

**Malnutrition: an under-recognised issue in our ageing
population**

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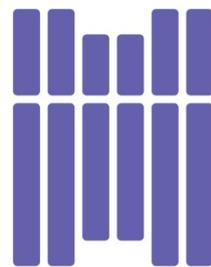
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Abstract

Background

Older adults are the largest group of nutritionally vulnerable people in Australia. With the proportion of Australians over the age of 65 years increasing, malnutrition is becoming an increasingly important clinical and public health issue for Australia. This PhD aims to examine the prevalence of malnutrition in the Australian Capital Territory (ACT) and surrounding region in selected acute care and residential aged care facilities (RACFs); to estimate the unclaimed financial reimbursement of hospital income in the acute care setting due to undiagnosed or undocumented malnutrition; to determine how many RACFs in Australia routinely use a nutrition screening tool on residents to identify those at risk of malnutrition; review practice following identification of aged care residents as being at risk of malnutrition; and to inform future strategies for improved identification of malnutrition which will ultimately impact on improved patient care.

Methods

Four individual studies were conducted to address the research questions in this thesis. The first was conducted in the acute care setting and used the Patient-Generated Subjective Global Assessment (PG-SGA) tool to determine the prevalence of malnutrition in 189 adult inpatients in the ACT region. Patients determined to be malnourished were audited to assess if malnutrition was documented and included in clinical coding. These data were compared to two historical control groups and two subsequent cohorts from the same hospital to determine the proportion of patients coded as being malnourished prior to our study and after our study. Unclaimed potential reimbursements to this hospital (per annum) were calculated based on previous studies. The second and third studies were conducted in the RACF setting and used the Subjective Global Assessment (SGA) tool to determine the prevalence of malnutrition in

57 and 101 residents respectively in the ACT region. In the third study, residents were also asked questions relating to the presence of any eating or swallowing difficulties, dentures, problems with gum or oral mucosa, and if assistance was required with meals. The fourth study collected data from a stratified sample of 229 RACFs in each state and territory in Australia. The Director of Nursing at each site was contacted by telephone and asked standardised questions relating to current nutrition screening practices at their residential aged care facility.

Results

In the acute care setting, 53% of inpatients were classified as malnourished. Significant associations were found between malnutrition and increasing age ($p = 0.040$), decreasing body mass index ($p < 0.001$), and increased length of stay ($p < 0.001$). Ninety-eight percent of malnourished patients were coded as malnourished in medical records. The results of the medical history audit of patients in historical and subsequent control groups showed between 0.9-5.4% of patients were coded as malnourished which is remarkably lower than the 52% of patients who were coded as malnourished from the point prevalence study data. This is most likely due to lack of identification. The estimated annual unclaimed financial reimbursement due to undiagnosed or undocumented malnutrition was AU\$8,536,200. In RACFs, 22-33% of residents were malnourished. In the RACF setting, malnutrition was also significantly associated with increasing age ($p = 0.038$). The majority of RACFs in Australia used a nutrition screening tool (82%), however only 52% used a tool which is validated in the RACF setting. There was a significant association between facilities using a nutrition screening tool and the staff members being trained to conduct nutrition screening ($p < 0.001$). Facilities that employed a dietitian were more likely to use a validated nutrition screening tool ($p < 0.005$).

Conclusion

Early recognition is one of the most effective ways to prevent and reduce the prevalence of malnutrition in older people, who are particularly vulnerable. Despite the awareness of this issue in the medical literature, these studies show that malnutrition continues to go unrecognised or undiagnosed. The findings highlight the importance of timely nutrition screening to identify older adults at risk of malnutrition, and regular dietetic assessment amongst high-risk patients to ensure malnutrition is recognised and diagnosed. It is imperative that validated tools are used to ensure malnutrition does not go undetected, and to provide training to staff to ensure that malnutrition is identified in a timely manner and documented appropriately.

Publications and Presentations

Peer-reviewed publications

1. **Kellett J**, Kyle G, Itsiopoulos C, Naunton M, Luff N. Malnutrition: the importance of identification, documentation and coding in the acute care setting. *Journal of Nutrition and Metabolism*. 2016, DOI 10.1155/2016/9026098
2. **Kellett J**, Kyle G, Itsiopoulos C, Naunton M, Bacon R. Malnutrition Prevalence in Aged Care Residents. A pilot study. *Topics in Clinical Nutrition*. 2015;30(3):276-280.
3. **Kellett J**, Kyle G, Itsiopoulos C, Naunton M, Bacon R, Costello L. Malnutrition prevalence and nutrition issues in five Australian Residential Aged Care Facilities. In Luszcz M and Feist H (Eds) *Making Research Matter: Program and Proceedings of the 13th National Conference of Emerging Researchers in Ageing*, pp72-75. Adelaide, 24-25 November, 2014. (Full peer-reviewed conference paper)
4. **Kellett J**, Kyle G, Itsiopoulos C, Naunton M. Nutrition screening practices amongst Australian residential aged care facilities. *Journal of Nutrition, Health and Aging*. February 2016, DOI 10.1007/s12603-015-0693-7

Conference presentations with peer-reviewed abstracts

1. **Kellett J**, Kyle G, Itsiopoulos C, Naunton M. ‘Nutrition Screening Practices amongst Australian Residential Aged Care Facilities.’ Dietitians Association of Australia 32nd National Conference, Perth, May 2015.
2. **Kellett J**, Kyle G, Itsiopoulos C, Naunton M, Bacon R, Costello L. ‘Malnutrition prevalence and nutrition issues in five Australian residential aged care facilities.’ 13th National Conference of Emerging Researchers in Ageing, Adelaide, November 2014.
3. **Kellett J**, Itsiopoulos C, Kyle G, Luff N. ‘Prevalence of malnutrition amongst adult inpatients at a tertiary teaching hospital in the ACT region.’ Australian Society for Medical Research New Investigator Forum, Canberra, June 2013.
4. **Kellett J**, Kyle G, Itsiopoulos C, Bacon R, Chapple L. ‘A snapshot of malnutrition prevalence in five residential aged care facilities in the ACT region.’ Dietitians Association of Australia 30th National Conference, Canberra, May 2013.
5. **Kellett J**, Itsiopoulos C, Kyle G, Luff N. ‘Prevalence of malnutrition amongst adult inpatients at a tertiary teaching hospital in the ACT region.’ Dietitians Association of Australia 30th National Conference, Canberra, May 2013.
6. **Kellett J**, Bacon R, Simpson A, Richards C. ‘Malnutrition prevalence in aged care residences.’ 16th International Congress of Dietetics, Sydney, September 2012.
7. **Kellett J**, Bacon R, Simpson A, Richards C. Malnutrition in Australian Aged Care Residents – A pilot study, Canberra Health Annual Research Meeting Program, Canberra, August 2012.

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Abbreviations

ACT	Australian Capital Territory
ASPEN	American Society for Parenteral and Enteral Nutrition
BMI	Body Mass Index
CNS	Clinical Nurse Specialist
DAA	Dietitians Association of Australia
DRG	Diagnosis Related Group
EN	Enrolled Nurse
MNA	Mini Nutritional Assessment
MNA-SF	Mini Nutritional Assessment – Short Form
MST	Malnutrition Screening Tool
MUST	Malnutrition Universal Screening Tool
PG-SGA	Patient-Generated Subjective Global Assessment
RACFs	Residential Aged Care Facilities
RDI	Recommended Dietary Intake
RN	Registered Nurse
SNAQ	Simplified Nutritional Assessment Questionnaire
SGA	Subjective Global Assessment

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Chapter 1: Introduction and Research Rationale

Globally, one in three people suffer from some form of malnutrition (undernutrition or overnutrition), and it is the number one driver of the global burden of disease (1). National statistics and recent media attention report that over 60% of Australians are affected by the serious health issues of overweight or obesity (2). However, another significant health problem both in Australia and internationally that does not receive the same amount of attention is undernutrition (or malnutrition as referred to in this thesis). Malnutrition is most significant in our ageing population (3). With the proportion of Australians over the age of 65 years increasing (4), malnutrition is becoming an increasingly important clinical and public health issue for Australia (3) and other developed countries (5).

Older adults are the largest group of nutritionally vulnerable people in Australia (6). They are at risk of malnutrition due to factors associated with ageing, such as a reduction in skeletal muscle mass and body weight (7), as well as other possible limitations, including difficulty swallowing (8), reduced appetite (9), inadequate nutritional intake (10), depression (11), and dementia (11). Studies have shown that malnourished older adults have poor physical function and delayed recovery from illness (12, 13), increased risk of osteoporosis (14), and also have an increased incidence of falls (12), hip fractures (15), and pressure ulcers (16).

As there are currently no data on malnutrition in adults residing in the Australian Capital Territory (ACT) region of Australia, or data on nutrition screening practices in Australian aged care residences, and with the proportion of Australians over the age of 65 increasing and older adults being the largest group of nutritionally vulnerable people in Australia, this thesis aimed to: (1) determine the prevalence of malnutrition in a sample of adult inpatients at a tertiary teaching hospital in the ACT region; (2) determine the estimated unclaimed financial

reimbursement to this hospital due to undiagnosed or undocumented malnutrition; (3) determine the prevalence of malnutrition in a sample of older adults in residential aged care facilities in the ACT region and identify nutrition issues that may affect dietary intake; (4) and to determine nutrition screening practices amongst Australian RACFs.

Chapter 2: Literature Review

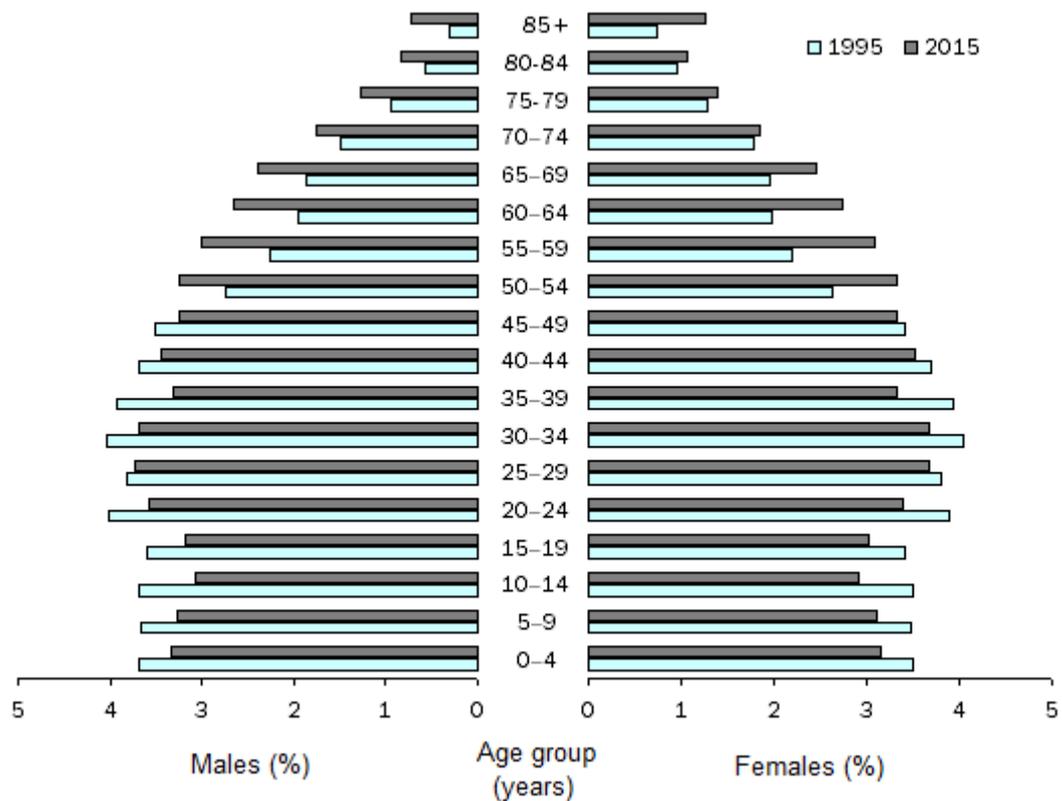
This chapter provides a review of Australian and International literature relating to malnutrition and ageing. The review explores: (1) Australia's ageing population; (2) the ageing population of the Australian Capital Territory (ACT) region; (3) residential aged care in Australia and the ACT; (4) the definition of 'malnutrition'; (5) causes of malnutrition in our ageing population; (6) clinical consequences of malnutrition; (7) financial consequences of malnutrition; (7) the prevalence of malnutrition in our ageing population; (8) identification of malnutrition; and (10) barriers to the prevention of malnutrition. This literature review provides a foundation on which to explore the research questions posed, which address gaps in the literature.

2.1 Australia's ageing population

The estimated population of Australia at 31 March 2016 was 24,051,400 (17). The annual population growth rate is currently 1.4% (17). The proportion of Australians over the age of 65 years is increasing and this is expected to continue due to an increasing life expectancy and sustained low birth rates (18). In 2016, 15% of the Australian population are aged 65 years or over (17), this is an increase from 9% in 1973 (19) and 12% in 1996 (20). Population ageing is expected to continue over the next two decades as the proportion of people aged over 65 is projected to rise from its current level of around 1 in 7 to 1 in 5 (2). This is the first time that Australia has seen such a large proportion of the population in this age group (20). Based on current population projections, the number of people aged 65 years and over in Australia is expected to exceed the number of children aged 0-14 years around the year 2030 (18). This trend of increasing life expectancy and population ageing is occurring in most developed countries (21). The number of older persons is expected to exceed the number of children in the world for the first time by 2045 (22). Figure 2.1 shows the Australian

population change by age group between 1995 and 2015.

Figure 2.1 – Population change by age group, 1995 to 2015 (18)



2.1.2 People aged 85 years and over

The number of people over the age of 85 years is also increasing. In 2016, 2% of the Australian population are aged 85 years and over (486, 700 people) (23). Over the past two decades, this segment of the population has increased by 148%, compared with a total population growth of 32.1% over the same period (18). The proportion of the population aged 85 years and over is projected to continue to increase to 1.0 million by 2036 (23). There are currently almost twice as many females (299,100) as males (173,000) in this proportion of the population, reflecting the higher life expectancy for females (18). Life expectancy in Australia is one of the highest in the world (23). Life expectancy in Australia is currently

increasing at birth, and also over the course of a person's life (23). This is a reflection of the better health of Australians, greater standards of living and improved access to high-quality health care (23).

The proportion of the population over 100 years of age also continues to increase (19). Over the past two decades, the number of Australians over the age of 100 has increased by 254% (19). There are currently three times as many females (3,400) as males (1,000) in this proportion of the population, again reflecting the higher life expectancy for females (19).

2.2 The ageing population of the ACT region

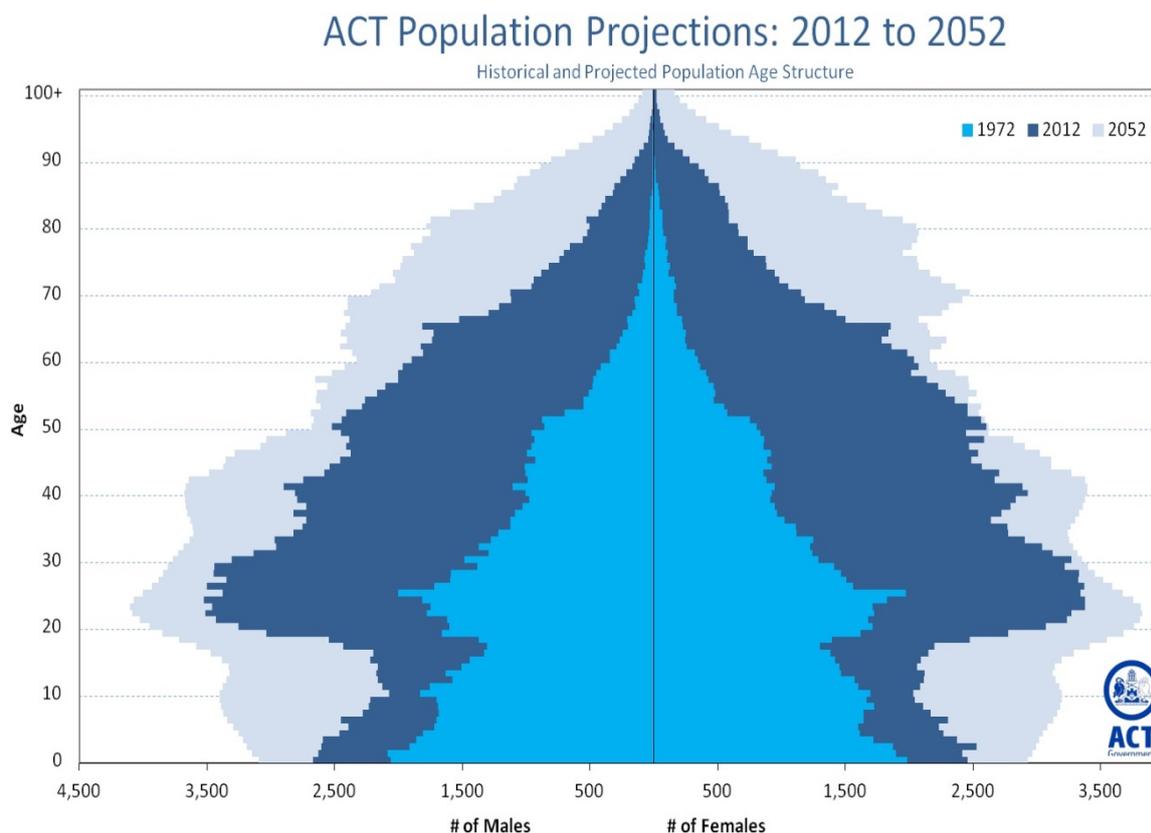
The ACT is a territory within Australia, where Canberra the capital city of Australia is situated. Canberra is a planned city and is situated between Australia's two largest cities, Sydney and Melbourne. The name Canberra means 'meeting place' in the local Ngunnawal Aboriginal language (24).

Figure 2.2.1 – Map of Australia and the ACT (25)



The estimated population of the ACT is currently 390,800 (18). The proportion of the ACT's population aged 65 years and over is currently around 12%, which is lower than the proportion of this population in Australia as a whole, currently 15% (26). In the twelve months to June 2015, there was an increase of 4.7% of people aged 65 years and over living in the ACT (18). This was the second largest increase in this age group experienced across all states and territories in Australia (18). The percentage of the ACT population aged 65 years and over is expected to rise to approximately 20% by 2056 (27), and 22.5% by 2062 (28). Figure 2.2 shows the ACT's population projections from 2012 to 2052.

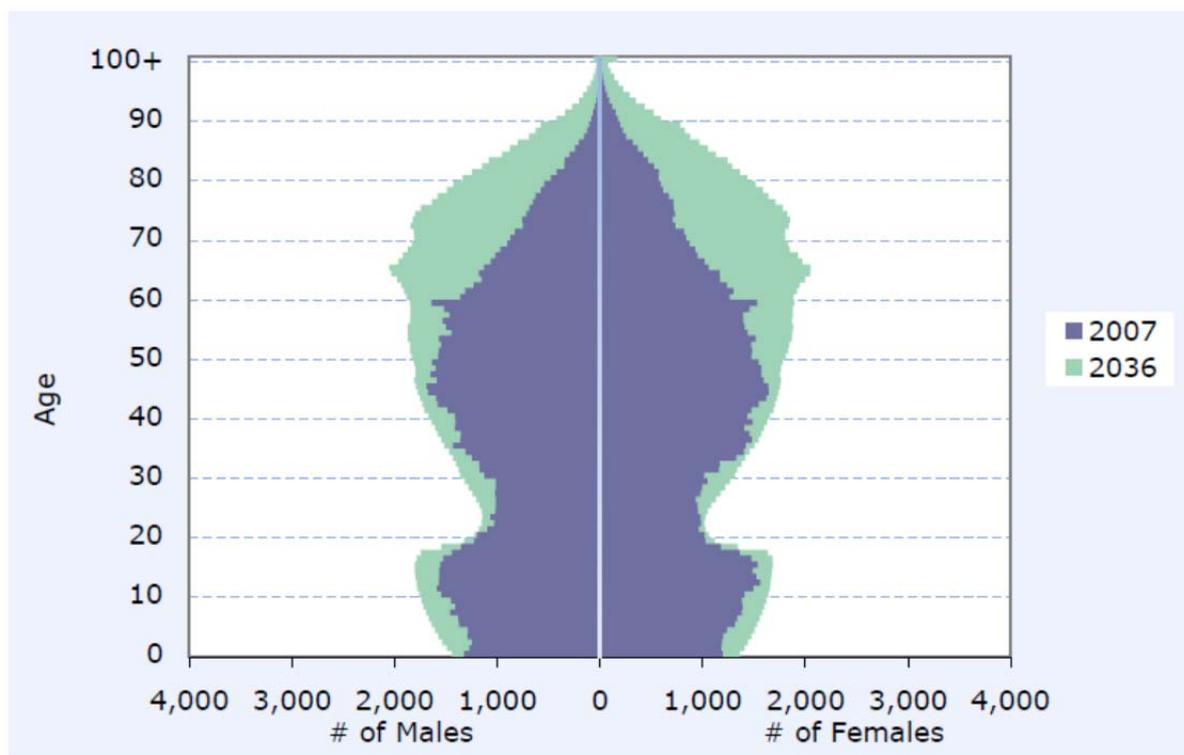
Figure 2.2.2 ACT Population Projections: 2012 to 2052 (28)



The ACT region also includes people living outside the ACT, in the South Eastern Region of NSW. Therefore, the demographic change of this region is also of relevance when

considering the ACT region. Within NSW, sixteen percent of residents (1.20 million people) are currently aged 65 years and over (29). However, whilst 65% of the total NSW population lives in Greater Sydney, only 56% of people aged 65 years and over lived there in 2015, with the large proportion of people aged 65 years and over retiring to coastal and rural areas of NSW, including the South Eastern region of NSW (29). The South Eastern NSW Population Projections: 2007 to 2036 are illustrated in Figure 2.2.3 below, and it can be seen that there is a large proportion of the population here who are 65 years and over, and this proportion of the population is projected to increase.

Figure 2.2.3 South Eastern NSW Population Projections: 2007 to 2036 (30)



People living in the ACT region use ACT services such as health facilities, and hospitals. The tertiary teaching hospital in the ACT supports a population of almost 540,000 (31) (even though the population of the ACT is 390,800 (18)) as it is a referral centre providing a range

of specialist services to the ACT region, which includes those living in the ACT and those living in the surrounding region, in the South Eastern Region of New South Wales (NSW).

2.3 Residential aged care in Australia

As at 30 June 2015, there were 273,503 people were living in residential aged care facilities (RACFs) throughout Australia (32). Therefore, approximately 7.6% of the Australian population aged 65 and over were in residential aged care at some time over the 2014-15 financial year, with 1 in 3 aged care residents being 85 years of age or older (32). Of the residents in aged care facilities during this time, 68% were women, and 27% were assessed as requiring a high level of care across the care domains of activities of daily living, behaviour, and complex health care (32).

2.4 Residential aged care in the ACT

In the ACT, there are currently 2,860 people living in permanent aged care facilities in the ACT (33). With the increasing ageing population, the number of people living in aged care facilities is expected to increase.

2.5 What is malnutrition?

The ‘mal’ in the term malnutrition, literally means ‘bad’ nutrition, therefore the term encompasses both under- and overnutrition (34). Malnutrition has most recently been defined by the American Society for Parenteral and Enteral Nutrition as cited in Muller et al (35) as, “an acute, subacute or chronic state of nutrition, in which varying degrees of overnutrition or undernutrition with or without inflammatory activity have led to a change in body composition and diminished function”. For the purpose of this research, the term malnutrition will refer to protein-energy undernutrition.

Jensen et al (36) have proposed three aetiology-based diagnoses for adult malnutrition in the clinical setting. These three diagnoses include: (1) Starvation-related malnutrition, where there is pure chronic starvation without inflammation; (2) Chronic disease-related malnutrition, where there is sustained inflammation of a mild to moderate degree; and (3) Acute disease or injury related malnutrition, where there is acute inflammation of a severe degree (36).

2.6 Causes of malnutrition in our ageing population

Older adults are the largest group of nutritionally vulnerable people in Australia (6). There are many factors that can cause or increase the risk of malnutrition in our ageing population. Older adults are at risk of malnutrition due to a variety of factors associated with ageing, medical problems, and other social and physical limitations. A summary of factors contributing to the risk of malnutrition in our ageing population are summarised in Table 2.6.

2.6.1 Age-related factors contributing to the risk of malnutrition in our ageing population

As adults age, daily energy requirements decrease due to a decreased muscle mass and changes in physiology (37), however within this reduced energy budget, the requirements for several nutrients are increased (37). For example, the Recommended Dietary Intake (RDI) for protein is increased from 0.84g/kg/day for 31-50 and 51-70 year old men to 1.07g/kg/day for men 70 years of age and older (37). The nutrient requirements of riboflavin, vitamin B6, calcium and vitamin D also increased for older adults (37). The ability to meet increased nutrient needs may be affected by the reduced kilojoule budget in older adults.

In a study examining nutritional risk in the community-living elderly in Australia, Burge and Gazibarich (38) identified changed eating habits due to an illness or condition, and

unintentional weight changes to be nutritional risk factors in this population. A loss of body weight or skeletal muscle mass in older persons has also been associated with poor outcomes (7). The losses in taste and smell that can occur with advancing age have been shown to lead to poor appetite, inappropriate food choices, and a decreased nutrient and energy consumption (39). Therefore it may be difficult to keep older adults interested in eating (6). In addition, the reduced growth hormone secretion that occurs in older adults is associated with an increase in adipose tissue and a decrease in lean body mass (40).

2.6.2 Medical problems contributing to the risk of malnutrition in our ageing population

A reduction or loss of appetite in older adults is common, which may affect nutritional intake (6, 9). With advancing age, there is also an increased incidence of chronic illness (41). Eighty-seven percent of people aged 65 years and over in Australia report having at least one chronic illness (23), with almost 1 in 3 (29%) of adults aged 65 years and over reporting having three or more chronic diseases, compared with 2.4% of Australians aged under 45 years of age (23). Consequently, with several chronic illnesses, older adults are more likely to take multiple medications, and polypharmacy has been identified as a nutritional risk factor for older adults (38).

Older adults may experience difficulty eating or swallowing (8), or poor oral health (e.g. poor dentition or xerostomia) (42, 43) which may affect their ability to eat. They may also experience increased nutritional requirements secondary to cancer, trauma or disease (44), malabsorption (secondary to vomiting or diarrhoea) (42), or an excess loss of nutrients (i.e. following surgery) (44).

There are many psychological conditions which may impact on nutritional intake and therefore contribute to the risk of malnutrition in our ageing population. Anxiety (45), dementia or confusion (11), depression (11, 46), loneliness (47, 48), and bereavement (48, 49), have all been associated with an increased risk of malnutrition in our ageing population.

