NATIONAL CONGRESS
ON FOOD, NUTRITION
AND THE DINING EXPERIENCE
IN AGED CARE

Literature Review

Summary Report

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List of Abbreviations

Glossary	
Abbreviation/Word	**Meaning**
AC	Aged Care
AD	Alzheimer's Disease
ADLs	Activities of Daily Living
AHSP	Appetite, Hunger, Sensory Perception
AIHW	Australian Institute of Health and Welfare
ASIRC	Australian Sustainable Industry Research Centre
BMI	Body Mass Index
CAMA	Corrected Arm Muscle Area
CHOICE program	Connecting, Honouring dignity, Offering support, supporting Identity, Creating opportunities, and Enjoyment.
CNAQ	Comprehensive Nutrition Assessment Questionnaire
CVA	Cerebrovascular Accident
EAT	Eating Assessment Tool
FAMET	Foodservice and Meal Environment Tool
IDDSI	International Dysphagia Diet Standardisation Initiative
LTC	Long-Term Care
MMSE	Mini Mental-State Examination
MNA-SF	Mini Nutritional Assessment-Short Form
MST	Malnutrition Screening Tool
MUST	Malnutrition University Screening Tool
N/A	Not Applicable
NH	Nursing Home
NHMRC	National Health and Medical Research Council of Australia
NR	Not Reported
ONS	Oral Nutritional Supplement
PATESIAC	Pathways and Tertiary Education Specific Interest Advisory Committee
QoL	Quality of Life
RACH	Residential Aged Care Home
RCT	Randomised Controlled Trial
RN	Registered Nurse
SES	Socioeconomic status
SGA	Selective Global Assessment
sHEHP	Structured high-energy high-protein (diet)
SNAQ	Simplified Nutritional Assessment Questionnaire
TM/TMF	Texture Modified Foods

Acknowledgments

Qualifications, experience and contribution of the authors:

Peter Kenny (BSc, MBA, MAICD) has held a range of Board positions over the past 25 years. He was appointed Chairman of the Maggie Beer Foundation in 2018, after serving as one of the inaugural Directors, he was a Founding Director of Colmar Brunton, one of Australia's largest consumer and social research companies and he was also Vice-President of the world's largest network of Independent Research Companies. In this role Peter chaired the Asia Pacific region and had a global role in the development of and education in market research methodologies. Peter has also held a broad range of senior executive roles covering consulting, strategy, brand development, marketing, consumer research, retail sales, food R&D and quality control. He has personally managed over 2000 research projects, ranging from due diligence to NPD and has served as an expert witness. The common threads to Peter's career have been his interest in the food industry and an understanding of the drivers of social change. *Contribution:* Peter was responsible for the overall design and management of the Landscape Survey, the Literature Review and the Collation of Manuals. Coordinated input and discussions with the Department of Health and the Congress Working Group.

Kurt Lushington is a Clinical Psychologist and Research Professor in the Justice and Society Unit of the University of South Australia. He is affiliated with the Centre for Brain, Body and Behaviour and Centre for Workplace Excellence. Kurt is interested in the psychophysiology of sleep and, as well, healthy ageing. His clinical speciality is sleep medicine, both applied and theoretical. Kurt is currently working on projects examining the impact of sleep disruption on daytime functioning and pathophysiology in children with sleep disordered breathing and working with industry groups examining the impact of fatigue on workplace performance and the impact of the digital environment on psychosocial safety. He is also leading cross-disciplinary teams looking at healthy ageing with projects examining financial capability, housing security, malnutrition and aged care and digital literacy. Kurt has published 120 peer reviewed articles and 19 book chapters. Over the period 2012-2020, Kurt was the Head of School for the School of Psychology, Social Work and Social Policy at UniSA. During his tenure, Kurt was responsible for introducing new degree programs in cognitive neuroscience, ageing and disability and counselling and overseeing the rise in the discipline of psychology's Excellence in Research Australia ratings from 2 (below world standard) to the maximum possible of 5 (well above world standard), placing the discipline in the top six in the country. *Contribution:* Responsible for (1) coordination and final production of the Landscape Survey, the Literature Review and the Collation of Manuals; (2) preparation of the specific reviews on 'ageing and taste' and 'nutrition and quality-of-life'; (3) oversight of the development and implementation of the Landscape Survey into the aged care setting; and (4) coordinated and analysed the Landscape Survey results.

Ebony Tucker is a current Psychology Honours student at the University of South Australia. Her interests are in the role of diet and food experiences on mood and wellbeing. Her Honours project focused on the relationship between nutritional status and quality of life in aged care, which involved the development of a systematic review and meta-analyses to determine the strength of the relationship in aged care settings and the effect of nutrition interventions on residents' quality of life. Involved in the Appetite for Life study at Kalyra Aged Care Woodcroft she received the opportunity to collaborate with industry partners and gain insight into life within aged care. Completing her thesis, Ebony aims to have her work published to help guide future research in the aged care sector and contribute to the improvement of residents' wellbeing. *Contribution:* Responsible for the conceptualization of the search strategy and data extraction, interpretation and drafting of the specific literature review on 'nutrition and quality-of-life'.

Christina Ambrosi, PhD in Psychology, in which she is implementing and evaluating the feasibility and benefits of a parenting intervention (Tuning in to Kids Together). Throughout her PhD, she has developed effective working relationships with key stakeholders, including community and family services across Australia. Christina has also been involved in public health research, funded by the National Health and Medical Research Council. These studies focused on promoting physical wellbeing by examining the efficacy of a gamification physical health intervention (Active Team) and exploring the impact of school holidays on children's diet and fitness. Christina has developed diverse research skills including survey development, project management, and conducting naturalistic/structured observations, interviews, and anthropomorphic assessments. In addition to her research, Christina is completing a Masters of Psychology (Clinical), with the intention of combining research and clinical practice to support family wellbeing. Christina draws on her knowledge of research and psychology in her current role as Course Coordinator at the South Australian Institute for Technology at Business and tutor at the University of South Australia. *Contribution:* Contributed to the conceptualization of the search strategy and data extraction, interpretation and drafting of the specific literature review on 'nutrition and quality-of-life'.

Maddison Mellow, Bachelor of Psychology/Cognitive Neuroscience (Honours) (University of South Australia). Maddison is a current PhD candidate investigating the best balance of physical activity, sleep and sedentary behaviour in the 24-hour day for cognitive function and dementia risk factors in older Australians. Her research interests are based around understanding the influence of lifestyle on brain health and function across the lifespan. She has experience in conducting lab-based neurophysiology studies, designing and undertaking systematic reviews and evaluation of community-based physical activity programs. *Contribution:* Contributed to (1) extracting data from published literature as part of the Literature Review on 'food, nutrition and the dining room experience in aged care' and (2) drafting and proofreading the research report.

Dr Ali Afsharian, BA and MA in Clinical Psychology (USWR, Iran). Ali's PhD (UniSA, Australia) focus was on Psychosocial Safety Climate (PSC) from composition and dispersion perspectives to highlight and prevent psychosocial risk factors at national and international levels at work. He investigated and compared PSC in different cultural contexts, Australian and Iranian workplaces. He is currently working as an academic researcher at Centre for Workplace Excellence at UniSA. Ali's research interests are mainly organisational and clinical psychology, psychosocial safety climate, psychosocial risk factors, employees' variability of underlying perception of managerial policies and management plans to design working environments; psychosocial health issues and risk factors at work, cross-cultural prevention and intervention for work health and safety and refugees' education, mental health and employment. *Contribution:* Contributed to data analysis for the Landscape Survey.

Dr Pennie Taylor, Bachelor of Health Science (Flinders University South Australia), Master of Nutrition and Dietetics (Flinders University South Australia), PhD Diabetes Nutrition and Technology (University of Adelaide). Pennie is a clinical dietitian consultant with EvolvME™ and nutrition scientist at CSIRO. She is experienced in designing, conducting and evaluating clinical and community trials, survey design and deliver, systematic literature and narrative reviews, developing and delivering nutrition-based programs health and wellness including chronic disease management, that are relevant to the health care environments. *Role:* Responsible for (1) conceptualization of the Landscape Survey; (2) preparation of the Literature Review and the Collation of Manuals specific to 'food, nutrition and the dining room experience in aged care'; (3) interpretation and synthesis of data from the Landscape Survey and the Literature Review specific to 'food, nutrition and the dining room experience in aged care'; and (4) drafting all sections of the overall report including key recommendations for discussion at the congress.

Dr Natalie Luscombe-Marsh, Bachelor of Science (University of Adelaide) Bachelor of Science (Hons) (University of Adelaide), PhD Nutrition and Disease (University of Adelaide). Natalie is an independent Nutritional Scientist and Research Consultant, having worked with CSIRO during the conceptualisation of the project plan. She has expertise in designing clinical and community-based trials in accordance with International Conference on Harmonisation Good Clinical Practice guidelines, and in conducting high quality systematic reviews to provide evidence summaries targeting evidence translation into community practice and to influence change. *Role:* Contributed to (1) conceptualization of the Landscape Survey; (2) preparation of the Literature Review and the Collation of Manuals specific to 'food, nutrition and the dining room experience in aged care'; (3) conceptualization of the search strategies, critical appraisal tools and report structure for the literature review specific to 'nutrition and quality-of-life'; (4) interpretation and synthesis of data from the research survey and the published literature; and (5) drafting all sections of the overall report including key recommendations for discussion at the congress.

Executive summary

- This literature review aims to provide the Congress attendees a narrative synthesis of insights derived from 36 papers from across the aged care literature and current best practice measures. The key themes and recommendations for discussion from these papers include:
    - ***Nutritional Guidelines in Aged Care:*** How to more effectively educate, implement and evaluate the use of best-practice nutrition guidelines across the most appropriate segments of the Aged Care workforce;
    - ***Food and Nutrition within Aged Care*****:** How to ensure that the nutritional needs of all residents are monitored routinely and met. The evidence suggests care staff need to be trained in how to conduct nutrition screening, and there is a call to action for nutrition managers and personal care staff to assist in the provision of care that is tailored to the needs of the resident;
    - ***Mealtime Experiences within Aged Care:*** How to more effectively educate, implement and evaluate the use of best-practice guidelines across the most appropriate segments of the Aged Care workforce to enhance behaviour during mealtimes, particularly for those residents with dementia;
    - ***Innovation in Food Services within Aged Care:*** How to more effectively implement and evaluate the effect of modifying the sensory, texture, and taste properties of meals, on quality of life and other important health outcomes including but certainly not limited to the emotional and nutritional status of residents.
- In addition to the 36 papers, the findings from a systematic literature review on nutrition and quality of life (QoL) are included. These findings demonstrated a positive relationship between nutritional status and self-perceived QoL, and that nutrition support (which varied in nature) can improve QoL.

- Based on the findings from our Landscape Survey (reported separately) there appears to be a gap in the literature that does not address the discordance between policy and practice in aged care homes and food service management. The Landscape Survey revealed a high proportion of the respondent aged care homes across Australia (52.8%) were regularly using the Australian Dietary Guidelines, whilst 59% of Individual homes and 80% of Provider homes were using the Best Practice Food and Nutrition Manual for Aged Care Homes [Bartyl and Bunney, 2015]. This demonstrates a willingness for each home to become engaged in the process of establishing a meal delivery process, including selection and implementation of standards in a residential aged care facility.

- Also included in this report (as Appendix 5) is a narrative review on taste and age, prepared by the Maggie Beer Foundation in conjunction with University of South Australia, Institute for Physical Activity and Nutrition (IPAN), School of Exercise and Nutrition Sciences, Deakin University. An often under-appreciated factor contributing to malnutrition in older adults is the age-related change in taste perception. In this review we examine the factors that influence taste in older adults with a focus on findings from residential age care settings. The review includes an overview of the physiology of taste, age-related changes in taste, impact of disease and medication on taste, and emerging findings examining the impact of time-of-day and sleep on taste. The review summarises the factors reported to promote taste and, hence, appetite, and discusses the need to change the focus from nutrients to food delivery. We conclude that strategies that improve food type, flavour perception, and the eating environment offer much promise in enhancing taste and, thereby, nutrition in older adults.

Purpose of the Report

The Australian Government Department of Health is partnering with the Maggie Beer Foundation in the delivery of a National Congress on Food, Nutrition and the Dining Experience in Aged Care (Congress).

The objectives of the Congress are to:

- bring together key stakeholders, including those working in aged care and on matters of aged care, to provide diverse perspectives, expertise and feedback (survey);
- identify current evidence-based literature and examples of best practice to help drive adoption on how to improve nutrition and food experiences for older Australians in aged care services and;
- help inform future Government policy decisions relevant to food and nutrition in aged care services.

In preparation for the Congress, the Foundation, in collaboration with the Department of Health, invited peak bodies (see list below) as well as prominent experts, to join a working group to assist with the planning and execution of the Congress. A key task of the working group was to compile a series of documents *for pre-reading to all attendees, to assist with informed discussions during the Congress.* The three pre-reading documents which form this report's structure are:

- **Collation of Manuals and Reports**: an overview of published manuals and reports that the providers of food in Residential Aged Care homes in Australia could use to guide best practice (reported separately from this document)
- **Landscape Survey**: a quantitative survey of current food related practices in Australian Residential Aged Care homes (reported separately from this document)
- **Literature Review:** comprises an examination of the relationship between nutrition and quality-of-life (QoL) in older residents of long-term care facilities and the factors affecting this relationship. The primary focus of the review will be an examination of the strategies that improve food and fluid intake of older adults in aged care with a focus on the impact of the physical environment on residents' psychosocial well-being during mealtimes (i.e. the impact of the dining experience). A secondary focus of the

review will be an examination of the strengths and limitations of the measurement tools used to assess nutrition and QoL in aged care residents (this document is the literature review).

Literature Review Report Structure

Section 1: General Background:

This is in the form of a narrative description of the characteristics of the Australian ageing population, to provide all attendees with a standard overview representing the environment.

Section 2: Literature Review

The literature review will examine the relationship between nutrition and quality-of-life (QoL) in older residents of long-term aged care homes and the factors affecting this relationship.

Section 3: Additional Papers and Reports submitted by the Working Group

In addition to the above literature review, the working group provided another 36 papers from which an overview of pertinent information including the outcomes, conclusions and limitations of the reported studies were tabulated. This section also contains conclusion and recommendations to clearly outline the findings of the collective papers. The aim of this section will be for readers and congress attendees to identify highlights but also gaps for discussion.

Acknowledgements are due to the following organisations for the conduct of this literature review with the consultant support of Dr. Natalie Luscombe-Marsh and Dr. Pennie Taylor:

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The Australian Government Department of Health is partnering with the Maggie Beer Foundation in the delivery of a National Congress on food, nutrition and the dining experience in aged care.

SECTION 1: General Background

The ageing population, including growth and projections

Nationally, the proportion of the population older than 65 years has continued to grow considerably over the past 2 decades. The National Centre for Social and Economic Modelling (NATSEM), who undertake independent and impartial research to model how diverse community groups (such as the 'baby boomer' population) impact policy and welfare design, have identified that the 5.5 million individuals born between 1946 to 1965 are now entering into the age of 65yr and over [Kelly, 2006; National Seniors Australia, 2012]. This growth in the ageing population, and entry of the baby boomers in particular, is associated with a marked increase in requirements for healthcare resources, with reports of over 40% of baby boomers being negatively impacted financially following the onset of the Global Financial Crisis (GFC), with those in poorer health among the most affected [National Seniors Australia, 2012]. To put this into context, over 1 in 7 Australians are now aged over 65yrs [Kelly, 2006; National Seniors Australia, 2012; AIHW 2018] and the ageing population growth phenomenon can be best displayed by the reported rates in growth over time.

In 2001 it was estimated that 12.5% (2.4 million) of the population were aged 65+ years, and by 2013 this increased to 14% of the Australian population (3.3 million people), with 1.9% (439,000) aged 85+ years. More recently (2017) this grew to 15% of the population (3.8 million) with the greatest growth in those aged 85+ years having reached 13% (497,000). This data demonstrates that the rate of growth over 12 years in those aged 65+ years has been steady with an increase of 1.1 million over 12 years (from 2001 to 2013), with a more rapid increase of 500,000 individuals over the subsequent 4 years (from 2013 to 2017) [AIHW, 2018; ABS, 2014; ABS 2017]. The number and proportion of Australians living beyond 65 years is expected to continue to grow. By 2057, it is projected there will be 8.8 million older people in Australia (22% of the population) and by 2097, 12.8 million people (25%) will be aged 65+ years [AIHW, 2018; ABS, 2014; ABS 2017]. The profile of ageing will also change, seeing a modest reduction in those aged 65-74 years (3.4 million) with an increase to 1 in 5 Australians

expected to live beyond 85 years (20% or 1.5 million) as early as 2047 [ABS, 2014; ABS 2017; United Nations, Department of Economics and social affairs, 2017].

The Diverse Older Australia

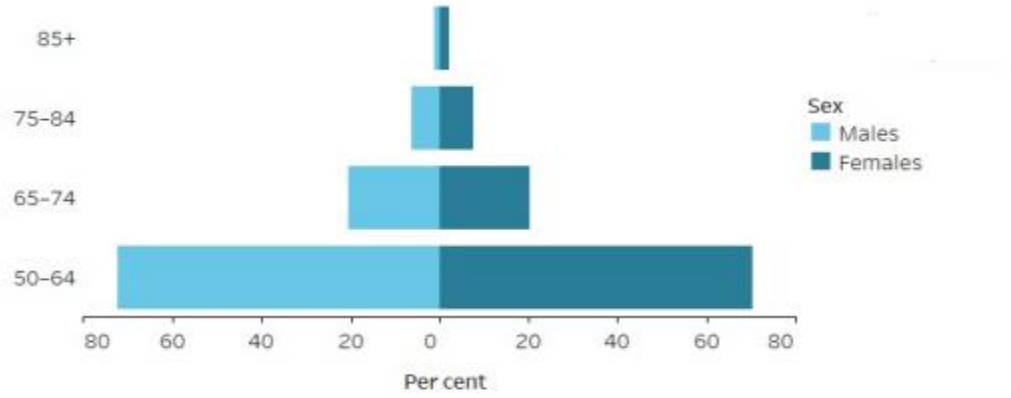
The older Australian population is not homogenous and is differentiated not only by various levels of socioeconomic backgrounds but also life experiences, lifestyles and spirituality, influencing the ageing process and subsequent support needs.

