asian (n=1), and Australian (n=1). The majority of participants were married (59.6%), 26.3% were widowed, 10.5% were divorced or separated and 3.5% had never married. The majority of participants were either living with their spouse (40.4%) or living with others (36.8%), with 22.8% living alone. For most participants, the pension was their only source of income (64.9%), those with other income made up the remaining 35.1%. For over half of the participants (57.9%), secondary school was their highest education. Tertiary education was reached by 28.1% of participants and 14% of participants only had primary school as their highest level of education.

4.2 Anthropometric Characteristics

Table 6: *Anthropometric characteristics of participants¹*

	Total	Men	Women	P-value
Calf circumference (cm) n=19	36.7 [33.7, 39.4]	37.5 [34.7, 41.5]	36.5 [33.4, 39.3]	0.48 ²
Demi-span n=12	78.0 [69.5, 80.0]	79.8 [77.8, 81.5]	70.0 [63.6, 78.5]	0.04 ²
Weight (kg) n=56	75.6 [64.7, 92.3]	87.9 [74.5, 98.6]	67.0 [58.2, 73.2]	<0.0001 ²
Height (cm) n=56	167.0 [160.0, 176.8]	172.0 [167.8, 180.5]	158.4 [154.9, 165.0]	<0.0001 ²
BMI (kg/m ²) n=55	27.3 [23.6, 31.4]	27.9 [24.7, 31.5]	25.8 [22.5, 30.95]	0.14 ²
*Normal (18.5 – 24.99 kg/m ²)	19 (34.5)	8 (26.7)	11 (44.0)	
*Overweight/obese (≥ 25 kg/m ²)	36 (65.5)	22 (73.3)	14 (56.0)	0.18 ³

P-value <0.05 is statistically significant

¹ Anthropometric characteristics reported in median [25th, 75th] percentiles

² Comparison between gender groups was determined using the Mann-Whitney test to compare medians

³ Comparison of genders was determined using the Pearson Chi-square test

*BMI categories reported in frequencies n (%)

The participant's anthropometric characteristics are shown in Table 6. Participants had a median [25th, 75th percentile] weight of 75.6 kg [64.7, 92.3] and a median height of 167.0 cm [160.0, 176.8]. The only significant differences between anthropometric characteristics in men and women were height, weight and demi-span. Men were significantly taller ($P<0.01$) than females and weighed significantly more ($P<0.01$) than females. Demi-span was only taken in 12 participants. The median demi-span was 27.3 cm [23.6, 31.4] with a significant difference of $P=0.04$ between men and women.

Calf circumference was taken in 19 of participants. The median CC was 36.7 cm [33.7, 39.4]. The median BMI was 27.3 kg/m² [23.6, 31.4]. Two thirds of participants (65.5%) had a BMI within the overweight or obese category. One third of participants (34.5%) had a BMI within the normal range. No participants were considered to be underweight.

4.3 Health factors

4.3.1 Key Co-morbidities

Key co-morbidities are presented in Table 7. The median [25th, 75th percentile] number of co-morbidities participants reported was 2 [1, 3]. Five participants (8.7%) reported no key-comorbidities. The number of co-morbidities that participants reported ranged from 0-9 conditions. Vascular and blood disorders were the most frequently reported co-morbidity in all participants (82.3%). Musculoskeletal and other co-morbidities were the second leading co-morbidities reported by 24.6% of participants. The third most common co-morbidity was diabetes and endocrine disorders reported by 21.1% of participants. Respiratory and neurological disorders were the least occurring co-morbidities with only 8.8% and 5.3% of participants reporting them respectively. No significant differences were found between co-morbidities in men and women.

4.3.2 Prescription medications

The number of prescription medications is presented in Table 8. Most participants were taking less than five prescription medications (70.2%) and only 17 (29.8%) were taking five or more. The median [25th, 75th percentile] number of medications taken by participants was 3 [1, 5]. The number of prescription medications taken by participants ranged from 0 – 10. There was no significant difference between men and women. Of those taking less than five medications, 10 (17.5%) participants were not taking any.

A total of 180 prescription medications were reported by participants. The four most commonly reported medications were: Aspirin (n=18), Cilazapril (n=18), Metoprolol (n=11) and simvastatin (n=16). Medications such as: Allopurinol (n=5), Bendrofluazide (n=5), Omeprazole (n=5) and Warfarin (n=5) were the next most commonly occurring medications.

Table 7: *Number of key co-morbidities*

	Total n (%) n=57	Men n=31	Women n=26
Cancer	0	0	0
Vascular and blood disorders	47 (82.3)	27 (87.1)	20 (76.9)
Musculoskeletal	14 (24.6)	7 (22.6)	7 (76.9)
Respiratory	5 (8.8)	3 (9.7)	2 (7.7)
Diabetes and endocrine	12 (21.1)	8 (25.8)	4 (15.4)
Neurological	3 (5.3)	1 (3.2)	2 (7.7)
Gastrointestinal	6 (10.5)	4 (12.9)	2 (7.7)
Other	14 (24.6)	10 (32.3)	4 (15.4)

Table 8: *Number of prescribed medications*

	Total n (%) n=57	Men n=31	Women n=26
≥5 prescribed medications	17 (29.8)	11 (35.5)	6 (23.1)
<5 prescribed medications	40 (70.2)	20 (64.5)	20 (76.9)

4.3.3 Over-the-counter medications

Over-the-counter medications were taken by 5 (8.8%) of participants. These included Paracetamol and Ibuprofen taken for occasional headache and pain relief.

4.3.4 Nutritional supplements

The number of nutrition supplements used by participants can be found in Table 9. Nutrition supplements were taken by half, n=29 (50.9%) of the participants. The median [25th, 75th] number of supplements that participants were taking was 1 [1, 5]. The number of supplements participants were taking ranged from 0-14 supplements. More men n=17 (54.8%) than women n=12 (46.2) were taking nutrition supplements. One participant reported taking Renilon, a prescribed supplement twice daily. However no other participants were taking any prescription supplements.

The most common supplements taken by participants included: Omega-3 (n=11), multivitamins (n=9), vitamin C (n=5) and Glucosamine (n=4).

Table 9: *Number of nutritional supplements*

	Total n (%) n=57	Men n=31	Women n=26
Taking supplements	29 (50.9)	17 (54.8)	12 (46.2)
Doesn't take supplements	28 (49.1)	14 (45.2)	14 (53.8)

4.3.5 Dental status

More than half of the participants had some form of dental appliance, n=30 (52.6%). Only three participants were found to be edentulous. There was no statistical difference in dental status between men and women. Information on dental status can be found in Table 10.