2.6.3 Social and physical limitations contributing to the risk of malnutrition in our ageing population

Several physical limitations have been identified which contribute to the risk of malnutrition in our ageing population. Walton et al (50) and Krahn et al (51) have found that older adults may have difficulty opening food packages and/or containers or reading food labels. Older adults may not have the ability to shop, cook, prepare food and feed independently (38, 48, 52), or may have other physical disabilities (48), or reduced mobility (48) which further impact on their ability to participate in these activities.

In the institutional setting, inadequate setting up of meal and assistance at meal time (53, 54), and interruptions during mealtime (55) can affect dietary intake. In addition, a poor variety of food provided by institutional food service departments (50), poor sensory characteristics of food (50, 53), poor presentation of food (50), or a lack of motivation to consume food (10, 52) may be contributing factors to inadequate nutritional intake.

There are also social factors which may contribute to the risk of malnutrition in our ageing population. For example, reduced social contact and interaction may result in older adults eating less (38). Excessive alcohol intake (38), food insecurity (48, 52, 56), inadequate food storage facilities (48), and lack of knowledge regarding dietary requirements (42) can also contribute to the risk of malnutrition in this group.

Table 2.6: Factors contributing to the risk of malnutrition in our ageing population

Age related factors

- Changed eating habits due to an illness or condition (38)
- Increased nutrient requirements (protein, riboflavin, vitamin B6, calcium, vitamin D) (37)
- Reduced/Altered taste and smell (39)
- Reduced energy requirements (37)
- Reduced growth hormone secretion (40)
- Reduction in appetite (6)
- Reduction in body weight (7, 38)
- Reduction in skeletal muscle mass (7)

Medical problems

- Anorexia/ loss of appetite (9)
- Chronic illness (41, 44)
- Difficulty eating or swallowing (8)
- Excess loss of nutrients (i.e. following surgery) (44)
- Increased nutritional requirements secondary to cancer, trauma or disease (44)
- Malabsorption (secondary to vomiting or diarrhoea) (42)
- Psychological conditions e.g. Anxiety (45), Dementia/Confusion (11), Depression (11, 46), Loneliness (47, 48), Bereavement (48, 49)
- Polypharmacy (38)
- Poor oral health e.g. poor dentition, xerostomia (42, 43)

Social and physical limitations

- Difficulty opening food packaging and/or containers or reading labels (50, 51)
 - Eating alone (38)
 - Excess alcohol intake (38)
 - Food insecurity (48, 52, 56)
 - Inability to shop, cook, prepare food and feed independently (38, 48, 52)
 - Inadequate food storage facilities (48)
 - Inadequate nutritional intake (57)
 - Inadequate set up and assistance at meal time (53, 54)
 - Interruptions during mealtime (55)
 - Lack of knowledge regarding dietary requirements (42)
 - Lack of motivation to consume food (10, 52)
 - Physical disabilities (48)
 - Poor variety of food provided by institutional food service departments (50)
 - Poor sensory characteristics of food (50, 53)
 - Poor presentation of food (50)
 - Reduced mobility (48)
-

2.7 Clinical consequences of malnutrition in our ageing population

Malnutrition has been independently associated with many adverse health outcomes. In a state of malnutrition, a depletion of body cell mass results from a reduced dietary intake or assimilation of energy and/or protein, and inflammation may also occur which promotes the catabolism of skeletal muscle (36). Therefore, there are many significant effects on clinical outcome measures.

Malnutrition affects physical well-being (34), interferes with health treatments (34), increases healthcare costs (34, 58) and has been associated with increased mortality (58-60). Studies have shown that malnourished older adults have poor physical function and delayed recovery from illness (12, 13), increased risk of osteoporosis (14), and also have an increased incidence of falls (12), hip fractures (15), pressure ulcers (16) and depressive symptoms (61). Additional consequences of malnutrition include an increased likelihood of admission to hospital (62), increased incidence of complications in hospital (58), and prolonged hospitalisation (58).

2.8 Financial consequences of malnutrition

Globally, malnutrition (both undernutrition and overnutrition) is costing the economy US\$3.5 trillion a year in both developing and developed countries (1). The financial impact of malnutrition (under- and overnutrition) in the United States has been estimated at US\$157 billion annually (or \$508 per U.S. resident) (63), with disease-associated malnutrition costing the health care system US\$15.5 billion in annual health care spending (64). Individuals who are 65 years of age or older account for nearly a third of this cost, or US\$4.3 billion annually, even though they currently represent 14% of the American population (64). Goates et al (64) have estimated that malnourished patients, on average, cost 20% more to treat in health care

costs. The financial cost of undernutrition in England was estimated at £19.6 billion in 2011-12 (65). These estimates consider the full cost burden of malnutrition and refer to both the direct and indirect healthcare costs (including loss of income due to ill health, for example). There are currently no data on the financial costs associated with undernutrition in Australia.

Due to the comorbidities associated with undernutrition, hospitalised patients who experience malnutrition will have more complications and this will cost more to treat. Malnutrition directly impacts health care costs and is captured in the activity-based funding model used for the funding of hospitals in Australia (66). Activity Based Funding is an output based funding model which funds a health care service for the cost of patient care. The amount of funding is dependent on the accurate documentation of all relevant diagnoses and the health care activities associated with the patient care during an admission in the patient clinical records and discharge summary (66). When a patient is discharged, their medical notes are audited by medical coders. A Diagnosis Related Group (DRG) is assigned based on the patient's major diagnosis, surgeries, co-morbidities, complications and other interventions recorded (67). Hospitals are subsequently reimbursed for the patient admission based on the DRG. Malnutrition, when documented as a co-morbidity or complication, has the ability to influence a DRG, often resulting in a higher classification which has the potential to attract greater hospital reimbursement (68).

Several previous Australian studies have reported estimations of unclaimed reimbursements for patient admissions where malnutrition was not recorded as part of the DRG (69-73). In 2009, a Melbourne study estimated an annual deficit to the hospital in reimbursements of \$1,850,540 for undiagnosed or undocumented cases of malnutrition (72). A similar study

conducted in Brisbane estimated annual unclaimed expenses of \$1,677,235 due to undiagnosed and undocumented malnutrition (73).

International studies have also reported estimated unclaimed reimbursements to hospitals based on unrecognised malnutrition using the DRG funding system. In a German study by Ockenga et al, in a gastroenterology ward in one hospital, it was estimated that there was an annual shortfall of €35,280 due to unrecognised malnutrition (74). In an American study, following a retrospective audit of medical records, it was estimated that there was the possibility of an increased reimbursement of US\$86,000 per annum to a hospital in Washington (75). This figure is much lower than other published studies due to the study being conducted in a small hospital, with less than 2,000 separations per annum (75).

2.9 Prevalence of malnutrition in our ageing population

Malnutrition has been identified as a significant clinical problem in hospital settings both nationally and internationally (3, 34, 67, 69, 76, 77). There have been many studies which have identified malnutrition in the elderly in hospital settings since the landmark article by Butterworth in 1974 (78). In this seminal paper, Butterworth (78) revealed the problem of malnutrition in hospital patients, and discussed changes in practice that needed to occur to diagnose, treat and prevent malnutrition in this setting. In an international review, Stratton et al (34) reported the prevalence of malnutrition to be between 10-60% in the acute care setting. The reported prevalence of malnutrition in recent Australian studies is 12-53% in acute settings (3, 69, 70, 77, 79-81). There are currently no data on the prevalence of malnutrition in the acute care setting in the Australian Capital Territory region of Australia.

There are limited data on malnutrition in older adults living in residential aged care facilities in Australia. In an International review, Stratton et al (34) found that more than half of all residents were malnourished. Current Australian research (conducted in Queensland) also indicates that up to 50% of elderly individuals living in long-term residential care facilities are malnourished (3, 82). There are currently no data on the prevalence of malnutrition in the residential aged care setting in the Australian Capital Territory of Australia.

In the rehabilitation setting, International research has found that malnutrition was prevalent in between 14-53% of rehabilitation patients (83-88), and Australian research has shown that the prevalence of malnutrition is between 6-49% (62, 79, 89-91).

In community-dwelling individuals, International studies have shown that prevalence of malnutrition in older adults is between 3-38% (34, 92), with up to 62% at risk of malnutrition (34). Australian studies have shown that the prevalence of malnutrition is between 5-11% (12, 93) in the community-dwelling elderly, with between 15-39% at risk of malnutrition (12, 93-95). There is currently no data on the prevalence of malnutrition in rehabilitation or community-dwelling settings in the Australian Capital Territory of Australia; however this is outside the scope of this thesis.

Previous studies have shown that malnutrition is significantly associated with increasing age in the acute care setting (3, 77), residential aged care setting (3), and in community-dwelling individuals (92). In an International review, across the hospital, rehabilitation, nursing home and community settings, Kaiser et al (5) found that two-thirds of older adults were at nutritional risk or malnourished.

In addition, a recent Australian study conducted by Marshall et al (96) found that malnourished older adults admitted to rehabilitation units in rural New South Wales, who are either severely or moderately malnourished, are likely to be discharged with moderate malnutrition, and remain moderately malnourished for at least 12 weeks in their homes (96). Similar results have been reported in studies determining malnutrition risk in older adults post-discharge from acute care facilities (97, 98).

Banks et al (3) and Corish and Kennedy (99) have noted that the wide variation in the reported prevalence of malnutrition is due to variation in the methodology and diagnostic criteria used to assess nutritional status. This makes it difficult to compare studies and to ascertain the actual prevalence of malnutrition in hospitals, residential care facilities or the community, or to apply these findings to the Australian setting in general.

2.10 Identifying those with or at risk of malnutrition

To improve the detection of malnutrition, numerous nutrition screening and nutrition assessment tools are available to identify risk of, and to diagnose malnutrition. There are a number of nutrition screening and nutrition assessment tools that have been validated across a variety of settings. To ensure that malnutrition is effectively identified, it is essential that validated nutrition screening and nutrition assessment tools are used (76). This section will define nutrition screening and nutrition assessment and discuss the tools that have been validated for these purposes.

2.10.1 Nutrition screening

Nutrition screening has been defined by the American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.) as cited in Mueller et al (35) as, “a process to identify an individual

who is malnourished or who is at risk for malnutrition to determine if a detailed nutrition assessment is indicated”.

2.10.1.1 Validated nutrition screening tools

There are six nutrition screening tools that have been validated in the acute care setting. These are the Malnutrition Screening Tool (MST) (100), Malnutrition Universal Screening Tool (MUST) (101), Mini Nutritional Assessment – Short Form (MNA-SF) (used in older adults only) (102), Nutritional Risk Screening (NRS-2002) (103), the Simplified Nutritional Assessment Questionnaire (SNAQ) (104), and the Patient-Generated Subjective Global Assessment Short Form (PG-SGA SF) (in chemotherapy outpatients only) (105).

There are five nutrition screening tools that have been validated in the residential aged care setting. These are the Mini Nutritional Assessment – Short Form (MNA-SF) (used in older adults only) (102), Malnutrition Universal Screening Tool (MUST) (101), Malnutrition Screening Tool (MST) (100), Simplified Nutritional Appetite Questionnaire (SNAQ) (106), and the Simple Nutrition Screening Tool (107, 108).

There are two nutrition screening tools that have been validated in the rehabilitation setting. These are the Mini Nutritional Assessment – Short Form (MNA-SF) (102), and Rapid Screen (62).

Five nutrition screening tools have been validated in the community setting. These are the Malnutrition Universal Screening Tool (MUST) (101), Mini Nutritional Assessment – Short Form (MNA-SF) (used in older adults only) (102), Simplified Nutritional Assessment Questionnaire (SNAQ) (104), Simplified Nutritional Appetite Questionnaire (SNAQ) (106),

and Seniors in the Community: Risk Evaluation for Eating and Nutrition (SCREEN II) (in older adults only) (109). (Please note that there are two different nutrition screening tools known as ‘SNAQ’. The Simplified Nutritional Assessment Questionnaire (104) was developed in the Netherlands, and the Simplified Nutritional Appetite Questionnaire (106) was developed in the United States of America). A summary of validated nutrition screening tools can be found in Table 2.10.1.

Table 2.10.1 Validated nutrition screening tools

Setting	Screening Tool	Validation of tool
Acute Care	Malnutrition Screening Tool (MST) (100)	All adults
	Malnutrition Universal Screening Tool (MUST) (101)	All adults
	Mini Nutritional Assessment – Short Form (MNA-SF) (102)	All adults
	Nutritional Risk Screening (NRS – 2002) (103)	All adults
	Simplified Nutritional Assessment Questionnaire (SNAQ) (104)	All adults
	Patient-Generated Subjective Global Assessment Short Form (PG-SGA SF) (105)	In adult chemotherapy outpatients only
Residential Aged Care Setting	Mini Nutritional Assessment – Short Form (MNA-SF) (102)	In older adults only
	Malnutrition Universal Screening Tool (MUST) (101)	All adults
	Malnutrition Screening Tool (MST) (100)	All adults
	Simplified Nutritional Appetite Questionnaire (SNAQ) (106)	All adults
	Simple Nutrition Screening Tool (107, 108)	All adults
Rehabilitation Setting	Mini Nutritional Assessment – Short Form (MNA-SF) (102)	In older adults only
	Rapid Screen (62)	All adults
Community Setting	Malnutrition Universal Screening Tool (MUST) (101)	All adults
	Mini Nutritional Assessment – Short Form (MNA-SF) (102)	In older adults only
	Simplified Nutritional Assessment Questionnaire (SNAQ) (104)	All adults
	Simplified Nutritional Appetite Questionnaire (SNAQ) (106)	All adults
	Seniors in the Community: Risk Evaluation for Eating and Nutrition (SCREEN II) (109)	In older adults only

2.10.1.2 Recommendations for nutrition screening

In Australia, the ‘Evidence-Based Practice Guidelines for the Nutritional Management of Malnutrition in Adult Patients Across the Continuum of Care’ recommended that nutrition screening occur in the acute care setting, RACFs, rehabilitation settings and in the community to improve the identification of malnutrition risk and to enable nutrition care planning (76). There are currently no evidence-based statements regarding the frequency of nutrition screening in Australia. However, the National Institute for Health and Care Excellence in the United Kingdom have recommended that in the acute care and rehabilitation settings, nutrition screening occur on admission with weekly re-screening (110). In RACFs, it is recommended that nutrition screening occur on admission, with periodic reassessment (110-113). It has been suggested that this reassessment occurs on a monthly basis in this population (114). In the community, screening should occur annually (93). Across all settings, screening should occur more frequently where there is clinical concern (110).

However, nutrition screening upon admission to acute care, rehabilitation or residential aged care facilities in Australia is not mandatory. In the United States of America, the Joint Commission on Accreditation of Healthcare Organisations has mandated that nutrition screening occur within 24 hours of admission to an acute care facility (115). Mandatory nutrition screening also occurs in other countries including the United Kingdom, the Netherlands and some parts of Denmark (116). Chima et al (117) reported since the hospital standards changed in 2003 to mandate that all inpatients be screened for nutrition risk within 24 hours of admission in the United States, 99% of health facilities now screen for nutrition risk on admission. A limitation of this study was that it did not specifically ask respondents about their use of validated nutrition screening tools. In Australia, where nutrition screening

on admission is not mandated, the seminal paper on nutrition screening practices in health care institutions by Ferguson and Capra in 1998 (118), reported that in 1995 less than 5% of Australian hospitals were conducting nutrition screening. In a following paper in 2008, the authors found that nutrition screening practices on admission to Australian hospitals had increased to 78%, however about 50% reported that all or most admissions were screened (119). At this time, approximately 50% of facilities did not have a formal policy regarding nutrition screening in their respective facilities (119).

2.10.2 Nutrition assessment

It is important to recognise that the above mentioned nutrition screening tools identify risk of malnutrition, but do not diagnose malnutrition. Nutrition assessment is used to identify nutrition-related risk, or the existence of malnutrition (35, 76). It has been defined as, “a comprehensive approach to diagnosing nutrition problems that uses a combination of the following: medical, nutrition, and medication histories; physical examination; anthropometric measurements; and laboratory data” (35).

2.10.2.1 Validated nutrition assessment tools

The following tools have been validated for the nutrition assessment of adults to diagnose malnutrition. In the acute care setting, valid nutrition assessment tools include: Subjective Global Assessment (SGA) (120), Mini-Nutritional Assessment (MNA) (121), and Patient Generated Subjective Global Assessment (PG-SGA) (122). In the residential aged care setting, rehabilitation setting, and community setting, valid nutrition assessment tools include the Subjective Global Assessment (SGA) (in older adults only) (120), and Mini-Nutritional Assessment (MNA) (in older adults only) (121). A summary of validated nutrition screening tools can be found in Table 2.10.2.

The SGA (120), is a validated nutrition assessment tool for detecting malnutrition in the acute care setting, residential aged care setting, rehabilitation setting and community setting (76). It determines nutritional status based upon a medical assessment and physical examination and provides an overall global assessment of well nourished, moderately malnourished, or severely malnourished (120). The SGA has a high degree of inter-rater reliability (with assessor agreement of 80-90% and a kappa value of 0.75-0.78) (3, 120). Recent Australian studies have used this validated tool to investigate the prevalence of malnutrition in the residential aged care setting (3, 82).

The MNA (121) is a validated nutrition assessment tool in older adults only (76, 121). The MNA tool has 18 measure items, and is designed to be performed in less than 15 minutes (121). The MNA involves an anthropometric assessment; general assessment (6 questions relating to lifestyle, medication and mobility); dietary assessment; and a subjective assessment (self-perception of health and nutrition) (121). The scoring for each part categorises older adults as either (1) well nourished; (2) at risk of malnutrition; or (3) malnourished (121).

The PG-SGA (122) is a validated nutrition assessment tool for detecting malnutrition in the acute care setting (76). It determines nutritional status based upon a medical assessment and physical examination and provides an overall global assessment of well nourished, moderately malnourished, or severely malnourished, and includes additional questions regarding the presence of nutritional symptoms and short-term weight loss (122). It was designed so that the components of the medical history can be completed by the patient using a check box format. The scored PG-SGA, unlike the SGA, which is categorical, is a continuous measure - the higher the score, the greater the risk for malnutrition (122). The PG-

SGA has high sensitivity and specificity and several recent studies have used this validated tool to investigate the prevalence of malnutrition in the acute setting (123, 124).

Table 2.10.2 Validated Nutrition Assessment Tools

Setting	Assessment Tool	Validation of tool
Acute Care	Subjective Global Assessment (SGA) (120)	All adults
	Mini-Nutritional Assessment (MNA) (121)	In older adults only
	Patient Generated Subjective Global Assessment (PG-SGA) (122)	All adults
Residential Aged Care Setting	Subjective Global Assessment (SGA) (120)	In older adults only
	Mini-Nutritional Assessment (MNA) (121)	In older adults only
Rehabilitation Setting	Subjective Global Assessment (SGA) (120)	In older adults only
	Mini-Nutritional Assessment (MNA) (121)	In older adults only
Community Setting	Subjective Global Assessment (SGA) (120)	In older adults only
	Mini-Nutritional Assessment (MNA) (121)	In older adults only

2.11 Barriers to the prevention of malnutrition

The issue of malnutrition is not considered to be a primary health concern amongst many practitioners and is commonly left untreated for long periods of time (12, 16, 76, 82). It has also been found that awareness of malnutrition is poor and malnutrition is often under-recognised (69, 76, 77). One of the reasons that malnutrition tends to be under-recognised, or goes unrecognised, is because many clinical indicators of malnutrition are similar in nature to those of the natural ageing process (12, 82).

In the seminal paper on hospital malnutrition, Butterworth (78) identified many procedural issues within the hospital setting that are barriers to the prevention and early diagnoses and

treatment of malnutrition. These issues include, patient's weight and height are not being recorded due to frequent rotation of staff at frequent intervals; patients being placed on saline IV fluids for prolonged period; a failure to observe patient's food intake; withholding meals because of diagnostic tests; and a lack of communication between clinical staff (78).

Studies have also found that a majority of patients assessed as malnourished had not been previously identified or were not documented as such, and were not receiving any specialised nutrition care (69, 77, 125). It has also been noted that there is a lack of knowledge and limited training of clinical staff in regards to malnutrition screening and assessment (3). Differing definitions and diagnosis tools of malnutrition are also barriers to the prevention of malnutrition (16).

Unfortunately, the issue of malnutrition is not yet on the political agenda in Australia. In Europe, there has been a call to fight malnutrition as per the 'Prague Declaration 2007: A call for action to fight malnutrition in Europe' (126). This is in response to a lack of national and EU policy agendas on the importance and urgency of detection of malnutrition in Europe, and involves an alliance between the European Society for Clinical Nutrition and Metabolism (ESPEN), the European Nutrition for Health Alliance (ENHA), the Medical Nutrition International Industries (MNI) and the members and partners of these organisations (126). This alliance is dedicated to proposing and implementing change and raising awareness of the importance of the detection of malnutrition in Europe (126). It is also imperative that greater attention be paid to the critical issue of malnutrition in the health care reform agenda in Australia as our population continues to age. Hopefully in the future we will see mandatory malnutrition screening in hospitals and RACFs, and malnutrition rates as a key performance indicators under health agreements.

2.12 Justification for this research:

1. Malnutrition is an important clinical and public health issue in Australia affecting not only those with acute and chronic disease, but is most significant in our ageing population.
2. With the proportion of Australians over the age of 65 increasing, and older adults being the largest group of nutritionally vulnerable people in Australia, it is imperative that the issue of malnutrition does not go unrecognised.
3. Malnutrition is largely under-recognised and under-diagnosed leading to a decline in nutritional status. There is currently a paucity of data on malnutrition in adults residing in the ACT region of Australia. The data collected as part of this research will identify the prevalence of malnutrition in several sites in the ACT region including the acute care setting and in several aged care facilities which will provide a baseline for effective monitoring and outcome measures, which will result in improved health care utilisation and cost outcomes.
4. Malnutrition directly impacts health care costs and is captured in the activity-based funding model used for the funding of hospitals in Australia. Based on the data collected as part of this research, the estimated annual unclaimed financial reimbursement due to undiagnosed or undocumented malnutrition will be determined in a tertiary teaching hospital in the ACT region.
5. Early recognition is one of the most important and effective ways to prevent and reduce the prevalence of malnutrition in older people. However, there are currently no data on nutrition screening practices in Australian RACFs.

2.13 Purpose of this research:

This PhD aims to determine the prevalence of malnutrition in the ACT and surrounding region in selected acute care and residential aged care facilities; to estimate the annual unclaimed financial reimbursement in the acute care setting due to undiagnosed or undocumented malnutrition; to determine how many RACFs in Australia routinely use a nutrition screening tool on residents to identify those at risk of malnutrition; review practice following identification of aged care residents as being at risk of malnutrition; and to inform future strategies for improved identification of malnutrition which will ultimately impact on improved patient care.

2.14 Research Questions:

1. What is the prevalence of malnutrition in adult inpatients in an acute care setting in the ACT region? What are the characteristics associated with malnutrition in this group of patients? What is the estimated annual unclaimed financial reimbursement in the acute care setting due to undiagnosed or undocumented malnutrition?
2. What is the prevalence of malnutrition in older adults in a sample of RACFs in the ACT and surrounding region?
3. Is the prevalence of malnutrition found in these studies consistent with data reported in recent Australian and International studies for hospital settings, and residential aged care?
4. (a) In the residential aged care setting, do age, gender, and previous dietetic intervention affect the prevalence of malnutrition?

(b) Is the prevalence of malnutrition higher amongst high-level care residents (compared to low-level care residents) in RACFs in the ACT and surrounding region?

5. How many RACFs in Australia routinely use a nutrition screening tool to determine those at risk of malnutrition, and to review practice following identification of residents at being at high risk of malnutrition?

Chapter 3: Methodological Background

This chapter provides a background to the methodology chosen for each phase of the research conducted as part of this thesis. The brief details of the methodology used for each of the specific studies undertaken in this PhD research are provided in the relevant manuscripts, located in Chapters 4, 5, 6 and 7 (to meet publishing word limits). This Methodological Background expands on these brief descriptions and discusses why these methods were chosen and the linkages between each phase of the research.

This thesis contains four individual studies. The first study determined malnutrition prevalence of adult inpatients in the ACT region and estimated the annual unclaimed financial reimbursement in the acute care setting due to undiagnosed or undocumented malnutrition. The second study determined the prevalence of malnutrition in a sample of older adults in residential aged care facilities in the ACT region. The third study determined the prevalence of malnutrition and identified nutrition issues in a sample of older adults living in residential aged care facilities in the ACT region. The fourth study determined nutrition screening practices amongst Australian RACFs and reviewed practice following identification of residents at being at high risk of malnutrition (Figure 3.1).

The sampling techniques applied to this thesis are purposive for studies 1-3, as these sites were collaborating sites for dietetic placements for the University of Canberra and accessible to the candidate. In the fourth study, data was collected from a stratified sample of residential aged care facilities in each state and territory in Australia. Table 3.1 provides an overview of the methods used to answer the research aims.