Aboriginal and Torres Strait Islander People

In 2016 the Aboriginal and Torres Strait Islander peoples comprised 3% (650,000) of the Australian population, with 25% (162,500) living in rural and remote areas of Australia [LoGiudice, 2016]. This is a marked increase from 2001 when the Indigenous Australian population was reported to be 1.6% if the total population [AIHW, 2018]. This increase may in part be due to the increase in those identifying as Indigenous, alongside an actual increase in the population over the past two decades.

The percentage of the older Indigenous population is demonstrated in Figure 1, showing that the proportion of those aged 50-64 years is considerably larger than those over 65 years, representing higher mortality and lower life expectancy of Indigenous Australians. The life expectancy of the Indigenous population is approximately 10 years less than that of the non-indigenous population [AIHW, 2015].

Figure 1: Age Structure of the older Indigenous population, by age and sex *(Source ABS 2017)*



It is widely reported that due to multiple environmental and endogenous insults throughout their lives, there is an increase in age-related conditions impacting Indigenous people at a younger age compared to non-indigenous Australians, and therefore planning for aged care services for Indigenous groups is to commence at aged 50 years [National Seniors Australia, 2012; AIHW 2018; ABS, 2017a; LoGiudice, 2016].

However, more recently it is projected that the Indigenous aged population, known as the "young old, 50-64 years" is rapidly growing, and therefore those 65 years and over are expected to increase to 61,900 by 2026 [AIHW, 2015; Sivertsen, 2019]. While the Indigenous population is comparatively small, the associated health issues are significant, further emphasizing the need for nutritional and social support. However, there are relatively low levels of support accessed through aged care homes, with a recent publication stating less than 1% of people living in aged care homes identify as Indigenous [Sivertsen, 2019]. Furthermore, with approximately 2,670 operational residential care homes across Australia, less than 24 homes (1%) had a minimum of 50% of their residents identify as Indigenous, although just over 1 in 4 (27%) of the Indigenous older people reported need for assistance with core activities including self-care, mobility and communication compared to 19% in the non-indigenous older population [LoGiudice, 2016; AIHW, 2015; Sivertsen, 2019; Australian Government Department of Health, Home Care Packages, 2017]. This suggests that representation of the Indigenous culture in current residential care needs further attention.

Reduced accessibility to health and aged care services, based on regionality, has been cited as one reason for the gap between Indigenous and nonindigenous Australians accessing residential aged care homes [ABS, 2016], whilst others cite lack of cultural and spiritual inclusivity, which may be a stronger limiting factor [Sivertsen, 2019].

Table 1: Aged care service usage rates per 1. 000 of the target population[(a),] by residential aged care service and Indigenous status 2016-2017

	Permanent residential aged care	Respite residential aged care
Indigenous	17.2	5.6
Non-indigenous	60.9	15.1

[(a)] Target population refers to the number Indigenous peoples aged 50 years and over and the number of Non-indigenous people aged 65 years and over.

Culturally and linguistically diverse (CALD) older Australia

In 2016, 37% of individuals aged over 65 years were born overseas (nearly 4 in 10), with 83% from non-English speaking countries (67% Europe and 16% Asia) [AIHW, 2018]. The migration trend has seen an 18% decline in European migrants and a 10% increase in migration from Asian countries between 2006 to 2016 [AIHW, 2018]

Despite limited evidence, it has been identified that the vast majority of older Australians from CALD backgrounds face barriers, like the older Indigenous population, in accessing and engaging with residential aged care homes [AIHW, 2018]. These barriers include poorer socio-economic status, substantial language barriers, lack of awareness of aged care services available to them bought on by language barriers, and lack of culturally and spiritually appropriate residential care providers available [AIHW, 2018].

Issues associated with navigation of the Australian aged care system become more pronounced for CALD persons, as information may not exist in their language or aged care services may not be promoted as CALD appropriate, resulting in reduced access to services that would result in positive health outcomes. Furthermore, for the CALD population, the onset of dementia is more problematic than for the non-CALD group, as dementia results in the loss of acquired language skills and it is important that aged care service providers understand the inherent difficulties faced by those of CALD backgrounds [Low et al., 2019].

Older Australians identifying as Lesbian, Gay, Bisexual, Transgender or Intersex

With the increase in acceptance of gender diversity is the recognition of the older Australian, who has lived through a period of social and cultural transition, who identify as lesbian, gay, bisexual, transgender or intersex (LGBTI). The LGBTI older Australian has likely experienced marginalisation, discrimination, isolation and family rejection, presenting with greater anxiety in disclosing their sexual orientation and gender identity, which reflects the limited data regarding the older Australian LGBTI population [AIHW, 2018, Australian Human Rights Commission, 2015; Department of Health, 2017].

In 2016, Australian census data captured same-sex couples, identifying 46,700 same-sex couples living in Australia at this time, of which 5% were aged over 65 years, with this proportion predicted to increase over the coming decades. This increase may come as a result of growing acceptance or a greater willingness to disclose sexual orientation or gender identity [ABS, 2017]. The census data also provided an "opt-in" for individuals to fully disclose the sexual orientation, allowing for the choice "other and provide more information" text boxes, not limiting to only male and female responses. As a result, 1,300 people had opted in identifying their sexual orientation as other, with most identifying as transgender (26%), another gender (18%) and non-binary (17%), with just 6% of these respondents aged 65 years and over [ABS, 2017]. Although this is a likely under-representation amongst the ageing population, the need to explore and promote equity and access for the LGBTI ageing population is highlighted by the *Aged Care Diversity Framework* [Department of Health, 2017].

Healthy Life Expectancy

In 2014-16, older men could expect to live for another 19.6 and women, another 22.3 years past their 65 years, an increase of 7.1 for men and 6.4 years for women since 1960-62, with the life expectancy of the Indigenous population estimated at 10 years less than non-indigenous groups [ABS, 2017c].

In concert with the increased life expectancy of the older Australian is the increasing healthy life expectancy, defined as the number of years that a person is expected to live free of disability. This increase has resulted in healthy life expectancy being considered together with disability [ABS, 2017c; AIHW, 2017]

In 2015, a survey by the Australian Institute of Health and Welfare [AIHW, 2015] including an exploration of disability and ageing, identified that at age 65 years:

- Men could expect to live an additional 9 years, free of disability
- Women could expect to live an additional 10 years, free of disability

However, the survey also identified that the duration lived with severe or profound disability had increased, reporting:

- Men could expect to live an additional 3.4 years with severe or profound core activity limitation (previously 3.7 years in 1998)
- Women could expect to live an additional 5.6 years with severe or profound core activity limitation.

Whist there is limited data exploring healthy life expectancy for sub-groups of the older population, according to an Australian Bureau of Statistics (ABS) survey, the Indigenous population were half as likely (35%) as nonindigenous people to assess their health as “excellent” or “very good”, with 27% of the older Indigenous population requiring assistance with activities of daily living, whilst the nonindigenous older population, nearly three-quarters (73%) reported they had “good, very good or excellent” health [ABS, 2016]. Overall, these data suggest that not only are Australians living longer, but the older Australian on average gained more years of life years without severe or profound core activity limitations.

Figure 2 Expected years of life at 65 years, by level of disability and gender over time [AIHW, 2017].

These demographic trends across the ageing Australian demographic have raised attention to the need for strategies to optimise the health and wellbeing of our older population, moving the focus towards improving quality of life and life lived with reduced disease, alongside longevity.

Nutritional Wellbeing

The nutritional wellbeing of the older adult is an essential component of their health, quality of life, and the ability of the ageing individual to continue to live comfortably, which is explored later in section 3 and manuals and references provided in section 4.

Many factors influence the older Australians' ability to remain healthy as they age, including behavioural, physiological and biochemical risk factors alongside ongoing decline in mental health and wellbeing. Several health issues including chronic disease are related to poor lifestyle choices. Previous reports suggest that for those aged over 65 years, 65% were reported to be physically inactive, 52% reported feeling stressed, and 72% reported being overweight or obese [ABS, 2014b; ABS, 2015]. Furthermore, the Australian Health Survey of 2011-2013 reported that older adults aged over 70 years were typically eating diets where

34% of dietary energy intake was coming from indulgence-based foods with low nutrient value (ideal <10% of intake). Moreover, no more than 9% of our older Australians were consuming the recommended serves of vegetables, consuming an estimated 170g total weight, which is equivalent to 2.3 serves of the recommended 5+ serves daily [Schols et al., 2009; Hodgkinson et al., 2003]

As a snapshot, these data highlight an under-nutrition risk due to a potential lower nutrient load in our older population. As such it is unsurprising that those transitioning from home to aged care homes are likely already malnourished, and treatment on entry into an aged care may need to be strongly considered in addition to strong routine review of residents already residing in aged care homes (to be discussed in section 3).

Good nutrition is a priority in supporting older adults [Schols et al., 2009; Hodgkinson et al., 2003; Abbey et al., 2015]. However, the question remains: is having consistent food, nutrition and dining guideline/standards that are relevant to the aged care environments essential to support the mental and functional independence of older people for as long as possible, including those who have transitioning to residential aged care homes? This perspective aligns with current goals of the Australian Government and the expectations of the broader nutrition community. Moreover, it is important that any guidelines/standards that are considered as important during the Congress are updated regularly to meet the current needs and expectations of older Australians' and their families, and are practical and relevant to the aged care environments needs [Schols et.al, 2009; Hodgkinson et.al, 2003; Abbey et al. 2015; A Matter of Care Australia's Aged Care Workforce Strategy, 2018] (literature discussed in section 3 and guidelines highlighted in section 4).

The Australian Dietary Guidelines (ADGs)

Eating nutritious food and balanced meals in combination with being physically active helps the older Australian to maintain muscle strength and a healthy weight. Therefore, relevant to the healthy ageing community-based population, the current Australian recommendations

for food and nutrient intakes for all Australians, including older adults, are provided in the Australian Dietary Guidelines (ADGs) [NHMRC, 2013].

These are then summarised for the public in the form of the Australian Guide to Healthy Eating (Appendix 1). The ADGs, developed in 2013, summarise 55,000 scientific articles to provide the best available evidence on the types and amounts of foods and food groups which are required to meet the older adults' unique ageing metabolic needs, promote health and wellbeing, and reduce the risk of diet-related conditions and chronic diseases for the general population.

In addition to the ADGs, the Nutrient Reference Values (NRVs) [NHMRC, 2006] provide a set of recommendations for nutrient-specific intakes based on currently available scientific knowledge. A closer look at the ADGs reveal that a diet to maintain optimal health and prevent chronic disease may not be easily attained by all older adults**.** In fact, it is important to recognise that these guidelines consider the dietary needs of healthy individuals over 70 years and they do not cater for older Australians with chronic health needs or frailty, therefore they are not suitable for use in food service in residential care homes.

Table 2 summarises the number of serves from each food group that are recommended for older (65+ years) women and men. Table 3 presents how this may look when planning meals across one day. In particular, the recommendation that close to one litre of dairy foods (in addition to main meals) is needed to meet the four serves recommended for older women would seem unrealistic for most older adults.

Table 2 summarises the number of serves from each food group that are recommended for an older (65+ years) women and men. [NHMRC 2006; NHMRC 2013; Montgomery et al. 2014].

Food Group	Serves Woman 65 yrs +	Serves Man 65 yrs +
Vegetables and legumes/beans	5	5.5
Fruit	2	2

Grain (cereal) foods, mostly wholegrain and/or high cereal fibre varieties	4	6
Lean meat and poultry, fish, eggs, tofu, nuts and seeds and legumes/beans	2	2.5
Milk, yoghurt, cheese and/or alternatives (mostly reduced fat)	4	2.5
Approx. number of additional serves from the five food groups or fats/oils/spreads or discretionary choices *	0-2.5	0-2.5

*Includes an allowance for unsaturated spreads or oils, nuts or seeds

Table 3 Sample Meal Plan to meet the Australian Dietary Guidelines (woman aged 70 yrs.).

MEAL	FOOD
Breakfast	2/3 cup cereal + 1 cup (250ml) of milk (Or 125ml milk mixed with 85g yoghurt)
Morning Tea	1 piece of fresh fruit
Lunch	2 slices of wholemeal bread with: 1 cup raw salad vegetables 2 thick slices (65g) meat + nut-based spread (2 tsp)
Afternoon Tea	¾ cup (190ml) yoghurt + ½ cup fruit Salad (canned, drained)
Dinner	Palm sized portion (80g) cooked meat with 2 cups of cooked vegetables ½ medium potato
Supper	½ cup fruit Salad (canned, drained) + 1 cup (250ml) custard

It can be seen from these recommendations that a significant quantity of foods is required. The next sections will discuss the anorexia of ageing, as well as a range of other social, environmental and medical factors may hinder one's ability to achieve these recommendations (Section 3 and Section 4).

Key Nutrient Recommendations

The ADGs provide the fundamental level of wholefoods needed for good health at a set age, which is provided by recognising serves of foods by their food group allocation. However, there is still much debate about the amount of foods and relevant nutrients required to enhance our health, especially as it is understood that dietary intake declines as we age. Nutrient requirements to support advancing age alter and often are needed in higher

amounts to support various biological parameters, including delay or prevention of cognitive decline, prevention of fractures and to maintain muscle function to prevent falls [NHMRC, 2006; NHMRC, 2013]. These nutrients can be difficult to achieve through the provision of food only, and supplementation may be required based on individual assessment.

For the vitamin and mineral requirements of older Australians, additional attention needs to be considered in meal planning for the following nutrients:

- Protein
- Calcium and Vitamin D
- B Vitamins (B12, Folate)
- Fibre (including starch)
- Water

Due to the extent of the topic area, a summary only has been provided on the common nutrients identified in Australia as being at risk. [Montgomery et al., 2014]

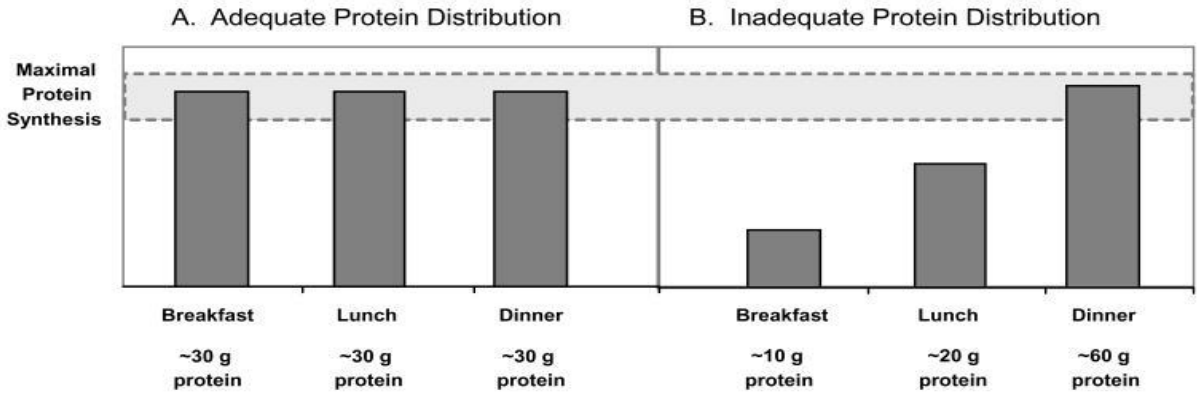
Protein intake of the older Australian

According to the most recent National Health Survey conducted in 2011-12 by the Australian Bureau of Statistics (which collected both body weight data and dietary intake data), dietary protein consumption was approximately 0.91 g/kg of bodyweight per day for all persons aged 65 years and over, which is below the target of 1.0-1.5 g/kg. [ABS, 2013; ABS, 2015].

Protein balance has been identified as a major determinant for healthy ageing and is of importance due to the high prevalence of protein-energy malnutrition in community-dwelling (5%) and institutionalised elderly (16-70%) [Bauer et al., 2013; Taylor and Luscombe-Marsh, 2016]. Optimal dietary protein intakes for older adults have been the subject of much debate over recent years, with attention on the role of protein in older adults for prevention and treatment of malnutrition and sarcopenia, and maintenance of physical function and independence.

To help the older adult maintain and possibly regain lean body mass and function, a group of leading researchers (PROT-AGE study group) [Bauer et al., 2013] recommend the average daily intake is at least 1.0 to 1.2g of protein per kilogram of body weight, per day. Older adults who have acute or chronic diseases need even more dietary protein (1.2-1.5 g/kg body weight/day). This broadly translates to a target of 25 to 30 g of protein per meal, for optimal protein synthesis (Figure 4).

Figure 4: graphical representation of the relationship between the amount of protein ingested at a meal and the anabolic response [Paddon-Jones and Leidy, 2014].