Table 10: *Dental status*

	Total n (%) n=57	Men n=31	Women n=26
Dentate	24 (42.1)	12 (38.7)	12 (46.2)
Edentulous	3 (5.3)	1 (3.2)	2 (7.7)
Dental Appliance	30 (52.6)	18 (58.1)	12 (46.2)

4.3.6 Support services

Most participants, n=51 (89.5%) did not receive any subsidised support service. No statistical difference was found in those receiving subsidised support services between men and women. Most participants did not need daily help, n=46 (80.7%). No statistical difference was found in those requiring daily help between men and women. Description of support services can be found in Table 11.

Table 11: *Description of support services received by the participants*

	Total n (%) n=57	Men n=31	Women n=26
Receiving subsidised support services	6 (10.5)	2 (6.5)	4 (15.4)
Not receiving subsidised support services	51 (89.5)	29 (93.5)	22 (84.6)
Requires daily help	11 (19.3)	6 (19.4)	5 (19.2)
Does not need daily help	46 (80.7)	25 (80.6)	21 (80.8)

4.4 Nutrition status

4.4.1 Mini Nutrition Assessment – Short Form scores

The MNA-SF is scored out of 14; those who scored between 12 and 14 had normal nutrition status. Those who scored between 8 and 11 were at-risk of malnutrition and those who scored between 0-7 were considered to be malnourished (Nestle Nutrition Institute, 2002). The median [25th, 75th percentile] MNA score was 14 [12, 14]. The majority of participants had normal nutrition status, n=53 (93%). Only three participants (5.3%) were found to be at-risk and one participant was malnourished. The breakdown of nutrition status can be found in Table 12.

Table 12: *Nutrition status of participants*

	Total n (%) n=57	Men n=31	Women n=26
Normal nutrition status (12-14)	53 (93.0)	30 (96.8)	23 (88.5)
At risk (8-11)	3 (5.3)	1 (3.2)	2 (7.7)
Malnourished (0-7)	1 (1.8)	0	1 (3.8)

4.4.2 Mini nutritional Assessment item scores

The majority of participants (89.5%) had no decrease in food intake over the last three months or any weight loss (89.5%). Most participants had good mobility (91.2%) and no psychological stress (89.5%) or psychological problems (87.7%). The breakdown of responses to the MNA questions are found in Table 13.

Comparisons were made between those in the not at risk group and those in the at-risk group. Results however should be interpreted with caution due to subject numbers being small. A Fisher's exact test was conducted and tended to indicate significant differences between those in the not at risk group and those in the at-risk group.

Of those in the not at risk group were significantly more likely to have no decrease in food intake than those with a severe or moderate decrease in food intake ($P=0.003$). Of those in the not at risk group were significantly more likely to have no weight loss than those in the at-risk group ($P=0.003$). Of those with normal nutrition status were significantly more likely to have better mobility than those in the at risk group ($P=0.001$). Of those in the not at risk group were significantly more likely to have experienced no psychological stress or acute disease than those in the at-risk group ($P=0.05$). Lastly,

those participants in the not at risk group were also significantly more likely to have no psychological problems compared to those in the at risk group.

Table 13: *MNA item questionnaire scores*

	Total n (%) n=57	Not at risk (>12) n=53	At-risk (≤11) n=4
Food intake			
Severe decrease	1 (1.8)	0	1 (25.0)
Moderate decrease	5 (8.8)	3 (5.7)	2 (50.0)
No decrease	51 (89.5)	50 (94.3)	1 (25.0)
Weight loss			
Weight loss >3kg	2 (3.5)	0	2 (50.0)
Does not know	1 (1.8)	0	1 (25.0)
Weight loss between 1-3kg	3 (5.3)	3 (5.7)	0
No weight loss	51 (89.5)	50 (94.3)	1 (25.0)
Mobility			
Able to get out of bed/chair but does not go out	5 (8.8)	2 (3.8)	3 (75.0)
Goes out	52 (91.2)	51 (96.2)	1 (25.0)
Psychological stress or acute disease			
Yes	6 (10.5)	4 (7.5)	2 (50.0)
No	51 (89.5)	49 (92.5)	2 (50.0)
Neuropsychological problem			
Severe dementia or depression	3 (5.3)	2 (3.8)	1 (25.0)
Mild dementia	4 (7.0)	2 (3.8)	2 (50.0)
No psychological problems	50 (87.7)	49 (92.5)	1 (25.0)
BMI (n=41)			
BMI 19 to less than 21	3 (5.3)	3 (5.7)	0
BMI 21 to less than 23	4 (7.0)	4 (7.5)	0
BMI 23 or greater	34 (59.6)	33 (62.3)	1 (25.0)
Calf circumference (n=16)			
CC 31 or greater	16 (28.1)	13 (24.5)	3 (75.0)

4.5 Dysphagia risk

4.5.1 EAT-10: Swallowing screening scores

The EAT-10 is scored out of forty; a score of three or more is considered to be at risk of dysphagia, a score of less than three is no risk of dysphagia (Belafsky et al., 2008). The majority of participants were not at risk of dysphagia, n=30 (96.8%). There was no statistical difference in those at risk and not at risk between men and women. Results from the EAT-10 screening tool can be found in Table 14.

Table 14: *Participants at risk of dysphagia from EAT-10 scores*

	Total n (%) n=57	Men n=31	Women n=26
Not at risk of dysphagia (<3)	55 (96.5)	30 (96.8)	25 (96.2)
At risk of dysphagia (≥3)	2 (3.5)	1 (3.2)	1 (3.2)

4.6 Cognition

4.6.1 Montreal Cognitive Assessment Score

The MoCA assessment is scored out of thirty; a score of 26 or above is considered normal (Nasreddine et al., 2005). A total of 53 MoCA's were collected. Uncompleted MoCA's were due to: three participants who did not want to complete the assessment and one participant was physically unable to complete the assessment. Results from the MoCA can be found in Table 15.

Participant MoCA scores ranged from 13-30. The median [25th, 75th percentile] MoCA score was 23 [20, 27]. The majority of participants had MoCA scores 'below normal', n=36 (67.9%) compared to a third of participants who had MoCA scores within the normal range, n=17 (32.1%). More men had MoCA scores 'below normal', n=21 (58.3%) than women, n=15 (41.7%).

Table 15: *Participant MoCA scores*

	Total n (%) n=53	Men n=28	Women n=25
Normal (≥26)	17 (32.1)	7 (41.2)	10 (58.8)
Below normal (<26)	36 (67.9)	21 (58.3)	15 (41.7)

4.7 Differences between nutrition status and risk factors

The differences between nutrition status and demographic, social and health characteristics can be found in Table 16.