Figure 3.1: The four studies included in this thesis

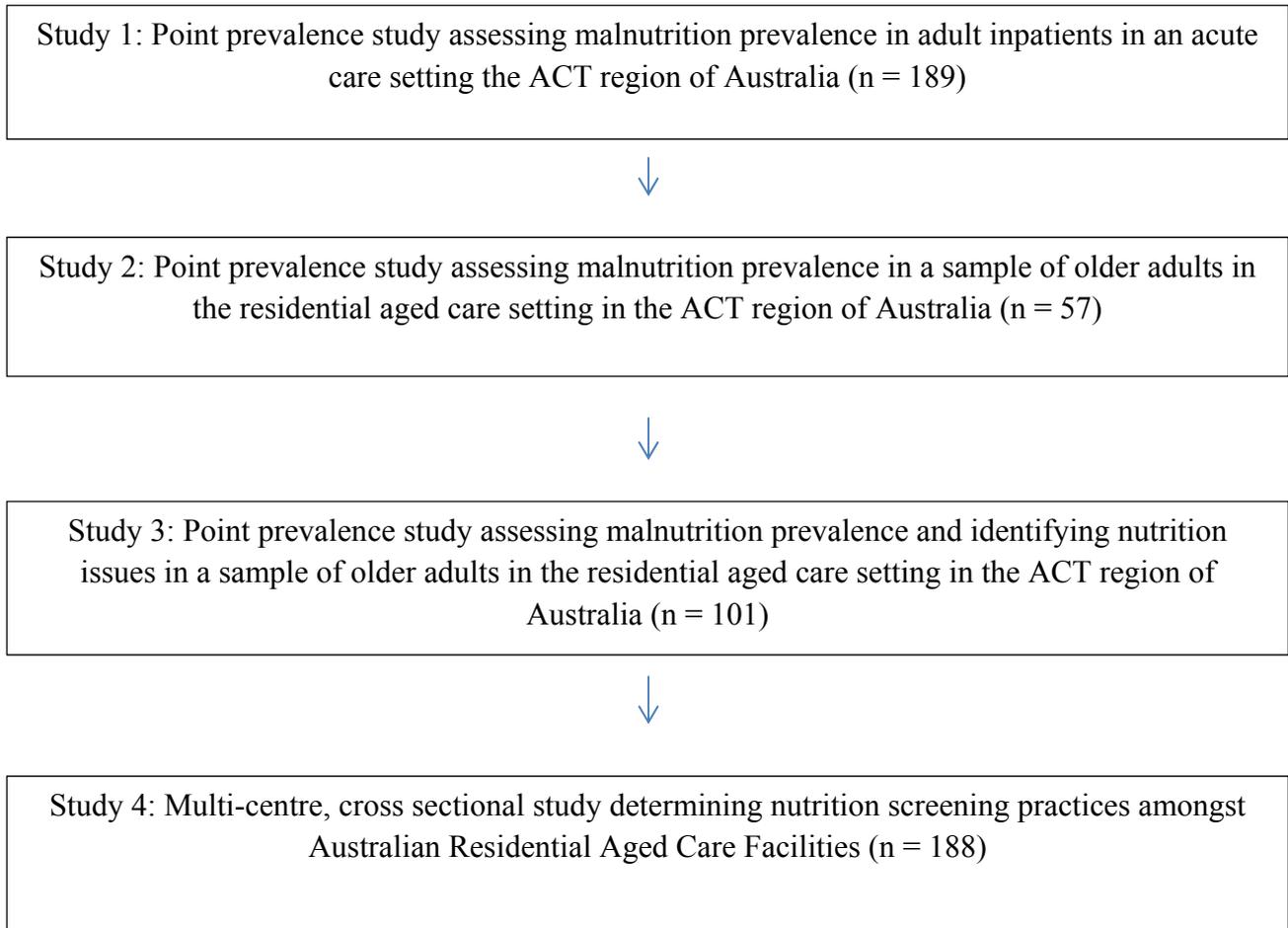


Table 3.1: Overview of the methods used to answer the research aims

Research questions	Data Source	Research Method	Data Instrument	Analysis	Reporting
<p>Study 1 What is the prevalence of malnutrition in adult inpatients in an acute care setting in the ACT region? What are the characteristics associated with malnutrition in this group of patients? What is the estimated annual unclaimed financial reimbursement in the acute care setting due to undiagnosed or undocumented malnutrition? Is the prevalence of malnutrition found in these studies consistent with data reported in recent Australian and International studies in this setting?</p>	<p>Hospital inpatients Medical records</p>	<p>Point prevalence study (Cross-sectional, Observational) Retrospective audit Comparison of data to other cohorts with same inclusion criteria Unclaimed potential reimbursements to this hospital based on previous studies</p>	<p>PG-SGA</p>	<p>Quantitative Associations between gender and continuous variables were assessed using the independent t-test. Associations between continuous variables and malnutrition prevalence were assessed using the One-Way ANOVA. The Mann-Whitney U test was used to examine differences in variables between the groups of patients according to malnutrition status as assessed by the PG-SGA. Intraclass correlation was used to show the measure of agreement</p>	<p>Results reported in the following publication: Kellett J, Kyle G, Itsiopoulos C, Naunton M, Luff N. Malnutrition: the importance of identification, documentation and coding in the acute care setting. Journal of Nutrition and Metabolism 2016, DOI 10.1155/2016/9026098</p>

				between multiple raters.	
<p>Study 2 What is the prevalence of malnutrition in older adults in a sample of RACFs in the ACT and surrounding region? Is the prevalence of malnutrition found in these studies consistent with data reported in recent Australian and International studies in this setting? In the residential aged care setting, do age, gender, and previous dietetic intervention affect the prevalence of malnutrition? Is the prevalence of malnutrition higher amongst high-level care residents (compared to low-level care residents) in RACFs in the ACT and surrounding region?</p>	Aged care facility residents	Point prevalence study (Cross-sectional, Observational)	SGA	<p>Quantitative</p> <p>Association between gender and continuous variables were assessed using the independent t-test.</p> <p>Associations between continuous variables and malnutrition prevalence were assessed using the One-Way ANOVA test.</p> <p>Associations between non-continuous variables were assessed using the Chi-squared test.</p>	Results reported in the following publication: Kellett J , Kyle G, Itsiopoulos C, Naunton M, Bacon R. Malnutrition prevalence in aged care residents. A pilot study. Topics in Clinical Nutrition 2015;30;276-280.
<p>Study 3 What is the prevalence of malnutrition in older adults in a sample of RACFs in the ACT and surrounding region? Is the prevalence of malnutrition found in these studies consistent with data reported in recent</p>	Aged care facility residents	Point prevalence study (Cross-sectional, Observational)	SGA Questionnaire	<p>Quantitative</p> <p>Association between gender and continuous variables were assessed using the independent t-test.</p>	Results reported in the following publication: Kellett J , Kyle G, Itsiopoulos C, Naunton M, Bacon R, Costello L. Malnutrition prevalence and nutrition issues in five Australian Residential Aged Care Facilities. In Luszcz M and Feist H (Eds)

<p>Australian and International studies in this setting? Is the prevalence of malnutrition higher amongst high-level care residents (compared to low-level care residents) in RACFs in the ACT and surrounding region? In the residential aged care setting, do age, gender, and previous dietetic intervention affect the prevalence of malnutrition?</p>				<p>Associations between continuous variables and malnutrition prevalence were assessed using the One-Way ANOVA test.</p> <p>Associations between non-continuous variables were assessed using the Chi-squared test.</p>	<p><i>Making Research Matter: Program and Proceedings of the 13th National Conference of Emerging Researchers in Ageing</i>, pp72-75. Adelaide, 24-25 November, 2014.</p>
<p>Study 4 How many RACFs in Australia routinely use a nutrition screening tool to determine those at risk of malnutrition, and to review practice following identification of residents at being at high risk of malnutrition?</p>	<p>Director of Nursing at Australian Residential Aged Care Facilities</p>	<p>Multi-centre Cross sectional Observational Telephone survey</p>	<p>Standardised questionnaire</p>	<p>Quantitative</p> <p>Associations between non-continuous variables were assessed using the Chi-squared test.</p> <p>Associations between non-continuous variables and continuous variables were assessed using the independent t-test.</p>	<p>Results reported in the following publication: Kellett J, Kyle G, Itsiopoulos C, Naunton M. Nutrition Screening Practices Amongst Australian Residential Aged Care Facilities. <i>Journal of Nutrition, Health and Aging</i> 2016. DOI 10.1007/s12603-015-0693-7.</p>

3.1 Study One: Point prevalence study assessing malnutrition prevalence in adult inpatients in an acute care setting in the ACT region of Australia

3.1.1 Study participants

This cross-sectional, observational study involved the collection of nutritional status data of adult inpatients in the aged care, rehabilitation, surgical, medical, critical care, acute care, orthopaedic, gastroenterology, vascular, neurology, renal, respiratory, cardiology, mental health and oncology wards at a tertiary teaching hospital in the ACT region.

Participant recruitment was on a voluntary basis. Prior to data collection all participants received a copy of an information sheet and consent form. All eligible patients were invited to participate. Patients over the age of 18 years admitted to the hospital over the study days were eligible for inclusion. Exclusion criteria were moderate-severe cognitive problems (as documented in the medical notes), no conversational English, day patients, terminal medical illness, antenatal, postnatal, or determined as unfit by medical officers. If a participant was identified as malnourished then this was documented in their medical notes and they were referred to the nutrition department for nutrition intervention. Data collection took place over two consecutive days in June 2012. The research was approved by the ACT Government Health Directorate Human Research Ethics Committee (ETH.6.11.126 and ETHLR.13.222), and informed written consent was obtained from all participants.

3.1.2 Nutrition assessment

Nutritional status of subjects was assessed using the scored Patient-Generated Subjective Global Assessment (PG-SGA) tool (122) which is a validated tool in the acute care setting across all adult age groups (76). It enables dietitians to determine nutritional status based upon a medical assessment and physical examination. The first four boxes of the PG-SGA

were completed by the dietitian (as per common practice in Australia). Each participant was classified as well-nourished (SGA A), moderately or suspected of being malnourished (SGA B) or severely malnourished (SGA C), and a total PG-SGA score was calculated. This score provides a guideline to the level of nutrition intervention required, with the higher the score, the greater the risk of malnutrition (122). A score ≥ 9 indicates a critical need for improved symptom management and/or nutrient intervention options (122). This was documented accordingly in the medical records by dietitians completing the nutrition assessment. Standardised pre-printed stickers were used for this purpose to help identify patients to the medical coders and to standardise dietetic practice (Figure 3.1). The version of the PG-SGA used was the 2001 version, which was version currently being used at the site when the study was conducted and therefore the version that the clinicians collecting the data were most familiar with.

Figure 3.1: Pre-printed malnutrition sticker used for point prevalence study

Date:	Time:
This patient participated in a research study in which nutritional status was assessed by a Dietitian using the assessment tool PG-SGA (Patient Generated – Subjective Global Assessment).	
The assessment conducted revealed this patient has _____ malnutrition, rating _____, score _____, as evidenced by:	
– Unintentional wt loss _____% or BMI _____kg/m ²	
– Suboptimal food/fluid intake <input type="checkbox"/>	
– _____ loss of subcutaneous fat or muscle	
In response to this finding a Nourishing Diet including oral nutrition supplements has been commenced for this patient. The Nutrition Dept will provide follow up care & adjustment to the nutrition intervention consistent with the Nutrition Dept priority framework and capacity.	
Dietitian: _____	Ext: 42567

3.1.3 Inter-rater reliability study

The sixteen dietitians who were involved in the data collection had previously used the PG-SGA tool as part of their routine patient care. To ensure that the tool was being used in a consistent way, standardised training in performing the PG-SGA was conducted for the sixteen dietitians involved in the data collection by the PhD candidate (Jane Kellett).

To determine the inter-rater reliability of all data collectors, an inter-rater reliability study was conducted during the week prior to the study data collection. For the inter-rater reliability study, sixteen eligible participants were recruited. Each dietitian assessed five different

participants, and each participant was assessed by five different dietitians. Inter-rater reliability of all dietitians involved in the data collection was determined and showed good agreement with the use of the PG-SGA (Intra class correlation (ICC) = 0.901; $p < 0.001$).

3.1.4 Medical records audit

Following the data collection, a retrospective review of the medical records of study participants was conducted by the PhD candidate to provide information regarding length of stay, DRG allocation, documentation of malnutrition, and dietetic intervention. This was to determine if the study participants who were diagnosed as malnourished in this study were documented as malnourished by the dietitians and coded as malnourished by the medical coders. These data were then compared to the medical records of two historical control groups (June 2011 and March 2012) and two subsequent cohorts (September 2012 and June 2013) to determine the proportion of patients coded as being malnourished prior to our study and after our study. All patient separations within these months using the same inclusion criteria were included in the data collection.

Unclaimed potential reimbursements to this hospital (per annum) were calculated based on previous studies (69, 72), where Agarwal et al (70) determined the average reimbursement per patient whose DRG changed because of malnutrition coding was AU\$3470. Agarwal et al (70) calculated that malnutrition coding for approximately 20% of malnourished patients led to an increase in financial reimbursement of AU\$3470 per patient. This figure of 20% is based on the average percentages of patients for whom the DRG changed because of malnutrition coding in studies by Lazarus and Hamlyn (69), and Gout et al (127), and the amount of \$3470 based on the average hypothetical reimbursement per patient from the

above mentioned studies (69, 127). The malnutrition prevalence data collected in June 2012 was used for this calculation.

3.1.5 Statistical analysis

Data were entered into IBM SPSS Version 21.0 software (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp). Patient characteristics were reported as frequencies, means and standard deviations. Non-parametric techniques were principally used to describe patient characteristics. Associations between gender and continuous variables were assessed using the independent t-test. Associations between continuous variables and malnutrition prevalence were assessed using the One-Way ANOVA test. The Mann-Whitney U test was used to examine differences in variables between the groups of patients according to malnutrition status as assessed by the PG-SGA. For this purpose, groups SGA B and SGA C (i.e. malnourished patients) were combined for statistical purposes. A p-value of less than 0.05 was considered to be statistically significant. Intraclass correlation was used to show the measure of agreement between multiple raters.

3.2 Study Two: Malnutrition prevalence in aged care residents - A pilot study

3.2.1 Study participants

This study was an observational study designed to identify the prevalence of malnutrition, conducted in two residential aged care facilities, catering for high and low care residents. Prior to data collection all residents received a copy of an information sheet and consent form. Participant recruitment was on a voluntary basis. People with intellectual or mental impairment and those highly dependent on medical care were excluded because they were unlikely to fully comprehend the requirements of the study and be able to give informed consent. If a participant was identified as malnourished then information was provided to the participant on how to access dietetic services within their aged care residence. As this was a point prevalence study, data collection took place on a single day for each site in September and October, 2011. All eligible residents were invited to participate. The research was approved by the University of Canberra Human Research Ethics Committee, protocol approval number HREC 11 97. Informed consent to participate in the study was obtained from all participants.

3.2.2 Nutrition assessment

The nutritional status of the 57 participants was assessed using the Subjective Global Assessment (SGA) (120, 128) which is a validated tool in residential aged care facilities (76). The SGA tool determines nutritional status based upon a medical assessment and physical examination. The percentages of well-nourished, moderately and severely malnourished subjects were determined for each site. Standardised training in performing SGA was conducted for dietitians involved in the data collection.

3.2.3 Statistical analysis

Data was entered into SPSS Version 19.0 software (2010, SPSS inc., Chicago, IL USA). Sample characteristics were reported as frequencies, means and standard deviations. Association between gender and continuous variables were assessed using the independent t-test. Associations between continuous variables and malnutrition prevalence were assessed using the one-way analysis of variance test. Associations between non continuous variables were assessed using the chi-squared test. A p-value of less than 0.05 was considered to be statistically significant.

3.3 Study Three: Malnutrition prevalence and nutrition issues in five Australian residential aged care facilities

3.3.1 Study participants

This study was cross-sectional and observational, to identify the prevalence of malnutrition, conducted in five residential aged care facilities from the Australian Capital Territory (ACT) region, catering for high and low care residents, using opportunistic sampling. Prior to data collection, all residents received a copy of a plain language information sheet and consent form. Participant recruitment was voluntary. Residents unable to provide informed consent (cognitive impairment, non-English speaking and those highly dependent on medical care) were excluded because they were unlikely to fully comprehend the requirements of the study and be able to give informed consent. If a recruited participant was identified as malnourished information was provided to the participant on how to access dietetic services within their aged care residence. As this was a point prevalence study, data collection took place on a single day for each study site in July and August 2012. The research was approved by the University of Canberra Human Research Ethics Committee, protocol approval number HREC 11 97. Informed consent to participate in the study was obtained from all participants.

3.3.2 Nutrition assessment

Nutritional status was assessed using the Subjective Global Assessment (SGA) (120), a validated tool used in the residential aged care setting (76). The SGA tool determines nutritional status based upon a medical assessment and physical examination. Subjects were classified as well-nourished, moderately or severely malnourished at each site, and the prevalence of malnutrition was determined. Height of residents was estimated by measuring ulna length as described by Thomas and Bishop (129). Body Mass Index (BMI) was derived from the estimated height (in cm) and measured weight (in kg).

Residents were also asked standardised questions relating to the presence of any eating or swallowing difficulties, dentures, problems with gum or oral mucosa, and if assistance is required with meals. They were also asked if they had seen a dietitian in the previous six months, if any nutritional supplements had been recommended, or if they were on a special diet (Appendix 1).

3.3.3 Inter-rater reliability

Standardised training in performing the SGA was provided by the PhD candidate, Jane Kellett, for the dietitians involved in the data collection. Inter-rater reliability of all dietitians involved in the data collection was determined and showed very good agreement with the use of the SGA (Intraclass correlation (ICC) = 0.906; $p < 0.001$).

3.3.4 Statistical analysis

Data were entered into IBM SPSS Version 21.0 software (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.). Sample characteristics were reported as frequencies, means and standard deviations. Association between gender and continuous variables were assessed using the independent t-test. Associations between continuous variables and malnutrition prevalence were assessed using the One-Way ANOVA test. Associations between non-continuous variables were assessed using the chi-squared test. A p-value of less than 0.05 was considered to be statistically significant.

3.4 Study Four: Nutrition screening practices amongst Australian aged care facilities

3.4.1 Study participants

This phase was a cross-sectional study which collected information from a stratified sample of residential aged care facilities in each state and territory in Australia in 2014. The Director of Nursing at every fourth residential aged care facility in each state and territory (as listed on the aged care connect website: www.agedcareconnect.com.au) was contacted by telephone and asked standardised questions relating to current nutrition screening practices at their residential aged care facility. RACFs were categorised as metropolitan or rural. A copy of the survey can be found in Appendix 2. The research was approved by the University of Canberra Human Research Ethics Committee, protocol approval number HREC 14 53. Informed consent to participate in the study was obtained from all participants.

3.4.2 Statistical analysis

Data were entered into IBM SPSS Version 21.0 software (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.). Sample characteristics were reported as frequencies, means and standard deviations. Associations between non-continuous variables were assessed using the Chi-squared test. Associations between non-continuous variables and continuous variables were assessed using an independent T-test. A p-value of less than 0.05 was considered to be statistically significant.

Chapter 4: Manuscript 1 - Malnutrition: the importance of identification, documentation and coding in the acute care setting

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FORM E: DECLARATION OF CO-AUTHORED PUBLICATION CHAPTER

For use in theses which include publications. This declaration must be completed for each co-authored publication and to be placed at the start of the thesis chapter in which the publication appears.

Declaration for Thesis Chapter 4

Declaration by candidate

In the case of Chapter 4, the nature and extent of my contribution to the work was the following:

Nature of contribution	Extent of contribution (%)
Jane Kellett was the main author of the manuscript, initiated the study, conducted the statistical analysis and supervised the project.	80%

The following co-authors contributed to the work.

Name	Nature of contribution	Extent of contribution (%)	Contributor is also a student at UC Y/N
Greg Kyle	Research supervision, assisted in the interpretation and writing of the manuscript	5%	N
Catherine Itsiopoulos	Research supervision, assisted in the interpretation and writing of the manuscript	5%	N
Mark Naunton	Research supervision, assisted in the interpretation and writing of the manuscript	5%	N
Narelle Luff	Site coordination, assisted in the interpretation and writing of the manuscript	5%	N

**Candidate's
Signature**



Date

22/7/2016

Declaration by co-authors

The undersigned hereby certify that:

- (1) the above declaration correctly reflects the nature and extent of the candidate's contribution to this work, and the nature of the contribution of each of the co-authors.
- (2) they meet the criteria for authorship in that they have participated in the conception, execution, or interpretation, of at least that part of the publication in their field of expertise;
- (3) they take public responsibility for their part of the publication, except for the responsible author who accepts overall responsibility for the publication;
- (4) there are no other authors of the publication according to these criteria;
- (5) potential conflicts of interest have been disclosed to (a) granting bodies, (b) the editor or publisher of journals or other publications, and (c) the head of the responsible academic unit; and
- (6) the original data are stored at the following location(s) and will be held for at least five years from the date indicated below:

Location(s)

University of Canberra

Signature 1

G Kyle

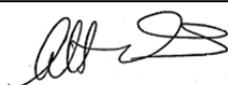


Date

22/07/2016

Signature 2

C Itsiopoulos



23/07/2016

Signature 3

M Naunton

	25/07/2016
	22/07/2016

Signature 4

N Luff

4.1 Introduction to the manuscript

The reported prevalence of malnutrition in previous Australian studies is between 12-53% in the hospital setting (3, 69, 70, 77, 79). However, there are currently no data on malnutrition in adults residing in the ACT region. The tertiary teaching hospital in this region supports a population of almost 540,000 (31), even though the estimated population of the ACT region is currently 390,800 (18). This is because the hospital is a referral centre providing a range of specialist services to both the ACT region and also people living outside of the ACT in the South Eastern Region of New South Wales (NSW) (31).

Previous studies have shown that malnutrition has adverse health outcomes on older adults, including an increased likelihood of admission to hospital (62), increased incidence of complications in hospital (58), and prolonged hospitalisation (58). The need for baseline data on the prevalence of malnutrition in this region is important allow for effective monitoring on this significant health issue for our older adults. Therefore the aim of this study was to determine the prevalence of malnutrition in a sample of adult inpatients at a tertiary teaching hospital in the ACT region to provide a baseline for effective monitoring and outcome measures, to determine characteristics associated with malnutrition in this group of patients, and to compare data to historical and subsequent control groups for prevalence of malnutrition and coding of malnutrition. Based on these data the estimated unclaimed financial reimbursement of hospital income due to undiagnosed and/or undocumented malnutrition was calculated.

4.2 Publication

4.2.1 Abstract

Malnutrition is a significant issue in the hospital setting. This cross-sectional, observational study determined the prevalence of malnutrition amongst 189 adult inpatients in a teaching hospital using the Patient-Generated Subjective Global Assessment tool and compared data to control groups for coding of malnutrition to determine the estimated unclaimed financial reimbursement associated with this co-morbidity. Fifty-three percent of inpatients were classified as malnourished. Significant associations were found between malnutrition and increasing age, decreasing body mass index, and increased length of stay. Ninety-eight percent of malnourished patients were coded as malnourished in medical records. The results of the medical history audit of patients in control groups showed between 0.9 – 5.4% of patients were coded as malnourished which is remarkably lower than the 52% of patients who were coded as malnourished from the point prevalence study data. This is most likely to be primarily due to lack of identification. The estimated unclaimed annual financial reimbursement due to undiagnosed or undocumented malnutrition based on the point prevalence study was AU\$8,536,200. The study found half the patients were malnourished, with older adults particularly vulnerable. It is imperative that malnutrition is diagnosed and accurately documented and coded so appropriate coding, funding reimbursement and treatment can occur.

Key words: hospital, malnutrition, nutrition assessment, nutritional status, patient-generated subjective global assessment

4.2.2 Introduction

Malnutrition has been identified as a significant clinical problem in hospital settings both nationally and internationally (34, 76). Malnutrition adversely affects physical well-being, interferes with health treatments, and increases healthcare costs (34). The reported prevalence of malnutrition in recent Australian studies is 12-53% in acute settings (3, 69, 70, 77, 79, 81).

Malnutrition has been defined by the American Society for Parenteral and Enteral Nutrition as cited in Mueller et al (35) as, “an acute, subacute or chronic state of nutrition, in which varying degrees of overnutrition or undernutrition with or without inflammatory activity have led to a change in body composition and diminished function”. For the purpose of this paper, the term malnutrition will refer to undernutrition.

Malnutrition directly impacts health care costs and is captured in the Activity-Based Funding model used for the funding of hospitals in Australia (67). Activity Based Funding is an output based funding model which funds a health care service for the cost of patient care. The amount of funding is dependent on the accurate documentation of all relevant diagnoses and the health care activities associated with patient care during an admission in the patient clinical records and discharge summary (67). When a patient is discharged, their medical notes are audited by medical coders. A Diagnosis Related Group (DRG) is assigned based on the patient’s major diagnosis, surgeries, co-morbidities, complications and other interventions recorded (68). Hospitals are subsequently reimbursed for the patient admission based on this DRG. Malnutrition, when documented as a co-morbidity or complication, has the ability to influence a DRG, often resulting in a higher classification which has the potential to attract greater hospital reimbursement (71).

Several previous Australian studies have reported estimations of unclaimed reimbursements for patient admissions where malnutrition was not recorded as a co-morbidity as part of the DRG (69-71, 73, 127). In 2009, a Melbourne study estimated an annual deficit to the hospital in reimbursements of \$1,850,540 for undiagnosed or undocumented cases of malnutrition (72). A similar study conducted in Brisbane estimated annual unclaimed expenses of \$1,677,235 due to undiagnosed and undocumented malnutrition (73).

The Australian Capital Territory (ACT) is a territory within Australia, where Canberra the capital city of Australia is situated. The estimated population of the ACT is currently 390,800 (18). However, the tertiary teaching hospital in this region supports a population of almost 540,000 as it is a referral centre providing a range of specialist services to both the ACT region and also people living outside of the ACT in the South Eastern Region of New South Wales (NSW) (31).

As there are currently no data on malnutrition in adults residing in the ACT, the aim of this study was to determine the prevalence of malnutrition in a sample of adult inpatients at a tertiary teaching hospital in the ACT region to provide a baseline for effective monitoring and outcome measures, to determine characteristics associated with malnutrition in this group of patients, and to compare data to historical and subsequent cohorts for prevalence of malnutrition and coding of malnutrition. Based on these data we were then able to estimate the unclaimed annual financial reimbursement to the hospital due to undiagnosed and/or undocumented malnutrition.

4.2.3 Materials and Methods

Study population

This cross-sectional, observational study involved the collection of nutritional status data of adult inpatients in the aged care, rehabilitation, surgical, medical, critical care, acute care, orthopaedic, gastroenterology, vascular, neurology, renal, respiratory, cardiology, mental health and oncology wards at a tertiary teaching hospital.

Participant recruitment was on a voluntary basis. Prior to data collection all participants received a copy of an information sheet and consent form. Patients over the age of 18 years admitted to the hospital over the study days were eligible for inclusion. Exclusion criteria were moderate-severe cognitive problems (as documented in the medical notes), no conversational English, day patients, terminal medical illness, antenatal, postnatal, or determined as unfit by medical officers. If a participant was identified as malnourished then this was documented in their medical notes and they were referred to the nutrition department for nutrition intervention. Data collection took place over two consecutive days in June 2012. All eligible patients were invited to participate. The research was approved by the ACT Government Health Directorate Human Research Ethics Committee (ETH6.11.126 and ETHLR.13.222), and informed written consent was obtained from all participants.

Nutrition assessment

Nutritional status of subjects was assessed using the scored Patient-Generated Subjective Global Assessment (PG-SGA) tool (122) which is a validated tool used in the acute care setting (76). It enables dietitians to determine nutritional status based upon a medical assessment and physical examination. Each participant was classified using a global category

rating as either well-nourished (SGA A), moderately or suspected of being malnourished (SGA B) or severely malnourished (SGA C), and a total PG-SGA score was calculated. This score provides a guideline to the level of nutrition intervention required, with the higher the score, the greater the risk of malnutrition (122). A score ≥ 9 indicates a critical need for improved symptom management and/or nutrient intervention options (122). This was documented accordingly in the medical records by dietitians completing the nutrition assessment. Standardised pre-printed stickers were used for this purpose to help identify patients to the medical coders and to standardise dietetic practice (Figure 4.2). The sixteen dietitians who were involved in collecting the data in this setting currently use the PG-SGA tool in the routine care of their patients. Standardised training in performing the PG-SGA was conducted for dietitians involved in the data collection by the PhD candidate (Jane Kellett). Inter-rater reliability of all 16 dietitians involved in the data collection was determined and showed good agreement with the use of the PG-SGA (Intra class correlation (ICC) = 0.901; $p < 0.001$).