Vitamin D and Calcium

Vitamin D and Calcium have important functions in bone metabolism, with vitamin D promoting calcium absorption and lessening age-related bone loss. Consequently, vitamin D is a key nutrient for older adults for whom falls and fractures are a significant risk. In Australia, approximately 5-10% of requirements are derived from diet with vitamin D only found in a few foods such as oily fish, meat and fortified margarines, and the remainder synthesised in the body following sunlight exposure. Although calcium is abundant in dairy and easier to obtain, according to the ADG's the volume required is challenging for the older person to consume [Nowson et al., 2012]. Due to the reduced sunlight exposure and capacity of skin to produce vitamin D with ageing, along with low dietary intakes, it is a common nutrient deficiency. A recent study of the Australian population showed 46% of females aged 65-74 were deficient (using the definition of <50nmol/L as deficiency), increasing to 57% in women aged >75, with lower rates in males (22% in men aged 65-74 and 28% in men aged >75) [Daly

et al., 2012]. Low vitamin D status has been associated with increased frailty as well as all-cause and CVD mortality. Frailty refers to the multidimensional concept used to describe a decline in physical function that accompanies ageing. Vitamin D is proposed to contribute to frailty as deficiency impairs muscle function, increasing falls risk and reducing immunity, increasing risk from viruses including COVID-19.

Strategies for managing risk of deficiencies are commonly vitamin D and /or calcium supplementation. However, other prevention and treatment strategies include lifestyle changes, with regular short exposure to sunlight (15-20 minutes) being adequate to maintain vitamin D stores within range. Although a relatively simple strategy, it is not always achieved by older adults and the high rates of deficiency particularly in the residential care setting. As such, the Australian and New Zealand position paper recommends that for high risk individuals, which includes older adults (particularly those in residential care, disabled, obese, dark-skinned and those with a chronic disease), vitamin D screening should be performed with supplementation without initial screening suggested as being potentially appropriate for some high risk groups, including dark skinned migrants and people in residential care [Nowson et al., 2012]. See Appendix 2 for nutrient reference values.

B Vitamins

B-vitamins (B-6, B-12, folate) play an important role in maintenance of normal cognitive function, red blood cell formation, DNA synthesis and vascular function. Common food sources of B-6 and folate included cereal grains, legumes, leafy vegetables, meat and seafood, whereas B12 is only found in foods of animal origin (meat, seafood, dairy products). B12 deficiency is common in older adults due to decreased absorption as a result of atrophic gastritis, reduction of intrinsic factor and use of proton-pump inhibitors over time [Flood et al., 2006]. There is a lack of effectiveness outcomes in support of routine supplementation, with discordance between the observational studies and clinical trials. This may be a result of variable dose, duration or timing of the supplementation, whether a specific “therapeutic window” exists when supplementation is most effective, as well as variation in an individual’s response to supplements. It is also possible that the beneficial effects of B-vitamins may be lost in a supplement form compared to when obtained through wholefoods from the diet,

making wholefood solutions the preference [Flood et al., 2006; Malouf and Grimley Evans, 2003]. Regarding meal preparation of B vitamin rich foods in the aged care sector, some B-vitamins and folate are both readily degraded by heat, therefore risk of deficiency may be increased in a setting where meals have been kept warm for extended periods, repeated reheating of food occurs and/or dietary intake is compromised. A review of food service cooking methods concluded that around one-fifth of folate and B-6 content can be lost during the service and delivery of meals in a food [Williams, 1996]. See Appendix 2 for nutrient reference values.

Dietary Fibre (including starch)

The role of dietary fibre in a healthy diet for the older Australian is valuable due to the risk of constipation. Constipation and gastrointestinal concerns such as abdominal discomfort and irritable bowel syndrome are major complaints of older adults with approximately 30% of older adults reporting using laxatives at least once a week. These gastrointestinal symptoms and conditions are noted to have a significant impact on important clinical outcomes, such as functional status and quality of life. Constipation has multiple causes including bowel obstruction, medications (such as opiates), iron and calcium supplements, metabolic causes, neurologic diseases, psychiatric diseases and nutritional causes, namely inadequate fluid and fibre intakes [NHMRC, 2013]. The NRVs recommend an adequate intake of fibre is 25g a day for women and 30g a day for men [NHMRC, 2006].

With regards to dietary fibre, reduction in variety coupled with poor dentition with reduced mastication and oral health problems are all contributing factors to an inadequate fibre intake in older adults. Adequate dietary fibre is essential for proper functioning of the gut and has also been related to risk reduction for several chronic diseases including heart disease, bowel cancer and diabetes [NHMRC, 2006; NHMRC, 2013].

Hydration

Dehydration is one of the greatest risks for the elderly in aged care, so much so that the Aged Care Royal Commission is investigating fluid charts for the purpose of mapping residents state of hydration. With increasing age comes the physiological change of reduced thirst sensation

resulting in older people failing to recognise the need to consume fluids. The likelihood of dehydration is also increased when fluid restriction is in place for medical reasons such as heart failure, and may also be worsened by medications such as diuretics and laxatives. In some cases, individuals restrict their own fluid intake as a means to reduce frequency of urination or incontinence, for comfort purposes [Wotton et al., 2008; Burns, 2016]. In these cases, it can be difficult to achieve a fluid balance and recommendations are directed at ensuring fluid intake earlier in the day to minimise urinary frequency at night.

Challenges in reaching hydration also extend to those with swallowing difficulties, due to the requirements of a modified texture diet and thickened fluids, and those with dementia or poorly controlled diabetes are also at greater risk of poor hydration [Wotton et al. 2008]. Hydration is extremely important for those with dementia, as dehydration leads to behavioural changes and further cognitive impairment such as delirium and depression [Wotton et al. 2008]. Previously, dehydration was often poorly acknowledged as a major contributor to postural hypotension which often results in falls and poor health [Wotton et al. 2008]. More recently, reports are starting to show that dehydration as little as 2% loss of total body weight results in changes in physiological and physical functioning [NHMRC 2013; Burns 2016].

Signs that an individual may be dehydrated include [Mentes 2006]:

- reduced urine output (frequency and volume)
- pale and strong-smelling urine
- dryness of the mouth
- sunken eyes
- dry, inelastic skin
- drowsiness
- attention, confusion or disorientation
- dizziness
- low blood pressure
- urinary tract infection

A strategy to improve hydration in aged care homes, for those identified as being at risk, is to initiate a fluid and food intake chart to closely monitor hydration status. Medications should also be considered as some can reduce or increase metabolic output and fluid retention or loss. Daily weighing may also assist older adults to guide the balance between fluid restriction and adequate hydration between each day, and therefore reduce any fears they often experience if they do feel thirsty and need to drink, or when fluids are maintained at recommended daily intakes. Whilst the NRVs recommend women aged 70 years and over consume 8 cups or 2.1L and males consume 10 cups or 3.4L of total fluids (75% fluids: 25% food) each day, it is recognised this volume is difficult to achieve. Risk of over-hydration leading to hyponatremia is also of concern, therefore a pragmatic recommendation for a daily intake of fluids is at least 1600 ml/24h in order to ensure adequate hydration [NHMRC 2006; Wotton et al. 2008] . Using the pragmatic recommendation, additional strategies need to also be adopted. These include: Aged Care staff to make hourly checks on residents to ensure access to and assistance with hydration is available; families should be encouraged to offer small and frequent sips of fluid to the resident across the day, especially after any activities or on hot or humid days; or engage with a practising dietitian to work with the facility to implement efficient and beneficial strategies, such including provision of wet foods such as pureed fruit, yogurt, jelly, custard and soup [Wotton et al. 2008; Burns 2016; Mentes 2016].

In summary, the overarching nutrient recommendations are (Appendix 2)**:**

- Protein: between 1.2 to 1.5 g/kg body weight /day
- Calcium, Vitamin D, B Vitamins as per Nutrient Reference Values
- Fibre: 25-30 g/day
- Fluid/water: 1.6L/ day

Menu Review Standards for Aged Care

Although the ADGs are described in this document to help Congress attendees recognise the various guidelines available, it is important to recognise that these guidelines do not cater for older Australians with chronic health needs or frailty, therefore they are not suitable for use in food service in residential care homes. However, the NRV's underpin the nutrient targets

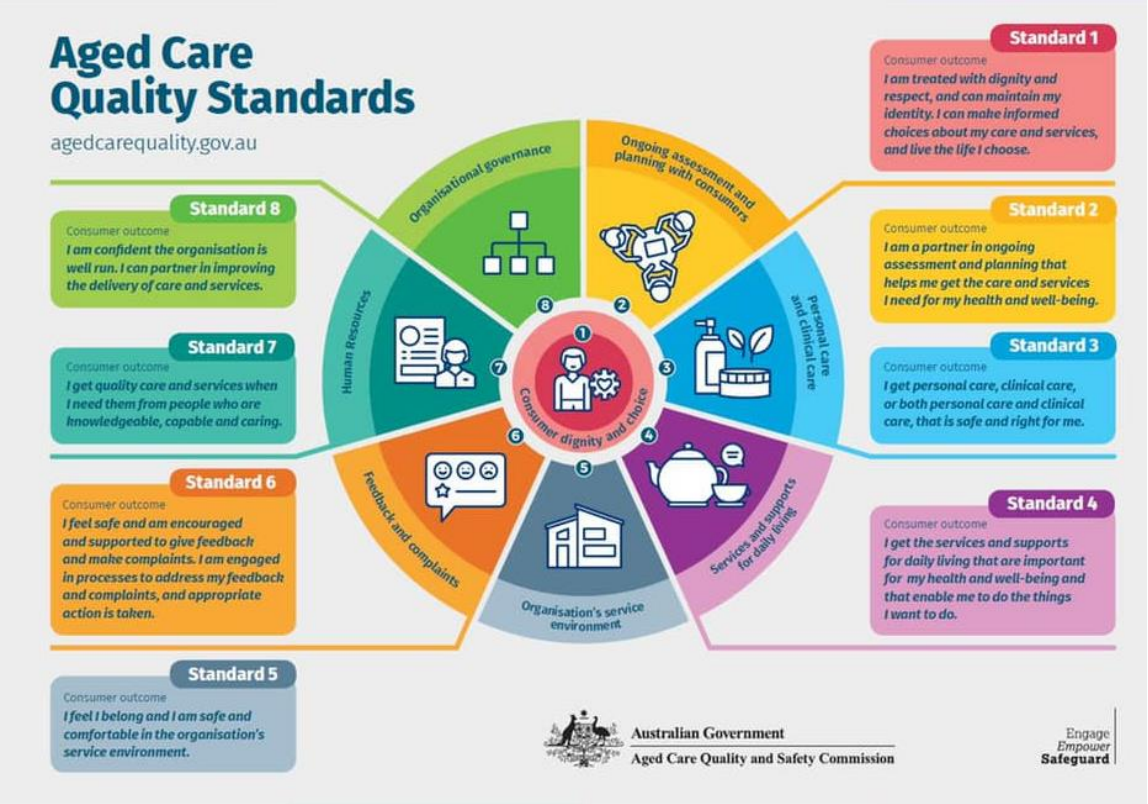
for the **aged care menu review standards** which are often a set of rules or guidelines that provide insight of how to use whole foods to achieve nutritional balance (these menu review guidelines and standards will be further explored in section 4).

The role of the Australian Aged Care Quality and Safety Commission (AACQSC) in review of the menu standards:

The AACQSC is the overarching accreditation agency that have several standards designed for aged care homes to follow during an accreditation process, and who are then audited against these standards. These homes must be accredited and compliant with these standards to continue receiving residential aged care subsidies from the Commonwealth Government. On July 1st 2019, the Aged Care Quality and Safety Commission began to assess and monitor the quality of care and services provided by residential aged care homes, against the standards listed below (additional resources available Appendix 3).

In general, these standards talk about the needs being assessed and reviewed regularly according to each standard. Standard 1 addresses the need for cultural inclusion and for consumers (residents) to exercise their choice, make decisions about their own care and the way services are delivered to them; Standard 2 considers assessment and planning for care pertinent to the health and wellbeing needs of the consumer (resident) i.e. documenting change in weight and implementation of localised strategies; Standard 3 addresses the need to optimise their health and wellbeing through clinical assessment and monitoring by having access to allied health staff (i.e. for malnutrition risks and ongoing management); Standard 4 addresses the need to provide services and support for activities of daily living, not limited to food services, meal provision (location and types), and timely referral for supportive care through ongoing assessment.

Figure 5: Aged Care Quality Standards Reference www.agedcarequality.gov.au



https://www.agedcarequality.gov.au/sites/default/files/media/Aged%20Care%20Quality%20Standards.pdf

Common standards utilised

There are several guidelines and standards available that are commonly referred to in practice which are mostly state-based guidelines (see Section 2 for survey response, to commonly used guidelines and standards and Appendix 3 for more information on the standards). Although some are aged care specific, others are based on acute care (inpatient or hospital) management of the older patient. The Best Practice Food and Nutrition Manual for Aged Care edition 2.2 [Bartyl and Bunney, 2015], initially published in 2004, and the second edition of the manual published in 2015, are the most comprehensive set of guidelines developed and prepared with input from wide ranging expert stakeholder engagement [Bartly and Bunney, 2015].

These guidelines are written with the aged care facility and the aged care facility workforce in mind and is not just a nutrition led perspective. As a snapshot, the menu standards and

guidelines resources available (and recently rescinded) in Australia are reported below (Table 5) with further resources outlined in Section 4.

Table 5: Overview of Common Australian Menu Review Standards and Links.

Name	Year	Notes and Link to resources
QLD Health Nutrition Standards for meals and menus	2018	Predominately Acute Care, food-based approach for implementation across Queensland. Practical user guide for short stay and long stay menu cycles. https://www.health.qld.gov.au/__data/assets/pdf_file/0030/156288/qh-nutrition-standards.pdf
NSW Nutrition standards for adult inpatients	2011	Acute hospital care standards – however the link provides a range of nutrition-based tools to describe diet types and how to implement changes to a base menu including: allergy, texture modified, fibre modified, fluid diets, potassium/sodium restriction, high energy and high protein, strategies to manage dysphagia vs dental reasons for texture modified diet (Most updated between 2015-2019) https://www.aci.health.nsw.gov.au/resources/nutrition/nutrition-food-in-hospitals/nutrition-standards-diets
WA Nutrition Standards for Adult Inpatients,	2012	(Rescinded August 2020)
VIC Nutrition Standards for Menu Items in Victorian Hospitals and Aged Care Homes,	2009	Nutrition focus, with Menus and portions based on a "Band" or "Level" concept for the provision of soups, main dishes (meat-based vs vegetarian) salads, sandwiches, desserts and vegetables. Also provides a recipe analysis protocol. onhttps://www2.health.vic.gov.au/about/publications/policiesandguidelines/nutrition-standards-for-menu-items-victorian-hospitals-residential-aged-care-homes
NSW Best Practice Food and Nutrition Manual, edition 2.2 ,	2015	Aged Care Facility centred. Comprehensive, workforce and consumer centred guidelines. Provides a range of tools and resources for easy adoption of recommendations and strategies. Incorporates CALD, Dining Room Experiences, Meal services and therapeutic dietary requirements and strategies https://www.cclhd.health.nsw.gov.au/wp-content/uploads/BestPracticeFoodandNutritionManualforAgedCare.pdf

For those who do not work in these states or are not expected to use the guidelines for residential aged care homes, the Best Practice Food and Nutrition Manual for Aged Care document by Bartl and Bunney [2015] is considered a very practical tool covering nutrition and special dietary requirements, with the link to the document providing a number of template documents in the appendices including auditing and screening tools that are recommended. **Appendix 4** contains more details about the Best Practice Food and Nutrition Manual for Aged Care document by Bartl and Bunney [2015].

Malnutrition prevalence and impact for older adults

As the population ages, so to do the number of older adults who are suffering, often in silence, from malnutrition. The World Health Organization (WHO) recognises malnutrition as one of six contributing factors to the declining physical and mental capacity of older people. While there is no consensus on a single definition of malnutrition, often it is defined as "faulty or inadequate nutritional status" [Chen et al 2001] and covers both under and over nutrition.

The high prevalence of malnutrition among older adults is a major concern as it has many negative implications for the older adult and the health care system. As stated at the end of Section 5, rates of malnutrition, and hence, multiple nutrient deficits are greater in residents in aged care homes and particularly long-term aged care homes than in those who reside in the community [Rist et al. 2012; Kaiser et al. 2012]). There are many studies demonstrating the prevalence of malnutrition in older adults who reside in different types of settings. For example, a large scale study in the Netherlands involving 20,255 patients across three different health care settings (6021 hospitalised patients, 11,902 nursing home patients, and 2,332 home care patients) showed that one in every five older adults from these varied settings were malnourished [Meijers et al. 2009]. Another study in Finland involving 375 service house residents aged 65 years and older, reported that 65% of the older residents were at risk of malnutrition and 21% were malnourished [Vikstedt et al 2011].

The impact of malnutrition

The impacts of malnutrition on a person's health are varied, and typically more than one aspect of health is reduced. Detrimental effects may include [Amarya et al. 2015; Visvanathan et al. 2009; Miller et al. 2008]:

- decreased taste acuity and smell
- impaired muscle function
- decreased bone mass
- anaemia
- reduced cognitive function
- poor wound healing

- impaired immune function
- increased infection
- longer hospital stays
- higher hospital re-admission rate
- increased mortality (Visvanathan et al. 2009; Miller et al. 2008).

The cost of malnutrition in Australia

Australian studies have found that malnutrition results in substantial financial losses to the health care system. Based on Victorian data (2003-2004), malnutrition represented 1.87% of all admissions across Victorian Hospitals and costs AU $10.7 million per annum, and is also estimated to contribute an additional AU $1,745 per hospital admission [Rowell et al. 2011]. At the national level, the AIHW further reported that the average health expenditure per person in 2004-2005 rose sharply with advancing age, from $1,961 for persons aged ≤65 years to $5,714 for 65 - 74 year olds, $8,500 for 75 - 84 year old, and $9,717 for people aged ≥85 years. In 2017-18, this increased by another 25% and has now stabilised [AIHW 2010; AIHW 2019]. Moreover, it is important to note that none of these estimates included costs associated with disengagement from society due to depression and isolation which would likely contribute a substantial amount to the overall cost of malnutrition. Thus, it is critical that the Australian Government invest in strategies to improve the health of older Australians.