4.7.1 Marital status

Most participants with normal nutrition status were married, n=32 (60.4%). Two participants (50%) in the at risk group were also married. One quarter of participants were widowed both in those with normal nutrition status, n=14 (26.4%) and the single participant in the at-risk group. Only six participants (11.3%) were divorced or

Table 16: Demographic, social and health characteristics by nutrition risk status (MNA score ≤ 11 and > 12)

	Not at risk (>12)	At-risk (≤ 11)
Total	n=53 (93%)	n=4 (7%)
Marital Status		
Married/partnered	32 (60.4)	2 (50.0)
Widowed	14 (26.4)	1 (25.0)
Divorced/separated	6 (11.3)	0 (0)
Never married	1 (1.90)	1 (25.0)
Living Situation		
Living alone	12 (22.6)	1 (25.0)
Living with spouse only	23 (43.4)	0 (0)
Living with others	18 (34.0)	3 (75.0)
Income		
Pension only income	34 (64.2)	3 (75.0)
Pension plus other income	19 (35.8)	1 (25.0)
Education		
Primary	7 (13.2)	1 (25.0)
Secondary	31 (58.5)	2 (50.0)
Tertiary	15 (28.3)	1 (25.0)
BMI (kg/m^2) n=55		
Normal ($18.5 - 24.99 \text{ kg/m}^2$)	17 (32.7)	2 (66.7)
Overweight/obese ($\geq 25 \text{ kg/m}^2$)	35 (67.3)	1 (33.3)
Key co-morbidities		
1-3 Health conditions	37 (69.8)	2 (50.0)
≥ 4 Health conditions	11 (20.8)	2 (50.0)
Medications		
≥ 5 prescribed medications	14 (26.4)	3 (75.0)
< 5 prescribed medications	39 (73.6)	1 (25.0)
Nutritional Supplements		
Taking supplements	27 (50.9)	2 (50.0)
Dental Status		
Dentate	22 (41.5)	2 (50.0)
Edentulous	3 (5.7)	0 (0)
Dental Appliance	28 (52.8)	2 (50.0)
Support services		
Receiving support services	5 (9.4)	1 (25.0)
Requires daily help	9 (17)	2 (50.0)
Final EAT-10 scores		
Not at risk of dysphagia (< 3)	53 (100)	2 (50.0)
At risk of dysphagia (≥ 3)	0	2 (50.0)
MoCA scores n=53		
Normal cognition (≥ 26)	15 (30.0)	2 (66.7)
Below normal (< 26)	35 (70.0)	1 (33.3)

separated and one participant with normal nutrition status and one participant at-risk had never been married. Participants who were married were then compared to all those either widowed, divorced or living alone. No significant difference was found between those with normal nutrition status and those at-risk when compared to those married and all those either widowed, divorced or living alone.

4.7.2 Living situation

Most participants were living with only their spouse or living with others, both in the normal nutrition status group and the at-risk group. These were n=23 (43.4%), n=18 (34.0%) and n=3 (75%) respectively. Only 12 participants (22.6%) in the normal nutrition status group were living alone and one participant in the at-risk group.

Participants living alone were then compared to all those living with others. No significant difference was found between those with normal nutrition status and those at-risk when compared to those living alone and all those living with others.

4.7.3 Income

The main source of income for both the normal nutrition status group, n=34 (64.2%) and the at-risk group, n=3 (75%) was pension only. There were only 19 (35.8%) participants who had other sources of income and only one participant in the at-risk group.

4.7.4 Education

For the majority of participants, secondary school was their highest level of education both in the normal nutrition status group, n=31 (58.5) and the at-risk group, n=2 (50%). Of those with normal nutrition status, n=15 (28.3%) had tertiary education and n=7 (13.2%) had primary school education.

Participants with primary education were then compared to those with higher education. No significant difference was found between those with normal nutrition status and those at-risk when compared to those with primary education and all those with higher education.

4.7.5 BMI

All participants, in the normal nutrition status group and in the at-risk group had either a normal BMI, n=17 (32.7%), n=2 (66.7) respectively or a BMI in the overweight/obese category, n=35 (67.3%), n=1 (33.3%) respectively.

4.7.6 Key Co-morbidities

A number of participants reported having 1-3 key co-morbidities with 37 (69.8%) of participants in the normal nutrition status group and 2 (50%) of participants in the at-risk group. Of those found to have four or more key co-morbidities, n=11 (20.8%) were those with normal nutrition status and n=2 (50%) at-risk.

4.8.7 Medications

Three quarters of participants with normal nutrition status were taking less than five prescription medications, n=39 (73.6%). Of those in the at-risk group three quarters were taking five or more prescription medications, n=3 (75%).

4.8.8 Nutritional Supplements

Half of the participants both in the normal nutrition status group (n=27 (50.9%)) and the at-risk group (n=2 (50%)) were taking nutrition supplements.

4.8.9 Dental Status

The majority of participants were either dentate or had a dental appliance. Of those in the normal nutrition status group, 22 (41.5%) were dentate and 28 (52.8%) had a dental appliance. In the at-risk group 50% were dentate and 50% had a dental appliance.

4.8.10 Support Services

The majority of participants did not receive any support services in the normal nutrition status group, n=48 (90.6%) or in the at-risk group, n=3 (75%). The majority of participants also did not require daily help in either the normal nutrition status group, n=44 (83%) or the at-risk group, n=2 (50%).

4.8.11 EAT-10 scores

All those in the normal nutrition status group were not at risk of dysphagia. Of those in the at-risk group, 50% were at risk and 50% were not at risk.

4.8.12 MoCA scores

Of those with normal nutrition status (n=53), more participants [n=35 (70%)] had 'below normal' scores. In the at-risk group (n=3), two participants scored within the normal range and one participant scored within the 'below normal' range.

Chapter 5. Discussion

5.1 Study outcome: Prevalence of nutrition risk

The aim of this study was to determine the prevalence of nutrition risk amongst independent community living older adults enrolled within the Waitemata DHB. This is one of the few studies in New Zealand that aims to explore the nutrition status and risk of dysphagia among community living older adults. The results of this study showed a prevalence of 7% (n=4) nutrition risk among the sample group (n=57) using the validated MNA-SF nutrition screening tool. In this study, three participants were at-risk of malnutrition (cut off scores between 8-11) and one participant was considered malnourished (score between 0-7).