Medical records audit

Following the data collection, a retrospective review of the medical records of study participants was conducted by the authors to provide information regarding length of stay, DRG allocation, documentation of malnutrition, and dietetic intervention. This was to determine if the study participants who were diagnosed as malnourished in this study were documented as malnourished by the dietitians and coded as malnourished by the medical coders. These data were then compared to the medical records of two historical control groups (June 2011 and March 2012) and two subsequent cohorts (September 2012 and June 2013) to determine the proportion of patients coded as being malnourished prior to our study and after our study. All patient separations within these months using the same inclusion

criteria were included in the data collection. A patient separation can be defined as, “the process by which an episode for an admitted patient ceases (130).”

Unclaimed potential reimbursements to this hospital (per annum) were calculated based on previous studies (69, 72), where Agarwal et al (70) determined the average reimbursement per patient whose DRG changed because of malnutrition coding was AU\$3470. Agarwal et al (70) calculated that malnutrition coding for approximately 20% of malnourished patients led to an increase in financial reimbursement of AU\$3470 per patient. This figure of 20% is based on the average percentage of patients for whom the DRG changed because of malnutrition coding in studies by Lazarus and Hamlyn (69) and Gout et al (72) and the amount of AU\$3470 based on the average hypothetical reimbursement per patient from the above-mentioned studies (69, 72). The malnutrition prevalence data collected in June 2012 was used for this calculation which is comparable to these previous studies for the purpose of calculating unclaimed financial reimbursements.

Statistical Analysis

Data were entered into IBM SPSS Version 21.0 software (IBM Corp., released 2012, IBM SPSS Statistics for Windows, version 21.0. Armonk, NY: IBM Corp). Patient characteristics were reported as frequencies, means and standard deviations. Non-parametric techniques were principally used to describe patient characteristics. Associations between gender and continuous variables were assessed using the independent t-test. Associations between continuous variables and malnutrition prevalence were assessed using the One-Way ANOVA test. The Mann-Whitney U test was used to examine differences in variables between the groups of patients according to malnutrition status as assessed by the PG-SGA. For this purpose groups SGA B and SGA C (i.e. malnourished patients) were combined for statistical

purposes. A p-value of less than 0.05 was considered to be statistically significant. Intraclass correlation was used to show the measure of agreement between multiple raters.

Figure 4.2: Pre-printed malnutrition sticker used for point prevalence study

Date:	Time:
This patient participated in a research study in which nutritional status was assessed by a Dietitian using the assessment tool PG-SGA (Patient Generated – Subjective Global Assessment).	
The assessment conducted revealed this patient has _____ malnutrition, rating _____, score _____, as evidenced by:	
<ul style="list-style-type: none">- Unintentional wt loss _____% or BMI _____kg/m²- Suboptimal food/fluid intake <input type="checkbox"/>- _____ loss of subcutaneous fat or muscle	
In response to this finding a Nourishing Diet including oral nutrition supplements has been commenced for this patient. The Nutrition Dept will provide follow up care & adjustment to the nutrition intervention consistent with the Nutrition Dept priority framework and capacity.	
Dietitian: _____	Ext: 42567

4.2.4 Results

One hundred and eighty-nine patients participated in the study over the two days. There were 434 adult inpatients at the hospital over the study period, and 163 were excluded (100

because of being determined unfit by medical officers, 22 because of contact precautions, 18 because of being antenatal/postnatal, 8 because of having no conversational English, 7 because of having moderate-severe cognitive problems, 6 because of having a terminal medical illness, 2 because of being aphasic). Of the 271 eligible patients approached to participate, 75 declined and 7 were away from their room at the time of data collection. Overall the response rate was 73.1%.

One hundred and seventeen participants (62%) were male, and 72 (38%) were female. The age range of the 189 participants was 18-97 (mean age 62.9 ± 17.9). Fifty-two percent of the participants were over the age of 65 years. The baseline characteristics of our participants are summarised in Table 4.2.1.

Forty seven percent ($n = 88$) of patients were classified as well-nourished, 47% of patients ($n = 89$) as moderately or suspected of being malnourished, and 6% ($n = 12$) of patients as severely malnourished. By ward, 96% of the participants from the oncology ward, 83% of the participants from the aged care ward, and 79% of the participants from the respiratory ward were found to be moderately or severely malnourished.

The characteristics of patients according to malnutrition status were assessed according to the Patient-Generated Subjective Global Assessment (PG-SGA) tool as shown in Table 4.2.2. There was no association between malnutrition status and gender ($p = 0.051$). There was a significant association between malnutrition and increasing age ($p = 0.040$). There was a significant difference between mean PG-SGA scores for each of the SGA classifications ($p < 0.001$), with the severely malnourished having the highest scores. There was also an association between SGA groups and body mass index (BMI), with the higher the SGA

classification, the lower the BMI ($p < 0.001$). There was a significant difference in length of stay between well-nourished patients (SGA A) (Md = 8, $n = 88$), and malnourished patients (SGA B and SGA C) (Md = 14, $n = 101$), $U = 2961$, $Z = -3.96$, $p < 0.001$, $r = -0.28$. On the study days in June 2012, malnutrition was coded for in 98.2% ($n = 99$) of patients assessed as malnourished. Eighty-five percent of malnourished patients were coded as having been seen by a dietitian.

The results of the medical history audit of patients that was conducted on patient separations in June 2011, March 2012, September 2012 and June 2013 are shown in Table 4.2.3. Between 0.9 and 5.4% of patients were coded as malnourished. The number of patients coded as malnourished was higher for the months of September 2012 and June 2013 (after the point prevalence study in June 2012), being 5.4% and 4.4% respectively. The number of malnourished patients seen by a dietitian increased from 74% to 89% between June 2011 and June 2013. The mean age of patients coded as being malnourished over all months was greater than 65 years. In June 2011 the mean age patients coded as being malnourished was 69.1 ± 18.2 , in March 2012 it was 70.1 ± 14.3 , in September 2012 it was 71.2 ± 17.1 , and in June 2013 it was 66.4 ± 19.9 .

Extrapolating from Agarwal et al (70), we can estimate the unclaimed potential reimbursements per annum to this hospital in the ACT region of Australia to be AU\$8,536,200. This figure was calculated considering that the average number of patient separations per month is 1938. If 53% of these patients are malnourished each month, then an estimated 1027 patients would be malnourished patients each month. Previous studies (69, 72) have found that 20% of the malnourished patients led to an average increase in financial

reimbursement of AU\$3470, therefore 20% of 1027 = 205, then 205 x \$3470 = AU\$711, 350 per month, and therefore AU\$8,536,200 per year.

Table 4.2.1: Demographic variables of 2012 point prevalence hospital study population (n=189)

Patient characteristic	Number
Age (years)	62.9 ± 17.9 (18 - 97)
Gender	
Male	117 (62%)
Female	72 (38%)
Nutritional status	
SGA A (well nourished)	88 (47%)
SGA B (suspected or moderately malnourished)	89 (47%)
SGA C (severely malnourished)	12 (6%)
PG-SGA score (median)	7 (0 – 25)

Table 4.2.2: Characteristics of patients according to malnutrition status as assessed by the Patient Generated Subjective Global Assessment (PG-SGA) tool (2012 study data, n = 189)

	SGA A (well nourished)	SGA B (suspected or moderately malnourished)	SGA C (severely malnourished)	P-value
Gender (n, (%))				0.051
Male	62 (33%)	47 (25%)	8 (4%)	
Female	26 (14%)	42 (22%)	4 (2%)	
Age (years)	59.4± 18.7	66.0 ± 17.0	66.0 ± 13.9	0.040
PG-SGA score	3.5 ± 2.6	12.0 ± 4.1	18.6 ± 3.2	<0.001
Body mass index (kg/m ²)	29.3± 7.8	25.3 ± 6.7	22.7 ± 5.9	<0.001

Table 4.2.3: Medical history audit of patients assessed as malnourished

Date	Number of patient separations	Number of patients coded as malnourished (%)	Mean age of patients coded as malnourished (range)	Number of malnourished patients seen by a dietitian (%)	Number of patients seen by a dietitian for any condition (excluding malnutrition)
June 2011	1963	19 (0.9)	69.1 ± 18.2 (30 – 93)	14 (74)	210/1963 (10.6%)
March 2012	2006	76 (3.8)	70.1 ± 14.3 (25 – 94)	64 (84)	154/2006 (7.7%)
Sept 2012	1906	103 (5.4)	71.2 ± 17.1 (18 – 99)	89 (86)	94/1906 (4.9%)
June 2013	1876	82 (4.4)	66.4 ± 19.9 (18 – 96)	73 (89)	95 /1876 (5.1%)

4.2.5 Discussion

In this observational study, we found the prevalence of malnutrition to be 53% amongst the adult inpatients, which is the highest prevalence of malnutrition recorded in an Australian study, equivalent to research conducted by Thomas et al in 2007 (81). Previous other Australian studies have found malnutrition to be prevalent in 12 – 42% of patients (3, 69, 77, 79). Within the hospital population, older adults are particularly vulnerable. Our study showed that there was a significant association between malnutrition and increasing age, decreasing body mass index (BMI), and an increased length of stay. Fifty-two percent of participants were over the age of 65, with the average age of participants (approaching this age group) being sixty-three years of age. The association between malnutrition status and gender was not significant, however there was a trend and our results did show that more females were malnourished compared with males. Previous research by Banks et al (3) and Middleton et al (77) found that gender did not have an effect on nutritional status in acute facilities.

When we compared our study data to two historical control groups and two subsequent control groups we found that between 0.9% and 3.8% of patients were coded as being malnourished before the study and 4.4%-5.4% of patients were coded as being malnourished in the subsequent control groups. These figures are significantly lower than the 52% of patients that were coded as malnourished from the point prevalence study data (98% of the patients diagnosed as malnourished (53%) were coded as being malnourished in the medical records). It is difficult to ascertain whether this difference in malnutrition coding figures was due to lack of identification, documentation, or coding in the control groups, but considering the total number of occasions of service for dietitians documented in the medical notes (Table 4.2.3), and the high accuracy of the medical coders found in this study (98%), it is most likely

to be primarily due to lack of identification (i.e. diagnosis) of malnutrition. In our point prevalence study, we used standardised pre-printed stickers to help identify malnourished patients to coders and to standardise dietetic practice, which may have increased the coding of the malnourished patients by the medical coders. These data also showed that, since the point prevalence study, there has been an increase in the number of patients coded as malnourished and an increase in the number of malnourished patients seen by a dietitian, which shows that point prevalence study increased the awareness of malnutrition by the hospital dietitians and increased the diagnosis and documentation of malnutrition. The increase in the number of patients coded as malnourished between June 2011 (0.9%) and March 2012 (3.8%) (prior to the study) may be a result of the clinicians' altered behaviour resulting from the awareness of the upcoming study which occurred in June 2012 (known as the Hawthorne Effect) (131).

It is also important to recognise that the point prevalence study was conducted under study conditions where 16 dietitians were conducting assessment, all eligible patients were assessed and malnutrition stickers were used. These are ideal conditions and may vary to "usual care", where factors affecting the identification of malnutrition may include poor completion of malnutrition screening by nursing staff, poor referral rates to the dietitian, and patients who are discharged before being seen by the dietitian for assessment. The historical and subsequent cohorts were representative of "usual care" which may also account for some of the differences in coding of malnutrition between groups.

We estimated that the unclaimed potential reimbursements per annum to this hospital to be AU\$8,536,200. This additional funding to the health facility could make a valuable contribution to the increased costs associated with treating these malnourished patients. For

example, if these costs were recovered, a portion of this additional funding could be directed to funding the employment of additional Accredited Practising Dietitians (APDs) to assist with the identification and management of patients with malnutrition, which may improve clinical outcomes.

Malnutrition as a health issue in the hospital setting, was first documented in the medical literature over forty years ago (78). Since then, many studies have been published on the topic of hospital malnutrition (3, 72). Despite the awareness of this issue in the medical literature, this study shows that malnutrition continues to go unrecognised or undiagnosed in the acute care setting. This finding is supported by previous Australian studies (69, 70, 77, 118, 119). Our findings highlight the importance of regular dietetic assessment amongst high-risk patients to ensure malnutrition is recognised and diagnosed. This may then facilitate timely and adequate patient care. It is also imperative that correct documentation of malnutrition gets coded in the medical notes so that an appropriate DRG can be determined which influences reimbursement of funds to the health facility.

The reported prevalence rate of malnutrition in this study may be an underestimation of this clinical issue, as a result of the exclusion criteria used. Patients with dementia were excluded who are a high-risk group for malnutrition (132). Including patients with dementia would require informed consent from family members and would require a family member or caregiver to be interviewed to get reliable data on elements of the PG-SGA. These patients may have a higher prevalence of malnutrition and their inclusion would provide a more accurate picture of malnutrition in the acute care setting in the ACT region of Australia.

A contributing factor towards the high prevalence of malnutrition found in this study may be a result of the increase in acuity of patient admissions over time. For example, in 2000-01 the average length of stay in an Australian Public Hospital was 3.7 days (133). The most recent data from 2014-2015 shows that this has now increased to 5.7 days (134). In addition, with our ageing population in Australia, there has been an increase in hospitalisations for people aged between 65 and 74 by an average of 6.0% each year between 2010-11 and 2014-15, which is faster than the population growth for this age group which was 4.6% each year for the same period (134). During 2014-2015, people aged 65 years and over accounted for 41% of hospitalisations in Australia and 49% of patient days, when they currently make up 15% of Australia's population (134). With the proportion of our ageing population continuing to increase, this may impact on the prevalence of malnutrition in the hospital setting.

Using validated nutrition assessment tools to diagnose malnutrition in the acute care setting is of paramount importance. In the acute care setting, valid nutrition assessment tools include the Subjective Global Assessment (SGA) (120), the PG-SGA (122), and the Mini-Nutritional Assessment (MNA) (in older adults only) (121). Diagnosing malnutrition in a timely fashion enables a dietetic referral to be triggered so that the patient can receive appropriate dietetic input. It has been suggested that validated nutrition assessment tools be used at baseline and then on a monthly basis to provide pre and post intervention comparisons (76).

Mitchell and Porter (135) highlight the lack of evidence in the care of malnourished hospital adults, which limits the ability of clinicians and healthcare managers to make informed, cost-effective treatment decisions for this vulnerable group of patients. There is also an evidence gap regarding the economic considerations of nutrition assessment. We do not currently

know if nutrition assessment is cost effective. A full cost-effectiveness study on the benefits of nutrition assessment would make a valuable contribution to malnutrition research.

In conclusion, this study has highlighted that malnutrition continues to be underdiagnosed in the acute care setting in Australia, with older adults being particularly vulnerable. Diagnosing malnutrition using validated assessment tools and documenting and coding accordingly may increase potential reimbursements for hospitals which enables funding to be directed towards better care. Using standardised pre-printed stickers may assist to identify malnourished patients to coders and standardising documentation by dietitians. Malnutrition has been strongly associated with adverse clinical outcomes such as an increased length of stay and higher rates of medical complications. Not diagnosing malnutrition presents a high risk to patients, and is a lost opportunity for financial reimbursement for the increased costs associated with the care of these vulnerable patients.

4.3 Contribution of this manuscript

Prior to this study there was a paucity of data on the prevalence of malnutrition in adult inpatients in the ACT region of Australia. Despite the awareness of malnutrition in the medical literature, this study shows that malnutrition continues to go unrecognised or undiagnosed in the acute care setting, with 53% of inpatients diagnosed as malnourished. The PG-SGA is useful not only to identify patients that can be treated by dietitians, but also impediments that can be treated by other healthcare professionals. For example, if nutrition impact symptoms are identified in Box 3, it may be appropriate for these symptoms to be addressed by a nurse or physician. In addition, if problems in physical functioning are identified in Box 4, a referral to a physical therapist may be indicated.

This high prevalence of malnutrition may be an underestimation as patients with cognitive impairment were excluded from the study, and these patients are a high risk group for malnutrition (132). Within the hospital population, older adults are particularly vulnerable, with this study highlighting that there was a significant association between malnutrition and increasing age. The majority of inpatients were older adults, with 52% of participants over the age of 65, and the average age of participants (approaching this age group) being sixty-three years of age. Our findings highlight the importance of regular dietetic assessment amongst high-risk patients to ensure malnutrition is recognised and diagnosed, as malnutrition continues to be a significant clinical issue, despite many years of previous research in this setting.

Chapter 5: Manuscript 2 - Malnutrition Prevalence in Aged Care Residents. A pilot study

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Citation:

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FORM E: DECLARATION OF CO-AUTHORED PUBLICATION CHAPTER

For use in theses which include publications. This declaration must be completed for each co-authored publication and to be placed at the start of the thesis chapter in which the publication appears.

Declaration for Thesis Chapter 5

Declaration by candidate

In the case of Chapter 5, the nature and extent of my contribution to the work was the following:

Nature of contribution	Extent of contribution (%)
Jane Kellett was the main author of the manuscript, initiated the study, collected data, conducted the statistical analysis and supervised the project.	75%

The following co-authors contributed to the work.

Name	Nature of contribution	Extent of contribution (%)	Contributor is also a student at UC Y/N
Greg Kyle	Research supervision, assisted in the interpretation and writing of the manuscript	5%	N
Catherine Itsiopoulos	Research supervision, assisted in the interpretation and writing of the manuscript	5%	N

Mark Naunton	Research supervision, assisted in the interpretation and writing of the manuscript	5%	N
Rachel Bacon	Collected data, performed the data analysis, assisted in the interpretation and writing of the manuscript	10%	N

**Candidate's
Signature**

	Date 22/07/2016
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Declaration by co-authors

The undersigned hereby certify that:

- (1) the above declaration correctly reflects the nature and extent of the candidate's contribution to this work, and the nature of the contribution of each of the co-authors.
- (2) they meet the criteria for authorship in that they have participated in the conception, execution, or interpretation, of at least that part of the publication in their field of expertise;
- (3) they take public responsibility for their part of the publication, except for the responsible author who accepts overall responsibility for the publication;
- (4) there are no other authors of the publication according to these criteria;
- (5) potential conflicts of interest have been disclosed to (a) granting bodies, (b) the editor or publisher of journals or other publications, and (c) the head of the responsible academic unit; and
- (6) the original data are stored at the following location(s) and will be held for at least five years from the date indicated below:

Location(s)

University of Canberra

Signature 1 G Kyle		Date 22/07/2016
Signature 2 C Itsiopoulos		23/07/2016
Signature 3 M Naunton		25/07/2016
Signature 4 R Bacon		27/07/2016

5.1 Introduction to the manuscript

The reported prevalence of malnutrition in previous Australian studies is up to 50% in long-term residential aged care facilities (3, 82). However, there are limited data on malnutrition in older adults living in residential aged care facilities in Australia, with only two recent studies conducted in Queensland, and currently no data on malnutrition in older adults residing in the ACT region. The need for baseline data on the prevalence of malnutrition in this region and setting is important allow for effective monitoring on this significant health issue for our older adults. This study is the first of two that was conducted as part of this doctorate which aims to determine the prevalence of malnutrition in older adults in a sample of RACFs in the ACT and surrounding region.

5.2 Publication

5.2.1 Abstract

Malnutrition is a significant clinical and public health problem. The prevalence of malnutrition was determined in a sample of older people living in 2 residential aged care facilities in Australia. The Subjective Global Assessment tool was used to determine the prevalence of malnutrition in 57 residents. The majority of residents were well nourished (67%), 26% moderately malnourished, and 7% severely malnourished. Prevalence of malnutrition was higher for those receiving high-level care (42%), but this was not statistically significant ($P = 0.437$). No relationship was found between malnutrition status and age ($P = 0.529$) or sex ($P = 0.839$).

Key words: aging, malnutrition, nutritional status

5.2.2 Introduction

The proportion of Australians over the age of 65 years is increasing, and this is expected to continue as a result of sustained low fertility and increasing life expectancy (136). Older adults are the largest group of nutritionally vulnerable people in Australia (6). They are at risk of malnutrition due to factors associated with aging, such as a reduction in skeletal muscle mass and body weight (7), as well as other possible limitations, including difficulty swallowing (8), reduced appetite (9), inadequate nutritional intake (10), depression (11), and dementia (11). Studies have shown that malnourished older adults have poor physical function and delayed recovery from illness (12, 13), increased risk of osteoporosis (14), and also have an increased incidence of falls (12), hip fractures (15), and pressure ulcers (16).

Malnutrition has been defined by the American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.) as cited in Mueller et al (35) as, “an acute, subacute or chronic state of nutrition, in which varying degrees of overnutrition or undernutrition with or without inflammatory activity have led to a change in body composition and diminished function”. For the purpose of this paper, the term malnutrition will refer to protein-energy undernutrition.

Data are limited data on malnutrition in older adults living in residential care facilities in Australia. Current Australian reports indicate that up to 50% of elderly individuals living in long term residential care facilities are malnourished (3, 82). In an international review, Stratton et al (34) also found that over half of all residents were malnourished.

Over 246,000 people were living in residential aged care facilities throughout Australia in 2011 (137). Residential aged care within Australia has two levels of care (low and high) based on the type and amount of care an individual requires. Low level care provides accommodation and lets you live independently whilst receiving assistance with personal

care (dressing and showering) with occasional nursing care. High level care is for those with a greater degree of frailty, who often need continuous nursing care (138).

The Subjective Global Assessment (SGA) (120, 128) is a validated nutrition assessment tool for detecting malnutrition in the residential aged care setting (76). It determines nutritional status based upon a medical assessment and physical examination and provides an overall global assessment of well nourished, moderately malnourished, or severely malnourished individuals. The SGA has a high degree of inter-rater reliability (with assessor agreement of 80-90% and a kappa value of 0.75-0.78) (16, 120).

The aim of this study was to determine the prevalence of malnutrition in two residential aged care facilities to provide a baseline for effective monitoring and outcome measures which will result in improved healthcare utilisation and cost outcomes.

5.2.3 Procedures

The study was an observational study designed to identify the prevalence of malnutrition, conducted in two residential aged care facilities, catering for high and low care residents. Participant recruitment was on a voluntary basis. Prior to data collection all participants received a copy of an information sheet and consent form. People with intellectual or mental impairment and those highly dependent on medical care were excluded because they were unlikely to fully comprehend the requirements of the study and be able to give informed consent. If a participant was identified as malnourished then information was provided to the participant on how to access dietetic services within their aged care residence.

The nutritional status of the 57 participants was assessed using the Subjective Global Assessment (SGA) (120, 128). The percentages of well-nourished, moderately and severely malnourished subjects were determined for each site. Standardized training in performing SGAs was conducted for dietitians involved in the data collection.

Data collection took place on a single day for each site in September and October, 2011. All eligible residents were invited to participate. Data was entered into SPSS Version 19.0 software (2010, SPSS inc., Chicago, IL USA). Sample characteristics were reported as frequencies, means and standard deviations. Associations between gender and continuous variables were assessed using the independent t-test. Associations between continuous variables and malnutrition prevalence were assessed using the One-Way ANOVA test. Associations between non continuous variables were assessed using the Chi-squared test. A p-value of less than 0.05 was considered to be statistically significant.

The research was approved by the University of Canberra Human Research Ethics Committee, protocol approval number HREC 11 97. Informed consent to participate in the study was obtained from all participants.

5.2.4 Findings

At the time of data collection, Site 1 had 60 high level care beds and 40 low level care beds, and Site 2 had 55 high level care beds, 35 low level care beds and 35 retirement living villas available. At Site 2, only those within low level care participated due to time constraints. Both sites have access to regular dietetic services. Fifty seven residents participated in the study across the two sites (37 from site 1 and 20 from site 2). Of the 44 residents approached to participate from site 1, 37 participated and 7 declined, giving a response rate of 92.5%. Of

the 34 residents approached to participate from site 2, 20 participated, 3 declined and 11 residents were either away from their room at the time of data collection or deemed unfit for participation, giving a response rate of 58.8%. Overall, the response rate was 73.1%.

Across the two sites 19 participants (33%) were 'high care' and 38 were 'low care', with 65% of all participants being female. The baseline characteristics of our sample of 37 female and 20 male residents are summarized in Table 5.2.1. The age range of the 57 residents was 59 – 100 years (mean age 84.4 ± 8.5 years). No significant differences were observed between genders with relation to site and level of care. The mean difference between age and gender was not significant at the 95% confidence level ($p = 0.091$). The mean weight for females was 61.4 ± 15.0 kg, and for males 80.81 ± 14.4 kg. Weight values were higher among males ($p < 0.001$).

The characteristics of the sample according to malnutrition status were assessed according to the Subjective Global Assessment (SGA) tool as shown in Table 5.2.2. Thirty-three percent of residents were identified as malnourished (26% moderately malnourished and 7 % severely malnourished) and 67% as well nourished. Although the prevalence of malnutrition was higher for residents receiving a high level of care (42%) there was no statistically significant difference in the prevalence of malnutrition between the sites ($p = 0.839$) or between high and low level care ($p = 0.437$). No relationship was found between malnutrition status and age ($p = 0.529$) or gender ($p = 0.839$). The mean difference between weight and malnutrition status was not significant at the 95% confidence level ($p = 0.086$).

Table 5.2.1: Demographic variables of 2011 point prevalence RACF study population (n = 57)

Variable	Female (n=37)	Male (n=20)	P-value
Age (years, mean \pm SD)	81.8 \pm 10.5	85.8 \pm 6.7	0.091
Site (n (%))			0.568
A	25 (68)	12 (32)	
B	12 (60)	8 (40)	
Level of care (n (%))			0.844
High	12 (63)	7 (37)	
Low	25 (66)	13 (34)	
Weight (kg, mean \pm SD)	61.4 \pm 15.0	80.81 \pm 14.4	<0.001

Table 5.2.2: Characteristics of residents according to malnutrition status as assessed by the Subjective Global Assessment (SGA) tool (2011 study data, n = 57)

Variable	SGA (A) Well nourished	SGA (B) Moderately malnourished	SGA (C) Severely malnourished	P-value
n (%)	38 (67)	15 (26)	4 (7)	
Gender (n (%))				0.839
Female	25 (68)	9 (24)	3 (8)	
Male	13 (65)	6 (30)	1 (5)	
Age (years, mean \pm SD)	83.7 \pm 9.7	86.5 \pm 5.6	82.8 \pm 3.7	0.529
Site (n (%))				0.839
A	25 (68)	9 (24)	3 (8)	
B	13 (65)	6 (30)	1 (5)	
Level of care (n (%))				0.437
High	11 (58)	7 (37)	1 (5)	
Low	27 (71)	8 (21)	3 (8)	
Weight (kg, mean \pm SD)	71.7 \pm 15.3	63.6 \pm 14.8	55.5 \pm 29.7	0.086

5.2.5 Discussion

In this observational study, we found the prevalence of malnutrition to be 33% among the aged care residents, which is lower than other recently conducted studies in Australia (3, 82). The prevalence of malnutrition in residents at both sites was similar. Previous Australian studies have found malnutrition to be prevalent in up to 50% of aged care residents (3, 82). The prevalence of malnutrition although higher for residents receiving high level care (42%) was not statistically significant different when compared to residents in low level care.