Factors contributing to malnutrition

Malnutrition is associated with many biological, physiological and environmental factors, some of which are modifiable [Brownie S et al., 2006]. While the exact determinants of malnutrition remain unknown, the mnemonic “MEALS ON WHEELS” is used within the field of geriatric medicine, and is helpful for those working with older aged care residents in which identifiable factors can contribute to malnutrition [Morley JE, 2012]. The factors include:

- **M**edications
- **E**motional (i.e. depression)
- **A**lcoholism, anorexia tardive, abuse (elder)
- **L**ate life paranoia
- **S**wallowing problems

- **O**ral problems
- **N**osocomial infections, no money (i.e. poverty)
- **W**andering/dementia
- **H**yperthyroidism, hypercalcemia, hypoadrenalism
- **E**nteric problems (malabsorption)
- **E**ating problems (i.e. tremor)
- **L**ow salt and low cholesterol diets
- **S**hopping and meal preparation problems, stones (cholecystitis)

Beyond these factors, ageing disrupts the mechanisms that regulate food intake, resulting in many older people experiencing reduced hunger and early satiety (i.e. a sense of fullness maybe elicited quickly) and low food/energy intake [Dietitians Association Australia. 2009; Australian New Zealand Society of Geriatric Medicine 2007]. Due to the multifactorial nature of malnutrition, it is increasing being recognised amongst healthcare professionals and researchers working in the aged care sector that there is a role for a wider multidisciplinary healthcare team being engaged in the assessment and management of malnutrition, including dietitians, pharmacists, gerontologists, speech pathologists as well as nurses and carers. This point was raised by many of the authors whose work we have reviewed in this report.

Changes in body weight and composition as a consequence of malnutrition

A further consequence of reduced appetite and low food intake is weight loss. Weight loss that is unintentional in older adults is serious compared to planned weight loss, as weight loss is associated with loss of muscle mass and too much muscle lost may result in a loss of muscle power and strength, predisposing the older person to frailty [Clegg et al., 2013; Thillainadesan et al., 2020; Norman 2008; Visvanathan R., 2003]. This muscle loss is also termed "sarcopenia" [Cruz-Jentoft AJ et al., 2010]. As a result, the ageing person's ability to remain living independently may decrease, and they may experience reduced mobility, poorer quality of life, social isolation, greater physical disability and even death [Phillips 2010].

In parallel with the loss of muscle mass as we get older, our body fat mass also increases due

factors such as changes in our circulating hormones that regulate metabolism and body fat stores, physical inactivity (becoming more sedentary), and eating foods that provide more hedonic reward but tend to be higher in calories and less nutrient dense. These changes also predispose people to additional increased health risks that are associated with obesity such as cardiovascular disease, diabetes, some types of cancers and greater risk of bone fractures [Zamboni et al 2008; Ilich J et al. 2016]. The combination of increased fat mass and reduced muscle mass is known as sarcopenic obesity [Stenholm et al 2008]. It is increasingly recognised that, like sarcopenia, sarcopenic obesity is also associated with disability, functional impairment, physical frailty, poor quality of life and significantly increased mortality rates [Benton et al 2011; Dominguez et al 2007].

Early identification and measuring malnutrition

Awareness is increasing within aged care homes that a healthy body weight and Body Mass Index (BMI) for older adults is different to what we have traditionally thought, and that unintentional weight change (loss or gain with no self-imposed measures) can be an early sign of a deterioration in health. Based on Australian and international data, a BMI classification for older people aged ≥65 years that falls below 23.0 or goes above 31.0 kg/m^2 warrants some level of regular oversight from trained staff to ensure that it does not fluctuate dramatically. However if it does, the reason for the fluctuations needs to be examined by a clinician such as a nurse, dietitian and /or doctor [Arjuna, 2016; Visvanathan, 2009; Winter et al., 2014; Miller 2008; Somes et al., 2002]. Moreover, Australian research of older aged care residents has demonstrated that a weight change (either loss or gain) of more than 5% of body weight over a 6 month period is clinically relevant and reasons for rapid weight change need to be addressed using appropriate medical nutrition therapy or potentially other treatment strategies [Arjuna et al. 2016; Miller et al 2008]. In fact, Arjuna and colleagues reported that 5% or greater weight loss was associated with higher pain scores and greater length of stay in the nursing home [Arjuna et al. 2016].

Tools for measuring malnutrition

Measuring and monitoring unintentional weight change in older persons is very important to delay/prevent loss of muscle mass, reduced muscle strength and therefore physical

performance. It is also very important to note that weight is the sum of water, bone, cartilage, muscle and fat mass. A significant change in weight (loss or gain) can therefore relate to a change in any combination of water, cartilage, muscle, bone and fat mass. Therefore, assessment of water retention or loss of fluid (dehydration) can all be a useful measure to identify weight change early.

In addition to the measurement of anthropometric indices, biochemical markers to identify malnutrition, various nutrition screening and assessment tools are in use within aged care homes. Malnutrition screening and assessment tools offer the least invasive methods to diagnose malnutrition – that is, they do not require biological specimens to be collected. However, it must be noted that many tools that are currently being used have limited specificity, sensitivity, validity, and reliability. Moreover, numerous systematic reviews have found no association between nutritional status measured using the tools and clinical outcomes of malnutrition in the older population [van Bokhorst-de van der Schueren et al. 2013; van Bokhorst-de van der Schueren et al. 2013]. In addition, the data they reviewed indicate that most single screening and assessment tools perform inconsistently in identifying malnutrition and predicting clinical outcomes of malnutrition in the older population [van Bokhorst-de van der Schueren et al. 2013; van Bokhorst-de van der Schueren et al. 2013].

Despite these limitations, for rapid screening of malnutrition, Mini Nutritional Assessment Screening Form (MNA-SF), Malnutrition Universal Screening Tool (MUST), Short Nutritional Assessment Questionnaire (SNAQ) and Geriatric Nutritional Risk Index (GNRI) appeared to perform better than other tools including Subjective Global Assessment (SGA), Mini Nutritional Assessment (MNA), DETERMINE, and Short Nutritional Assessment Questionnaire 65+ (SNAQ 65+) for identifying malnutrition among hospitalised, institutionalised and community-dwelling older adults [Elia et al 2012; Phillips et al. 2010; Cereda et al 2009; Cereda et al 2008]. In contrast, for a more lengthy but comprehensive assessment of nutritional status, the Mini-Nutritional Assessment (MNA) and Subjective Global Assessment (SGA) are the preferred tools and often used as a valid standard internationally [van Asselt DZ 2012; van Bokhorst-de van der Schueren et al. 2012; Argarwal 2013]. In Australia, current best-practice guidelines for measuring malnutrition recommend the SGA Tool, the MNA tool

and the Patient Generated Subjective Global Assessment (PG-SGA) [ACSQHC, 2018]. However, it should be noted that in the absence of a single gold standard method to assess malnutrition, best-practice guidelines [ACSQHC, 2018] and researchers [Isenring et al., 2011] advocate for the use a combination of two or more of these tools to determine and monitor the nutritional status of older people. In fact, Isenring and colleagues [2011] reported that MST (screening tool) had best agreement with SGA (full assessment) followed by MUST, MNA-SF and SNAQ. MNA predicted 44.9% at risk of malnutrition, similar to CAMA (43.5%) and calf circumference (40.2%), whereas BMI predicted 24.4%.

Treating malnutrition in aged care

Health care professionals are still needing to understand that the treatment of older adults who are malnourished and underweight due to loss of muscle and bone mass need to be slightly different from the treatment given to those who are malnourished but also carry excess fat, particularly deep visceral fat, and have a relatively low muscle to fat mass ratio [Zamboni et al. 2008; Bauer et al. 2013; Molino et al. 2016]. That is, underweight malnourished older residents need energy-dense foods and meals that are also rich in all the key nutrients mentioned previously. In contrast, older residents who are overweight but malnourished need to be encouraged to do some form of physical activity (especially resistance exercise) in combination with providing them with meals that are not energy-dense (i.e. need to be lower in calories or smaller meals), at least until they can build more muscle and reduce visceral fat.

In a research setting, randomised control trials conducted in healthier adults aged 65 years and older indicate that oral nutritional supplements containing multiple nutrients, and particularly proteins that have a high content of essential amino acids, are effective for building or maintaining muscle mass and function and for weight management. However, research into the benefits of protein supplementation in malnourished or frail older adults from aged care and hospital settings, has yielded inconsistent results which can be observed in a series of systematic reviews. The main reason for inconsistent findings relate to the heterogeneity of protocols used for protein supplementation and whether multi-component

exercise was included in combination with the nutrition intervention. Within the aged care setting, observational and/or cross-sectional studies regarding the benefits of fortifying meals with additional nutrients including protein have also yielded mixed results for similar reasons for inconsistencies. However, on balance, the authors of several systematic reviews of this topic indicate that nutrition interventions can be effective in improving clinical outcomes related to malnutrition, are low risk (i.e. do no harm), and have a low cost of implementation. The quality of evidence for introducing malnutrition interventions (environmental, food-based or supplements) in AC is low [Hugo et al, 2018; Cave et al. 2019; Sossen et al. 2020]. Building a greater evidence base of the long-term benefits, including the physical and emotional health benefits, quality of life, and also the cost-benefits, can be overcome by using more standardised protocols for identifying and treating malnutrition. In addition, the challenges associated with the administration of fortified meals in aged care settings can potentially be overcome by educating the relevant care staff and cooks/chefs preparing the meals.

Nutritional Status and Quality of Life (QoL)

Note the topic of this section is covered in detail in the systematic literature review attached in the Appendix 4. However, a brief overview is provided below.

As associations between malnutrition and poor psychological outcomes are increasingly identified, many research studies are considering how poor nutritional status may be hindering QoL in ageing populations [Amarantos et al., 2001; Rasheed & Woods, 2013; Vetta et al., 1999]. QoL is defined by the World Health Organisation [WHO, 2020a] as an individual's perception of their life's position in the context of their culture and value systems, and in relation in their goals, expectations, standards and concerns.

QoL is measured in many ways. The most frequently used QoL measure appears to be the EuroQoL-5-Dimensions (EQ-5D) an instrument which has been validated across ageing

populations [Abizanda et al., 2015; Costan et al., 2012; Holland et al., 2003; Martin et al., 2019; Torma et al., 2015]. However, there are many other QoL specific scales and some researchers even measure it using specific indicators including self-reported perception of a persons' well-being, enjoyment of life, and dependence in daily activities. Table 1 in the literature review presented in Appendix 5 contains an extensive list of various QoL scales that have been used, but it must be noted there are even more tools being used across the research landscape.

Whilst the literature examining the relationship between malnutrition and QoL in older populations remains scarce, relatively limited available evidence suggests that poor QoL is associated with poor nutrition and inadvertent weight loss [Bernabeu-Wittel et al., 2010; Gombos et al., 2008]. Although the effect of malnutrition on QoL cannot be definitively explained, it is well established that malnutrition impacts one's ability to participate in daily activities of living [Amarantos et al., 2001]. However, on a positive note, there is considerable evidence that various types of nutrition and lifestyle interventions can improve QoL to varying degrees and across a variety of settings including aged care facilities, community and rehabilitation facilities [Rasheed & Woods, 2013; Kwon et al., 2015; Rondanelli et al., 2016; Sugawara et al., 2010]. Depending on the items within the QoL assessment tool, research suggests that residents who receive some type of nutritional intervention experience improvement such as decreased perceived pain and increased physical, social, and mental function, and better general health. More recently, there has been a small but growing body of literature suggesting that the dining experience may have a powerful influence on both nutrition and QoL [Carrier et al., 2009; Evans et al., 2001; Herzberg, 1997]. The dining experience, an often under-appreciated factor in nutrition research, encompasses aspects such as food quality, food presentation, and the eating/dining environment (Mathey, et al., 2001; Nijs et al., 2006). It would be valuable for future studies to examine such aspects of the dining experience and how these may be tailored to benefit both nutritional status and QoL - see the results section and discussion in Appendix 5.

The Impact of Mealtime Experiences on QoL in Aged Care

In recent years there has been a shift towards a more consumer-centred aged care nutrition and wellbeing strategy, that is not only consistent with the changing landscape of the older Australian population, but is also consistent with direction outlined in Australia's Aged Care Workforce Strategy 2018 and the Aged Care Quality Standards 2019 [A Matter of Care Australia's Aged Care Workforce Strategy, 2018; Aged Care Quality Standards, 2019].

Supported by the growing body of Australian literature, there is a drive to design the aged care meal delivery system on stakeholder/consumer feedback and resident insights, inclusive of meal timing and selection, cultural preferences, portions and dining experiences alongside clinical nutrition needs [Abbey et al 2015; Watkins, et al 2017; Milte et al 2017; Bennet et al 2015].

When older Australians enter an aged care environment, their autonomy greatly diminishes, resulting in residents in homes often forfeiting their ability to make decisions on meal timing, the environment in which they consumer their meals and their choice and proportion of meals consumed [Abbey et al., 2015]. However, mealtimes are for many residents an important part of a residents' life as they provide a form of social connectedness within their community. It is known that certain foods may evoke fond memories of past experiences and provide comfort, familiarity and self-determination [Brownie, S. and Horstmanshof, 2012; Burack, OR. 2012], but it also well acknowledged that this is complicated by changes in taste and appetite as we age [Syed et al., 2016]. Given this, it is plausible that food choice and consumption can be associated with overall wellbeing of the older resident in aged care homes. In fact, several Australian reports suggest when residents were engaged and could make meal choices suitable to them from aged care menus, a 30% increase in food service satisfaction was realised [Abbey, 2015; Hugo, et al 2018].

Many factors effect food choice and food intakes at mealtimes and these include, but are not limited to:

- taste, smell and appearance of meals
- texture and meal size

- food preferences
- cultural
- dining room environment
- meals budget

Each of these factors are discussed in some detail in additional papers and reports submitted by the working group, which have been tabulated under Theme 2, 'mealtime experiences in aged care'. In addition, some innovative ways that certain aged care homes are addressing improvement of meals are tabulated under Theme 3, 'innovation in food service in aged care'. Finally, several papers tabled under 'nutritional guidelines in aged care' also discuss what is working and what is not working at some aged care homes around mealtime. For example, Bennett et al [2015] triangulated data from 111 resident files from 2 regional aged care homes, and analysed data from mealtime observations, resident questionnaires and staff questionnaires. They reported that there many discrepancies between the ideas of staff and residents around preferences for mealtimes and psychosocial needs at mealtimes. There were also stark differences between what was occurring during mealtime observations (including but not limited to, insufficient physical and verbal assistance, non-adherence to mealtime management plans, residents eating alone in bedrooms) and what staff thought was happening during mealtimes. However, it should be noted that published research on this topic is limited and more evaluation of mealtime experiences across much larger segments of aged care are required which collate the experiences from the residents, their families and also the aged care staff. Arguably, the greatest insight into what is happening across many aged care homes in relation to the food and mealtime experiences of Australian residents is currently coming out of the Lantern Project [https://thelanternproject.com.au/]. Hugo and colleagues [2018] are leading the way into examining the cost-effectiveness of nutrition interventions in aged care, but the scant evidence we have collated for this review indicate that much more needs to be done to understand how the mealtime experience can be improved using a cost-effective framework in every aged care home to enhance quality of life and health outcomes.

SECTION 2: Literature Review Examining the Relationship between Nutrition and Quality of Life in Aged Care

Note the full report is attached in Appendix 5

Minimal research has investigated the relationship between poor nutritional status and quality of life (QoL) within aged care settings, where rates of malnutrition appear to be highest.

This systematic review and meta-analyses was conducted to examine the relationship between nutritional status and QoL in ageing individuals residing in aged care homes.

Our results revealed a small, but significant positive relationship between nutritional status and QoL. Whilst a meta-analysis of quasi-experimental studies demonstrated a significant improvement in participants' QoL following a nutrition intervention, a final meta-analysis of randomised controlled trials (RCTs) did not. Although the significant effects were small, these findings align with previous literature in other aged care settings and indicate that increased nutritional status may help enhance QoL in residents of aged care. However, the relationship is bidirectional and it is highly likely that different types of interventions to enhance QoL, i.e. creating more consumer familiar physical environments with aged care homes, may also improve nutritional intakes and nutritional status. Future research is needed to determine causality in the relationship and how other confounding factors in aged care may influence both nutritional status and QoL.

SECTION 3: Additional Papers and Reports submitted by the Working Group

Thirty-six papers, reports and manuals were referred by members of the Congress Working Group to the Congress team responsible for developing the literature review. These were collated to inform discussions during the Congress and to provide Congress attendees with a synthesis of relevant material for pre-reading.

Of the 36 papers:

- 12 discussed the theme of Food and Nutrition in Aged Care,
- 7 discussed Mealtime Experiences in Aged Care,
- 6 discussed Innovation in Food Service, and
- 11 discussed Nutritional Guidelines in Aged Care

Appendix 6 provides a tabulated summary of the title, author, journal, year, country of origin, type of study design, sample demographics and key words, for each of the 36 papers. This table is organised by papers from Australia followed by papers from around the world within each section. Please note that a further 7 papers were submitted by the Congress Working Group after the compilation of the body of this Literature Review. These papers have been included as Appendix 7.

The following sub-sections – i.e. section 10.1 to 10.4 - provides a tabulated summary of the findings and conclusions, including limitations, for key 36 papers provided by the Congress Working Group as well as members of the team writing this report.