In Australia, Winter et al. (2013) investigated the prevalence of nutrition risk in a group of 225 older adults aged 75 years and over (mean age 81 ± 4.3 years) using the MNA-SF screening tool. Of the participants, 17% were at-risk and 83% had normal nutrition status. Similar to the present study only one participant was found to be malnourished. Another Australian study by Isenring et al. (2013) looked at the prevalence of nutrition risk in a sample of 254 older adults aged greater than 65 years (mean age 74.3 ± 6.0 years). Four percent were found to be at-risk and 96% were not at risk. The lower prevalence in this study may have been due to the younger study population. Lastly, Nykanen et al. (2012) looked at the nutrition status in a group of 696 older adults aged 75 years and older (mean age 81 ± 4.6 years) in Finland. Fifteen percent were at nutrition risk and 85% had normal nutrition status. This study found that those who were at-risk were older (83 years) than those not at risk (80 years).

In New Zealand, the SCREEN tool (Seniors in the Community: Risk Evaluation for Eating and Nutrition, version II) has been used to investigate nutrition risk in community living older adults. The SCREEN is another commonly used nutrition risk screening tool which has been validated for the use in adults living in the community (Keller et al., 2005; Keller, McKenzie, & Goy, 2001). In the city of Christchurch, Watson et al. (2010) studied 152 community living adults aged 70 years and older either living alone or with one other person, and identified 54% at nutrition risk. In the Bay of Plenty, Wham, Teh, et al. (2011) found 52% of 112 community living adults aged between 75 and 85 years were at nutrition risk. In the Hawkes Bay, McElnay et al. (2012) also had similar findings with 57% of participants at risk in a sample of 473 older adults. Lastly, in Auckland, Wham, Carr, et al. (2011) found a smaller prevalence of nutrition risk with 31%

of participants at risk. However, in this study the sample size was fairly small (n=51) compared to the other studies conducted in New Zealand.

Nevertheless, the prevalence of nutrition risk was greater in these New Zealand studies compared to the current study. There are several reasons why the prevalence of nutrition risk may have been lower in the current study. Firstly, the sample size of other studies was greater, with participant numbers ranging from 112 to 696 whilst the current study only included 57 participants. Secondly, the studies in New Zealand used a different tool to assess nutrition risk. There is currently no single 'gold standard' tool in use when assessing nutrition status as a variety have been validated for the use in community adults (Green & Watson, 2006). In the present study, the MNA-SF tool was used. In a review of nutrition screening tools for older adults in the community the MNA-SF and SCREEN II were rated the highest but the MNA-SF was deemed the more appropriate for community settings due to its high validity, reliability and sensitivity (Phillips et al., 2010). Other studies using different nutrition risk tools such as the MNA and DETERMINE checklist have shown that nutrition risk was prevalent in 4.6% to 16% of community-living older people in Poland and Singapore (Wyka et al., 2012; Yap et al., 2007). In addition to this, a review of nutrition risk studies using the MNA screening tool found the average prevalence of nutrition risk was $24 \pm 0.4\%$ 8-76% in a variety of international countries (Guigoz, 2006).

Another plausible explanation for the low prevalence in the current study was that the age of this cohort was a relatively young population group compared to other studies. The median age [25th, 75th percentile] of the current study population group was 72 [68, 76] with majority of the group (70.2%) between the ages of 65-74 years. In the study by Wham, Teh, et al. (2011) 51% (n=55) of participants were found to be at risk of malnutrition with the average age of this group at 79 years. Additionally, Takeuchi et al. (2014) found in those who were at risk, there was a greater prevalence in those aged 75 years and older (range 24%-27%) (n=153) compared to those aged under 75 years (range 20-24%) (n=721). The present study is the first of its kind in the Waitemata DHB, and while the results may not be generalizable to all community living older adults or the wider Waitemata DHB geographic area, it does however confirm that nutrition risk may be prevalent in other community living people in New Zealand.

5.2 Characteristics of participants with normal nutrition status

Many factors can influence nutrition status such as socio-demographic and health characteristics (Dunne, 2008). In our population sample we found that participants who had normal nutrition status had the following factors in common: all had BMI's within the normal weight category or obese category, 87% had completed secondary or tertiary education as their highest level of education, 79% had either no co-morbidities or less than four co-morbidities, 77% were either living with a spouse or living with others, 74% were taking less than five medications, 60% were married, 58% were New Zealand European ethnicity, 42% were dentate and no one in the population group was found to be at risk of dysphagia.

In the current study a large proportion of the participants identified as being New Zealand European ethnicity (58%). Other ethnicity groups were New Zealand Maori (14%), Pacific (12.3%) and other (15.8%). According to the 2006 census the older population (≥ 65 years) of Waitemata DHB is made up of predominantly New Zealand European (85.8%), with only 2.4% New Zealand Maori, 2.3% Pacific Islander and 9.7% other ethnic groups (Waitemata DHB, 2007). Therefore, Maori and Pacific ethnic groups are slightly over-represented in this study compared to the Waitemata DHB ethnic spread. Although the ethnic makeup is different to that of Waitemata DHB it is a closer match to the ethnic makeup of the total New Zealand population which is made up of 58% New Zealand European, 14% Maori, 12.3% Pacific and 15.8% (Waitemata DHB, 2007). New Zealand research suggests that nutrition risk is five times greater in older Maori than non-older Maori (McElnay et al., 2012), therefore due to the larger proportion of Maori in the current study this provides further valuable insight into the nutrition risk status of this population group.

Overall, this study found that participants were a relatively healthy group of older people. For example 9% of participants with normal nutrition status reported having zero co-morbidities and 70% reported having 1-3 co-morbidities, with only 21% reporting four or more co-morbidities. This is similar to that found in the New Zealand Older People's Health Chart Book. Of those aged over 65 years, 15% reported no co-morbidities, 67% reported 1-3 co-morbidities and 18% reported four or more co-morbidities (Ministry of Health, 2006c). Therefore it is unsurprising that most participants (93%) in the current study were found to have a normal nutrition status.

Most participants with normal nutrition status in this population group were married or partnered (60.4%) and either living with their spouse (43.4%) or living with others (34%). The sharing meals of meals and having others present when eating has been shown to help improve meal consumption, resulting in higher intake of calories (Locher et al., 2005). In contrast, those who live alone have been shown to have poor nutrition intake as a result of forgetting to eat, lack of motivation to prepare meals and not wanting to eat the food once it is cooked (Watson et al., 2010; Wylie et al., 1999). Living arrangements can have an effect on diet quality and can be a major barrier to maintaining nutrition status (American Dietetic Association, 2005). Living alone has been found to be a key risk factor for nutrition risk (McElnay et al., 2012; Watson et al., 2010; Wham, Carr, et al., 2011). Encouraging older adults to eat together and share meals with friends and family may help improve dietary intake and help to maintain nutrition status.