Both of these residential aged care facilities currently receive regular services from a dietitian. Thus, conducting the same process at other sites across Australia could provide a different picture of the prevalence of malnutrition in aged care facilities in Australia. It is possible that other facilities may not have the same access to dietetic intervention or the same level of staff awareness of malnutrition and the importance of referring residents to a dietitian.

The profile of an aged care facility resident is most likely to be a female over the age of 80 (139). We also found that residents were more likely to be female (65%) with a mean age of 81.8 ± 10.5 years. The association between the prevalence of malnutrition and age was not significant. This is contrary to research that has shown that the prevalence of malnutrition is associated with an increased age (3, 82). However, this may be due to our small sample size, a limitation of this study. Only 57 participants participated across two residential aged care facilities. Also, because the assessments were only at two sites, and the recruitment process was voluntary, it is likely that the sample was not representative of the population of individuals living in residential aged care facilities in Australia.

There was also no significant association between malnutrition and gender ($p = 0.839$) in this study. This is not consistent with previous research by Banks et al (3) who found that males in residential aged care facilities had increased risk of malnutrition. This may be a result of our small sample size, with only 20 males participating in the study.

This study excluded people with dementia who are a high risk group for malnutrition (82, 140). Including residents with dementia would require informed consent from family members and would require a family member or carer to be interviewed to get reliable data on elements of the SGA. Therefore obtaining ethical approval would be more difficult. However, these residents may have a higher prevalence of malnutrition and their inclusion would provide a more accurate picture of malnutrition in aged care facilities in Australia.

The prevalence of malnutrition found in this project (33%) is lower than data reported in recent Australian and International studies for residential aged care. Further study is required to determine the overall prevalence of malnutrition in aged care facilities in Australia. Greater numbers of participants are required to ensure the validity of the results and generalizability of the findings. Carers of residents with dementia may be able to assist in the provision of information so that additional information can be included in future research. It would also be useful to collect data from facilities with limited access to dietetic services as this would provide an insight into the effectiveness of dietetic intervention in this population.

5.3 Contribution of this manuscript

Prior to this study, there was a paucity of data on the prevalence of malnutrition in older adults in the ACT region of Australian in the residential aged care setting. This study found that 33% of older adults in this setting were malnourished, which is lower than the other two

recently studies previously conducted in Australia (3, 82). These previous studies, conducted by Banks et al (3) and Gaskill et al (82) found that malnutrition was prevalent in up to 50% of aged care residents. The prevalence of malnutrition was higher for residents receiving high-level care (42%), however this was not statistically significant when compared with residents living in low-level care. In this study, there was no association between malnutrition status and age. The exclusion of people with intellectual or mental impairment and those highly dependent on medical care may have also impacted on the prevalence of malnutrition found in this study. This group of residents were necessarily excluded due to ethical concerns, however, their inclusion may have provided a more accurate representation of malnutrition in this setting.

This study was a pilot, with a small sample size, which was opportunistic in nature. As the methodology applied to this study was found to be sound, it was applied to a larger sample in the following study. The next manuscript determines the prevalence of malnutrition in five residential aged care facilities. In addition, it also gathers information on nutrition issues which may affect dietary intake. A larger sample size may show an association between malnutrition status and age as per previous studies (3, 82).

Chapter 6: Manuscript 3 - Malnutrition prevalence and nutrition issues in five Australian residential aged care facilities

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Citation:

Kellett J, Kyle G, Itsiopoulos C, Naunton M, Bacon R, Costello L. 2014. Malnutrition prevalence and nutrition issues in five Australian Residential Aged Care Facilities. In Luszcz M and Feist H (Eds) *Making Research Matter: Program and Proceedings of the 13th National Conference of Emerging Researchers in Ageing*, pp72-75. Adelaide, 24-25 November, 2014. (Full peer-reviewed conference paper) (Appendix 5)

FORM E: DECLARATION OF CO-AUTHORED PUBLICATION CHAPTER

Declaration for Thesis Chapter 6

Declaration by candidate

In the case of Chapter 6, the nature and extent of my contribution to the work was the following:

Nature of contribution	Extent of contribution (%)
Jane Kellett was the main author of the manuscript, initiated the study, collected data, conducted the statistical analysis and supervised the project.	75%

The following co-authors contributed to the work.

Name	Nature of contribution	Extent of contribution (%)	Contributor is also a student at UC Y/N
Greg Kyle	Research supervision, assisted in the interpretation and writing of the manuscript	5%	N
Catherine Itsiopoulos	Research supervision, assisted in the interpretation and writing of the manuscript	5%	N
Mark Naunton	Research supervision, assisted in the interpretation and writing of the manuscript	5%	N
Rachel Bacon	Collected data, assisted in the interpretation and writing of the manuscript	5%	N
Lee-anne	Collected data, assisted in the	5%	N

Chapple (formerly Costello)	interpretation and writing of the manuscript		
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Candidate's Signature		Date 22/07/2016
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Declaration by co-authors

The undersigned hereby certify that:

- (1) the above declaration correctly reflects the nature and extent of the candidate's contribution to this work, and the nature of the contribution of each of the co-authors.
- (2) they meet the criteria for authorship in that they have participated in the conception, execution, or interpretation, of at least that part of the publication in their field of expertise;
- (3) they take public responsibility for their part of the publication, except for the responsible author who accepts overall responsibility for the publication;
- (4) there are no other authors of the publication according to these criteria;
- (5) potential conflicts of interest have been disclosed to (a) granting bodies, (b) the editor or publisher of journals or other publications, and (c) the head of the responsible academic unit; and
- (6) the original data are stored at the following location(s) and will be held for at least five years from the date indicated below:

Location(s) University of Canberra

Signature 1 G Kyle		Date 22/07/2016
Signature 2 C Itsiopoulos		23/07/2016
Signature 3 M Naunton		25/07/2016
Signature 4 R Bacon		27/07/2016
Signature 5 L Chapple (formerly Costello)		25/07/2016

6.1 Introduction to the manuscript

This is the second manuscript in this doctorate determining the prevalence of malnutrition in older adults in a sample of RACFs in the ACT and surrounding region. This manuscript is looking at a larger sample size, and in addition, will identify nutritional issues amongst residents that may affect dietary intake.

6.2 Publication

6.2.1 Abstract

Aim: To determine the prevalence of malnutrition and identify nutrition issues in a sample of older adults living in five Australian residential aged care facilities (RACFs).

Methods: The Subjective Global Assessment tool was used to determine the prevalence of malnutrition in 101 aged care residents from five Australian RACFs.

Results: In this population, 66% of the residents were women, and 29% of residents were classified as high care. Seventy eight percent of the residents were classified as well nourished, 20% as moderately malnourished, and 2% severely malnourished. Seventy-three percent of residents used dentures, and 25% had seen a dietitian in the previous six months. Malnutrition was significantly associated with increasing age, and decreasing Body Mass Index (BMI). Malnourished residents were more likely to have had nutritional supplements recommended. There was no significant association between malnutrition and gender or malnutrition and level of care.

Conclusions: The prevalence of malnutrition identified in this study was lower than data reported in recent Australian and international studies for residential aged care. Reasons for the lower rate of malnutrition in this sample might be due to the access, awareness and referral of dietetic services in these facilities, small sample size, and exclusion of high risk residents (including those cognitively impaired and medically unfit).

6.2.2 Introduction

Malnutrition is a health issue in our ageing population that often goes unrecognised (3). With the proportion of Australians over the age of 65 years increasing (4), malnutrition is becoming an increasingly important clinical and public health issue for Australia. People over the age of 65 have been shown to experience higher rates of malnutrition (3), with those in long-term care facilities at the greatest nutritional risk (82). Malnutrition in older adults leads to increased morbidity and mortality (77), poor physical function and delayed recovery from illness (12), increased incidence of falls (12), hip fractures (15), and pressure ulcers (16).

Malnutrition has been defined as “a state of nutrition in which a deficiency or excess (or imbalance) of energy, protein, and other nutrients causes measurable adverse effects on tissue/body form (body shape, size and composition) and function and clinical outcome” (141). For the purpose of this paper, the term malnutrition refers to protein-energy undernutrition.

There are limited data on malnutrition prevalence in Australian aged care residents. The most recent studies were conducted in 2007 and 2008 and reported that up to 50% of older adults living in Australian residential aged care facilities were malnourished (3, 82).

The aim of this study was to assess the nutritional status of residents in five residential aged care facilities to determine the prevalence of malnutrition and to identify nutritional issues that may affect dietary intake.

6.2.3 Methods

The study was cross-sectional and observational, to identify the prevalence of malnutrition, conducted in five residential aged care facilities from the Australian Capital Territory (ACT) region using opportunistic sampling. Participant recruitment was voluntary. Prior to data collection, all participants received a copy of a plain language information sheet and consent form. Residents unable to provide informed consent (cognitive impairment, non-English speaking and those highly dependent on medical care) were excluded because they were unlikely to fully comprehend the requirements of the study and be able to give informed consent. If a recruited participant was identified as malnourished information was provided to the participant on how to access dietetic services within their aged care residence.

Nutritional status was assessed using the Subjective Global Assessment (SGA), a validated tool used in the residential aged care setting (76). The SGA tool determines nutritional status based upon a medical assessment and physical examination. Subjects were classified as well-nourished, moderately or severely malnourished at each site, and the prevalence of malnutrition was determined. Height of residents was estimated by measuring ulna length as described by Thomas and Bishop (2007) (129). Body Mass Index (BMI) was derived from the estimated height (in cm) and measured weight (in kg).

Residents were also asked additional questions relating to the presence of any eating or swallowing difficulties, dentures, problems with gum or oral mucosa, and if assistance is required with meals. They were also asked if they had seen a dietitian in the previous six months, if any nutritional supplements had been recommended, or if they were on a special diet (Appendix 1).

One of the authors (JK) provided standardised training in performing SGA for the dietitians involved in the data collection. Inter-rater reliability of all dietitians involved in the data collection was determined and showed very good agreement with the use of the SGA (Intraclass correlation (ICC) = 0.906; $p < 0.001$).

As this is a point prevalence study, data collection took place on a single day for each study site. Data were entered into IBM SPSS Version 21.0 software (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.). Sample characteristics were reported as frequencies, means and standard deviations. Association between gender and continuous variables were assessed using the independent t-test. Associations between continuous variables and malnutrition prevalence were assessed using the One-Way ANOVA test. Associations between non-continuous variables were assessed using the Chi-squared test. A p-value of less than 0.05 was considered to be statistically significant. The research was approved by the University of Canberra Human Research Ethics Committee. Informed consent to participate in the study was obtained from all participants.

6.2.4 Results

One hundred and one residents participated in the study across the five sites. Two hundred and ten residents were eligible for inclusion from across the five sites. Of these, 37 declined, and 72 were not available, giving a response rate of 48.0%. The baseline characteristics of our study population are summarised in Table 6.2.1.

The characteristics of residents according to malnutrition status are shown in Table 6.2.2. The association between age and malnutrition was found to be significant ($F = 3.390$, $df = 2$, $p =$

0.038). There was also an association between malnutrition status and Body Mass Index (BMI), with the higher the SGA classification, the lower the BMI ($F = 16.460$, $df = 2$, $p < 0.001$).

There were a higher number of participants from high level care who were malnourished (24% compared to 21% of participants from low care), but the association between level of care and malnutrition was not significant ($\chi^2 = 0.488$, $df = 2$, $p = 0.784$). There was no significant difference in the prevalence of malnutrition between sites ($\chi^2 = 11.617$, $df = 8$, $p = 0.169$).

Table 6.2.1: Demographic variables of 2012 point prevalence RACF study population (n = 101)

Resident characteristic	Number
Age (years)	85.71 ± 6.9 (Range 63 – 97)
Gender	
Male	34 (34%)
Female	67 (66%)
Type of care	
Low level care	72 (71.3%)
High level care	29 (28.7%)
Nutritional status	
SGA A (well nourished)	79 (78%)
SGA B (moderately malnourished)	20 (20%)
SGA C (severely malnourished)	2 (2%)

Table 6.2.2: Characteristics of residents according to malnutrition status as assessed by the Subjective Global Assessment (SGA) tool (2012 study data, n = 101)

	SGA A Well nourished	SGA B Moderately malnourished	SGA C Severely malnourished	P-value
Gender				0.536
Male	28 (82%)	6 (18%)	0	
Female	51 (76%)	14 (21%)	2 (3%)	
Age (years)	85.10 ± 7.0	87.25 ± 5.8	96.50 ± 0.7	0.038
BMI (kg/m²)	28.10 ± 5.0	21.85 ± 3.7	17.90 ± 1.4	<0.001
Level of care				0.784
High	22 (76%)	6 (21%)	1 (3%)	
Low	57 (79%)	14 (20%)	1 (1%)	

With regard to the frequency of eating and swallowing problems amongst residents, 7% of residents had swallowing difficulties (including choking, gagging or spitting food). Twelve percent required assistance with meals including meal set up, prompting, cueing to eat, cutting up food or full feeding. The majority of residents had dentures (73%), and 17% had problems with gum or oral mucosa. Twenty-five percent of residents had seen a dietitian in the previous six months, and 11% of residents had been recommended a nutritional supplement. Twelve percent of residents were on a special diet (diabetic (9%), texture modified (2%), or fluid restriction (1%). There was a significant association between malnutrition and residents who had been recommended a nutritional supplement ($p = 0.009$).

6.2.5 Discussion

In this observational study, we found the prevalence of malnutrition to be 22% amongst the aged care residents. This is lower than data reported in recent Australian and international studies for residential aged care (3, 82, 140). The prevalence of malnutrition in residents in all sites was similar. Previous Australian studies have found malnutrition to be prevalent in up to 50% of aged care residents (3, 82).

Reasons for the lower rate of malnutrition in this sample may be due to the access, awareness and referral of dietetic services in these facilities, small sample size, and high risk residents (such as cognitively impaired and medically unfit) not participating in the study. Residents with dementia are at a high risk of malnutrition (82). Their inclusion would be more representative of the mix of residents in aged care facilities.

Malnutrition was significantly associated with increasing age which is consistent with previous research (3, 82). However malnutrition was not associated with gender, or level of care. This is inconsistent with previous research by Banks et al (2007) (3) who found that males were more likely to be malnourished, and Gaskill et al (2008) (82) who found that residents receiving high level care were more likely to be malnourished.

6.2.6 Implications for policy and practice

Early recognition is one of the most important and effective ways to prevent and reduce the prevalence of malnutrition in older people. Nutrition screening is a simple, cost-effective and efficient way to identify malnutrition in our residential aged care residents. Introducing new Australian National Aged Care Standards to include mandatory malnutrition screening of all

aged care residents, with appropriate follow-up by Accredited Practising Dietitians, would ensure that the important health issue of malnutrition does not go unrecognised.

Summary

The prevalence of malnutrition found in this study is lower than data reported in recent Australian and international studies for residential aged care. Further research is required to determine the overall prevalence of malnutrition in aged care facilities in Australia.

Acknowledgements

We would like to acknowledge the work of Carole Richards, and University of Canberra Nutrition students – Nirmala Arachchige, Gemma Cooper, Nicky Elischer, Lisa King, Lay Tin Lee, Jess Melmoth, Benya Poothanapibul, Rhiannon Snipe, Laura Thompson, and Clare Wolski.

6.3 Contribution of this manuscript

Prior to these two studies determining the prevalence of malnutrition in older adults in the ACT region of Australia in the residential aged care setting, there was a paucity of data in this region of Australia, and also limited data on malnutrition in older adults living in residential care facilities in Australia. This study found that 22% of older adults in this setting were malnourished, which is lower than the previously conducted study (Chapter 5) (142), and other previously conducted studies in Australia (3, 82). This study found that malnutrition was significantly associated with increasing age as per previous studies by Banks et al (3) and Gaskill (82). This study found that there are a number of nutritional issues in this population which may impact on dietary intake. The most common of these was the use of dentures, which were used by 73% of the residents in the study.

The prevalence of malnutrition in both of these studies conducted in the residential aged care setting (Chapter 5 and Chapter 6) (142, 143) were lower than data reported in recent Australian and international studies (3, 82, 140). There are several factors which may have influenced the lower rate of malnutrition. In both of these studies, there was access, awareness and referral of dietetic services in the facilities, both studies had relatively small sample sizes, and there was an exclusion of high risk residents, which included both those who were cognitively impaired, and medically unfit.

Chapter 7: Manuscript 4 - Nutrition Screening Practices amongst Australian Residential Aged Care Facilities

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FORM E: DECLARATION OF CO-AUTHORED PUBLICATION CHAPTER

Declaration for Thesis Chapter 7

Declaration by candidate

In the case of Chapter 7, the nature and extent of my contribution to the work was the following:

Nature of contribution	Extent of contribution (%)
Jane Kellett was the main author of the manuscript, initiated the study, conducted the statistical analysis and supervised the project.	85%

The following co-authors contributed to the work.

Name	Nature of contribution	Extent of contribution (%)	Contributor is also a student at UC Y/N
Greg Kyle	Research supervision, assisted in the interpretation and writing of the manuscript	5%	N
Catherine Itsiopoulos	Research supervision, assisted in the interpretation and writing of the manuscript	5%	N
Mark Naunton	Research supervision, assisted in the interpretation and writing of the manuscript	5%	N

Candidate's Signature

	Date 22/07/2016
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Declaration by co-authors

The undersigned hereby certify that:

- (1) the above declaration correctly reflects the nature and extent of the candidate's contribution to this work, and the nature of the contribution of each of the co-authors.
- (2) they meet the criteria for authorship in that they have participated in the conception, execution, or interpretation, of at least that part of the publication in their field of expertise;
- (3) they take public responsibility for their part of the publication, except for the responsible author who accepts overall responsibility for the publication;
- (4) there are no other authors of the publication according to these criteria;
- (5) potential conflicts of interest have been disclosed to (a) granting bodies, (b) the editor or publisher of journals or other publications, and (c) the head of the responsible academic unit; and
- (6) the original data are stored at the following location(s) and will be held for at least five years from the date indicated below:

Location(s) University of Canberra

Signature 1 G Kyle		Date 22/07/2016
Signature 2 C Itsiopoulos		23/07/2016
Signature 3 M Naunton		25/07/2016

7.1 Introduction to the manuscript

The importance of screening aged care residents to identify those at risk of malnutrition has been identified (76, 110), however there are currently no national or international data on nutrition screening practices in RACFs. This novel study aims to determine how many RACFs in Australia routinely use a nutrition screening tool on residents to determine those at risk of malnutrition and to review practice following identification of residents as being at high risk of malnutrition.

7.2 Publication

7.2.1 Abstract

Objectives: To determine the proportion of Residential Aged Care Facilities (RACFs) in Australia who use a nutrition screening tool on residents to identify those at risk of malnutrition, and to review practice following identification of residents as being at high risk of malnutrition. **Design:** Multi-center, cross sectional observational study. **Setting:** Residential Aged Care Facilities. **Participants:** The Director of Nursing at each site was contacted by telephone and asked questions relating to current nutrition screening practices at their residential aged care facility. **Measurements:** Data was collected from a stratified sample of 229 residential aged care facilities in each state and territory in Australia.

Results: 82% of RACFs (n = 188) use a nutrition screening tool on residents to identify those at risk of malnutrition, however only 52% of RACFs (n = 119) used a screening tool which is validated in the residential aged care setting. There was a significant association between facilities using a nutrition screening tool and the staff members being trained to conduct nutrition screening ($p < 0.001$). Facilities that employed a dietitian were more likely to use a validated nutrition screening tool ($p < 0.005$). The most frequently used nutrition screening

tool was the ‘Mini Nutritional Assessment – Short Form (MNA-SF)’, which was used by 32% (n = 60) of the RACFs, followed by the ‘Malnutrition Universal Screening Tool (MUST)’ (15%, n = 29). **Conclusion:** We found that the majority of RACFs in Australia use a nutrition screening tool, however many of these RACFs use a tool which has not been validated in the RACF setting. This study highlights the need for greater dietetic advocacy in using validated nutrition screening tools to ensure malnutrition is identified.

Keywords: aging, malnutrition, nutrition screening, residential home.

7.2.2 Introduction

Malnutrition is frequently unrecognised in older adults living in residential aged care facilities (RACFs) (76). Malnutrition in older adults has been strongly associated with adverse clinical outcomes such as poor physical function and delayed recovery from illness (12, 13, 90), increased risk of osteoporosis (14), and an increased incidence of falls (12), hip fractures (15), pressure ulcers (16), and depressive symptoms (61). Recent Australian data has reported that up to 50% of aged-care residents are malnourished (3, 82).

Nutrition screening has been defined by the American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.) as cited in Mueller et al (35) as, “a process to identify an individual who is malnourished or who is at risk for malnutrition to determine if a detailed nutrition assessment is indicated”. Nutrition screening in residential aged care facilities requires documentation of nutrition information and the use of nutrition care plans which triggers dietetic interventions which in turn leads to a reduction in hospital admissions by 31% and reducing the length of hospital stays by 58% (144).

There are five nutrition screening tools that have been validated in the residential aged care setting. These are the Mini Nutritional Assessment-Short Form (MNA-SF) (used in older adults only) (102), Malnutrition Universal Screening Tool (MUST) (101), Malnutrition Screening Tool (MST) (100), Simplified Nutritional Appetite Questionnaire (SNAQ) (106), and Simple Nutrition Screening Tool (107, 108).

Isenring et al (145) assessed the validity of several malnutrition screening tools for use in the long-term aged care residential setting and anthropometric parameters against the Subjective Global Assessment tool (SGA) which is a validated nutrition assessment tool in the residential aged care setting (120). They found that the Malnutrition Screening Tool (MST) (100), MUST (101) and MNA-SF (102) have acceptable concurrent validity. The MST (100) had the best sensitivity and specificity compared to SGA, followed by the MNA-SF (102), MUST (101) and Simplified Nutritional Assessment Questionnaire (SNAQ) (106).

As there are currently no data on nutrition screening practices in Australian aged care residences, the aim of this research was to determine how many RACFs in Australia routinely use a nutrition screening tool on residents to determine those at risk of malnutrition and to review practice following identification of residents as being at high risk of malnutrition.

7.2.3 Methods

In this cross-sectional study, data was collected from a stratified sample of residential aged care facilities in each state and territory in Australia in 2014. A sample of 25% of the RACFs in Australia was systematically selected in a 1 in 4 order from an alphabetically listed group. The Director of Nursing at every fourth residential aged care facility in each state and territory (as listed on the aged care connect website: www.agedcareconnect.com.au) was

contacted by telephone and asked standardised questions relating to current nutrition screening practices at their residential aged care facility. RACFs were categorised as metropolitan or rural.

Data were entered into IBM SPSS Version 21.0 software (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.). Sample characteristics were reported as frequencies, means and standard deviations. Associations between non-continuous variables were assessed using the Chi-squared test. Associations between non-continuous variables and continuous variables were assessed using an independent T-test. A p-value of less than 0.05 was considered to be statistically significant.

The research was approved by the University of Canberra Human Research Ethics Committee, protocol approval number HREC 14 53. Informed consent to participate in the study was obtained from all participants.

7.2.4 Results

Of 2756 RACFs in Australia, 869 were contacted by telephone. Of these, 88 declined, and 552 were not available to speak or could not be contacted, providing a response rate of 26.4%. Two-hundred and twenty-nine RACFs participated in the study across all states and territories in Australia. Thirty-one from Queensland, 26 from New South Wales, 64 from Victoria, 9 from the Australian Capital Territory, 21 from Tasmania, 43 from South Australia, 6 from the Northern Territory and 29 from Western Australia.

The median number of residents within all facilities was 65.0 (range 10-210). The baseline characteristics of our study population are summarised in Table 7.2.

Table 7.2: Baseline characteristics of study population

Type of care	Median number of residents	Range
Low care	7	0-140
High care	45	0-185
Dementia	18	0-95

Eighty-two percent (n = 188) of RACFs reported using a nutrition screening tool to identify residents at risk of malnutrition, however only 52% of RACFs (n = 119) used a screening tool which has been validated in the residential aged care setting. Nutrition screening occurs when the resident arrives at the RACF in 75% (n = 172) of RACFs. There was no association between using a nutrition screening tool and location (metropolitan or rural/remote) (p = 0.512). All RACFs in both South Australia and the Australian Capital Territory used a nutrition screening tool. Figure 7.2.1 shows the frequency of nutrition screening after arrival in Australian RACFs.