Theme 1: Food and Nutrition in Aged Care

Twelve papers focussed largely on the topics of food and nutrition within various aged care settings. Of these, ~5 were cross-sectional analyses of nutritional data collected with the aged care setting, 4 were qualitative narratives of specific approaches to feeding the various types of residents within aged care, 1 was a position statement, and 2 were reports on nutrition

approaches. The types of residents examined within these papers included frail older adults with significant loss of function, many who were completely dependent on feeding assistance and had some level of dysphagia and malnutrition. Of these papers, 6 were from Australia, 2 from the USA, 2 from Italy and there was 1 paper each from Sweden, Japan and New Zealand.

Table 7 provides a summary of the findings and conclusions, including limitations, from these 12 key papers. Based on the synthesis of this information, the following key considerations warrant discussion at the Congress:

1. How to more effectively educate, implement and evaluate the use of nutritional screening tools, in addition to regular assessments of body weight, to identify residents who are at risk of or are suffering from malnutrition;
2. How to ensure that the nutritional needs of all residents are monitored routinely. The evidence suggests care staff need to be trained in how to do nutrition screening, and there is a call to action for nutrition managers and personal care staff to assist;
3. How to enhance the food preferences and nutritional needs of resident, as there is some evidence indicating that various food and nutrition interventions can enhance the quality of life of residents when these needs are meet. Continuing evaluation of how food and nutrition interventions to improve quality of life and the health outcomes of residents is needed to strengthen the evidence;
4. How to more easily enable all health professionals (that each resident interacts with) to be involved in their nutrition and health care – the evidence demonstrates that dentists, speech pathologists, and other specialist doctors as well as the dietitian, can provide insights into the food preferences, choices and needs of a resident . Whenever possible, family, friends and the resident themselves should be involved in planning around choice within the menu;
5. To develop a plan to educate staff on how they can best support residents during mealtime, particularly those who are classified as totally dependent, to ensure every resident has enough support with eating to enjoy their meal and hence meet nutrition requirements. Increasing staff ratios needs some consideration, but education of all segments of the aged care workforce will assist in helping to support residents.

Table 7. Food and Nutrition in Aged Care

Food and Nutrition in Aged Care Settings							
Theme	**Author (Year)**	**Study Aims**	**Methods**	**Main Findings**	**Limitations**	**Conclusions**	**Recommendations**
Food and Nutritional Status	Sossen, Bonham & Porter (2020)	To determine whether a high-energy high-protein diet incorporated in to standard menu could reduce unintentional weight loss in AC residents with frailty, significant illness, loss of independence and dementia compared to oral nutritional supplement (ONS) group.	N=67 in diet group, N=55 in ONS group. Weight change, BMI and SGA measured at baseline, 2mths and 6mths. Diet = fortified items similar in energy and protein content compared to ONS prescription.	High-energy high-protein diet resulted in higher additional energy and protein consumed over day compared to ONS group, and an overall positive weight change (gain) at each timepoint (whilst ONS group lost weight). Potential lack of accuracy of reporting of administration and consumption levels.	No randomization; differences between groups at baseline (BMI, SGA prevalence, feeding assistance, dementia prevalence).	Incorporating high-energy high-protein diet in AC setting is feasible and may reduce unintentional weight loss. There are challenges associated with administration of this diet in AC settings.	Future research using high-quality methods needed, to determine optimal approach to delivering best-practice nutrition care in AC settings.
	Iuliano et al (2013)	To determine nutritional adequacy of food served to residents in low-level AC; to determine if food waste contributed to insufficient nutritional intake	Data from 199 low-level AC residents (across 18 homes) collected on 3-6 days at various times of year. Dietary data collected by dietitians based on weighed intake of foods, beverages and supplements served and consumed (snacks and main meals) including brand names, preparation method, recipes, macro- and micronutrient content. Foods categorised based on Australian Guide to Healthy Eating. Serves of food	14% participants classified as underweight (based on BMI). Both men and women were provided with and consumed adequate meats and fruit, but were not provided recommended vegetables and dairy. Residents also had excess 'extra' foods (e.g., cakes, confectionary, soft drinks, alcohol). Residents did not consume adequate grain foods. Food waste was 0-15%, with greater waste for meat and grains. Mean energy intake was on average ~1000kJ/day below estimated energy requirements of men (8333±943kJ/day) and women (7105±680kJ/day). Fibre intake was below recommended levels in 95% of residents. Mean intakes of micronutrients magnesium, potassium, zinc, calcium and folate were below recommended for residents. Sodium intake was up to 3 times greater than recommended intake. Excess sugar consumed.	Cross-sectional design, use of convenience sample, lack of exploration around reasons for inadequate intake.	Cognitively-sound elderly residents who are able to self-feed are not provided recommended serves of multiple macro- and micronutrients and therefore do not meet recommended intake levels.	'Extra' foods, such as confectionary, soft drinks, cake and alcohol, should be substituted for serves of vegetables, dairy and wholegrain foods to improve nutritional quality of food offered without compromising food volume or intake. Vitamin D supplementation, as well as an increase of 2 serves of vegetables, 0.5 serves of wholegrain cereals and 1.5 serves of dairy per day are recommended. Herbs and spices should be used to increase flavour instead of additional salt where possible.

			expressed as proportion of recommended sizes.				
	Nowson, Sherwin & McPhee (2003)	To estimate intake of key nutrients in NHs (high level care) and hostel (low level care) residents; to compare nutrient intake between residents with and without eating impairments (between three TMF groups, full, soft/minced and pureed)	Monitoring of plate waste assessed for three meals per resident, weight eaten and nutrient intake per meal calculated. Eating impairment identified as one of following: eyesight loss, problems with arms/hands, dentures, swallowing difficulty or dementia.	Dietary intake: 33% full diet in NHs VS 90% at hostels. Total energy, calcium and fibre served in meals lower in NHs, no difference between settings for protein and vitamin D. 67% residents in NHs had eating impairments; no difference in daily nutrient intake between residents with and without eating impairment. Self-feeding ability had no significant effect on nutrient intake of NH residents.	Convenience sampling; foods outside of usual mealtimes not captured; one day of intake per person captured	Reduced energy intake underlies difference in nutrient intake between nursing home and hostels.	Nutrient intake needs to be effectively monitored. Identification of eating impairment and early provision of feeding assistance may increase intake and prevent weight loss effectively.
Food and QoL	Hugo et al. (2018)	To describe The Lantern Project, a collaboration between AC professionals and resident advocates (national and international organisations, local community networks, tertiary and university institutions, and carers) aiming to improve the dining experience of AC resident. The goal is to reduce malnutrition risk through improving dietary intake and meals.	N/A	The Lantern Project was established in 2013 and its foundations are based on four collaborative pillars: diversity (>500 AC stakeholders involved in project); mutual benefit (members share common vision and outcomes apply to their field and enrich their practice); openness/transparency (members are expected to share opportunities and conflicts of interest with the group); and equity (all members are invited to engage in the conversation regardless of position or profession). The key objectives of The Lantern Project were formulated following a detailed needs assessment, identifying the complexity of malnutrition in Australian AC homes and the vast contributing factors. Monthly meetings are held between members, each with a topical theme (e.g., edible gardens, resident empowerment, positive ageing). Research by the Lantern group and	N/A	The transdisciplinary nature of The Lantern Project facilitates the development of tangible solutions by considering problems from multiple perspectives, bridging theory and practice. The Lantern Project's vision is "*improving the QoL of AC residents through the joy of good food".* Outcomes have effectively impacted on policy and are disseminated in a meaningful way. Outcomes are evidence-based and translated in a way which aims to ultimately reduce the prevalence of malnutrition in the AC setting.	N/A

				collaborative meetings work in symbiosis and inform one another. The Lantern Project regularly engages with dietitian students and have run several key research projects.			
	Bailey et al (2017)	To explore residents' perceptions of food choice and restriction in RACFs.	6 residents in RACF undertook semi-structured interview. Questions surrounded experiences with food at home and RACF, challenges with food choice in AC, risks taken past and present regarding food choice, and impact of food regulations and restrictions on enjoyment of food.	Participants were able to self-feed but required assistance with some ADLs. Residents demonstrated a variety of experiences with food at home before entering AC facility. Some participants reported high food waste whereas others reported 'going to bed hungry' regularly. High contrast in personal taste across residents. Most participants were not afraid to take risks with food and many were unable to identify risky foods or risks associated with food consumption. Residents believed it should be their choice whether they take risks with food or not, and believed regulations should not prevent food choice and selection based on personal preference.	Both RACFs served same food (part of single organisation). Small sample size limits generalisability of experiences and findings.	Challenges in meeting individuals' preferences for foods in RACFs are partly due to high variability in responses to the same foods, reflecting variability in preferences for and personal experiences with food. Residents place high importance around food choice and managing risks.	Residential AC providers should attempt to balance residents' personal preferences and needs with requirements of large-scale food production. Further research should explore impact of food regulations on food choice. Further research should investigate meaning of risk to residents in RACFs and their understanding of risky foods.
	Dorner & Friedrich (2018)	Outlines position of Academy of Nutrition and Dietetics on individualized nutrition-based approaches to improve QoL and nutrition in older adults across range of care settings.	N/A	Individualised nutrition approaches can enhance QoL and nutritional status in residents of LTC, post-acute care and other settings. Least restrictive diet possible is encouraged, particularly for individuals who choose QoL as a priority over improving health/increasing longevity.	Research/position statement is based on United States care settings and guidelines only.	Nutrition care should be included as reimbursable service. Regular/liberalised diet that allows resident choice is preferred. Individualising diets can improve QoL.	Resident/patient diet plans should be developed with the resident/patient. Informed choices, goals and preferences of individual should be considered, and decisions on diet should not be based purely on diagnosis.
	Crogan et al. (2004)	Discuss meaning that food has to NH residents, whether residents can identify effect of food on QoL	9 NH residents interviewed in "tell me a story" format. Participants asked to talk about a time when food tasted good and they enjoyed eating,	Three themes identified (concerns and stories). Mimicking food from home (traditional foods, making food from scratch, eating a variety of food); making choices about food (having favourite foods available, staff being attentive to residents' input); and tailoring the system (hiring staff who	Sample representativeness, dietary needs and health issues of interviewees not addressed	Residents longed for family rituals surrounding eating and similarities to home.	Consider and regularly assess dietary desires of residents and honoring requests where possible. Mimic family dining experience (home-like environment, 6-8 people per table). Serve culturally appropriate food at least monthly for residents. Sufficiently trained

			their opinion of the food at NH, what a typical NH meal consisted of, and what a hypothetical "perfect" meal would consist of.	can cook, being provided with fresh, quality food including fruits and vegetables).			and adequate number of staff recommended.
Food for Specific Health Issues	Grant et al. (2019)	To provide an overview of the physiology of taste, age-related changes in taste, the impact of medication and disease on taste, and the impact of sleep and time-of-day in taste.	A narrative synthesis of the literature was conducted.	Taste sensitivity is diminished in older adults, and more so in older adults in acute care settings. Contributing factors to decreased taste sensitivity include reduction in taste bud density, and age-related changes in saliva. Altered taste perception is commonly observed in AD, obesity, heart disease and diabetes mellitus. Age-related changes in oral health, vision, taste, smell and gastrointestinal function change food perception and enjoyment. A number of medications affect taste perceptions including chemotherapeutic drugs, antiretroviral medications and proton pump inhibitors. Emerging research suggests that time-of-day and circadian rhythm influences thresholds for taste stimuli and perception of taste, but research is limited. Food consumption reduces with age, and perception of taste is one of the main factors influencing energy intake in older adults. In addition to this factor, food delivery contributes greatly to food consumption in AC. Food delivery factors include accessibility of packaging, appearance, presentation and variation of food, and aspects of the dining environment such as familiarity, comfort, ambience, sound and social interactions.	Search strategy or criteria for including papers was not provided.	Taste perception is considerably altered with age and more so in presence of disease and medications. It is important to address food type, flavour perception and dining environment in AC settings in addition to nutritional content/value of prepared foods for residents. Gaps in understanding remain surrounding age-related changes in neural systems that are responsible for taste and appetite, as well as influence of circadian rhythm and reduced sleep on taste.	The focus of food provision in AC should go beyond nutritional content and include consideration of food delivery. Incorporating natural ingredients rich in intense flavour (e.g., soy, garlic, onion, flavoured oils, spices) may increase appetite and pleasure involved in food consumption, leading to increased consumption. Using a variety of colourful, presentable foods in small portion sizes that are energy dense are recommended strategies or enhancing flavour perception using visual cues. The dining environment should be designed to enhance comfort, providing a home-like environment with familiar foods served.

	Miles et al. (2020)	To characterize prevalence and characteristic of residents on TM diets in RACFs	interRAI™ database accessed. Data across 10 RACFs assessed (mealtime observations, mealtime audits and menu audits)	High level feeding assistance given to residents on TM diets, but not all types of TM diets available at all homes. Only 5/10 AC homes had nutrition training. Adequate vegetable portions but inadequate carbohydrate and protein servings (compared to national standards) in NSW hospitals. TM diets = one third of meals produced in AC homes, associated with increased feeding assistance but not reduced meal consumption.	Mealtime observations were "one-off" snapshots, all conducted at lunch times. Menu audits were self-report. interRAI data reliant on accurate reporting by staff.	TM diets (one third of meals produced in AC settings) associated with increased feeding assistance but not reduced meal consumption. Fortification to compensate need to add liquid in pureeing process was sparce. Only half of all residents ate full meal, and all diet types failed to meet compliance for carbohydrate and protein portions frequently.	Implementation research in to IDDSI adoption in AC settings is needed. Initiatives needed to maximize mealtime nutrition.
	Nomura et al. (2019)	To identify dentition status and care levels corresponding with food consistency supplied in RACFs	Medical and dental data obtained. Resident's care level classified from 1 (independent eating, assistance with ADLs required) to 5 (support for ADLs, excretion and eating required). Meal data obtained (including TMFs).	Number of remaining teeth and tooth contact pairs higher for subjects supplied with ordinary meals compared to TM meals. Increasing care levels significantly associated with food consistency (higher care level = more likely to be consuming TM meals).	Swallow requirements not considered. Dietary intake variation not addressed.	Elderly residents with care level <3 should have ordinary meals. Dentures can increase health and QoL.	Dentists should participate in discussion when deciding on food consistency in conjunction with healthcare team.
	Palese et al. (2018)	To discuss feeding dependence prevalence and predictors in Italy (NH settings)	Functional, clinical, social and psychological conditions of residents in NHs assessed at admission and every 6mth following. Feeding dependence assessed at resident level.	20.7% of residents were totally dependent on help in feeding daily, were more often clinically unstable with higher prevalence of dysphagia, unintentional weight loss and pressure sores. Predictors of total dependence in feeding included moderate/severe dementia, dysphagia, pressure sores, clinical instability, unsociability and unintentional weight loss. Protective factors of feeding dependence included close relationships with family caregivers and volunteers.	Exclusion of enteral/parenteral feeding individuals (inaccurately assumes loss of ability to self-feed). Retrospective study.	Feeding dependence prevalence (56.7% of sample in need of partial or total feeding support) was higher compared to international levels. There are a number of modifiable and non-modifiable predictors of feeding dependence.	Staff education and training recommended based on the complexity of the resident profile that emerged from this study. New policies required surrounding workforce skills based on predictors identified. Intervention studies aimed at identifying best approach to maintaining feeding independence recommended.
	Pezzana et al. (2015)	To collect information on nutritional intervention requirements in LTC	Nutritional status (evaluated using MNA-SF), dietary assessments, oral	Malnutrition prevalence = 35.2%, risk of malnutrition = 52.6%. Malnutrition positively correlated with age, dementia syndromes, swallowing	Regional LTC homes assessed, may not be generalizable nationwide (Italy).	Nutritional issues are highly common and underdiagnosed/undertreated in LTC homes. The prevalence	Nutritional screening should be implemented into routine care (at admission and during patient's stay). Safety and adequacy

		settings; to collect information on role of institutional factors in nutritional care	intake and chewing ability evaluated at baseline. Nutritional intervention decided between dietician and doctor in agreement with national and international guidelines.	difficulties, pressure ulcers, and total dependence in ADLs. Need for nutritional intervention detected in 958/1253 patients, adequate management in place for only 49.6%. 67.5% and 28% of patients not receiving adequate nutritional care were malnourished or at risk of malnutrition. Residents in larger LTC settings more likely to require improvement in nutrition care.	Research conducted in higher income region (Piedmont).	of malnutrition and need for nutrition care is greater in larger LTC settings.	(texture and calorie content) of food needs to be regularly monitored. Education programs for healthcare professionals and involvement of nutrition care specialist in these settings. Research in varying regions is recommended using this organisational model.
	Nordenram et al. (1996)	To identify differences in dental status, oral function and nutrition status between patients with Alzheimer's disease (AD) living in care institutions (case group) and community-dwelling, cognitively healthy older adults (control group).	Both groups assessed over 3mths. Cognitive function, functional chewing ability, eating habits (and food consistency), anthropometric measures (BMI as nutritional status indicator).	Patients with AD have greater need for mashed food and more support at mealtimes. Having natural teeth strongly correlated with normal food consistency and positively correlated to cognitive function. Overnutrition more common in control group. Malnutrition more common in case group.	Swallow reflexes not considered. BMI not ideal marker of nutritional status.	Nutritional status differs between AD patients in care settings and community-dwelling cognitively healthy elderly. Nutritional status not shown to be influenced by dental status. Ability to eat unaided (self-feed) strongly correlated with cognitive status.	Absolute weight should be used to measure nutritional status rather than BMI in individuals with AD.