In the normal nutrition status group 58.5% had secondary school education and 28.3% had tertiary education making up 86.8% of the group. Well-educated people have been shown to have good knowledge of nutritional health (Callen & Wells, 2003). In a group of 68 community living older adults in the United states Callen and Wells (2003), found those older adults who were better educated demonstrated better healthy nutritional behaviour such as cutting down on fats, using lean meats and healthy methods of cooking and also trying to include whole foods in their diet rather than processed foods. McElnay et al. (2012) found that nutritional knowledge in a group of older adults was lacking and expressed the need for dietary health promotion targeted specifically to older people. Understanding of the importance of good nutrition as people get older is important as eating the right foods can positively impact on health (Ministry of Health, 2013c). It could be assumed that our study population may have had more of an interest in food and nutrition knowledge and as a result of this most participants had normal nutrition status.

In the present study we found that all participants within the normal nutrition status group had BMI's either within the normal range (32.7%) or in the overweight or obese category (67.3%). Nutrition plays an important role in maintaining a healthy body composition. No participants with normal nutrition status were found to be underweight. A possible explanation for this may be that 70.2% of this group are aged between 65 and 75 years. Current statistics show that older adults aged between 65-74 years have the highest rates of obesity compared to adults under 65 years in New Zealand, whilst adults in the over 75 group, BMI values begin to trend downwards (Ministry of Health,

2012a). A low BMI has been shown to contribute to increased risk of poor health status and an increase in mortality (Sergi et al., 2005). More importantly a low body weight can also increase nutrition risk (Wham, Teh, et al., 2011). Wham, Teh, et al. (2011) found that participants who had a low level of body fat were found to be associated with higher nutrition risk. Given that the current study population group only had normal and elevated BMI's we would expect to see them with normal nutrition status.

In the current study three quarters of participants with normal nutrition status were taking less than five prescription medications (73.6%). The definition of polypharmacy is the use of five or more medications concurrently (Heuberger, 2012; Ministry of Health, 2013c). However in the present study, the population group was mostly aged between 65 – 74 years. In older adults, prescribing rates are high and continue to rise with age (Martyn et al., 1998; Ministry of Health, 2013c). According to New Zealand statistics, 36% of adults between the ages of 65 – 74 have on average 10 or more prescriptions per year. However, as they get older, the number of adults with 10 or more prescriptions increases to 43% in adults aged 75 years and over. This could be up to 20 medications per prescription (Statistics New Zealand, 2004). This is consistent with the work of Keller (2006) who found that those who had normal nutrition status were taking less prescription medications than those who were at nutritional risk (Keller, 2006). The present study has a younger population group, therefore would be more likely to have a small number of participants with polypharmacy.

Nearly half of the participants with normal nutrition status were dentate (41.5%) or had dentures (52.8%). Good dental status is an important factor in order to maintain nutrition status because as adults get older loss of teeth and poor denture quality can contribute to chewing difficulties (Lamy et al., 1999). Individuals who have chewing difficulties may experience altered eating habits affecting dietary intake which could lead to nutrition risk (Lamy et al., 1999). Participants in the present study who were dentate or had dentures may be able to maintain nutrition status better, as they can eat a greater variety of foods and not have to avoid chewy foods such as meat. Older adults who are dentate have been found to eat a greater variety of foods and have better nutrient intakes compared to those who are edentulous (Sheiham & Steele, 2001). Good dental status can also help to maintain nutrition status. Older adults who have natural teeth or dentures are less likely to have poor nutrition status than those who are edentulous (Saarela et al., 2014).

Lastly, in the present study, those with normal nutrition status were all screened for dysphagia and no participants were found to be at risk. It is suspected that this may be due to dysphagia being more common in those with oesophageal reflux, stroke, dementia, COPD, or those with severe neck, back or head injuries (Kawashima et al., 2004; Ragdale, 2014; Sura et al., 2012). This study population was particularly healthy with little history of such co-morbidities. The effects of dysphagia can lead to inadequate dietary intake, which could potentially put them at nutrition risk. In a study by Serra-Prat et al. (2012) nutrition risk was found to be significantly associated ($P=0.010$) with dysphagia and also impaired swallowing. Due to majority of the current study population having normal nutrition status it is not surprising that there were no participants at risk of dysphagia.

5.3 Characteristics of participants at nutrition risk

The characteristics of those at risk differed to those not at nutrition risk. In particular, those at risk ($n=4$) were all women. Similar results were seen by Winter et al. (2013) in a study of 225 Australian community living older adults, finding 63% of those at nutrition risk were female. In the Older People's Health Chart Book, women (26%) were more likely to have four or more co-morbidities than men (14.8%) (Ministry of Health, 2006c). This could be in relation to women having poorer health status, however current statistics show that women live longer than men (Statistics New Zealand, 2007). Women may live with more co-morbidities but men may die younger. According to the New Zealand Health and Burden of Disease study men experience 13% more fatal health loss than women (Ministry of Health, 2013d).

The present study identified four participants at nutrition risk. One participant identified as being Maori and two were Pacific. In New Zealand, Maori have the highest rates of most health conditions according to the New Zealand Health Survey (Ministry of Health, 2013e). Maori specifically have higher rates of respiratory disorders, heart disease, stroke and diabetes (Ministry of Health, 2013e). Disparities are also present in Pacific older adults with levels of obesity and diabetes being comparatively higher than other ethnicities (Ministry of Health, 2012a). A New Zealand study conducted in the Hawkes Bay in a sample of 473 Maori and Non-Maori participants, found Maori were five times more likely to be at nutrition risk than Non-Maori. In the present study 14% ($n=8$) were Maori and 12.3% ($n=7$) were Pacific suggesting it would be expected that a higher portion of Maori participants would be in the at-risk group. If it was a larger sample size

more significant differences between Maori and Non-Maori may have been found between those at-risk and those not at risk.

In this study results showed three participants within the at-risk group (n=4) were on five or more regular medications. The impact of being on five or more prescription medications can increase an individual's risk of food drug interactions, which could affect food intake and also nutrition status (Heuberger, 2012). Our results are similar to that found by Keller (2006). In a sample of 367 Canadian older adults living in the community, those at high nutrition risk (35%) used significantly ($P<0.001$) more medications and had more medical problems than those who were not at high nutritional risk (65%). Nearly 40% of men and 45% of women reported using more than three prescription drugs, over the counter medications, or vitamin-mineral supplements each day (Keller, 2006). Nykänen et al. (2012) also found malnutrition was associated with increasing number of regular medication use in a sample of 696 older community adults in Finland. The average number of medications used by those found at-risk was five, similar to that in the present study, where those in the at-risk group had an average number of four medications at once.