Figure 7.2.1: Frequency of nutrition screening after arrival in Australian RACFs

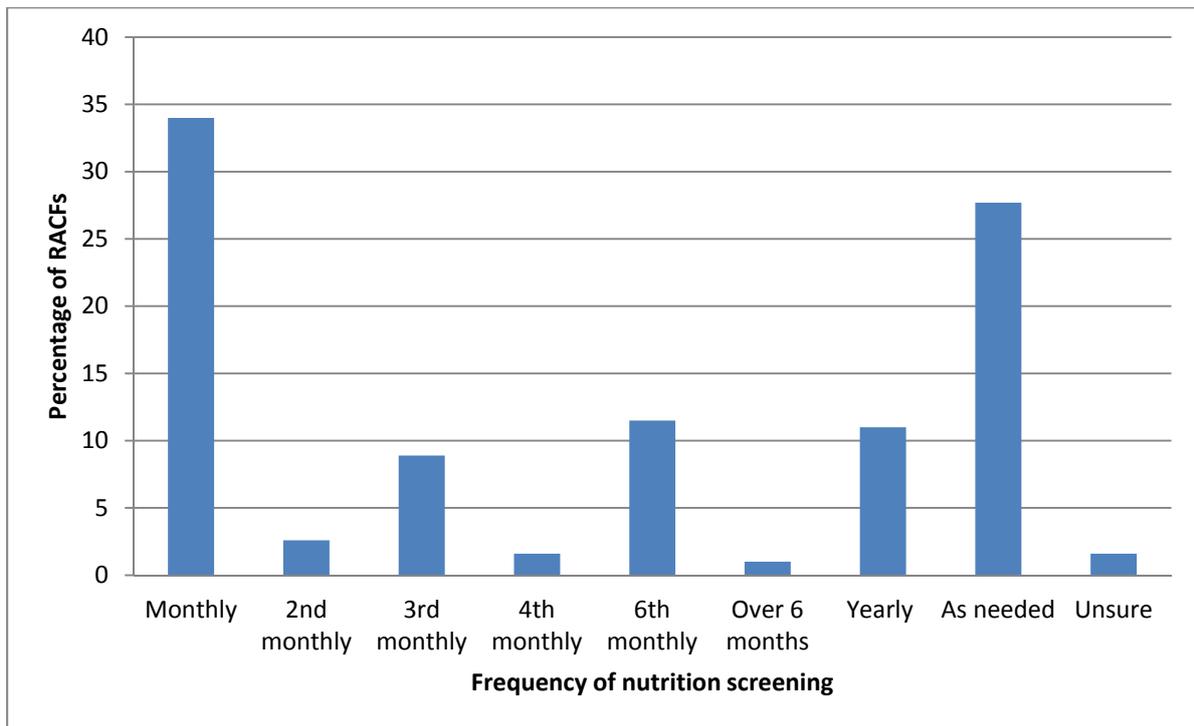


Figure 7.2.2: Distribution of nutrition screening tools used amongst RACFs in Australia (n=188)

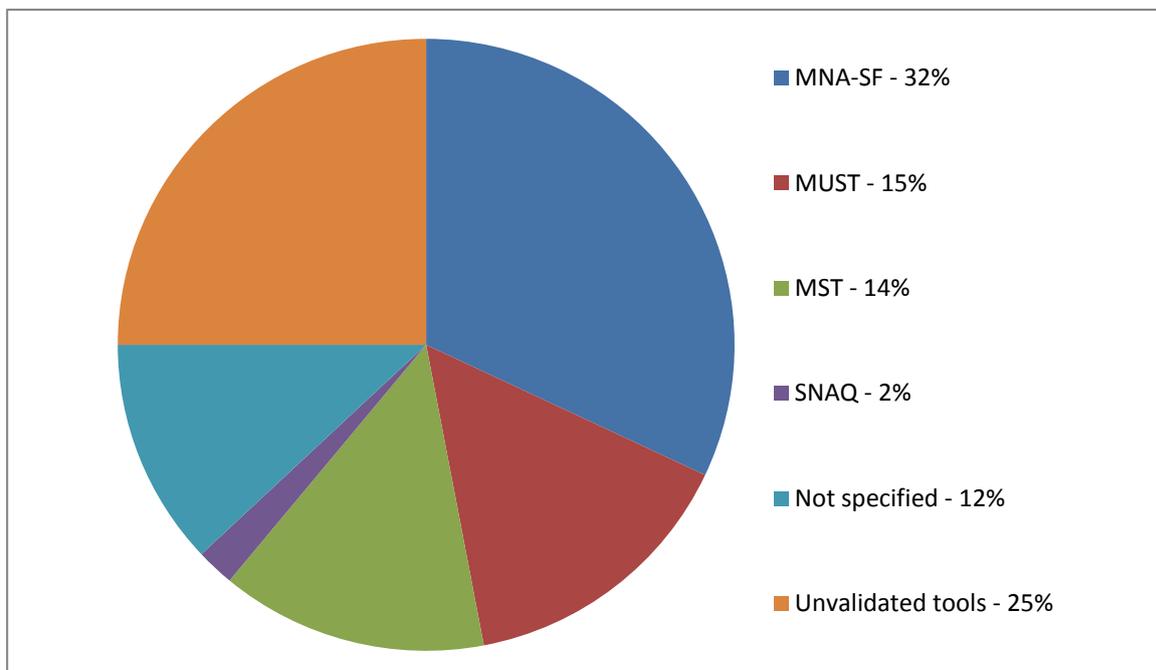


Figure 7.2.2 shows the distribution of nutrition screening tools used amongst RACFs in Australia. The most frequently used nutrition screening tool was the ‘Mini Nutritional Assessment – Short Form (MNA-SF)’, which was used by 32% (n = 60) of RACFs. Followed by the ‘Malnutrition Universal Screening Tool (MUST)’ (15%, n = 29), and the ‘Malnutrition Screening Tool (MST)’ (14%, n = 27). The ‘Simplified Nutritional Appetite Questionnaire (SNAQ)’ was used by 2% (n = 3) of RACFs. Twelve percent of RACFs (n = 22) were unsure as to which nutritional screening tool was used in their facility, and 8% (n = 16) used a nutritional screening tool which was “developed by the organisation”.

‘Nutrition and hydration assessment’ as the nutritional screening tool was used by three sites (2%), and one site (0.5%) used the ‘Aged Care Funding Instrument (ACFI)’ as their screening tool. Twelve RACFs (6%) used a nutrition screening tool as part of a computer package. Four sites (2%) used ‘I-care’, three sites (2%) used ‘Leading Nutrition: Weight Tracker’, three sites (2%) used ‘Platinum 5’, one site (0.5%) used ‘Management advantage’ and one site (0.5%) used ‘Autumn Care’

The staff members in 63% of RACFs (n = 144) had been trained to conduct nutrition screening. In 23% (n = 44) of RACFs, the same staff member screens residents, with the staff member who screens residents varying in 58% (n = 111) of RACFs, and the staff member who screens the residents sometimes varying, but often the same staff member in 18% (n = 35) of RACFs. The staff member most likely to conduct the nutrition screening was the Registered Nurse (RN) (45.3%, n = 86), or a combination of staff members (including a combination of Enrolled Nurses (EN), RNs, Clinical Nurse Specialists (CNS), Dietitians and Personal Care Workers) (44%, n = 84). A Dietitian was responsible for conducting nutrition screening in 10 RACFs (5%), and a CNS in 7 RACFs (4%), and an EN in 3 RACFs (2%).

There was a significant association between facilities using a nutrition screening tool and the staff members being trained to conduct nutrition screening ($p < 0.001$).

Residents that are identified to be 'at risk' of malnutrition were both referred to a dietitian and placed on a high protein, high energy diet in 40% of RACFs ($n = 76$). Seventy-three RACFs (38%) referred 'at risk' residents to a dietitian, and 31 RACFs (16.2%) placed 'at risk' residents on a high protein, high energy diet. Eleven RACFs (6%) did not refer to a dietitian or place the resident on a high protein, high energy diet. The responses from these facilities were varied and included; placing the resident on a food intake chart, further monitoring, and referring resident to a General Practitioner (GP).

Seventy-eight percent of RACFs ($n=178$) employed a dietitian. In 39% ($n = 69$) of these facilities this was on an 'ad-hoc' or 'as-needed' basis. Thirty percent ($n = 53$) of these facilities employed a dietitian on a casual basis only, with 16% ($n = 28$) employed for less than ten hours per week, 2% ($n = 4$) employed for less than twenty hours per week, and 10% ($n = 18$) employed between 20 and 40 hours per week. Three percent of RACFs ($n = 6$) were unsure how many hours per week the dietitian is employed at their facility.

In the 178 RACFs that employed a dietitian, the dietitian in 103 facilities (58%) were involved in menu planning, 133 were involved in menu review (75%), 92 were involved in nutrition screening (52%), and 167 (94%) were employed to conduct resident consultations. Facilities that employed a dietitian were more likely to use a validated nutrition screening tool ($p < 0.005$).

Of the 41 RACFs who did not currently use a nutrition screening tool, fifteen (7%) stated that they were considering implementing a nutrition screening tool in the future. Four RACFs made a comment that overweight residents or weight gain in residents was a bigger issue for them rather than under-nutrition.

7.2.5 Discussion

This is the first study to our knowledge that has contributed knowledge to the paucity of research exploring nutrition screening practices and employment of dietitians in RACFs in Australia. In this study we found that 82% of RACFs in Australia use a nutrition screening tool, however only 52% of RACFs use a tool which has been validated in the residential aged care setting. It is imperative that validated nutrition screening tools are used to ensure that malnutrition does not go undetected, and to enable staff to introduce relevant interventions such as a high protein, high energy diet.

Fourteen percent of facilities used a tool that was either “developed by the organisation” (8%, n = 16) or was part of a computer package (6%, n = 12). Although this study did not evaluate which screening tool was included in these computer packages, with the increase in the use of technology and mobile devices, it is important that Dietitians are involved in the development and implementation of relevant computer packages or mobile device applications in the aged care setting to ensure that appropriate, validated nutrition screening tools are used in this capacity. In this study, we found that facilities that employed a dietitian were more likely to use a validated nutrition screening tool ($p < 0.005$). Dietitians are nutrition experts who are able to assist RACFs to identify and implement relevant nutrition screening tools for the residential aged care setting.

Although the importance of screening and assessment of aged care residents to identify those at risk of malnutrition has been identified (76, 110), there are currently no evidence-based statements regarding frequency of nutrition screening for malnutrition in residential aged care settings. However, it has been recommended that nutrition screening occurs on admission in RACFs with periodic reassessment (110-113). It has been suggested that this reassessment occurs on a monthly basis in this population (114), or more frequently where there is clinical concern (110). In this study, we found that 34% of RACFs screened residents for malnutrition on a monthly basis, and 28% of RACFs screened residents when there was a clinical concern. Merrell et al (113) found that RACFs did not conduct routine nutritional screening to identify those at risk of malnutrition, contrary to national guidelines, but relied on ad-hoc observations and monitoring. Increasing knowledge of the importance of nutrition screening and the suggested frequency amongst RACF staff may improve the frequency of nutrition screening. Nutrition screening should therefore be occurring on admission, and then on a monthly basis (or more frequently where there is a clinical concern).

There was a significant association between facilities using a nutrition screening tool and the staff members being trained to conduct nutrition screening. This is consistent with previous research by Porter et al (146) who found that factors enabling nutrition screening amongst nursing staff were proficient skills and knowledge. Porter et al (146) found that factors that enable nutrition screening included nurses' positive perceptions of the value of the process, and competence in completing the task. Merrell et al (113) also found that attitudes towards nutritional care appear to be linked to staff education improved residents' nutritional status. Beattie et al (147) found that nursing staff have limited knowledge regarding human fluid requirements and the nutrition needs of aged care residents. Bauer et al (148) also found that the majority of residential aged care nursing staff were unable to identify the 'normal' Body

Mass Index (BMI) of older residents. A failure to recognise nutrition as an important aspect of care has been identified as contributing to malnutrition and dehydration in RACFs (147, 149). Our finding highlights the importance of ensuring that residential aged care staff have access to training on nutrition screening, which provides an introduction to further education on the importance of nutrition in RACFs.

A large number (78%, n = 178) of the RACFs employed a dietitian, however the majority of these facilities (84%, n = 150) only employed a dietitian on either an 'ad-hoc' basis, a casual basis, or less than ten hours per week. Findings from a previous study conducted in the Netherlands (150) found that only 54% of the undernourished aged care residents received nutritional intervention from a dietitian. A limitation of this study is that we did not follow-up on the impact of employing dietitians on the malnutrition prevalence in the RACFs. Future research should also compare patient outcomes in facilities with a full-time dietitian versus an 'ad-hoc' dietetic service.

With the ageing population, and the increasing need for RACFs in Australia, this sector of the health service is an area of potential employment opportunities for Accredited Practising Dietitians. National Quality of Care Principles for Australian RACFs currently include the requirement that 'meals of adequate variety, quality and quantity for each care recipient' be provided (151). Dietitians need to be engaged in with RACFs to ensure that the nutritional needs of the residents are being met. In addition, Dietitians may improve the nutritional status of residents by being actively engaged in activities such as menu planning, menu review, nutrition screening, nutrition assessment, resident consultations, and staff and resident education sessions.

Early recognition is one of the most important and effective ways to prevent and reduce the prevalence of malnutrition in older people. Nutrition screening is a simple, cost-effective and efficient way to identify malnutrition in our residential aged care residents. This study highlights the need for greater dietetic advocacy in using validated nutrition screening tools and using them at an appropriate frequency. Introducing new Australian National Aged Care Standards (Quality of Care Principles) to include mandatory malnutrition screening of all aged care residents, with appropriate follow-up by Accredited Practising Dietitians, may reduce the risk of malnutrition not being recognised.

7.3 Contribution of this manuscript

This is the first study that has contributed knowledge to the paucity of research exploring nutrition screening practices and employment of dietitians in RACFs in Australia. A key finding from this study was that only 52% of RACFs use a nutrition screening tool that has been validated in the residential aged care setting. Using validated nutrition screening tools is of utmost importance to ensure that the risk of malnutrition is identified to enable the introduction of relevant interventions. There was a significant association between facilities using a nutrition screening tool and the staff members being trained to conduct nutrition screening, which highlights the importance of ensuring residential aged care staff have access to training on nutrition screening.

Facilities that employed a dietitian were more likely to use a validated nutrition screening tool. The findings showed that although a large number of the RACFs employed a dietitian, the majority of these facilities employed the dietitian on an ‘ad-hoc’ basis, a casual basis, or less than ten hours per week. With our ageing population, aged care is an emerging area of

practice for dietitians in Australia. Dietitians need to be engaged with RACFs to ensure the needs of the residents are being met.

Chapter 8 – Discussion

8.1 Introduction to Chapter

Chapter 8 discusses the key findings arising from this thesis and the significant contribution the research has made to knowledge in the area of malnutrition in Australia's ageing population. This research aimed to determine the prevalence of malnutrition in the ACT and surrounding region in selected acute care and residential aged care facilities; to estimate the unclaimed financial reimbursement in the acute care setting due to undiagnosed or undocumented malnutrition; to determine how many RACFs in Australia routinely use a nutrition screening tool on residents to identify those at risk of malnutrition; and to inform future strategies for improved identification of malnutrition which will ultimately impact on improved patient care. The strengths and limitations of the research will be considered, and recommendations for future research suggested.

8.2 Finding One – The prevalence of malnutrition in adult inpatients in the acute care setting in the ACT region of Australia was 53%.

This is the highest prevalence of malnutrition published in an Australian study involving adult inpatients, equivalent to research conducted by Thomas et al in 2007 (81). Previous Australian studies have found malnutrition to be prevalent in 12-53% of inpatients (3, 69, 70, 77, 79, 81). Malnutrition as a health issue in the hospital setting was first documented in the medical literature over forty years ago (78) and since then, many studies have been published on the topic of hospital malnutrition (3, 67, 69, 77, 81), so malnutrition in the hospital setting is not a novel concept or problem. However, this finding is significant for several reasons. Firstly, we need to consider that the acuity of patient admissions in Australia is increasing. For example, in 2000-01 the average length of stay in an Australian Public Hospital was 3.7 days (133), however the most recent data from 2014-2015 shows that this has now increased

to 5.7 days (134). Secondly, with the ageing population in Australia, there has been an increase in hospitalisations for people aged between 65 and 74 by an average of 6.0% each year between 2010-11 and 2014-15, which is faster than the population growth for this age group which was 4.6% each year for the same period (134). During 2014-2015, people aged 65 years and over accounted for 41% of hospitalisation in Australia and 49% of patient days, when they currently make up 15% of Australia's population (134). With the proportion of our ageing population continuing to increase, this may impact on the prevalence of malnutrition in the hospital setting as this study found that malnutrition was significantly associated with an increase in age. This is consistent with previous research conducted by Banks et al (3). Finally, these findings show that despite the awareness of malnutrition in the acute care setting in the medical literature, malnutrition continues to go unrecognised or undiagnosed in the acute care setting. This finding is supported by previous Australian studies (69, 77, 118, 119, 152).

This reported prevalence of malnutrition in the acute care setting may be an underestimation of this clinical issue, as a result of the exclusion criteria used. Patients with dementia were excluded who are a high-risk group for malnutrition (132). Including patients with dementia would require informed consent from family members and would require a family member or caregiver to be interviewed to get reliable data on elements of the PG-SGA. These patients may have higher prevalence of malnutrition and their inclusion would provide a more accurate picture of malnutrition in the acute care setting in the ACT region of Australia.

8.3 Finding Two – Characteristics associated with malnutrition in this group of inpatients were increasing age, decreasing body mass index and increased length of stay.

This research demonstrated a significant association between malnutrition and increasing age, decreasing body mass index (BMI), and an increased length of stay. The association between malnutrition status and gender was not significant ($p = 0.051$), however there was a trend and our results did show that more females were malnourished compared with males. Previous research by Banks et al (3) and Middleton et al (77) found that gender did not have an effect on nutritional status in acute care facilities.

With the significant association between malnutrition and increasing age, and an increased length of stay, these findings highlight that older adults are particularly vulnerable within the acute care setting. Within the context of an increased average length of stay in Australian hospitals (134), and an increase in hospitalisations for older adults aged between 65 and 74 (134), as mentioned above, the relevance of this finding is particularly poignant.

8.4 Finding Three – The estimated annual unclaimed financial reimbursements in the acute care setting due to undiagnosed or undocumented malnutrition was AU\$8,536,200.

Malnutrition impacts severity of illness and increases length of stay, and if it is not captured via DRG coding in an output based costing model, hospitals are not adequately reimbursed for the patients they treat. In this study, the financial impact of malnutrition was estimated, and the unclaimed potential reimbursements per annum to this hospital were estimated to be AU\$8,536,200. This figure is striking, and higher than previous estimated unclaimed reimbursements (72, 73), reflecting the low number of patients currently being diagnosed and

coded as malnourished versus the actual prevalence of malnutrition determined in this research. Diagnosing malnutrition using validated assessment tools and documenting and coding accordingly may increase potential financial reimbursements for hospitals which enables funding to be directed towards better patient care.

This research examined four control groups (two historical control groups, and two subsequent cohorts) in the same hospital with the same inclusion criteria, to determine the proportion of patients coded as malnourished prior to our study and after our study. It was found that between 0.9% and 3.8% of patients were coded as being malnourished before the study and 4.4% and 5.5% of patients were coded as being malnourished in the subsequent control groups. These figures are significantly lower than the 52% of patients that were coded as malnourished from the point prevalence data (98% of the patients diagnosed as malnourished (53%) were coded as being malnourished in the medical records). It is difficult to ascertain whether this difference in malnutrition coding figures was due to the lack of identification, documentation, or coding in the control groups, but considering the total number of occasions of service for dietitians documented in the medical notes (Table 4.2.3), and the high accuracy of the medical coders found in the study (98%), it is most likely to be primarily due to lack of identification (i.e. diagnosis) of malnutrition.

This research used a validated nutrition assessment tool in the acute care setting, the PG-SGA (122), to diagnose malnutrition. Nutrition screening can be used to identify risk of malnutrition to determine if a detailed nutrition assessment is indicated (35). In Australia, it has been recommended that nutrition screening occurs on admission with weekly re-screening (76). However, nutrition screening in Australian hospitals is not mandatory. A seminal paper on nutrition screening practices in health care institutions, reported that in 1995

less than 5% of Australian hospitals were conducting nutrition screening (118). In a following paper in 2008, the authors found that nutrition screening on admission had increased to 78%, however about 50% reported that all or most admissions were screened (119). At this time, approximately 50% of facilities in Australia did not have a formal policy regarding nutrition screening in their respective facilities (111). Mandating nutrition screening to occur within 24 hours of admission in Australia, may increase the identification of ‘at risk’ patients to dietitians who would then be able to conduct nutrition assessments as indicated to diagnose malnutrition in a timely manner to ensure that appropriate treatment can occur. Advocating within the acute care setting in Australia for formal policies regarding nutrition screening practices may also assist in this capacity. Chima et al (117) reported since the hospital standards changed in 2003 to mandate that all inpatients be screened for nutrition risk within 24 hours of admission in the United States, 99% of health facilities now screen for nutrition risk on admission.

In this point prevalence study in the acute care setting, standardised pre-printed stickers were used to identify malnourished patients to coders and to standardise dietetic practice, which may have increased the coding of malnourished patients by the medical coders. With the increasing use of electronic health records, a similar electronic version of “a sticker” may be useful. In relation to electronic health records, the Academy of Nutrition and Dietetics in the United States of America are currently in the process of getting ‘Electronic clinical quality measures’ endorsed for four malnutrition electronic measures (153). The Electronic clinical measures use data from electronic health records to measure health care quality assist in ensuring that health care is delivered safely, effectively, equitably and in a timely fashion (153). The four Electronic Clinical Quality Measures that are currently being proposed for use by the Academy of Nutrition and Dietetics are: (1) Completion of a Malnutrition

Screening within 24 hours of admission; (2) Completion of a Nutrition Assessment for patients identified as at-risk for malnutrition within 24 hours of a malnutrition screening; (3) Nutrition Care Plan for patients identified as malnourished after a completed nutrition assessment; (4) Appropriate documentation of a malnutrition diagnoses (153).

8.5 Finding Four – The prevalence of malnutrition determined in the acute care setting was the highest prevalence of malnutrition recorded in an Australian study.

As mentioned above, the prevalence of malnutrition determined in the acute care setting in the ACT region of Australia was 53% which is the highest prevalence of malnutrition published in an Australian study, equivalent to research published by Thomas et al in 2007 (81). As previously discussed, factors that may have contributed to this high prevalence of malnutrition in the acute care setting are: (1) an increase in the acuity and length of stay in the acute care setting (134); (2) an increase in hospitalisations for older adults aged over 65 years of age (134); (3) nutrition screening within 24 hours of admission to an acute care facility not currently mandated in Australia; (4) lack of awareness of this important clinical issue.

It is important to address the level of malnutrition in the ACT region if we are to be in line with the Living Longer, Living Better reform (154) and the Commonwealth Home Support Programme (CHSP) (155), which both aim to assist older adults to be able to stay living in their own home in Australia.

8.6 Finding Five – The prevalence of malnutrition in older adults in a sample of Residential Aged Care Facilities in the ACT and surrounding region was between 22% and 33%.

There were two studies within this research which determined the prevalence of malnutrition in the residential aged care setting (142, 143). The first conducted in 2011 (142), and the second conducted in 2012 (143). The first study determined malnutrition to be prevalent in 33% of aged care residents, with 26% moderately malnourished, and 7% severely malnourished, the second study found that 22% of residents were malnourished with 20% moderately malnourished, and 2% severely malnourished.

8.7 Finding Six – The prevalence of malnutrition in the RACF setting was lower than other reported data in Australia.

The prevalence of malnutrition in the RACF setting found in this research was lower than other reported data in Australia. Previous recent Australian studies have found malnutrition to be prevalent in up to 50% of aged care residents (3, 82). There are several factors that may have influenced the lower rates of malnutrition in the ACT and surrounding region. Firstly, the residential aged care facilities that were included in this research had access to dietetic services; therefore conducting the same study at other sites may provide a different picture of the prevalence of malnutrition in aged care facilities in Australia. Although there is currently no published literature regarding the involvement of dietetic services and the prevalence of malnutrition in the residential aged care setting, it is possible that facilities without access to dietetic services may have a higher prevalence of malnutrition. Another factor which may have influenced the lower rates of malnutrition in this research was the small sample sizes. In addition, some high risk residents (cognitively impaired and medically unfit) did not participate in the studies. Residents with dementia are at a high risk of malnutrition (140). Their inclusion would be more representative of the mix of residents in RACFs.

8.8 Finding Seven – The prevalence of malnutrition was higher amongst high-level care residents in RACFs in the ACT region of Australia.

In both studies investigating malnutrition amongst aged care residents, there were a higher number of participants from high level care who were malnourished (42% compared with 29% of participants from low care in the pilot study (142), and 24% compared to 21% of participants from low care in the second study (143)). However, in both studies this association was not significant. This is inconsistent with previous research by Gaskill et al (82) who found that residents receiving high level care were more likely to be malnourished.

At the time of data collection, aged care residents in Australia were classified as high-care or low-care. The classification of ‘high-level care’ residents and ‘low-level care’ residents was removed from the 1 July 2014. Permanent aged care facility places are now approved on an ‘ageing in place’ basis, which reduces administration for consumers and providers without compromising levels of care to residents (154). ‘Ageing in place’ in residential care ensures that services are provided in response to the changing needs of older Australians (154).

8.9 Finding Eight – In the residential aged care setting, age was significantly associated with malnutrition.

Although our pilot study did not show a significant association between malnutrition and increasing age due to the small sample size ($n = 57$) (142), the second study, with a larger number of participants ($n = 101$) did show a significant association between malnutrition and increasing age (143). This association is consistent with previous research by Banks et al (3) and Gaskill et al (82). This highlights the increased vulnerability of older adults in RACFs, which is of increasing concern with Australia’s ageing population.

In the residential aged care setting, this research did not show an association between malnutrition and gender, in either study (142, 143). This is inconsistent with research by Banks et al (3) who found that males were more likely to be malnourished, but consistent with research by Gaskill et al (82) who also found no association between malnutrition and gender.

8.10 Finding Nine – Eighty-two percent of RACFs in Australia use a nutrition screening tool to identify those at risk of malnutrition.

In the first study of its kind looking at nutrition screening practices in RACFs in Australia, we found that 82% of RACFs in Australia use a nutrition screening tool (156). However, only 52% of RACFs use a nutrition screening tool that has been validated in the aged care setting (156). To ensure that malnutrition does not go undetected and to enable staff to introduce relevant interventions, it is imperative that validated nutrition screening tools are used, otherwise the number of residents at risk of malnutrition may be under-reported. This finding highlights the need for greater dietetic advocacy in using validated nutrition screening tools in this setting.

In addition to the number of RACFs not using a validated tool, another concern identified was the frequency at which nutrition screening tools are currently being used in this setting (156). Nutrition screening currently occurs when the resident arrives at the RACF in 75% of RACFs, with only 34% of screening occurring on a monthly basis following admission, and 28% of RACFs screening residents when there is a clinical concern (156). There are currently no evidence-based statements regarding the frequency of nutrition screening for malnutrition in Australian RACFs, but the National Institute of Health and Care Excellence in the United Kingdom have recommended that nutrition screening occurs on admission in RACFs (110)

with periodic reassessment (110-113). The Victorian Government Department of Human Services in Australia have been suggested that this reassessment occur on a monthly basis (114), or more frequently when there is clinical concern (110).

Increasing the knowledge of residential aged care staff on the importance of nutrition screening and the suggested frequency, may improve the initiation and frequency at which nutrition screening is occurring in this setting. The Australian National Aged Care standards (Quality of Care Principles, 2014) (151) ensure the appropriate provision of care and services occur within accredited residential aged care facilities. Within these standards there is no statement and/or requirement for RACFs in Australia to conduct nutrition screening on residents. Mandating nutrition screening of all aged care residents in Australia by introducing new Australian National Aged Care standards may reduce the risk of malnutrition not being recognised in the population.

8.11 – Finding Ten – The majority of residents identified to be ‘at risk’ of malnutrition were both referred to a dietitian and placed on a high protein, high energy diet in RACFs.

Residents who were identified to be ‘at risk’ of malnutrition in the residential aged care setting in Australia were both referred to a dietitian and placed on a high protein, high energy diet in 40% of RACFs. Thirty-eight percent of RACFs referred ‘at risk’ residents to a dietitian, and 16% placed ‘at risk’ residents on a high protein, high energy diet. Six percent did not refer to a dietitian or place the resident on a high protein, high energy diet. Ensuring ‘at risk’ residents are identified so that appropriate treatment can occur is of utmost importance to reduce the prevalence of malnutrition and the associated negative health and financial consequences. In the RACF setting, Christensson et al (151) found that by providing

individual meal plans based on the resident's requirements, improved nutritional status and functional capacity in malnourished residents.