Theme 2: Mealtime Experiences in Aged Care

Seven papers focused largely on the topics of food and nutrition for healthy aging. Of these, ~4 were discussion papers, 1 was a research agenda, 1 was a literature review and 1 was a case report. The papers had a strong focus on determinants that enhance food intake and the mealtime experience of residents, and which in turn have positive health effects in terms of quality of life and wellbeing. Several papers also examined strategies on how mealtime experience could increase quality of life. The types of residents examined within these papers included frail older adults with significant loss of function, many who were completely dependent on feeding assistance and had some level of dysphagia and malnutrition. Of these papers, 4 were from Australia and 3 were from Canada.

Table 8 provides a summary of the findings and conclusions, including limitations, from these 7 papers.

Based on the synthesis of this information, the following key considerations warrant discussion at the Congress:

1. How to more effectively educate, implement and evaluate the use of best-practice nutrition guidelines across the most appropriate segments of the aged care workforce to enhance behaviour during mealtimes, particularly for those residents with Alzheimer's and other forms of dementia;

2. How to address current staff stress rates that appear to be impacted by not having enough education and support in these areas;

3. How to more effectively educate, implement and evaluate which new behavioural change strategies are most effective for improving the health, wellbeing and quality of life of residents and also of staff;

4. How to more effectively educate, implement and evaluate which mealtime food choices are most preferred by residents, including those from different cultural backgrounds;

5. How to more effectively engage and evaluate the impact from engaging multiple stakeholders from across the aged care sector including health professionals, cooks/chefs, nutrition managers, as well as residents and their families, in the development of future best-practice guidelines;

6. In relation to new supporting behaviour change and food choice and intake during mealtimes, the following points need to be considered:

- optimising sensory properties within the room
- supporting social connectedness but also providing areas for privacy
- smaller dining rooms appear to support a more personal meal experience
- ensuring layout of dining room is safe and has a familiar ambience

Table 8. Mealtime Experiences in Aged Care

Mealtime Experiences							
Theme	**Author (Year)**	**Study Aims**	**Methods**	**Main Findings**	**Limitations**	**Conclusions**	**Recommendations**
Mealtime Experiences and Nutritional Status	Keller, Beck & Namasivayam (2015)	To identify and prioritize determinants of nutritional intake for persons living in LTC by expert consensus	2-day meeting (Ontario, Canada) attended by researchers, stakeholders and clinicians. 2-step process used to identify potential determinants of nutritional intake.	20 determinants identified across meal quality, mealtime experience and meal access categories. Top 5 determinants (descending order): social interactions of residents; self-feeding ability; dining environment (noise, ambience, distractions, light, room temperature); staff attitude, knowledge and skills; adequate time to eat and adequate support from staff.	Did not consider biomedical factors influencing food intake. Selected group of experts based on recent publications in field.	A list of interventions which may improve food intake through targeting identified determinants provided in research agenda. Suggested interventions include training for staff, families and volunteers surrounding eating assistance, standardized audits of mealtimes, creating ambiance in the dining environment, providing variety of seating arrangements and prioritizing food presentation.	Other outcomes to consider in future intervention studies include behaviour at mealtimes, burden/stress of staff, mealtime processes, QoL, wellbeing, happiness, autonomy, functional ability, staff satisfaction, and person-centered approaches to care. Future consensus-building processes should involve LTC stakeholders and other disciplines (e.g., dentists, physiotherapists, occupational therapists, family, resident stakeholders, physicians).
Mealtime Experiences and QoL	Milte et al (2017)	To describe food and dining experiences of people with cognitive impairment in NHs	Interviews with grounded theory approach to identify themes.	Four themes identified: knowing, respecting individual's needs and preferences; wants of residents are not always heard surrounding preferences for meals (meal timing, portion size or choice of meal); severe dementia impacts ability to communicate desires and preferences around meals (loss of control and ability to make choices); tension between food as health determinant and food as medium for QoL. Minor themes included appearance of food and the impact of appearance of food on appetite, importance of dining experience for QoL.	Potential limitations include representativeness of sample and small number of family members in sample	Food and dining experience are important for wellbeing and QoL of NH residents.	Increase involvement of specialists in provision of TMFs (speech pathologists and dietitians). Future work should focus on interventions to improve mealtimes and promote resident QoL, and focus on how to support implementation within budget and practical constraints.
	Bernoth et al (2014)	To explore serendipity of residents accessing sufficient food and fluids in RACFs.	Combination of findings from two studies (2009 and 2011) exploring experiences of living in or having	Multiple factors leading to likelihood of malnourishment or dehydration were identified, including staff issues impacting	It is possible that only participants who had negative experiences with aged care (AC)	Nutritional neglect of residents in RACFs happens on a continuum, beginning with disregard	Not reported.

			family/friend living in RACF. 43 participants undertook in-depth, unstructured interviews. Participants spoke of difficulties of themselves (or loved ones) accessing sufficient food and fluids in AC, and the "serendipitous nature" of receiving adequate food and fluids (chance rather than a basic human right).	the dining experience, and quality of food served to residents. Attention given to food hygiene (to reduce risk of food-borne disease) restricts variety of food provided to residents. Several sub-themes relating to serendipity of receiving food and fluids were identified: the dining room experience, quality of the food, food hygiene and malnutrition outcomes. Dining rooms often understaffed during mealtimes resulting in residents feeling unsafe or uncomfortable. Serving culturally appropriate foods and availability of fruit for snacking were important factors in nutritional status of residents. Cleanliness of kitchen and serving utensils/crockery not given same attention as prevention of food-borne disease, limiting food options and choice. Comorbidities often not accounted for at mealtimes, reducing accessibility and ease of meals and increasing risk of malnutrition.	felt strongly enough to participate in the studies.	for food cultures, deficits in food quality and dining room experiences. These factors result in compromised safety of residents, malnutrition and dehydration. Food and fluids provided to residents are not always appropriate.	
	Wu et al (2018)	To evaluate effectiveness of CHOICE program to improve dining experience for LTC residents. Aim of CHOICE program: make mealtimes more relationship-centered	CHOICE program implemented in two AC home areas (N=64 residents). Mealtime scans used to measure physical, social, person/relationships and quality of dining environment factors. Semi-structured interviews conducted with staff. Four assessment timepoints (baseline, 8wk, 16wk, 32wk).	CHOICE program improved all assessed aspects in one home. Staff gained new appreciation for importance of mealtime experiences for residents. Subculture of different home areas an important factor to consider when designing strategies. Culture among staff is an important factor for successful implementation of program.	Intervention not tailored to each home. Interviewer was also interventionist which may have resulted in confirmation bias.	Short interventions are able to improve some aspects of mealtime experience in LTC homes. Programs need to be tailored to subculture of homes.	Future CHOICE development should take more collaborative approaches to implementation and evaluation by including residents, family members and volunteers in development process.
	Chaudhury, Hung & Badger (2013)	To identify role of supportive dining environment in promoting functional	Systematic search of databases related to care services, dining and	7 goals for physical environment to promote person-centered care identified: supporting functional ability; maximizing orientation;	Small sample sizes and lack of control/comparison	Well-designed physical dining settings play vital role in fostering positive	Care facility designers and administrators should consider benefits of physical/environmental

		ability, safety/security, familiarity, sensory stimulation, social interaction in LTC settings	dementia. 22 journal articles included and summarized.	providing a sense of safety and security; creating familiarity and home-likeness, providing optimal sensory stimulation; providing opportunities for social interaction; supporting privacy and personal control.	groups in included intervention studies.	mealtime experiences for residents in LTC homes	modifications, staffing and mealtime practices to promote best practice person-centered care and positive mealtime experiences in LTC. Factors such as dining room design, aesthetics, seating arrangements and style of food service should be considered as they have a strong influence on food intake.
	Hung & Chaudhury (2011)	To explore concept of personhood in dining experience of residents with dementia living in LTC; to identify themes which support or undermine personhood	Study conducted across two LTC homes (10 residents per site). One LTC facility was smaller and more homelike, the other more institutional with noise a frequent complaint. 24 mealtime observations conducted over 3 mths. Interviews with residents and focus groups with staff also conducted.	8 themes relating to personhood aspects: outpacing/relaxed pace; withholding/holding; stimulation; disrespect/respect; invalidation/validation; distancing/connecting; disempowerment/empowerment; ignoring/inclusion. Smaller dining environment allowed more individualized experience for residents. Larger dining environment had more noise complaints and disorientation (layout and size of room) from residents, staff reported providing care in rushed and dehumanized way.	Not reported.	Positive mealtime care requires staff to seek connections with residents. Physical environment plays important role in mealtime experiences for residents with dementia in LTC settings. Smaller dining environment is less distracting and allows for more individualized care and interaction with staff.	Staff encouraged to meet regularly and engage in reflective practice to discuss mealtimes. Smaller dining environments may be more pleasurable for dining for residents with dementia and allow more personalized interactions from staff to promote personhood. Future studies should include people living with dementia in research.
Mealtime Experiences and Dysphagia	Kenny (2015)	Discusses impact of dysphagia diagnosis on nutritional and psychosocial outcomes, and speech pathologist's role in supporting patient autonomy and facilitating shared decision making	Composite case developed from several findings of study of ethics in speech pathology. Composite case: Marco (male) aged 68 yrs referred to outpatient rehabilitation following CVA which resulted in dysphagia and right-sided hemiplegia.	Food culture and preferences of patient should be acknowledged by speech pathologist when designing intervention. Dysphagia algorithm described (3 steps to facilitate shared decision-making when patient resists dietary recommendations): quality patient/family education; repeat education to explore and address reasons for noncompliance; team meeting with patient, family and medical team.	Shared decision making may be limited by time and difficulty coordinating meeting times between involved parties.	Social, cultural and/or religious factors may influence adherence to TM diet, such as importance of sharing 'normal' meal with friends. Should consider potential social/cultural underpinnings of patient's choices to adhere with diet or otherwise.	Successful dysphagia management requires consideration of risks/benefits of consuming patient's preferred food, potential social/cultural ties to food consumption which may influence resistance of TM diet.

Theme 3: Innovation in Food Service in Aged Care

Six papers focused largely on the topic of innovation within food services within aged care. Of these papers, 3 were qualitative analyses and 3 were narrative or systematic reviews related to how food was being prepared in homes, and particularly in relation to the preparation of special diets for residents suffering from malnutrition, frailty, dementia and dysphagia. Of these papers, 4 were from Australia, and 2 were from Canada.

Table 9 provides a summary of the findings and conclusions, including limitations, from these 6 papers.

Based on the synthesis of this information the following key considerations warrant discussion at the Congress:

1. How to further increase the education of nutrition managers, cooks and/or chefs, and potential other members within the aged care workforce on topics including but not limited to:

- implementation and evaluation of standardised guidelines, recipes and cooking procedures;
- preparation of texture-modified food using cost-effective methods and ingredients;
- preparation of nutrient enriched/fortified meals and meal components using cost-effective ingredients without affecting meal volume;
- preparation of more appealing meals that evoke all the senses using cost-effective ingredients like herbs, spice mixes, condiments, and visually appealing plating techniques;
- preparation of culturally appropriate meals and meal components.

2. How to more effectively implement and evaluate the effect of modifying the sensory, texture, and taste properties of meals, on quality of life and other important health outcomes including but certainly not limited nutritional status.

Table 9. Innovation in Food Service in Aged Care

Innovation in Food Service							
Theme	**Author (Year)**	**Study Aims**	**Methods**	**Main Findings**	**Limitations**	**Conclusions**	**Recommendations**
Food Production in Aged Care	Hugo et al (2018)	To explore average food and ingredient expenditure and trends in Australian RACFs	Retrospective analysis of survey results collected between 2014 and 2016. 817 RACFs responded. Costs related to catering including cutlery and crockery, raw food, ingredients and ONS were assessed and sorted in to bands ranging from highest care needs (band 1) to lowest care needs (band 5).	An average of $8.00 (AUD) spent per resident per day including cost of food, ingredients, supplements, crockery, cutlery, paper goods and meal replacements. Band 1 showed highest average spend per day ($6.29 AUD) on food and ingredients alone (and highest mean spend on ONS and food replacements). Band 3 reported lowest spend on food and ingredients per day ($5.40 AUD per resident). These budgets appeared to be significantly lower than food budgets in Australian community settings, correctional homes, and internationally. Increase in money spent on ONS from 2015 to 2016, and decrease in average daily spend on food and ingredients, indicating that AC providers may choose supplements over fresh food. 2014 statistics showed older couples spent average of $17.25 AUD per person per day, triple that of the AC budget, despite many similarities in energy and protein needs.	Not reported.	The current, expensive malnutrition problem in Australian RACFs is not being solved. Increasing AC profit by reducing spending on food and ingredients impacts quality of care and can increase malnutrition prevalence. Australian RACFs are spending 1.4 times less than Canadian AC homes, 3.8 times less than Norwegian AC homes and 1.5 times less than US homes.	Future research should aim to explore how increase in food spend influences health outcomes. Advocacy groups (such as The Lantern Project) should continue discussion with government around implementing minimum food budgets, improving nutrition education in RACFs and improving nutritional care within budgetary constraints.
	Abbey et al (2015)	To examine strategies of menu planning in RACFs in Australia, and whether the menu planning facilitated adequate levels of choice for residents receiving TM and general diets.	Three separate studies using various data collection techniques used and triangulated. Study 1: National Menu Survey asking of general information about AC home and food service system, menu and staffing information. 274 hotel services/catering manager respondents (of 2664 contacted), Study 2: menu review of menus provided with surveys, analysed for	Study 1: Majority of menu cycles were 4 weeks in length, production systems were mostly cook-fresh. 47% of homes offered hot breakfast. 6% offered alternative options for morning tea, 36% offered lunch alternatives, 80% offered evening meal alternatives but there were no alternatives offered for supper. Only 3% of menus offered hot breakfast for TM diets. No alternative choices on TM meals were offered except for entrée. Large number of homes did not indicate how they integrated TM in to their menu. Study 2: findings of observational study were mostly consistent with National Menu Survey. Morning and afternoon teas were inconsistent with written menu. Written menu consistently not followed for TM diets, meals repeated on same day and from previous days. Menu choice for those on TM	Written information on menus collected by surveys were poor in detail. Only one observer used in case study. Small sample size. Generalisability uncertain as responders may have been more compliant to guidelines.	The Australian Aged Care Standards need to be revised and changed to facilitate meal choice and ensure quality in meals.	Future work should examine how feedback from residents and the factors contributing to successful eating experiences interact with the menu planning process. Monitoring and regulation of the Australian Aged Care Accreditation Standards need to be strengthened. Future work should investigate how menu choice and variety in meals influences QoL in AC residents.

			choice, alternatives offered. Study 3: observational case study of meal environment in 36 AC homes. FAMET used for observations.	diets poorer in quality and choice as left overs were often used.			
	Ilhamto et al (2014)	To investigate challenges and preferred practices associated with pureed food production in LTC homes.	27 nutrition managers, 25 cooks across 25 LTC homes interviewed. Thematic analysis used to identify factors involved with in-house production of pureed food.	Challenges involved were categorised in to four themes: difficulty using standardised recipes; varied interpretation of government guidelines; lack of consistency in terminology and texture; wanting to improve visual appeal. 68% respondents produced pureed food by memory with no recipe. Differing perceptions of required pureed food consistencies.	Not reported.	Dietary staff need to be well educated about dietary needs of residents with dysphagia but given autonomy in designing pureed food menus. Standardisation of pureed food production is needed, as there is currently variability in quality.	Preferred practices: involving cooks in pureed recipe formation and improvements; tailoring to residents' needs and preferences; understanding changes to flavour, appearance and nutrition when food is pureed, and how to compensate for these changes. Use thickeners and liquids minimally to maintain nutrient density. Consider cultural background and familiarity of foods to residents.
Strategies to Increase Nutrient Intake	Cave et al (2019)	Review aimed to evaluate previous work exploring relationships between strategies in food fortification, sustainability and mode of delivery in AC homes.	4 databases searched using search terms related to AC, micronutrients and food fortification. Studies deemed eligible if the population was older adults in AC homes, interventions involved food fortification with protein, energy and/or micronutrients, and outcomes identified mode of delivery and nutrition intake.	17 studies included (11 RCTs, 6 quasi-experimental). 6 studies fortified on-site whereas remaining used pre-made. Fortification strategies included addition of milk powder, cream/double cream, cheese, butter, sour cream, oil, hydrolysed starch and rapeseed oil. Most common mode of delivery were desserts, yoghurt, cheese, bread, soups, juices and cereals. Two studies measured cost of intervention, increasing daily energy intake by 1600-2100kJ per day cost $1.81 and $0.18 (AUD) per resident per day respectively. Fortified foods were highly accepted, and success of interventions were dependent on cooperation of staff.	Lack of homogeneity between study designs, interventions and outcomes. Most studies were short-term (longest = 12 months). Only one study had follow-up following cessation of intervention, and nutrition was declining at follow-up.	Food fortification strategies are effective in increasing energy, micronutrient and protein intakes in older adults in AC. Previous interventions demonstrate nutrition intake, status and adherence were benefited more by food fortification than ONS.	Future research should aim to explore intervention costs and sustainability of food fortification within AC.
	Hugo et al (2018)	To compare the cost-effectiveness of implementing nutrition interventions in RACFs	Systematic review of evidence from 4 RCTs and 4 non-RCTs.	Nutrition interventions can be effective in improving clinical outcomes related to malnutrition, are low risk and have a low cost of implementation. The quality of evidence for introducing malnutrition interventions	No observational studies included	Food-based nutrition interventions implemented in the AC setting for malnutrition	Future research should use well-defined frameworks for economic analysis. Stronger study designs with improved quality and validated

		versus usual care for malnutrition		(environmental, food-based or supplements) in AC is low.		are clinically effective and low cost.	malnutrition measures are needed to inform cost-effective treatment options for AC providers and governance.
	Dunne & Dahl (2007)	To describe strategies to treat malnutrition in residents in LTC	Not reported.	Several strategies discussed. Increased meal frequency not superior for residents with dysphagia. Increased meal energy density (smaller portions) effective for patients in hospital settings. ONS may cause decrease in habitual food intake to compensate, reducing effectiveness. Fortification of foods may increase nutrient intake without increasing food quantity.	Not reported. Methods for obtaining papers in review not reported in manuscript.	Current methods for mitigating malnutrition in LTC not adequate.	Further research in to fortified foods as strategy to increase nutritional uptake in LTC residents needed.