Another characteristic of those in the at-risk group was three out of four participants required support services or daily help. As adults get older the ability to shop and prepare foods may become more difficult or they may have trouble accessing stores. Helping older adults in their own homes can help them to maintain independence and stay active within the community. It can also help to ensure individuals are getting the food they need, having meals cooked for them and help with everyday living. In the study by Callen and Wells (2003) participants identified having family and friends to help with buying groceries and cooking was the top aid to maintaining nutritional health. This can also help social connectedness as eating or living alone has been found to be a key nutrition risk factor (Wham, Carr, et al., 2011).

In contrast, receiving home help has been found to be a predictor for nutrition risk in older adults as older individuals are unable to carry out simple tasks on their own. In a sample of 158 community living older adults in Norway those who were at nutrition risk were receiving more home help, nursing care and help from family than those with normal nutrition status (Tomstad et al., 2012). Similarly, in a sample of 51 community living older adults in Auckland, participants who required assistance with housework, meal preparation, shopping, paying the bills and help with dressing and feeding were more likely to be at nutrition risk than those who didn't require assistance (Wham, Carr,

et al., 2011). Ensuring older adults get the support they need may help them to remain in the community. It is also important that those who are looking after these older adults in the community are aware of nutritional issues so that early identification of problems occurs as this may help to prevent future nutritional complications.

In this study two participants in the at-risk group had risk of dysphagia. Dysphagia is a symptom and means difficulty swallowing. It therefore follows that those with difficulty swallowing may experience nutritional issues. Studies confirm links between dysphagia and nutrition risk. Serra-Prat et al. (2012) investigated the relationship between dysphagia and nutrition risk in a sample of community living older adults aged 70 years and older in Spain. The prevalence of nutrition risk among participants was found to be significantly associated with dysphagia ($P=0.010$) and impaired efficiency of swallowing ($P=0.015$). Another recent study which investigated the association between nutrition status and dysphagia risk in community-dwelling frail older adults in Japan found those at risk of dysphagia had a significantly higher prevalence of malnutrition ($P=0.02$) than those not at risk (Takeuchi et al., 2014). This supports the current finding that those participants who are at nutrition risk may also be at risk of dysphagia.

People who are at risk of dysphagia will often experience symptoms including pain when swallowing, coughing, regurgitation, and the need for liquid to wash the food down or have difficulty clearing saliva before a diagnosis is made (Katzka & Kochman, 2004). These symptoms may cause people to change their way of eating and as a result can put them at risk of developing poor nutrition status. This is because these symptoms may cause restriction of foods or food groups or having to modify the consistency of liquids and foods so that they are more easily ingested (Katzka & Kochman, 2004). This can result in low acceptability and poor adherence to foods which may result in inadequate nutritional intake (Sura et al., 2012). A study which investigated the association of swallowing dysfunctions and nutrition status in a group of 1065 older adults living in the community in the United States, found those with swallowing difficulties had poorer nutrient intakes compared to those with no swallowing problems (Mann et al., 2013). Participants were found to be deficient in a number of nutrients including fibre, potassium, calcium, magnesium, vitamin D and folate. Findings from this study suggest swallowing difficulties can place individuals at risk of poor nutrition status due to inadequate nutrient intake. It is important for those found to be at risk of dysphagia that follow-up treatment occurs in order to reduce the long term effects of dysphagia symptoms and also to help improve nutrition status.

5.4 Strengths

There are a number of nutrition assessment tools suitable for the use in older adults (Green & Watson, 2006). However, the MNA has been widely used in older adults and is often referred to as the gold standard (Guigoz, 2006). A strength of this study was the use of the MNA-SF which is a valid and reliable nutrition risk screening questionnaire designed specifically for community-living older adults to identify those who are malnourished and those at risk of malnutrition.

Other questionnaires including the SCREEN II tool and DETERMINE checklist have also shown to be valid and reliable, however, they have not been as extensively used within community dwelling populations (Green & Watson, 2006; Phillips et al., 2010). The MNA-SF is quicker and easier to use than the MNA tool and has been shown to have high diagnostic accuracy in relation to nutrition status in older adults within the community (Rubenstein et al., 2001). The use of the MNA-SF in the current study ensured that nutrition risk status of the participants were reliable for the participants living within the community setting. It was also easy to administer and only took a mean time of ten minutes which helped to reduce response burden.

A further strength of the current study was the training the research student received on how to administer the MNA-SF assessment and employ interview techniques for older people. This helped to ensure the information was appropriately collected and measurements taken were performed using the recommended best practice techniques. Accuracy of anthropometric measurements was considered essential to avoid misplacing participants into the wrong nutrition risk group. The research student was also the single interviewer, helping reduce inter-individual variability.

The final strength of this study was the representation of participants from different ethnic groups. This is one of the few studies to investigate differences in nutrition risk status among different ethnic groups. In the present study 14% of participants were Maori and 12% were Pacific similar to the ethnic distribution of people living in Auckland which 8% are Maori and 11% are Pacific (Auckland District Health Board, 2014). In the study by McElnay et al. (2012) in the Hawke's Bay, Maori made up 9% of the study population.

5.5 Limitations

This study provided a snapshot of the current nutrition status of independent living older adults in the Waitemata DHB community. However, there were limitations as a result of small participant numbers. A total of 368 individuals received a letter inviting them to participate in the study and were contacted by phone. As a result of the small sample size, the results should be interpreted cautiously. Only 57 older adults agreed to participate in the study. As there was only a short period of time for recruitment, further individuals were not contacted due to the data collection timeframe unable to be extended further. If the study had been extended over a longer period of time the participation rate could have been higher.

This was a cross-sectional design and therefore the findings were not causal but we were able to report associations. The sample of participants recruited was self-selected and not randomised. An administrator within the Waitemata Health Union provided a list of potential participants for the research student that fitted the eligibility criteria. Therefore it could be assumed that those who were chosen by the administrator may have been 'healthier'. Furthermore, because this was a self-selected group it could be assumed that those who agreed to be in the study had more of an interest in research. Therefore, the extent to which these study findings can be applied to the wider population of community-living older adults in Auckland is unknown. A randomized sample may have provided a more representative group of older adults living in the community to reduce selector bias. However the selection of possible participants by the General Practice was made only by age criteria and whether there was any contraindication to participation (specifically severe or terminal illness so as not to unduly burden participants). The researchers did not select or have a role in selecting the study pool. The selection pool therefore may be representative of the population that attends this specific general practice. Use of another general practice would likely have presented a different demographic and results may then have differed as may participation rates.