8.12 - Future strategies for improved identification of malnutrition which will ultimately impact on improved patient care.

Within the context of our ageing population, and with this research demonstrating that malnutrition is significantly associated with increasing age in both the acute care setting and the residential aged care setting, the timely recognition of malnutrition is of paramount importance. This research has highlighted that the prevalence of malnutrition may be also be a result of other issues such as lack of communication (ie documentation), staff knowledge/training, and/or prioritisation of nutrition. As such, this research has identified many strategies to improve the identification of malnutrition which may impact on improved patient care.

Mandatory nutrition screening in the acute care and residential aged care settings in Australia with appropriate follow up by APDs may improve the identification of 'at risk' patients and residents. The Dietitians Association of Australia have published 'Evidence-Based Practice Guidelines for the Nutritional Management of Malnutrition in Adult Patients Across the Continuum of Care' (76), which recommend that routine screening for malnutrition should occur in all settings to improve the identification of malnutrition risk and enable nutritional care planning. This would require introducing new standards in the Australian Council on Healthcare Standards Evaluation and Quality Improvement Program (EQuIP) in acute care facilities, and in the Australian National Aged Care standards (Quality of Care Principles, 2014) in RACFs. In a systematic review of nutrition screening interventions, Elia et al (116) found that in the absence of formal screening procedures, more than half of the patients at

risk of malnutrition in various settings do not appear to be recognised and/or are not referred for treatment. It is therefore recommended that each health care setting should have a transparent policy regarding routine nutrition screening (116).

Ensuring that there is adequate training of dietitians (and potentially nursing staff and allied health assistants if they are involved in the nutrition screening) to ensure that malnutrition risk is identified and referred for treatment is important. This research found that there was a significant association between RACF using a nutrition screening tool and staff members being trained to conduct nutrition screening (156). This is consistent with previous research by Porter et al (146) who found that factors enabling nutrition screening amongst nursing staff were proficient skills and knowledge. This finding highlights the importance of ensuring that all residential aged care staff have access to training on nutrition screening, which then provides an introduction to further education on the importance of nutrition in aged care residents.

This research also found that although a large number of the RACFs (78%) employed a dietitian, the majority of these facilities employed the dietitian on an ‘ad-hoc’ or casual basis. Advocating for dietitians to be employed by RACFs may assist in the improvement of the nutrition status of aged care residents as dietitians are able to be actively engaged in the timely identification of ‘at risk’ residents, and follow-up nutrition assessment and treatment intervention for these residents. Dietitians are also able to assist facilities to implement nutrition screening policies.

In the acute care setting, it is essential that dietitians are trained regarding the appropriate/accurate documentation of malnutrition to ensure that malnutrition is identified,

documented and coded appropriately. If malnutrition is documented and coded correctly, appropriate financial reimbursement can occur to the health care facility, which can be directed towards better patient care. This research found that using standardised stickers may assist in this process (157). In addition to this, it is imperative that medical, nursing and allied health staff are trained regarding the importance of referring ‘at risk’ patients to the dietitian for nutrition assessment to occur in a timely manner. ‘At risk’ patients need to be identified so that treatment can occur in a timely fashion. Nutritional interventions in malnourished patients can produce positive clinical benefits (116).

8.13 Strengths and limitations of this research

The hospital malnutrition study conducted as part of this PhD provided insight into the current prevalence of hospital malnutrition in the ACT region in light of increasing patient acuity and an increase in admissions by adults over the age of 65 years of age in Australian hospitals. Despite hospital malnutrition not being a novel concept, this study highlighted that this is still a relevant and important clinical health issue, with older adults being particularly vulnerable. In this setting, it was found that malnutrition was under-diagnosed which in addition to having a potential negative affect on the patient, was estimated as having a financial implication on the healthcare facility, with the estimated unclaimed annual financial reimbursement due to undiagnosed or undocumented malnutrition to be AU\$8,536,200 in this facility.

The studies investigating malnutrition prevalence in RACFs have added to the body of research in this setting in Australia. Research in this setting has been limited, and is of increasing importance with Australia’s ageing population. The data collected in the ACT and surrounding region for this research is the first malnutrition prevalence data published in this

region of Australia and has therefore provides baseline data for effective monitoring and outcome measures.

The fourth study conducted as part of this PhD, was the first study of its kind to contribute to the paucity of research exploring nutrition screening practices and employment of dietitians in RACFs. This novel research highlighted the need for ensuring that validated nutrition screening tools are used to ensure that malnutrition is identified in this setting. A limitation of this study was that it did not follow-up on the impact of employing dietitians on the malnutrition prevalence in the RACF.

There were several other limitations of this research. Firstly, the research was cross-sectional in nature. Whilst cross-sectional studies are useful in providing a ‘snapshot’ of the frequency and characteristics of the health status in a population at a point in time, exposure and outcome are measured at the same time so cause-and-effect relationships are not certain (158). Secondly, limited samples of health facilities were included in the research which reduces the ability to be able to apply these findings to other settings. In addition, the first three studies only included facilities in the ACT and surrounding region of Australia.

The reported prevalence rate of malnutrition in the first three studies may be an underestimation of this health issue as a result of the exclusion criteria used. Patients and residents with moderate-severe cognitive impairment were excluded, who are a high-risk group for malnutrition (132). In the fourth study, determining Nutrition Screening practices amongst Australian RACFs, surveys were conducted via a phone interview, and therefore the data could not be validated.

8.14 Recommendations for future research

There is currently an evidence gap regarding the economic considerations of nutrition assessment. A full prospective cost-effectiveness study on the benefits of nutrition assessment would make a valuable contribution to malnutrition research.

Following on from the study which determined the proportion of RACFs in Australia who used a nutrition screening tool on residents to identify those at risk of malnutrition, future research should consider looking at the employment of dietitians in this setting, and compare patient outcomes in facilities with a full-time dietitian versus an ‘ad-hoc’ dietetic service.

Due to the paucity of research in the area of malnutrition in the residential aged care setting, further research in this area will provide additional insight into this relevant health issue in our ageing population in Australia. Greater numbers of participants are required to ensure the validity of the results and the generalisability of findings. In addition, collecting data from facilities with limited access to dietetic services would provide an insight into the effectiveness of dietetic intervention in this population.

Across both the acute care setting and the RACFs, it would be beneficial to include patients and residents with dementia in future research investigating the prevalence of malnutrition in these settings, as this group are a high risk group for malnutrition but there is currently limited data on this patient group. This would require gaining consent from the patient or resident’s Power of Attorney. Caregivers or family members may be able to assist in the provision of relevant information required as part of the patient or resident’s nutrition assessment.

8.15 Chapter Summary

Malnutrition continues to be a clinical and public health issue for our ageing population.

Despite hospital malnutrition first being recognised over 40 years ago, the prevalence of malnutrition in the hospital setting continues to occur in 1 in 2 acute care patients, with older adults more likely to be malnourished compared to younger adults. With the increasing patient acuity and increasing average length of stay in Australia's hospitals in addition to the increase in hospitalisations for older adults, the importance of identifying malnutrition in a timely manner to allow for appropriate treatment to occur has never been more apparent. The subsequent documentation and coding of the malnutrition plays an important role in the financial reimbursement to the healthcare facility as demonstrated by this research.

In the RACF setting, malnutrition continues to be an under-recognised and under-diagnosed condition with these studies showing that over 30% of aged care residents are currently malnourished. Including high risk residents such as those with dementia, would be likely to increase this figure. This research confirms the necessity and importance of routinely performing nutritional status evaluations in elderly patients in the acute care setting and in aged care residents; to ensure that validated tools are used for this purpose; and to provide training to staff to ensure that malnutrition is identified in a timely manner.

Mandating or ensuring that there are policies to conduct nutrition screening within 24 hours of admission in the acute care setting and the residential aged care setting may assist with the identification of malnutrition, with those at risk being referred to an Accredited Practising Dietitian (APD) which is of utmost importance for older adults who are especially vulnerable.

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APPENDIX 1 - Standardised questions used for RACFs

Point Prevalence Malnutrition Study

Participant		
Does the resident have any of the following problems with eating or drinking?	Yes	No
Swallowing difficulties including choking, gagging or spitting food		
Assistance is required with meals including meal set up, prompting, cueing to eat, cutting up food or full feeding		
Problems with gum or oral mucosa		
Dentures		
Has the resident seen a dietitian in the last 6 months?		
Have oral nutrition supplements been recommended?		
Is the resident on a special diet?		
If yes, please state the type of diet that has been prescribed_____		

APPENDIX 2 - RACF nutrition screening practices telephone survey questions

Site number:

State/Territory:

Date:

Malnutrition Screening Project

Phone Script and Survey Questions

Hello, my name is XXX, and I'm calling from the University of Canberra. I would like to discuss the frequency of malnutrition screening among the residents at your facility. Can I please speak to the Director of Nursing?

Hello, my name is XXX and I'm calling from the University of Canberra. We're conducting a research project looking at malnutrition screening of residents in residential aged care facilities and would like to include this facility in the study. Participation involves answering some questions over the phone and should take between 5 and 10 minutes to answer. All information provided will remain confidential and all data will be de-identified. You may withdraw at any time.

Would you like to be involved in the study?

If yes, please state that you agree to participate in the project.

Survey Questions:

1. How many residents are at your facility? _____

2. How many of these are low care/high care and dementia residents?

Low care _____

High care _____

Dementia _____

3. Does your facility use a nutrition screening tool to identify residents at risk of malnutrition?

- Yes (go to question 4)
- No (go to question 10)
- Unsure

4. Does this occur on arrival?

- Yes
- No
- Unsure
- Other _____

5. After arrival, how often does your malnutrition screening occur for each resident?

- Never
- Monthly
- 2nd Monthly
- 3rd Monthly
- 4th Monthly
- 5th Monthly
- 6th Monthly
- Over 6 months
- Yearly
- Other _____
- Unsure

6. What nutritional screening tool do you use?

- Malnutrition Screening Tool (MST)
- Malnutrition Universal Screening Tool (MUST)
- Mini Nutritional Assessment – Short Form (MNA-SF)
- Simplified Nutritional Appetite Questionnaire (SNAQ)
- Simple Nutrition Screening Tool
- Other _____
- Unsure

7. Does the same staff member usually screen the same resident? Or does it vary?

- Same staff member
- Staff member varies
- Sometimes varies, often the same staff member.
- Unsure

8. Who is the staff member that conducts this screening? (may tick more than one response)

- Enrolled Nurse
- Registered Nurse
- Clinical Nurse Specialist
- Dietitian
- Unsure
- Other _____

9. What happens to the residents that are identified to be 'at risk'?

- Referred to a Dietitian
- Placed on High Protein/High Energy Diet
- Unsure
- Other _____

10. Have your staff members been trained to conduct nutrition screening?

- Yes
- No
- Unsure
- Other _____

11. Do you currently employ a dietitian at your facility?

- Yes (go to question 12)
- No (go to question 14)
- Unsure
- Other _____

12. If yes, how many hours per week is the Dietitian employed?

- < 10 hours per week
- <20 hours per week
- Between 20-40 hours per week
- Casual basis only
- Unsure
- Other _____

13. What is the role of the Dietitian in your facility? (may tick more than one response)

- Menu planning
- Menu review
- Nutrition screening
- Resident consultations
- Other _____

14. If you don't currently use a nutrition screening tool, are you considering implementing nutrition screening in the future?

- Yes
- No
- Unsure
- Other _____
- Not applicable, this site currently uses a nutrition screening tool

15. Do you have any comments or questions regarding this survey?

Comment:

Would you like to receive a copy of the results of this research?

- Yes
- No

If yes, where would you like it emailed:

Email.....

Thank you very much for your time! Have a great day!

APPENDIX 3 - Manuscript: Malnutrition: the importance of identification, documentation, and coding in the acute care setting

Research Article

Malnutrition: The Importance of Identification, Documentation, and Coding in the Acute Care Setting

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Malnutrition is a significant issue in the hospital setting. This cross-sectional, observational study determined the prevalence of malnutrition amongst 189 adult inpatients in a teaching hospital using the Patient-Generated Subjective Global Assessment tool and compared data to control groups for coding of malnutrition to determine the estimated unclaimed financial reimbursement associated with this comorbidity. Fifty-three percent of inpatients were classified as malnourished. Significant associations were found between malnutrition and increasing age, decreasing body mass index, and increased length of stay. Ninety-eight percent of malnourished patients were coded as malnourished in medical records. The results of the medical history audit of patients in control groups showed that between 0.9 and 5.4% of patients were coded as malnourished which is remarkably lower than the 52% of patients who were coded as malnourished from the point prevalence study data. This is most likely to be primarily due to lack of identification. The estimated unclaimed annual financial reimbursement due to undiagnosed or undocumented malnutrition based on the point prevalence study was AU\$8,536,200. The study found that half the patients were malnourished, with older adults being particularly vulnerable. It is imperative that malnutrition is diagnosed and accurately documented and coded, so appropriate coding, funding reimbursement, and treatment can occur.

1. Introduction

Malnutrition has been identified as a significant clinical problem in hospital settings both nationally and internationally [1, 2]. Malnutrition adversely affects physical well-being, interferes with health treatments, and increases healthcare costs [2]. The reported prevalence of malnutrition in recent Australian studies is 12–53% in acute settings [3–8].

Malnutrition has been defined by the American Society for Parenteral and Enteral Nutrition as cited in Mueller et al. [9] as “an acute, subacute or chronic state of nutrition, in which varying degrees of overnutrition or undernutrition with or without inflammatory activity have led to a change in body composition and diminished function.” For the purpose of this paper, the term malnutrition will refer to undernutrition.

Malnutrition directly impacts health care costs and is captured in the Activity-Based Funding model used for the funding of hospitals in Australia [10]. Activity-Based Funding is an output based funding model which funds a health care service for the cost of patient care. The amount of funding is dependent on the accurate documentation of all relevant diagnoses and the health care activities associated with patient care during an admission in the patient clinical records and discharge summary [10]. When a patient is discharged, their medical notes are audited by medical coders. A Diagnosis Related Group (DRG) is assigned based on the patient’s major diagnosis, surgeries, comorbidities, complications, and other interventions recorded [11]. Hospitals are subsequently reimbursed for the patient admission based on this DRG. Malnutrition, when documented as a comorbidity or complication, has the ability to influence a DRG, often

resulting in a higher classification which has the potential to attract greater hospital reimbursement [12].

Several previous Australian studies have reported estimations of unclaimed reimbursements for patient admissions, where malnutrition was not recorded as a comorbidity as part of the DRG [6, 7, 13–15]. In 2009, Melbourne study estimated an annual deficit to the hospital in reimbursements of \$1,850,540 for undiagnosed or undocumented cases of malnutrition [14]. A similar study conducted in Brisbane estimated annual unclaimed expenses of \$1,677,235 due to undiagnosed and undocumented malnutrition [15].

The Australian Capital Territory (ACT) is a territory within Australia, where Canberra the capital city of Australia is situated. The estimated population of the ACT is currently 390,800 [16]. However, the tertiary teaching hospital in this region supports a population of almost 540,000 as it is a referral centre providing a range of specialist services to both ACT region and people living outside of the ACT in the South Eastern Region of New South Wales (NSW) [17].

As there are currently no data on malnutrition in adults residing in the ACT, the aim of this study was to determine the prevalence of malnutrition in a sample of adult inpatients at a tertiary teaching hospital in the ACT region to provide a baseline for effective monitoring and outcome measures, to determine characteristics associated with malnutrition in this group of patients, and to compare data to historical and sub-sequent cohorts for prevalence of malnutrition and coding of malnutrition. Based on these data we were then able to estimate the unclaimed annual financial loss of hospital income due to undiagnosed and/or undocumented malnutrition.

2. Materials and Methods

2.1. Study Population. This cross-sectional, observational study involved the collection of nutritional status data of adult inpatients in the aged care, rehabilitation, surgical, medical, critical care, acute care, orthopaedic, gastroenterology, vascular, neurology, renal, respiratory, cardiology, mental health, and oncology wards at a tertiary teaching hospital.

Participant recruitment was on a voluntary basis. Prior to data collection all participants received a copy of an information sheet and consent form. Patients over the age of 18 years admitted to the hospital over the study days were eligible for inclusion. Exclusion criteria were moderate-severe cognitive problems (as documented in the medical notes), no conversational English, day patients, terminal medical illness, and patients who were antenatal, postnatal, or determined as unfit by medical officers. If a participant was identified as malnourished then this was documented in their medical notes and they were referred to the nutrition department for nutrition intervention. Data collection took place over two consecutive days in June 2012. All eligible patients were invited to participate. The research was approved by the ACT Government Health Directorate Human Research Ethics Committee (ETH6.11.126 and ETHLR.13.222), and informed written consent was obtained from all participants.

2.2. Nutrition Assessment. Nutritional status of subjects was assessed using the scored Patient-Generated Subjective

Date:	Time:
This patient participated in a research study in which nutritional status was assessed by a Dietitian using the assessment tool PG-SGA (Patient Generated – Subjective Global Assessment).	
The assessment conducted revealed this patient has _____ malnutrition, rating _____, score _____, as evidenced by:	
<ul style="list-style-type: none"> - Unintentional wt loss _____% or BMI _____ kg/m² - Suboptimal food/fluid intake <input type="checkbox"/> - _____ loss of subcutaneous fat or muscle 	
In response to this finding a Nourishing Diet including oral nutrition supplements has been commenced for this patient. The Nutrition Department will provide follow up care & adjustment to the nutrition intervention consistent with the Nutrition Department priority framework and capacity.	
Dietitian: _____ Ext: 42567	

FIGURE 1: Preprinted malnutrition sticker used for point prevalence study.

Global Assessment (PG-SGA) tool [18] which is a validated tool used in the acute care setting [1]. It enables dietitians to determine nutritional status based upon a medical assessment and physical examination. Each participant was classified using a global category rating as either well-nourished (SGA A), moderately or suspected of being malnourished (SGA B), or severely malnourished (SGA C), and a total PG-SGA score was calculated. This score provides a guideline to the level of nutrition intervention required, with the higher the score, the greater the risk of malnutrition [18]. A score ≥ 9 indicates a critical need for improved symptom management and/or nutrient intervention options [18]. This was documented accordingly in the medical records by dietitians completing the nutrition assessment. Standardised preprinted stickers were used for this purpose to help identify patients to the medical coders and to standardise dietetic practice (Figure 1). The sixteen dietitians who were involved in collecting the data in this setting currently use the PG-SGA tool in the routine care of their patients. Standardised training in performing the PG-SGA was conducted for dietitians involved in the data collection by one of the authors (JK). Interrater reliability of all 16 dietitians involved in the data collection was determined and showed good agreement with the use of the PG-SGA (Intraclass correlation (ICC) = 0.901; $p < 0.001$).

2.3. Medical Records Audit. Following the data collection, a retrospective review of the medical records of study participants was conducted by the authors to provide information regarding length of stay, DRG allocation, documentation of malnutrition, and dietetic intervention. This was to determine if the study participants who were diagnosed as malnourished in this study were documented as malnourished by the dietitians and coded as malnourished by the medical coders. These data were then compared to the medical records of two historical control groups (June 2011 and March 2012) and two subsequent cohorts (September 2012 and

TABLE 1: Demographic variables of 2012 point prevalence study population ($n = 189$).

Patient characteristic	Number
Age (years)	62.9 ± 17.9 (age range: 18–97)
Gender	
Male	117 (62%)
Female	72 (38%)
Nutritional status	
SGA A (well-nourished)	88 (47%)
SGA B (suspected or moderately malnourished)	89 (47%)
SGA C (severely malnourished)	12 (6%)
PG-SGA score (median)	7 (PG-SGA score range: 0–25)

June 2013) to determine the proportion of patients coded as being malnourished prior to our study and after our study. All patient separations within these months using the same inclusion criteria were included in the data collection. A patient separation can be defined as, “the process by which an episode for an admitted patient ceases [19].”

Unclaimed potential reimbursements to this hospital (per annum) were calculated based on previous studies [6, 14], where Agarwal et al. [7] determined the average reimbursement per patient whose DRG changed because malnutrition coding was AU\$3470. Agarwal et al. [7] calculated that malnutrition coding for approximately 20% of malnourished patients led to an increase in financial reimbursement of AU\$3470 per patient. This figure of 20% is based on the average percentage of patients for whom the DRG changed because of malnutrition coding in studies by Lazarus and Hamlyn [6] and Gout et al. [14] and the amount of \$3470 based on the average hypothetical reimbursement per patient from the above-mentioned studies [6, 14]. The malnutrition prevalence data collected in June 2012 was used for this calculation which is comparable to these previous studies for the purpose of calculating unclaimed potential financial reimbursements.

2.4. Statistical Analysis. Data were entered into IBM SPSS Version 21.0 software (IBM Corp., released 2012, IBM SPSS Statistics for Windows, version 21.0, Armonk, NY: IBM Corp). Patient characteristics were reported as frequencies, means, and standard deviations. Nonparametric techniques were principally used to describe patient characteristics. Associations between gender and continuous variables were assessed using the independent *t*-test. Associations between continuous variables and malnutrition prevalence were assessed using the One-Way ANOVA test. The Mann-Whitney *U* test was used to examine differences in variables between the groups of patients according to malnutrition status as assessed by the PG-SGA. For this purpose groups SGA B and SGA C (i.e. malnourished patients) were combined for statistical purposes. A *p* value of less than 0.05 was considered to be statistically significant. Intraclass correlation was used to show the measure of agreement between multiple raters.

3. Results

One hundred and eighty-nine patients participated in the study over the two days. There were 434 adult inpatients at

the hospital over the study period, and 163 were excluded (100 because of being determined unfit by medical officers, 22 because of contact precautions, 18 because of being antenatal/postnatal, 8 because of having no conversational English, 7 because of having moderate-severe cognitive problems, 6 because of having terminal medical illness, and 2 because of being aphasic). Of the 271 eligible patients approached to participate, 75 declined and 7 were away from their room at the time of data collection. Overall the response rate was 73.1%.

One hundred and seventeen participants (62%) were male, and 72 (38%) were female. The age range of the 189 participants was 18–97 years (mean age 62.9 ± 17.9). Fifty-two percent of the participants were over the age of 65 years. The baseline characteristics of our participants are summarised in Table 1.

Forty seven percent ($n = 88$) of patients were classified as well-nourished, 47% of patients ($n = 89$) were classified as moderately or suspected of being malnourished, and 6% ($n = 12$) of patients were classified as severely malnourished. By ward, 96% of the participants from the oncology ward, 83% of the participants from the aged care ward, and 79% of the participants from the respiratory ward were found to be moderately or severely malnourished.

The characteristics of patients according to malnutrition status were assessed according to the Patient-Generated Subjective Global Assessment (PG-SGA) tool as shown in Table 2. There was no association between malnutrition status and gender ($p = 0.051$). There was a significant association between malnutrition and increasing age ($p = 0.040$). There was a significant difference between mean PG-SGA scores for each of the SGA classifications ($p < 0.001$), with the severely malnourished having the highest scores. There was also an association between SGA groups and body mass index (BMI), with the higher the SGA classification, the lower the BMI ($p < 0.001$). There was a significant difference in length of stay between well-nourished patients (SGA A) (median = 8, $n = 88$) and malnourished patients (SGA B and SGA C) (median = 14, $n = 101$), $U = 2961$, $Z = -3.96$, $p < 0.001$, and $r = -0.28$. On the study days in June 2012, malnutrition was coded in 98.2% ($n = 99$) of patients assessed as malnourished. Eighty-five percent of malnourished patients were coded as having been seen by a dietitian.

The results of the medical history audit of patients that was conducted on patient separations in June 2011, March

TABLE 2: Characteristics of patients according to malnutrition status as assessed by the Patient Generated Subjective Global Assessment (PG-SGA) tool (2012 study data, $n = 189$).

	SGA A (well-nourished)	SGA B (suspected or moderately malnourished)	SGA C (severely malnourished)	<i>p</i> value
Gender (<i>n</i> , (%))				0.051
Male	62 (33%)	47 (25%)	8 (4%)	
Female	26 (14%)	42 (22%)	4 (2%)	
Age (years)	59.4 ± 18.7	66.0 ± 17.0	66.0 ± 13.9	0.040
PG-SGA score	3.5 ± 2.6	12.0 ± 4.1	18.6 ± 3.2	<0.001
Body mass index (kg/m ²)	29.3 ± 7.8	25.3 ± 6.7	22.7 ± 5.9	<0.001

TABLE 3: Medical history audit of patients assessed as malnourished.

Date	Number of patient separations	Number of patients coded as malnourished (%)	Mean age of patients coded as malnourished (range)	Number of malnourished patients seen by a dietitian (%)	Number of patients seen by a dietitian for any condition (excluding malnutrition)
June 2011	1963	19 (0.9)	69.1 ± 18.2 (30–93)	14 (74)	210/1963 (10.6%)
March 2012	2006	76 (3.8)	70.1 ± 14.3 (25–94)	64 (84)	154/2006 (7.7%)
Sept 2012	1906	103 (5.4)	71.2 ± 17.1 (18–99)	89 (86)	94/1906 (4.9%)
June 2013	1876	82 (4.4)	66.4 ± 19.9 (18–96)	73 (89)	95/1876 (5.1%)

2012, September 2012, and June 2013 are shown in Table 3. Between 0.9 and 5.4% of patients were coded as malnourished. The number of patients coded as malnourished was higher for the months of September 2012 and June 2013 (after the point prevalence study in June 2012), being 5.4% and 4.4%, respectively. The number of malnourished patients seen by a dietitian increased from 74% to 89% between June 2011 and June 2013. The mean age of patients coded as being malnourished over all months was greater than 65 years. In June 2011 the mean age of patients coded as being malnourished was 69.1 ± 18.2; in March 2012 it was 70.1 ± 14.3, in September 2012 it was 71.2 ± 17.1, and in June 2013 it was 66.4 ± 19.9.

Extrapolating from Agarwal et al. [7], we can estimate the unclaimed potential reimbursements per annum to this hospital in the ACT region of Australia to be AU\$8,536,200. This figure was calculated considering that the average number of patient separations per month is 1938. If 53% of these patients are malnourished each month, then an estimated 1027 patients would be malnourished each month. Previous studies [6, 14] have found that 20% of the malnourished patients led to an average increase in financial reimbursement of \$3470; therefore 20% of 1027 = 205 and then 205 × \$3470 = AU\$711,350 per month and therefore AU\$8,536,200 per year.

4. Discussion

In this observational study, we found the prevalence of malnutrition to be 53% amongst the adult inpatients, which is the highest prevalence of malnutrition recorded in an Australian study, equivalent to research conducted by Thomas et al. in 2007 [8]. Previous other Australian studies have found malnutrition to be prevalent in 12–42% of patients [3–7]. Within the hospital population, older adults are particularly vulnerable. Our study showed that there was a

significant association between malnutrition and increasing age, decreasing body mass index (BMI), and an increased length of stay. Fifty-two percent of participants were over the age of 65, with the average age of participants (approaching this age group) being sixty-three years of age. The association between malnutrition status and gender was not significant, however there was a trend and our results did show that more females were malnourished compared with males. Previous research by Banks et al. [3] and Middleton et al. [5] found that gender did not have an effect on nutritional status in acute facilities.