Theme 4: Nutritional Guidelines in Aged Care

Eleven papers focused on nutritional guidelines and nutrition frameworks used within aged care settings. Of these papers, 4 were discussion frameworks, 3 were cross sectional studies, 1 was a legal report, 1 was a systematic review, 1 was an audit report, and 1 was a prospective cohort study. 7 were from Australia, 1 was from the USA, 1 was from Hong Kong, 1 from New Zealand, and 1 was from the UK.

Table 10 provides a summary of the findings and conclusions, including limitations, from these 11 papers.

Based on the synthesis of this information the following key considerations warrant discussion at the Congress:

1. How to more effectively educate, implement and evaluate the use of best-practice nutrition guidelines across the most appropriate segments of the aged care workforce;

2. How to more effectively educate, implement and evaluate the best frameworks to manage dysphagia (e.g. IDDSI framework as one potential example);

3. How to more effectively educate, implement and evaluate the use of nutritional screening tools, in addition to regular assessments of body weight, to identify residents who are at risk of, or are suffering from malnutrition. The evidence suggests that the several malnutrition screening tools including MST, MUST and MNA-SF, and CAMA and calf circumference (anthropometric) are acceptable and more user-friendly compared to SGA and MNA full nutrition assessments which may save staff time. However, to ensure that all residents are monitored routinely, more care staff beyond just dietitians need to be trained in how to do these assessments.

Table 10. Guidelines and Protocols in Aged Care

Nutritional Guidelines and Protocols in Aged Care							
Theme	**Author (Year)**	**Study Aims**	**Methods**	**Main Findings**	**Limitations**	**Conclusions**	**Recommendations**
Nutritional Guidelines	Cichero et al (2016)	To describe the International Dysphagia Diet Standardisation Initiative (IDDSI) framework, which aims to develop standardised terminology for TM foods and liquids for people with dysphagia.	Inaugural multi-professional expert panel meeting held in Toronto (2012). 5 stakeholder-specific survey collected information on current use of terminology. Systematic review conducted on influence of food texture and liquid on swallowing physiology. Draft international framework developed.	Final IDDSI framework contains 7 levels to classify TM foods from Drinks (levels 0-4) to Foods (levels 3-7). Drinks range from thin (level 0), slightly thick (level 1), mildly thick (level 2), moderately thick (level 3) and extremely thick (level 4), whereas foods range from liquidized (level 3), pureed (level 4), minced & moist (level 5), soft & bite-sized (level 6) and regular (level 7). Levels 3 and 4 of drinks and foods are overlapped.	Sample sizes of stakeholder survey groups weren't even. People with dysphagia and their caregivers made up smallest stakeholder group.	IDDSI framework provides standardized categorization of food texture and liquid thickness for people with dysphagia of all ages, recommendations for food texture specifications and measurement, food particle size and food hardness, cohesiveness and adhesiveness corresponding to each level of the framework.	The IDDSI framework provides a platform for development of research in dysphagia.
Resident Management, Screening and Protocols	Bennett et al (2015)	To compare documented, reported and observed mealtime management, and to explore the factors which influence optimal mealtime care	Two regional RACFs recruited (one for-profit, one not-for-profit, 56-bed and 61-bed respectively). Data obtained from four sources: review of resident files; mealtime observations; resident questionnaires; staff questionnaires.	Resident file reviews revealed five common categories of information around mealtime care, including recommended meal texture/fluid consistency with no reference to dietician assessment, formal assessment of mealtime difficulties by professional staff, strategies to facilitate mealtime experience for residents, resident's likes and dislikes for meal set-up, and informal reports of mealtime difficulties and strategies. Mealtime observations revealed minimal physical and verbal interaction between staff and residents, and residents are alone in one third of mealtimes observed. 70% residents ate in bedroom although level of privacy was rated minimal to fair for 88% of observations. 63% mealtimes coded as "no ongoing interaction" between staff and residents. All mealtime observations coded as minimal appropriate or inappropriate interaction involved residents with communication difficulties. Researcher	Potential observer bias due to one researcher conducting observations.	Comparing data from multiple sources revealed considerable inconsistency in mealtime management across two RACFs, and lack of adherence to principles of person-centered care. Many care staff were unaware of specific needs of residents during mealtimes. Many residents had not undergone formal mealtime assessments to determine needs. Limitations relating to time pressure and staffing contribute to breakdown between patients' needs and preferences and actual experiences during mealtimes.	Complexities of mealtime management need to be acknowledged, and specialists, researcher, policy-makers and facility management should work together to find sustainable solutions. Further research is needed to understand how residents define the concept of social dining in RACFs, to better meet their psychosocial needs and preferences during mealtimes.

				recommended assistance and supervision was consistently higher than actual observed assistance in visual, verbal and physical domains. Insufficient assistance given to residents who were classified as needing to be fed by an RN. Resident questionnaires demonstrated that most residents showed preferences for general food groups as well as specific food/fluid items, and mealtime setup and procedures, and all residents had preferences about privacy. Staff questionnaires revealed that 56% of staff believed residents did not have mealtime likes, dislikes or preferences. 63% of staff not aware that resident had documented management for mealtime strategies. Residents received diets inconsistent with documentation during 51% of observations.			
	Isenring et al (2011)	To determine concurrent validity of several malnutrition screening tools and anthropometric measures against validated nutrition assessment tools	Two blinded, trained researchers administered set of nutrition screening tools on same day (MST, MUST, MNA-SF and SNAQ), weight history obtained. Separate blinded researcher administered SGA and MNA (full nutrition assessments), BMI, CAMA and calf circumference measurements (anthropometric).	MST (screening tool) had best agreement with SGA (full assessment) followed by MUST, MNA-SF and SNAQ. MNA predicted 44.9% at risk of malnutrition, similar to CAMA (43.5%) and calf circumference (40.2%) whereas BMI predicted 24.4%.	Prevalence of malnutrition in one facility may have been underestimated (no data on sample representativeness available).	Malnutrition screening tools MST, MUST and MNA-SF, and CAMA and calf circumference anthropometric screening measures demonstrated acceptable sensitivity and specificity compared to SGA and MNA full nutrition assessments	Future studies that implement screening procedures should consider training of staff member, available resources and ease of use of tools. Research in larger sample encouraged to investigate predictive validity (for QoL and mortality outcomes).
	Coroners Act, South Australia (1997)	To investigate factors contributing to death of Mr Giuseppe Maiolo. Coroner: Wayne Chivell	Coronial inquest conducted; report generated.	Mr Maiolo had left hemisphere CVA with swallowing problems. Dietary regime had changed from vitaminized to soft/normal. New diet identified as ill-defined option given his medical condition. Soft meal option (sandwich	N/A	Mr Maiolo's death was a result of asphyxia due to choking on food	Swallowing should have been assessed by speech therapist prior to dietary changes.

				with meat) resulted in asphyxiation. Eating was unsupervised.			
	Fleurke et al (2020)	To synthesise literature surrounding role of dietitian in management of malnutrition in elderly, compared to role of other health professionals	Systematic search of databases, including empirical research which investigated role of dietitians as main subject and directed at management of malnutrition in elderly. Papers needed to consider role of dietitian in relation to other health professionals.	Three main themes identified. 'Characteristics of settings influencing dietetic role via screening': referral to dietitians often depends on effective malnutrition screening by other health professionals who don't always have sufficient time/knowledge to screen. 'Attitudes of other health professionals that influence the dietetic role': health care professionals who aren't aware of role of dietitian but continue to make decisions on nutritional care place little priority on screening for malnutrition. 'Dietetic role boundaries': increased workload to manage screening and delegate roles a common issue among dietitians.	Some included studies were opinion articles (gave insight in to what dietetic role should be, not what it is).	Strongly protocolled malnutrition screening legitimises role of dietitian, consolidates their role and optimises management of malnutrition. Increasing education about role of dietitian among other health professionals may result in more procedural malnutrition screening.	Dietitians should aim to educate managers/non-dietetic staff on role of dietitian and its importance in patients' health and wellbeing. More systematic procedural screening for malnutrition recommended.
	Hansjee (2018)	To outline steps used in development and implementation of protocols guiding eating and drinking in people with dementia, at high risk of aspiration; to investigate impact of protocol on length of hospital stay.	Risk-feeding protocol was developed based on gaps in practice identified in previous audit (2011). Protocol document outlines reasons why patient is candidate for risk feeding, if patient has capacity to make decision on route of nutrition, and flow on care plans if required. Reviewed protocol applied to small sample of patients, length of stay calculated, number of days from admission to nutrition plan development also calculated.	Average delay of 6 days from admission to nutrition plan prior to protocol implementation. 37-50% of patients received nutrition care plan on day of admission following protocol implementation.	Small sample sizes throughout initial audit.	Average length of stay can be reduced when protocols for decision making to guide development of nutrition plans for patients with dementia are implemented effectively. Reducing prolonged admissions increases QoL. Protocols promote safer and more coordinated discharge.	Future studies should involve consultation with multi-professional experts in designing protocols for community settings.
	Pu et al (2017)	To investigate risk factors for dysphagia in elderly	Potential risk factors included EAT score, oral motor assessment	Model 1: dysphagic group had higher proportion of men compared with women, NH residents compared to day	Missing data for variables in hands-on assessments	Dentition, oral motor function and cognitive function are significant	Further research to further explain relationships between risk factor variables and geriatric dysphagia is

		persons living in AC homes.	score, MMSE score, medical history and several functional status ratings. Outcome: swallowing function, determined by speech therapist (categorized as dysphagic or non-dysphagic). Model 1 used evidence from case files; Model 2 used hands-on assessments.	care attendees, dependence on caregivers for ADLs, need for assistance in feeding, need for mobility support (e.g., walking aid or wheelchair). Model 2: dysphagia associated with MMSE score, edentulousness and oral motor assessment score.	prevented all variables being combined for analyses.	indicators of swallowing dysfunction in elderly. Case file information can help identify frail elderly individuals at risk of dysphagia.	needed. Monitoring risk factors over time may provide insight in to their contribution to development of dysphagia in elderly.
	Miles et al (2016)	To explore risk feeding management in hospitalized patients with chronic, progressive or life-limiting conditions.	A qualitative, descriptive, interpretive approach. Participants were patients, family members and health professionals (speech pathologists, ward specialists, dietitians, registrars, consultants and house officers).	Four themes identified: supporting practice, communication, complexity of feeding decisions and patient and family centered care. Some professionals lack formal education in risk feeding management and there is a lack of guiding documents. Effective management requires effective communication with families, patients and staff. Factors including medical team governance, incomplete transfer of information at shift change over, cognitive functioning of patient and family dynamics complicate feeding decisions. Informed consent, QoL and patient rights need to be balanced for successful management in patient and family centered care approaches.	Sample may not be representative given limited number of patients with communication disorders in study.	Effective decision making and management for feeding decisions requires collaboration and communication between health professionals involved, patients and their families.	Four themes identified (supporting practice, communication, complexity of feeding decisions and patient and family centered care) can provide foundations for future research. Four themes can also be used in development and implementation of guidelines to support decision making in risk feeding in clinical practice.
	Wilson et al (2005)	To determine reliability, validity and clinical utility of short appetite assessment tool	247 LTC residents and 868 community-dwelling adults completed CNAQ (lower scores indicating deteriorating appetite) and the AHSP). Patients weighed at time of consent and at 6 months follow up.	CNAQ was sub-divided to remove reliability-reducing items, creating simplified nutritional appetite questionnaire (SNAQ). Both SNAQ and CNAQ were validated in identifying persons at risk of significant weight loss. SNAQ score of <14 and CNAQ score of <28 may identify persons at risk of significant weight loss.	Narrow geographic location of participants (low SES), minimal variability in ethnicity (majority white), small proportion of young males (test reliability of appetite assessments commonly reduced in young men).	The SNAQ, a 4-item simplified nutritional appetite questionnaire, is a valid tool for detecting adults at risk of significant weight loss.	Larger studies in cohorts of various socioeconomic status, income, ethnicity and marital status are recommended.

Education and Training in Aged Care	Centre for Workforce Futures, PATESIAC & ASIRC (2020)	To discuss qualification pathways in the AC sector	ASIRC sought feedback from AC stakeholders surrounding three main questions: 1) what do you know about existing qualifications pathways? 2) what you consider might facilitate these pathways and; 3) what you consider to be barriers to retention and progress within AC sector.	1. Any professional or worker involved in AC (e.g., financial planning, administration as well as direct care providers) should have specific AC focus in training and continuing professional development. This need could be addressed by having a national accreditation and qualification recognition system. 2. Facilitators for pathways include micro-credentials and short courses, online training delivery, meaningful work placement, flexible qualifications, job design and pathways, standardized job descriptions designations pathways and the Kaiawhina Workforce Action Plan/Kaiawhina Health & Disability Workforce Pathway. 3. Identified barriers included lack of specific AC relevance, challenge of aligning unregulated and regulated qualifications, migrant workers' accreditation and language, literacy and numeracy skills and the cost of upskilling, among others.	No mention of how many AC stakeholders provided feedback.	Demand for AC workers is expected to increase considerably following COVID period. AC sector needs to address issues of recruitment, engagement and retention of staff to avoid decrease in numbers when economy recovers. Many organisations now testing holistic approaches to recruitment that include testing behaviours, aptitudes, attitudes and competencies of recruits as well as formal qualifications, given the increasing expectation of more personalised and intimate roles of care staff with residents.	Authors hope to shift architecture of jobs and create new positions in AC to meet the growing demand as AC recipients' needs and expectations change.
	Beattie et al (2012)	To identify knowledge of staff regarding nutritional needs of AC residents, mealtime practices and attitudes towards mealtime practices.	Cross-sectional survey conducted among staff in dementia-specific sections at a large RACF. Participants were asked series of questions around opinions of food service in their facility, quality and variety of food served, assistance required and provided, staff involvement with nutritional assessments, and questions on nutritional knowledge.	76 participants involved in study. (60% nursing staff, majority aged 45-60 yrs). 62% of respondents indicated they assisted residents with eating once a day or more. Total scores on nutritional knowledge questionnaire (possible score 1-10) = mean 4.67. Highest scores obtained for questions surrounding risk factors for malnutrition, whereas lowest scores obtained for questions surrounding macro- and micro-nutrients, their sources and functions. 52% respondents conducted nutritional assessments (most common assessment was weight loss status (40%), swallowing difficulty (39%) and fluid intake/output (38%)). 26% staff assessed type/consistency of food offered. 83% respondents considered	Data obtained from single RACF. Potential response bias (respondents may have better nutritional knowledge than non-responders).	Care staff in Australian RACFs may lack sufficient nutrition knowledge. Conditions such as malnutrition and dehydration are frequently avoidable through accurate assessment, requiring skills and knowledge of care staff in RACFs to identify such issues. Increased training and development in nutritional awareness and assessment skills may be a cost-effective meant of optimising nutritional status and QoL for RACF residents.	Nutritional education and training should be encouraged for care staff as a cost-effective strategy to meet dietary and nutritional care needs of residents. Familiarisation with nutrition screening tools and education at pre-qualification level are important strategies.

				nutritional assessments to be important (only 53% carried out nutritional assessments). Barriers to promoting optimum nutrition included insufficient time to conduct mealtime observations, being unaware of resident's feeding difficulties, lacking knowledge on nutritional assessment and unappetising appearance of food at AC facility.			

Conclusions

The overarching conclusion and reoccurring theme found throughout this report is that there is a need to consider the changing landscape of the older Australian residing in aged care homes, to enable facilities to provide the relevant choices of good food in supportive and engaging environments, supported by health care monitoring.

To reach this point however, there is a discordance in the use and needs presented in the standards and guidelines that are being utilised across the aged care facilities, which needs to be addressed.

This discordance could potentially be because these standards and guidelines are either not mandatory, not addressing the facility's needs, not consumer-facing or are not practically suited for the interdisciplinary nature of the aged care facility and the needs of the older Australian.

Therefore, the recommendations for the Congress are for members of the workforce to come together and explore, discuss, and determine the needs of the consumer within aged care facilities. Questions such as those listed below may help with discussions:

- What is needed in the physical environment to support the needs of the workforce, resident, families and organisation?
- What foods are nutritionally beneficial and fit the needs of the organisation and residents?
- Is the growing diversity in the ageing population driving needs for policy change?
- Is the workforce effective in delivering needs to the resident? What can be influenced and what needs to be influenced?
- What are the gaps in food service that can be supported by other disciplines? Is there an overlap in control?

  As older adults often do not achieve recommended dietary intakes, is there room for innovation in process, foods, and/or policy to bridge this gap?

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Appendices

Appendix 1 Australian Guide to Healthy Eating

The following table indicates the minimum serves from each food group required to meet the nutritional requirements of a person aged 51- 70+ years. Unless specified otherwise the requirements are for both men and women. There should be a variety of options made available for each of the food groups. Serves sizes and recommended number of serves are from the *Australian Guide to Healthy Eating* (Commonwealth of Australia 2013).