The nutrition screening was completed by face to face interviews in the participant's homes. The participant's use of medications, nutrition supplements and current health conditions were all self-reported. In order to reduce any error, where possible, reported medications were verified from prescription forms and medication packages, however not all the participants information may have been reported accurately. Having access

to participant's medical notes may have been helpful but for privacy reasons these were not available.

Finally, there were limitations with regards to the assessment of cognitive function. In the present study the MoCA assessment, a validated tool for the use in screening for MCI, was used to assess cognitive function (Nasreddine et al., 2005). The benefit of using the MoCA was that it was a stand-alone cognitive tool and could be administered in a short period of time to reduce respondent burden. However, after conducting the participant interviews the results did not seem to be reliable and a good representation of the group's cognition. Some of the participants refused to complete the MoCA questionnaire or attempt to answer particular sections. Additionally, for some participants a language barrier may have affected their understanding of the questions leading to unanswered sections, therefore the scoring was inaccurate and therefore extremely difficult to score over 26 which is considered normal. Over two thirds (68%) of participants scored below what is considered normal cognition therefore results should be interpreted cautiously. If there was more time another cognitive assessment may have provided a better representation of the study population group cognitively.

Chapter 6. Recommendations and conclusions

6.1 Recommendations

Findings from the present study indicate that the prevalence of nutrition risk in the current sample of community-dwelling older adults was low. These results are dissimilar to that found in other studies in New Zealand, although similar findings have been seen in international research (Isenring et al., 2013; Nykanen et al., 2012; Winter et al., 2013). However further research is needed to better understand the nutrition risk status of older adults throughout New Zealand communities as rates may vary with geographic location or urban verse rural settings.

In the present study there were only two participants at risk of dysphagia. It is recommended that when assessing for nutrition risk if there are concerns regarding swallowing then dysphagia is screened for also. Early identification of dysphagia is important in order to provide early intervention and to reduce the chances of failing health due to poor dietary intake.

It is also recommended to further investigate the nutrition risk status of older Maori. One study in New Zealand found Maori are five times more likely to be at nutrition risk compared to non-Maori (McElroy et al., 2012). Health disparities still exist between Maori and Non-Maori older adults therefore it is important that older Maori are supported in a way that is meaningful to them. From the current findings a study with higher participant numbers and a larger Maori population is recommended to provide further insight.

On the basis of the current findings it is recommended older New Zealanders follow the Food and Nutrition guidelines for healthy older people set out by the Ministry of Health. These are evidence based guidelines to help older adults to achieve and maintain good nutritional health and wellbeing (Ministry of Health, 2013c). The food and nutrition guidelines also recommend that for older adults to eat with others. This helps to improve food intake and social connectedness.

6.2 Conclusions

6.2.1 Summary of the study

This study was designed as a cross-sectional study to determine the prevalence of nutrition risk amongst independent community living older adults in the North Shore and Waitemata area. Fifty seven older adults aged between 65 and 93 years were included in this study. Participants were screened for nutrition risk using the MNA-SF tool. Information on demographic, social and health factors was also collected in one-on-one interviews within the participant's homes. Participants were also screened for dysphagia risk using the EAT-10 and cognition assessment using the MoCA. Nutrition risk factors related to nutrition risk status were compared in those with normal nutrition status and those at-risk. Results of this study suggest that while the rate of nutrition risk was lower compared to that in previous studies in older community living adults, 7% of participants were identified to be at nutrition risk. Most (93%) participants had normal nutrition status, indicating that the study population group was relatively healthy.

In contrast to those at nutrition risk participants who had normal nutrition status tended to be married or had a partner (60.4%), were more likely to be living with their spouse or others (77.4%) than living alone (22.6%) and more participants had completed secondary school tertiary education (86.8%). Additionally, none of these participants were found to be underweight, most participants took less than five prescription medications (73.6%), most were dentate or had a dental appliance (94.3%) and there were no participants at risk of dysphagia. Those demonstrating nutritional risk were a small group (n=4) but did share gender (n=3), ethnicity (n=3), risk of dysphagia (n=2), number of medications (n=3) and use of support services (n=3) factors.

6.2.3 Conclusions

In conclusion, this study found a low prevalence of nutrition risk in a sample of healthy community-dwelling older adults. We found that those participants who had normal nutrition status were mostly of New Zealand European ethnicity, were married or partnered, had less co-morbidities and were on less prescription medications. Most participants were dentate or had a dental appliance and none reported dysphagia. Our results contribute to the body of evidence that nutrition screening is important to identify those at nutrition risk in our communities. It is particularly important that we interact with Maori and Whanau to increase awareness of nutritional problems in this population group. Early identification of nutrition risk can help to prevent nutritional problems in older adults and to enable them to remain active and healthy within the community.

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Appendix 1.



Dear

I am writing to invite you to participate in a study about Nutrition in adults in Auckland. Your Medical Practice, XX, is participating in this research in association with Waitemata District Health Board and Massey University.

The study aims to develop a 'snap shot' of the nutritional status of adults over the age of 55 years living in the Waitemata District Health Board region. It involves collecting data about participants' diets and how they eat and making some simple measures of the body. The information will be analyzed to determine whether there are ways that nutrition affects health and living conditions. This will guide researchers in developing programmes and allocating resources to education regarding nutrition.

If you chose to participate you will be asked to meet with a researcher who will conduct an interview with you about diet and how well you can eat, and then measure the circumference of your arm, calf and your body height and weight. The interview will take approximately 30-60 minutes. No further time is required. Information will be strictly confidential and only seen by the research team. General amalgamated data will be reported to the DHB and public via journal articles and education but this will not contain any personal identifying information. If a problem was detected you would be offered appropriate support and treatment if needed.

If you would like to participate or find out more about the study please contact

Lynelle (Elle) Dagley

Gerontology Nurse Specialist - Nga Kaitiaki Kaumatua

Comprehensive Care Ltd

Phone: +64 9 415 1091 ext 8701

DDI: 09 414 6732

Mobile: 021 689 131

www.comprehensivecare.co.nz

Emily Fraser, Masters Student
0274385350
fraseremily8@gmail.com

We would appreciate your participation. We will phone you within 10 days of receiving this letter to see if you would like to be involved. Thank you for your consideration.

Kind regards

The Research Team

Dr Jacqui Allen, FRACS

Otolaryngologist

Waitemata District Health Board

Dr Lannes Johnson

Clinical Director

Waitemata PHO

Dr Carol Wham

Supervisor, Dietician

Massey University

Appendix 2.