When we compared our study data to two historical control groups and two subsequent control groups we found that between 0.9% and 3.8% of patients were coded as being malnourished before the study and 4.4%–5.4% of patients were coded as being malnourished in the subsequent control groups. These figures are significantly lower than the 52% of patients that were coded as malnourished from the point prevalence study data (98% of the patients diagnosed as malnourished (53%) were coded as being malnourished in the medical records). It is difficult to ascertain whether this difference in malnutrition coding figures was due to lack of identification, documentation, or coding in the control groups, but considering the total number of occasions of service for dietitians documented in the medical notes (Table 3) and the high accuracy of the medical coders found in this study (98%), it is most likely to be primarily due to lack of identification (i.e., diagnosis) of malnutrition. In our point prevalence study, we used standardised preprinted stickers to help identify malnourished patients to coders and to standardise dietetic practice, which may have increased the coding of the malnourished patients by the medical coders. These data also showed that, since the point prevalence study, there has been an increase in the number of patients coded

as malnourished and an increase in the number of malnourished patients seen by a dietitian, which shows that point prevalence study increased the awareness of malnutrition by the hospital dietitians and increased the diagnosis and documentation of malnutrition. The increase in the number of patients coded as malnourished in between June 2011 (0.9%) and March 2012 (3.8%) (prior to the study) may be a result of the clinicians' altered behaviour resulting from the awareness of the upcoming study which occurred in June 2012 (known as the Hawthorne Effect) [20].

It is also important to recognise that the point prevalence study was conducted under study conditions, where 16 dietitians were conducting assessment, all eligible patients were assessed, and malnutrition stickers were used. These are ideal conditions and may vary to "usual care," where factors affecting the identification of malnutrition may include poor completion of malnutrition screening by nursing staff, poor referral rates to the dietitian, and patients who are discharged before being seen by the dietitian for assessment. The historical and subsequent cohorts were representative of "usual care" which may also account for some of the differences in coding of malnutrition between groups.

We estimated the unclaimed potential reimbursements per annum to this hospital to be AU\$8,536,200. This additional funding to the health facility could make a valuable contribution to the increased costs associated with treating these malnourished patients. For example, if these costs were recovered, a portion of this additional funding could be directed to funding the employment of additional Accredited Practising Dietitians (APDs) to assist with the identification and management of patients with malnutrition, which may improve clinical outcomes.

Malnutrition as a health issue in the hospital setting was first documented in the medical literature over forty years ago [21]. Since then, many studies have been published on the topic of hospital malnutrition [3, 14]. Despite the awareness of this issue in the medical literature, this study shows that malnutrition continues to go unrecognised or undiagnosed in the acute care setting. This finding is supported by previous Australian studies [5, 6, 22–24]. Our findings highlight the importance of regular dietetic assessment amongst high-risk patients to ensure that malnutrition is recognised and diagnosed. This may then facilitate timely and adequate patient care. It is also imperative that correct documentation of malnutrition gets coded in the medical notes so that an appropriate DRG can be determined which influences reimbursement of funds to the health facility.

The reported prevalence rate of malnutrition in this study may be an underestimation of this clinical issue, as a result of the exclusion criteria used. Patients with dementia were excluded who are a high-risk group for malnutrition [25]. Including patients with dementia would require informed consent from family members and would require a family member or caregiver to be interviewed to get reliable data on elements of the PG-SGA. These patients may have a higher prevalence of malnutrition and their inclusion would provide a more accurate picture of malnutrition in the acute care setting in the ACT region of Australia.

A contributing factor towards the high prevalence of malnutrition found in this study may be a result of the increase in acuity of patient admissions over time. For example, in 2000–2001, the average length of stay in an Australian Public Hospital was 3.7 days [26]. The most recent data from 2014–2015 shows that this has now increased to 5.7 days [27]. In addition, with our ageing population in Australia, there has been an increase in hospitalisation for people aged between 65 and 74 years by an average of 6.0% each year between 2010–2011 and 2014–2015, which is faster than the population growth for this age group which was 4.6% each year for the same period [27]. During 2014–2015, people aged 65 years and over accounted for 41% of hospitalisation in Australia and 49% of patient days, when they currently make up 15% of Australia population [27]. With the proportion of our ageing population continuing to increase, this may impact on the prevalence of malnutrition in the hospital setting.

Using validated nutrition assessment tools to diagnose malnutrition in the acute care setting is of paramount importance. In the acute care setting, valid nutrition assessment tools include the Subjective Global Assessment (SGA) [28], the PG-SGA [18], and the Mini-Nutritional Assessment (MNA) (in older adults only) [29]. Diagnosing malnutrition in a timely fashion enables a dietetic referral to be triggered so that the patient can receive appropriate dietetic input. It has been suggested that validated nutrition assessment tools be used at baseline and then on a monthly basis to provide pre- and postintervention comparisons [1].

Mitchell and Porter [30] highlight the lack of evidence in the care of malnourished hospital adults, which limits the ability of clinicians and healthcare managers to make informed, cost-effective treatment decisions for this vulnerable group of patients. There is also an evidence gap regarding the economic considerations of nutrition assessment. We do not currently know if nutrition assessment is cost-effective. A full cost-effectiveness study on the benefits of nutrition assessment would make a valuable contribution to malnutrition research.

In conclusion, this study has highlighted that malnutrition continues to be underdiagnosed in the acute care setting in Australia, with older adults being particularly vulnerable. Diagnosing malnutrition using validated assessment tools and documenting and coding accordingly may increase potential reimbursements for hospitals which enables funding to be directed towards better care. Using standardised preprinted stickers may assist in identifying malnourished patients to coders and standardising documentation by dietitians. Malnutrition has been strongly associated with adverse clinical outcomes such as an increased length of stay and higher rates of medical complications. Not diagnosing malnutrition presents a high risk to patients and is a lost opportunity for financial reimbursement for the increased costs associated with the care of these vulnerable patients.

Competing Interests

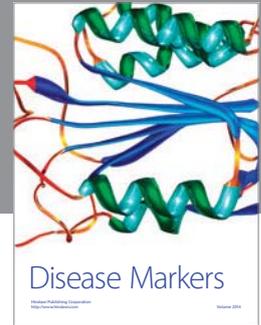
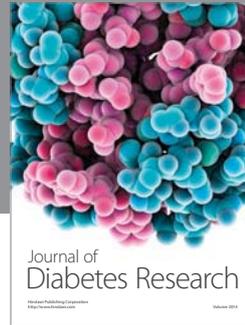
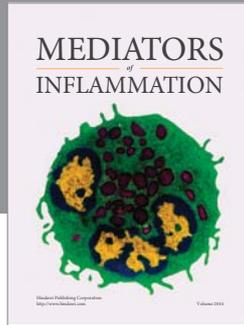
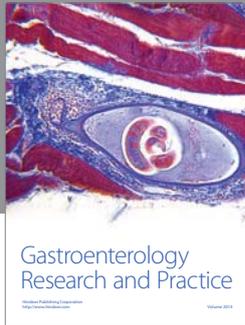
The authors have no competing interests.

Authors' Contributions

All authors have contributed significantly. Jane Kellett was the main author of the manuscript, initiated the study, conducted the statistical analysis, and supervised the project. Greg Kyle, Catherine Itsiopoulos, Mark Naunton, and Narelle Luff assisted in the interpretation and writing of the manuscript. All authors agreed on the manuscript. The content has not been published or submitted for publication elsewhere.

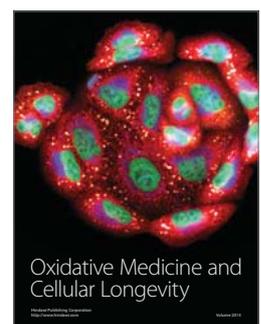
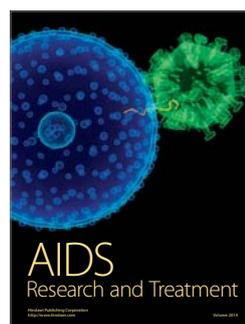
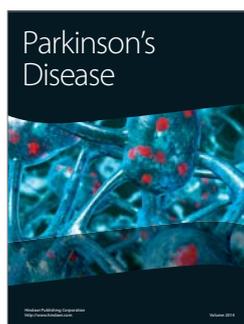
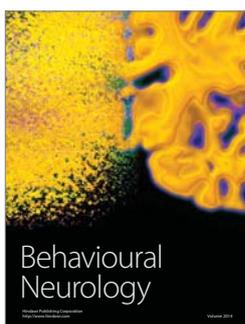
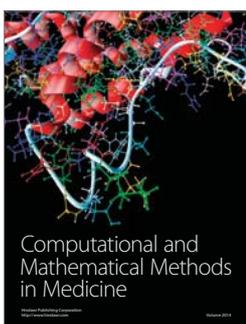
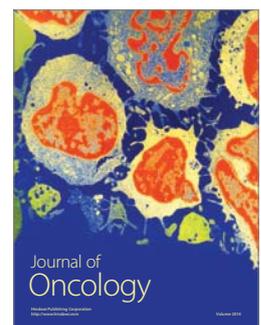
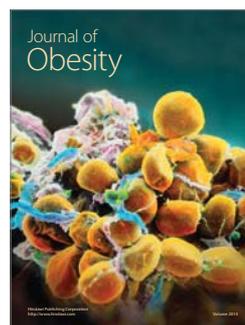
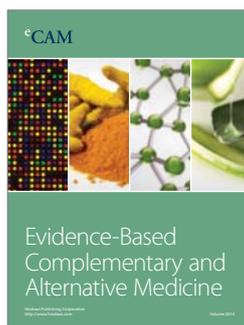
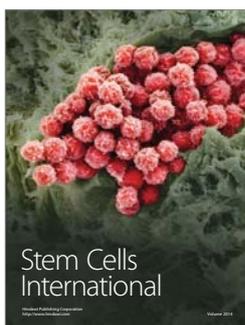
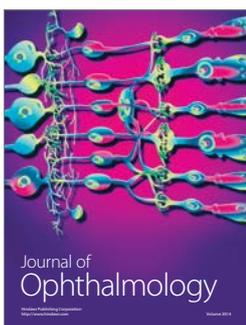
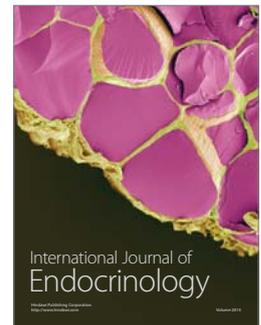
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APPENDIX 4 - Manuscript: Malnutrition prevalence in aged care residents. A pilot study

Appendix 4

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This appendix is available as:

Kellett, J., Kyle, G., Itsiopoulos, C., Naunton, M. & Bacon, R. (2015). Malnutrition prevalence in aged care residents : a pilot study. *Topics in Clinical Nutrition*, 30(3), 276-280.

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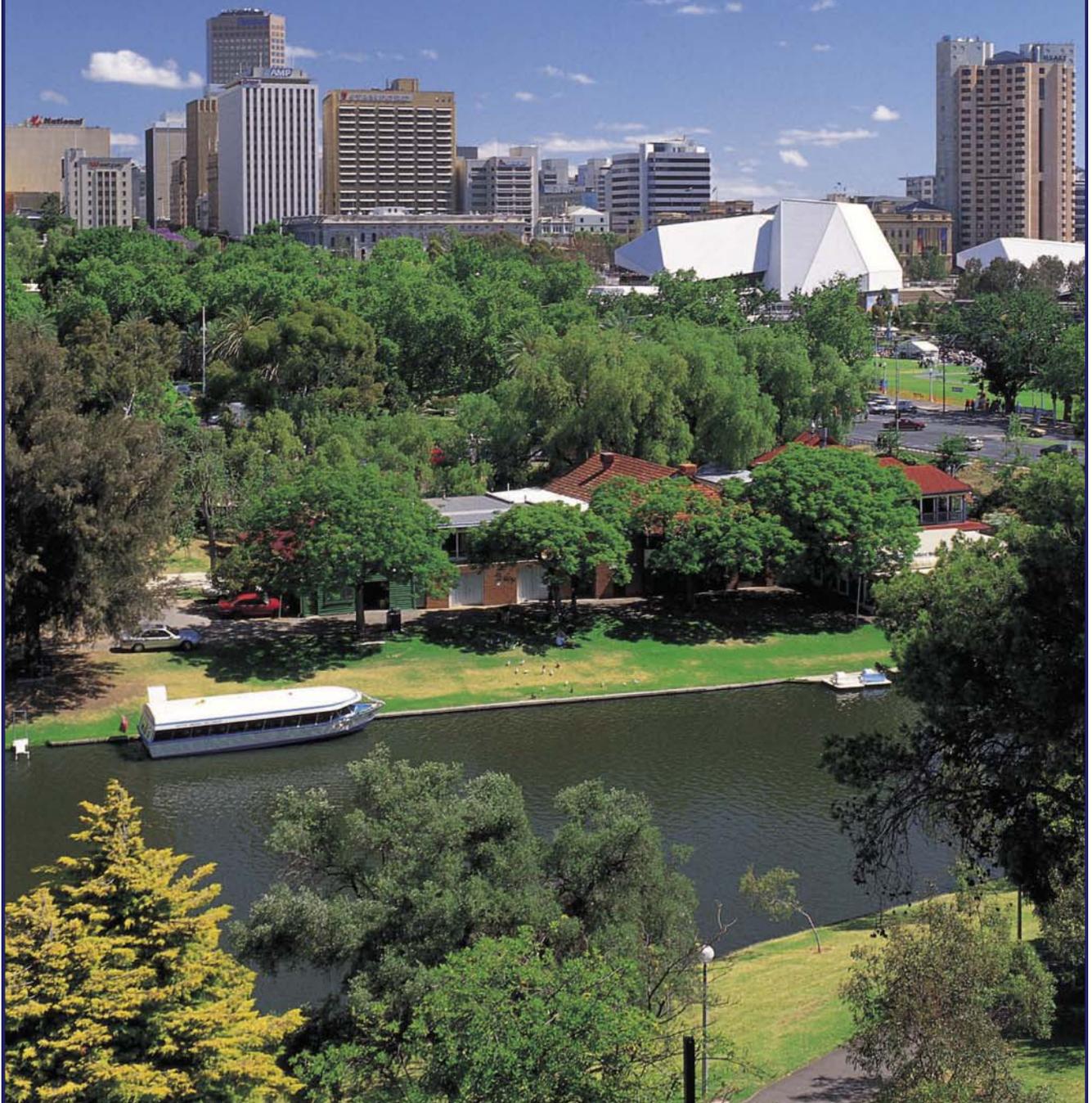
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DOI	10.1097/TIN.0000000000000042
Abstract	
<p>Malnutrition is a significant clinical and public health problem. The prevalence of malnutrition was determined in a sample of older people living in 2 residential aged care facilities in Australia. The Subjective Global Assessment tool was used to determine the prevalence of malnutrition in 57 residents. The majority of residents were well nourished (67%), 26% moderately malnourished, and 7% severely malnourished. Prevalence of malnutrition was higher for those receiving high-level care (42%), but this was not statistically significant ($P = .437$). No relationship was found between malnutrition status and age ($P = .529$) or sex ($P = .839$).</p> <p>Key words: aging, malnutrition, nutritional status</p>	

**APPENDIX 5 - Manuscript: Malnutrition prevalence and nutrition issues in five
Australian residential aged care facilities**

13th National Conference of Emerging Researchers in Ageing

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MALNUTRITION PREVALENCE AND NUTRITION ISSUES IN FIVE AUSTRALIAN RESIDENTIAL AGED CARE FACILITIES

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Abstract

Aim: To determine the prevalence of malnutrition and identify nutrition issues in a sample of older adults living in five Australian residential aged care facilities (RACFs).

Methods: The Subjective Global Assessment tool was used to determine the prevalence of malnutrition in 101 aged care residents from five Australian RACFs.

Results: In this population, 66% of the residents were women, and 29% of residents were classified as high care. Seventy eight percent of the residents were classified as well nourished, 20% as moderately malnourished, and 2% severely malnourished. Seventy-three percent of residents used dentures, and 25% had seen a dietitian in the previous six months. Malnutrition was significantly associated with increasing age, and decreasing Body Mass Index (BMI). Malnourished residents were more likely to have had nutritional supplements recommended. There was no significant association between malnutrition and gender or malnutrition and level of care.

Conclusions: The prevalence of malnutrition identified in this study was lower than data reported in recent Australian and international studies for residential aged care. Reasons for the lower rate of malnutrition in this sample might be due to the access, awareness and referral of dietetic services in these facilities, small sample size, and exclusion of high risk residents (including those cognitively impaired and medically unfit).

Introduction

Malnutrition is a health issue in our ageing population that often goes unrecognised (Banks, Ash, Bauer, & Gaskill, 2007). With the proportion of Australians over the age of 65 years increasing (Australian Bureau of Statistics, 2008), malnutrition is becoming an increasingly important clinical and public health issue for Australia. People over the age of 65 have been shown to experience higher rates of malnutrition (Banks et al., 2007, p. 174), with those in long-term care facilities at the greatest nutritional risk (Gaskill et al., 2008). Malnutrition in older adults leads to increased morbidity and mortality (Middleton, Nazarenko, Nivison-Smith & Smerdely, 2001), poor physical function and delayed recovery from illness (Visvanathan, et al., 2003), increased incidence of falls (Visvanathan, et. al., 2003), hip fractures (Namaty, Hickson, Byrnes, Ruxton & Frost, 2006), and pressure ulcers (Banks, Bauer, Graves, & Ash, 2010).

Malnutrition has been defined as “a state of nutrition in which a deficiency or excess (or imbalance) of energy, protein, and other nutrients causes measurable adverse effects on tissue/body form (body shape, size and composition) and function and clinical outcome” (Elia, 2000). For the purpose of this paper, the term malnutrition refers to protein-energy undernutrition.

There are limited data on malnutrition prevalence in Australian aged care residents. The most recent studies were conducted in 2007 and 2008 and reported that up to 50% of older adults living in Australian residential aged care facilities were malnourished (Banks et al., 2007, p. 175; Gaskill et. al., 2008).

The aim of this study was to assess the nutritional status of residents in five residential aged care facilities to determine the prevalence of malnutrition and to identify nutritional issues that may affect dietary intake.

Methods

The study was cross-sectional and observational, to identify the prevalence of malnutrition, conducted in five residential aged care facilities from the Australian Capital Territory (ACT) region using opportunistic sampling. Participant recruitment was voluntary. Prior to data collection, all participants received a copy of a plain language information sheet and consent form. Residents unable to provide informed consent (cognitive impairment, non-English speaking and those highly dependent on medical care) were excluded because they were unlikely to fully comprehend the requirements of the study and be able to give informed consent. If a recruited participant was identified as malnourished information was provided to the participant on how to access dietetic services within their aged care residence.

Nutritional status was assessed using the Subjective Global Assessment (SGA), a validated tool used in the residential aged care setting (Watterson et al., 2009). The SGA tool determines nutritional status based

upon a medical assessment and physical examination. Subjects were classified as well-nourished, moderately or severely malnourished at each site, and the prevalence of malnutrition was determined. Height of residents was estimated by measuring ulna length as described by Thomas and Bishop (2007). Body Mass Index (BMI) was derived from the estimated height (in cm) and measured weight (in kg).

Residents were also asked additional questions relating to the presence of any eating or swallowing difficulties, dentures, problems with gum or oral mucosa, and if assistance is required with meals. They were also asked if they had seen a dietitian in the previous six months, if any nutritional supplements had been recommended, or if they were on a special diet.

One of the authors (JK) provided standardised training in performing SGA for the dietitians involved in the data collection. Inter-rater reliability of all dietitians involved in the data collection was determined and showed very good agreement with the use of the SGA (Intraclass correlation (ICC) = 0.906; $p < 0.001$).

As this is a point prevalence study, data collection took place on a single day for each study site. Data were entered into IBM SPSS Version 21.0 software (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.). Sample characteristics were reported as frequencies, means and standard deviations. Association between gender and continuous variables were assessed using the independent t-test. Associations between continuous variables and malnutrition prevalence were assessed using the One-Way ANOVA test. Associations between non-continuous variables were assessed using the Chi-squared test. A p-value of less than 0.05 was considered to be statistically significant. The research was approved by the University of Canberra Human Research Ethics Committee. Informed consent to participate in the study was obtained from all participants.

Results

One hundred and one residents participated in the study across the five sites. Two hundred and ten residents were eligible for inclusion from across the five sites. Of these, 37 declined, and 72 were not available, giving a response rate of 48.0%. The baseline characteristics of our study population are summarised in Table 1.

The characteristics of residents according to malnutrition status are shown in Table 2. The association between age and malnutrition was found to be significant ($F = 3.390$, $df = 2$, $p = 0.038$). There was also an association between malnutrition status and Body Mass Index (BMI), with the higher the SGA classification, the lower the BMI ($F = 16.460$, $df = 2$, $p < 0.001$).

There were a higher number of participants from high level care who were malnourished (24% compared to 21% of participants from low care), but the association between level of care and malnutrition was not significant ($\chi^2 = 0.488$, $df = 2$, $p = 0.784$). There was no significant difference in the prevalence of malnutrition between sites ($\chi^2 = 11.617$, $df = 8$, $p = 0.169$).

With regard to the frequency of eating and swallowing problems amongst residents, 7% of residents had swallowing difficulties (including choking, gagging or spitting food). Twelve percent required assistance with meals including meal set up, prompting, cueing to eat, cutting up food or full feeding. The majority of residents had dentures (73%), and 17% had problems with gum or oral mucosa. Twenty-five percent of residents had seen a dietitian in the previous six months, and 11% of residents had been recommended a nutritional supplement. Twelve percent of residents were on a special diet (diabetic (9%), texture modified (2%), or fluid restriction (1%). There was a significant association between malnutrition and residents who had been recommended a nutritional supplement ($p = 0.009$).

Table 1. Demographic variables

Resident characteristic	Number
Age (years)	85.71 ± 6.9 (Range 63 – 97)
Gender	
Male	34 (34%)
Female	67 (66%)
Type of care	
Low level care	72 (71.3%)
High level care	29 (28.7%)
Nutritional status	
SGA A (well nourished)	79 (78%)
SGA B (moderately malnourished)	20 (20%)
SGA C (severely malnourished)	2 (2%)

Table 2. Characteristics of residents according to malnutrition status as assessed by the Subjective Global Assessment (SGA) tool

	SGA A Well nourished	SGA B Moderately malnourished	SGA C Severely malnourished	P-value
Gender				0.536
Male	28 (82%)	6 (18%)	0	
Female	51 (76%)	14 (21%)	2 (3%)	
Age (years)	85.10 ± 7.0	87.25 ± 5.8	96.50 ± 0.7	0.038
BMI (kg/m ²)	28.10 ± 5.0	21.85 ± 3.7	17.90 ± 1.4	<0.001
Level of care				0.784
High	22 (76%)	6 (21%)	1 (3%)	
Low	57 (79%)	14 (20%)	1 (1%)	

Discussion

In this observational study, we found the prevalence of malnutrition to be 22% amongst the aged care residents. This is lower than data reported in recent Australian and international studies for residential aged care (Banks et al., 2007; Gaskill et al., 2008; Suominen et al., 2005). The prevalence of malnutrition in residents in all sites was similar. Previous Australian studies have found malnutrition to be prevalent in up to 50% of aged care residents (Banks et al., 2007; Gaskill et al., 2008).

Reasons for the lower rate of malnutrition in this sample may be due to the access, awareness and referral of dietetic services in these facilities, small sample size, and high risk residents (such as cognitively impaired and medically unfit) not participating in the study. Residents with dementia are at a high risk of malnutrition (Gaskill et al., 2008). Their inclusion would be more representative of the mix of residents in aged care facilities.

Malnutrition was significantly associated with increasing age which is consistent with previous research (Banks et al., 2007; Gaskill et al., 2008). However malnutrition was not associated with gender, or level of care. This is inconsistent with previous research by Banks et al (2007) who found that males were more likely to be malnourished, and Gaskill et al (2008) who found that residents receiving high level care were more likely to be malnourished.

Implications for policy and practice

Early recognition is one of the most important and effective ways to prevent and reduce the prevalence of malnutrition in older people. Nutrition screening is a simple, cost-effective and efficient way to identify malnutrition in our residential aged care residents. Introducing new Australian National Aged Care Standards to include mandatory malnutrition screening of all aged care residents, with appropriate follow-up by Accredited Practising Dietitians, would ensure that the important health issue of malnutrition does not go unrecognised.

Summary

The prevalence of malnutrition found in this study is lower than data reported in recent Australian and international studies for residential aged care. Further research is required to determine the overall prevalence of malnutrition in aged care facilities in Australia.

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APPENDIX 6: Manuscript - Nutrition screening practices amongst Australian residential aged care facilities

Appendix 6

This appendix has been removed due to copyright restrictions.

This appendix is available as:

Kellett, J., Kyle, G., Itsiopoulos, C. & Naunton, M. (2016). Nutrition screening practices amongst Australian residential aged care facilities. *Journal of Nutrition, Health and Aging*, 20(10), 1040-1044.

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DOI	10.1007/s12603-015-0693-7
Abstract	
<p>Objectives To determine the proportion of Residential Aged Care Facilities (RACFs) in Australia who use a nutrition screening tool on residents to identify those at risk of malnutrition, and to review practice following identification of residents as being at high risk of malnutrition.</p> <p>Design Multi-center, cross sectional observational study. Setting: Residential Aged Care Facilities.</p> <p>Participants The Director of Nursing at each site was contacted by telephone and asked questions relating to current nutrition screening practices at their residential aged care facility.</p> <p>Measurements Data was collected from a stratified sample of 229 residential aged care facilities in each state and territory in Australia.</p> <p>Results 82% of RACFs (n = 188) use a nutrition screening tool on residents to identify those at risk of malnutrition, however only 52% of RACFs (n = 119) used a screening tool which is validated in the residential aged care setting. There was a significant association between facilities using a nutrition screening tool and the staff members being trained to conduct nutrition screening (p < 0.001). Facilities that employed a dietitian were more likely to use a validated nutrition screening tool (p < 0.005). The most frequently used nutrition screening tool was the 'Mini Nutritional Assessment–Short Form (MNA-SF)', which was used by 32% (n = 60) of the RACFs, followed by the 'Malnutrition Universal Screening Tool (MUST)' (15%, n = 29).</p> <p>Conclusion We found that the majority of RACFs in Australia use a nutrition screening tool, however many of these RACFs use a tool which has not been validated in the RACF setting. This study highlights the need for greater dietetic advocacy in using validated nutrition screening tools to ensure malnutrition is identified.</p>	