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
hdec@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

<i>Document</i>	<i>Version</i>	<i>Date</i>
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 Hiini	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 3.



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	Authoriser	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

Appendix 4.

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 underweight¹³

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
He Kamaka Waiora (Maori Health)
Waitematā and Auckland DHB's,
Private Bag 93 503,
Takapuna, Auckland
Ph + 64 9 4868920 ext 3204
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Tereki Stewart
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Waitematā and Auckland DHB's
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Appendix 5.

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 who may not survive 2 years

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 survey's 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.

The following procedures are NOT PART OF REGULAR CARE AND WILL ONLY BE DONE IF YOU JOIN THE STUDY:

You will complete a dysphagia specific quality of life instrument, the 10-item Eating Assessment Tool (EAT-10).

You will meet a researcher and answer questions regarding your diet and health.

You will have body measurements taken including your weight, height, calf circumference and arm length.

Another way to find out what will happen to me during the study is to read the chart/table below.

Consent form signed	X
Take EAT-10 survey	X
Meeting with researcher for interview and body measurements	X

HOW LONG WILL I BE IN THE STUDY?

You will be asked to participate in the study for a single visit lasting about 60-90 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 identified. 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 6.



PATIENT INFORMATION SHEET

Research Title:

Multidimensional Nutritional Assessment in an Elderly Urban Population

Primary / Principal Researcher:

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Otolaryngologist, Waitemata District Health Board

University of Auckland

021 897 444

Co-Investigators:

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Takapuna
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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.

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 complete a short questionnaire about your swallowing.
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 60-90 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:

- 5) Age greater than 65 yr (European ethnicity), age greater than 55 yr (Maori and Pacific Island ethnicity)
- 6) Able to complete self-assessment questionnaire
- 7) Willing to undergo anthropomorphic measures
- 8) Admitted to ward or residential care within no longer than three working days

Exclusion Criteria:

- 9) Age less than 65 or 55 yrs (depending on ethnicity).
- 10) Presence of a tracheotomy tube or airway obstruction necessitating a tracheotomy tube.
- 11) Patients with orocutaneous or pharyngocutaneous fistulae at the time of evaluation.
- 12) Patients with known metabolic or nutritional malabsorption disorders.
- 13) Patients with psychiatric illness affecting nutrition eg. Anorexia nervosa.
- 14) Patients with a life expectancy < 2 years.

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 - Maori Research Review Committee Waitemata DHB encourage those who identify themselves as Maori and who are participating in health research or clinical trials to seek cultural support and advice from either Mo Wai Te Ora – Maori Health Services or their own Kaumatua or Whaea. For assistance please contact the Services Clinical Leader for Mo Wai Te Ora – Maori Health on 09 486 1491 ext: 2324 or the Maori 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 7.

Older Adults Nutrition Risk and Dysphagia Screening

Student Dietitian Interviewer:.....

Interview Date: / /

Personal

1. ID number:.....

2. Last name:.....

3. First name:

4. NHI number:.....

5. DOB:/...../.....

6. Age:.....(years)

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

Demographic

13. Which of these best describes your ethnicity?

1 = New Zealand European

2 = New Zealand Maori

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)

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

Number of medications: _____

Medication	Comment

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

Number of supplements: _____

Nutrition Supplement	Comment

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 Nutrition Assessment (Nestle Nutrition Institution)

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	does not know	weight loss between	no weight loss
-------------	---------------	---------------------	----------------

greater than 3 kg		1 and 3 kg		
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	
0	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 No problem	1	2	3	4 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

Interviewer to answer the following

How well do you rate:

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

Comments (required if answer is 1 or 2):

Appendix 8.



To whom it may concern,

I am writing to inform you that your patient xx recently participated in a study to investigate nutrition risk status of older adults. Your Medical Practice is participating in this research in association with Waitemata District Health Board and Massey University. This study aims to develop a 'snap shot' of the nutrition risk status of adults over the age of 55 years living in the Waitemata District Health Board region by collecting anthropometric measures and responses to validated questionnaires to determine nutrition risk and risk of dysphagia.

Xx participated in this study on DAY/MONTH and results indicate xx is at high risk of malnutrition/risk of dysphagia. xx has given us consent to inform you of this information to enable follow up for further support.

If you have any further questions regarding this information please feel free to contact me or any other members of the research team.

Kind regards

Emily Fraser (Dietetics Masters Student)

fraseremily8@gmail.com

0274385350

The Research Team

Dr Jacqui Allen, FRACS
Otolaryngologist
Waitemata DHB

Dr Lannes Johnson
Clinical Director
Waitemata PHO

Dr Carol Wham
Clinical Supervisor, Dietician
Massey University

Appendix 9.

MONTREAL COGNITIVE ASSESSMENT (MOCA) Version 7.1 Original Version

NAME :
Education :
Sex :

Date of birth :
DATE :

VISUOSPATIAL / EXECUTIVE		NAMING		MEMORY		ATTENTION		LANGUAGE		ABSTRACTION		DELAYED RECALL		Optional		ORIENTATION		POINTS																																										
 [] []		 []		 []		Read list of words, subject must repeat them. Do 2 trials, even if 1st trial is successful. Do a recall after 5 minutes. <table border="1" style="width: 100%; text-align: center;"> <tr> <td></td> <td>FACE</td> <td>VELVET</td> <td>CHURCH</td> <td>DAISY</td> <td>RED</td> </tr> <tr> <td>1st trial</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>2nd trial</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>			FACE	VELVET	CHURCH	DAISY	RED	1st trial							2nd trial						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		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. []		Similarity between e.g. banana - orange = fruit [] train - bicycle [] watch - ruler		Has to recall words WITH NO CUE <table border="1" style="width: 100%; text-align: center;"> <tr> <td>FACE</td> <td>VELVET</td> <td>CHURCH</td> <td>DAISY</td> <td>RED</td> </tr> <tr> <td>[]</td> <td>[]</td> <td>[]</td> <td>[]</td> <td>[]</td> </tr> </table>		FACE	VELVET	CHURCH	DAISY	RED	[]	[]	[]	[]	[]	Category cue Multiple choice cue <table border="1" style="width: 100%; text-align: center;"> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>												[] Date [] Month [] Year [] Day [] Place [] City		Draw CLOCK (Ten past eleven) (3 points) [] [] [] Contour Numbers Hands	Copy cube []
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Normal $\geq 26 / 30$

TOTAL

___/30

Administered by: _____

Add 1 point if ≤ 12 yr edu