Food Group	Minimum Serves per day	Recommended Serve Size
Vegetables and legumes	Men: 5 ½ Women: 5	75 g for all vegetables. Starchy: 75 g (1 small or ½ a medium potato, ½ cup sweet potato or sweet corn) Cooked green or orange: 75 g (1/2 cup) Salad: 75 g (1 cup) Legumes: 75 g (1/2 cup cooked)
Fruit	2	150 g (1 piece) of medium-sized fruit e.g. apple, banana 150 g (2 pieces) small fruit e.g. apricots or plums 150 g (1 cup) diced, cooked or canned fruit 125 ml (1/2 cup) 100% fruit juice 30 g dried fruit e.g. 1 ½ tablespoons sultanas
Grain (cereal) foods, mostly wholegrain and/or high fibre cereal varieties	Men: 6 Women: 4	1 slice of bread or ½ medium roll or flat bread (about 40 g) ½ cup cooked rice, pasta or noodles ½ cup cooked porridge or polenta 2/3 cup breakfast cereal flakes ¼ cup muesli 1 crumpet (60 g), 1 small English muffin or scone (35 g)
Protein Foods: **Lean meats and poultry, fish, eggs, tofu, nuts and seeds, and legumes/beans**	Men: 2 ½ Women: 2	65 g cooked lean meats e.g. beef, lamb, pork, kangaroo (½ cup lean mince, 2 small chops or 2 slices roast meat) 80 g cooked poultry e.g. chicken or turkey 100 g cooked fish 2 large eggs (120 g) 130g cooked meat casserole/stew 150g cooked meat casserole/stew with vegetables
Milk, yoghurt, cheese and alternatives.	Men: 2 ½ Women: 4	250 ml (1 cup) milk – fresh, UHT long life, reconstituted dried or calcium enriched soy beverage 125 ml (1/2 cup) evaporated unsweetened milk 200 g (3/4 cup or 1 small carton) yoghurt 40 g (2 slices or 4x3x2 cm piece) hard cheese e.g. cheddar 120 g ricotta
Fat: The AGTHE recommends an allowance of 4 serves per day for people over 70 years. One serve = 10 g unsaturated table margarine, 7 g unsaturated oil e.g. olive or canola, 10 g nuts or nut butters. Additional fat will help to increase energy intake if a resident is underweight.		
Discretionary choices: These foods are high in saturated fat, sugar, salt or alcohol and are not as nutritious as other foods. They add pleasure and variety to a diet and recommended 0 – 2½ serves per day.		

Note: Additional serves may be required from various food groups, unsaturated fats and oils or discretionary foods to meet energy requirements. A portion of food served may be smaller or larger than the AGTHE serve size. If half the size it would be considered a half serve and if twice the size 2 serves.

Appendix 2 Nutrient Reference Values Definitions and Specifications

The following section provides an overview of the Nutrition reference values for the nutrients at risk (ref pg. 10) and also highlights the definitions of reference values used.

Recipes will be assessing against the Nutrient reference values for each core at risk nutrient for males and females >51years.

At present the 2003 HACC guidelines for meal services recommend that the provision of a main meal and dessert/soup should provide at least one-third of the RDI for energy and two-thirds of the RDI for Vitamin C and one-half the RDI from other vitamins, minerals and protein. These guidelines are also assuming that the consumer will also take a further 2 meals across the day to meet the 100% of the dietary requirements.

As recent reports and current literature have highlighted, nutritional inadequacies still occur despite consumers receiving regular meals.

During this review, dietary energy requirements and the micro and macro-nutrients listed below were considered: below were considered:

Macronutrients	Vitamins	Minerals & trace elements
Energy	Vitamin B_{12}	Calcium
Protein	Folate	Iron
Dietary fibre	Vitamin C	Zinc
	Vitamin D	

Macronutrients

Energy (Based on Standard Height; weight and PAL)

Age yr	BMI = 22.0[a]		BMR MJ/d	Physical activity level (PAL)[b] Males MJ/day						BMR MJ/d	Physical activity level (PAL)[b] Females MJ/day					
	Ht (m)	Wt (kg)	Male	1.2	1.4	1.6	1.8	2.0	2.2	Female	1.2	1.4	1.6	1.8	2.0	2.2
51-70	1.5	49.5	-	-	-	-	-	-	-	4.9	6.0	6.9	7.9	8.9	9.8	10.9
	1.6	56.3	5.8	7.0	8.2	9.3	10.4	11.5	12.7	5.2	6.2	7.3	8.3	9.3	10.4	11.4
	1.7	63.6	6.1	7.3	8.6	9.8	11.1	12.3	13.6	5.4	6.5	7.6	8.7	9.8	10.7	12.0
	1.8	71.3	6.5	7.8	9.1	10.4	11.7	13.1	14.4	5.7	6.9	8.0	9.1	10.3	11.4	12.6
	1.9	79.4	6.9	8.3	9.6	11.1	12.4	13.8	15.2	6.0	7.2	8.4	9.6	10.8	12.0	13.2
	2.0	88.0	7.3	8.8	10.2	11.7	13.2	14.7	16.1	-	-	-	-	-	-	-
>70	1.5	49.5	-	-	-	-	-	-	-	4.6	5.6	6.5	7.4	8.3	9.3	10.2
	1.6	56.3	5.2	6.3	7.3	8.3	9.4	10.4	11.5	4.9	5.9	6.9	7.8	8.8	9.8	10.8

	1.7	63.6	5.6	6.7	7.8	8.9	10.0	11.2	12.3	5.2	6.2	7.2	8.3	9.3	10.3	11.4
	1.8	71.3	6.0	7.1	8.3	9.5	10.7	11.9	13.1	5.5	6.6	7.7	8.7	9.8	10.9	12.0
	1.9	79.4	6.4	7.6	8.9	10.2	11.4	12.7	14.0	5.8	6.9	8.1	9.2	10.4	11.5	12.7
	2.0	88.0	6.8	8.1	9.5	10.8	12.2	13.5	14.9	-	-	-	-	-	-	-

Protein

Age	EAR	RDI
Men		
51-70 yr	52 g/day (0.68 g/kg)	64 g/day (0.84 g/kg)
>70 yr	65 g/day (0.86 g/kg)	81g/day (1.07 g/kg)
Women		
51-70 yr	37 g/day (0.60 g/kg)	46 g/day (0.75 g/kg)
>70 yr	46 g/day (0.75 g/kg)	57 g/day (0.94 g/kg)

Dietary Fibre

Age	AI
Men	
51-70 yr	30 g/day
>70 yr	30 g/day
Women	
51-70 yr	25 g/day
>70 yr	25 g/day

Vitamins D. C. Folate and Vitamin B12

	Vitamin D	Vitamin C		Folate		Vitamin B12	
Age	**AI**	**EAR**	**RDI**	**EAR**	**RDI**	**EAR**	**RDI**
Men							
51-70 yr	10.0 µg /day	30 mg/day	45 mg/day	320 µg/day	400 µg/day	2.0 ug/day	2.4 ug/day
>70 yr	15.0 µg /day	30 mg/day	45 mg/day	320 µg/day	400 µg/day	2.0 ug/day	2.4 ug/day
Women							
51-70 yr	10.0 µg /day	30 mg/day	45 mg/day	320 µg/day	400 µg/day	2.0 ug/day	2.4 ug/day
>70 yr	15.0 µg /day	30 mg/day	45 mg/day	320 µg/day	400 µg/day	2.0 ug/day	2.4 ug/day

Minerals and Trace Elements, Calcium, Iron and Zinc.

	Calcium		Iron		Zinc	
Age	**EAR**	**RDI**	**EAR**	**RDI**	**EAR**	**RDI**
Men						
51-70 yr	840 mg/day	1,000 mg/day	6 mg/day	8 mg/day	12 mg/day	14 mg/day
>70 yr	1,100 mg/day	1,300 mg/day	6 mg/day	8 mg/day	12 mg/day	14 mg/day
Women						
51-70 yr	1,100 mg/day	1,300 mg/day	5 mg/day	8 mg/day	6.5 mg/day	8 mg/day
>70 yr	1,100 mg/day	1,300 mg/day	5 mg/day	8 mg/day	6.5 mg/day	8 mg/day

Definitions adapted from the NHMRC:

EAR (Estimated Average Requirement)

A daily nutrient level estimated to meet the requirements of half the healthy individuals in a particular life stage and gender group.

RDI (Recommended Dietary Intake)

The average daily dietary intake level that is sufficient to meet the nutrient requirements of nearly all (97–98 per cent) healthy individuals in a particular life stage and gender group.

AI (Adequate Intake) (used when an RDI cannot be determined)

The average daily nutrient intake level based on observed or experimentally-determined approximations or estimates of nutrient intake by a group (or groups) of apparently healthy people that are assumed to be adequate.

EER (Estimated Energy Requirement)

The average dietary energy intake that is predicted to maintain energy balance in a healthy adult of defined age, gender, weight, height and level of physical activity, consistent with good health. In children and pregnant and lactating women, the EER is taken to include the needs associated with the deposition of tissues or the secretion of milk at rates consistent with good health.

UL (Upper Level of Intake)

The highest average daily nutrient intake level likely to pose no adverse health effects to almost all individuals in the general population. As intake increases above the UL, the potential risk of adverse effects increases.

Having considered emerging evidence on the connections between diet and health and the recent recommendations from other countries, the preliminary workshops identified more than 40 nutrients for the Working Party to consider.

Appendix 3: Aged Care Quality Standards

Australian Government
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Standard 1

Consumer dignity and choice

Consumer outcome:

1(1) I am treated with dignity and respect, and can maintain my identity. I can make informed choices about my care and services, and live the life I choose.

Organisation statement:

1(2) The organisation:

1(2) (a) has a culture of inclusion and respect for consumers; and

1(2) (b) supports consumers to exercise choice and independence; and

1(2) (c) respects consumers' privacy.

Requirements

1(3) The organisation demonstrates the following:

1(3) (a) Each consumer is treated with **dignity and respect**, with their identity, **culture and diversity** valued.

1(3) (b) Care and services are **culturally safe**.

1(3) (c) Each consumer is supported to exercise **choice and independence**, including to:
- i) **make decisions** about their own care and the way care and services are delivered; and
- ii) **make decisions** about when family, friends, carers or others should be involved in their care; and
- iii) **communicate their decisions**; and
- iv) make connections with others and **maintain relationships** of choice, including intimate relationships.

1(3) (d) Each consumer is **supported to take risks** to enable them to live the best life they can.

1(3) (e) **Information** provided to each consumer is **current, accurate and timely**, and communicated in a way that is clear, easy to understand and enables them to exercise choice.

1(3) (f) Each consumer's **privacy is respected** and personal **information kept confidential**.

Standard 2

Ongoing assessment and planning with consumers

Consumer outcome:

2(1) I am a partner in ongoing assessment and planning that helps me get the care and services I need for my health and well-being.

Organisation statement:

2(2) The organisation undertakes initial and ongoing assessment and planning for care and services in partnership with the consumer. Assessment and planning has a focus on optimising health and well-being in accordance with the consumer's needs, goals and preferences.

Requirements

2(3) The organisation demonstrates the following:

2(3) (a) **Assessment and planning**, including consideration of risks to the consumer's health and well-being, informs the delivery of **safe and effective care** and services.

2(3) (b) Assessment and planning identifies and addresses the consumer's **current needs**, goals and preferences, including advance care planning and **end of life planning** if the consumer wishes.

2(3) (c) Assessment and planning:
- i) is based on ongoing **partnership with the consumer** and others that the consumer wishes to involve in assessment, planning and review of the consumer's care and services; and
- ii) **includes other organisations**, and individuals and providers of other care and services, that are involved in the care of the consumer.

2(3) (d) The outcomes of assessment and planning are effectively communicated to the consumer and documented in a **care and services plan** that is readily available to the consumer, and where care and services are provided.

2(3) (e) Care and **services are reviewed regularly** for effectiveness, and when circumstances change or when incidents impact on the needs, goals or preferences of the consumer.

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Standard 3

Personal care and clinical care

Consumer outcome:

3 (1) I get personal care, clinical care, or both personal care and clinical care, that is safe and right for me.

Organisation statement:

3 (2) The organisation delivers safe and effective personal care, clinical care, or both personal care and clinical care, in accordance with the consumer's needs, goals and preferences to optimise health and well-being.

Requirements

3 (3) The organisation demonstrates the following:

3 (3) (a) Each consumer gets **safe and effective personal care, clinical care**, or both personal care and clinical care, that:
- i) is **best practice**; and
- ii) **tailored** to their needs; and
- iii) optimises their **health and well-being**.

3 (3) (b) Effective **management of high-impact** or high-prevalence **risks** associated with the care of each consumer.

3 (3) (c) The needs, goals and **preferences** of consumers **nearing the end of life** are recognised and addressed, their comfort maximised and their dignity preserved.

3 (3) (d) Deterioration or change of a consumer's mental health, cognitive or physical function, capacity or condition is **recognised and responded to** in a timely manner.

3 (3) (e) Information about the consumer's condition, needs and preferences is **documented and communicated** within the organisation, and with others where responsibility for care is shared.

3 (3) (f) Timely and appropriate **referrals** to individuals, other organisations and providers of other care and services.

3 (3) (g) **Minimisation of infection**-related risks through implementing:
- i) standard and transmission-based precautions to prevent and **control infection**; and
- ii) practices to promote **appropriate antibiotic prescribing** and use to support optimal care and reduce the risk of increasing resistance to antibiotics.

Standard 4

Services and supports for daily living*

Consumer outcome:

4 (1) I get the services and supports for daily living that are important for my health and well-being and that enable me to do the things I want to do.

Organisation statement:

4 (2) The organisation provides safe and effective services and supports for daily living that optimise the consumer's independence, health, well-being and quality of life.

Requirements

4 (3) The organisation demonstrates the following:

4 (3) (a) Each consumer gets **safe and effective services** and supports for daily living that meet the consumer's needs, goals and preferences and optimise their independence, health, well-being and quality of life.

4 (3) (b) Services and **supports for daily living** promote each consumer's emotional, spiritual and psychological well-being.

4 (3) (c) Services and supports for daily living assist each consumer to:
- i) participate in their **community** within and outside the organisation's service environment; and
- ii) have social and personal **relationships**; and
- iii) do the things of **interest** to them.

4 (3) (d) Information about the consumer's condition, needs and **preferences** is **communicated** within the organisation, and with others where responsibility for care is shared.

4 (3) (e) Timely and appropriate **referrals** to individuals, other organisations and providers of other care and services.

4 (3) (f) Where **meals** are provided, they are varied and of suitable **quality and quantity**.

4 (3) (g) Where **equipment** is provided, it is safe, suitable, clean and **well maintained**.

* **Services and supports for daily living** include, but are not limited to, food services, domestic assistance, home maintenance, transport, recreational and social activities.

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Standard 5

Organisation's service environment*

Consumer outcome:

5 (1) I feel I belong and I am safe and comfortable in the organisation's service environment.

Organisation statement:

5 (2) The organisation provides a safe and comfortable service environment that promotes the consumer's independence, function and enjoyment.

Requirements

5 (3) The organisation demonstrates the following:

5 (3) (a) The service **environment is welcoming** and easy to understand, and optimises each consumer's sense of belonging, independence, interaction and function.

5 (3) (b) The service **environment**:

i) is **safe, clean, well maintained** and comfortable; and

ii) enables consumers to **move freely**, both **indoors and outdoors**.

5 (3) (c) Furniture, fittings and equipment are **safe, clean, well maintained** and suitable for the consumer.

* An organisation's **service environment** refers to the physical environment through which care and services are delivered, including aged care homes, cottage style respite services and day centres. An organisation's service environment does not include a person's privately owned/occupied home through which in-home services are provided.

Standard 6

Feedback and complaints

Consumer outcome:

6 (1) I feel safe and am encouraged and supported to give feedback and make complaints. I am engaged in processes to address my feedback and complaints, and appropriate action is taken.

Organisation statement:

6 (2) The organisation regularly seeks input and feedback from consumers, carers, the workforce and others and uses the input and feedback to inform continuous improvements for individual consumers and the whole organisation.

Requirements

6 (3) The organisation demonstrates the following:

6 (3) (a) Consumers, their family, friends, carers and others are encouraged and supported to **provide feedback** and **make complaints**.

6 (3) (b) Consumers are made aware of and have access to advocates, **language services** and other methods for raising and resolving complaints.

6 (3) (c) Appropriate **action is taken** in response to complaints and an **open disclosure** process is used when things go wrong.

6 (3) (d) Feedback and complaints are **reviewed and used** to improve the quality of care and services.

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Appendix 4: Literature Review: Nutritional Status and Quality of Life

Is nutritional status impacting the quality of life of elderly residents residing in long-term care? A systematic review and meta-analysis.

Ebony Tucker

Justice and Society

University of South Australia

Supervisors:

Professor Kurt Lushington

Ms Christina Ambrosi

Dr Natalie Luscombe-Marsh

Research project submitted in partial fulfilment of the requirements of the Bachelor of Psychology (Honours) program at the University of South Australia

October 2020

Statement of authorship

I certify that this research report does not contain material that has been accepted for the award of any other degree or diploma in any other institution, and that to the best of knowledge, it contains no material previously published or written by another person except where due reference is made.

Statement of contribution

I, Ebony Tucker, was involved in the research project as follows:

- Conception of the research scope and question;
- Individual data collection and extraction;
- Data quality assessment;
- Individual data analysis; and
- Reporting of results and discussion

Word count

The size of the research report is 6,139 words, not including the references and appendices or tables.

Supervisor's declaration

As the supervisor of this research report I declare that this work conforms to University guidelines and is of suitable quality for submission.

Prof Kurt

As the co-supervisor of this research report I declare that this work conforms to University guidelines and is of suitable quality for submission.

Ms Christina

As the co-supervisor of this research report I declare that this work conforms to University guidelines and is of suitable quality for submission.

Dr Natalie Luscombe-Marsh

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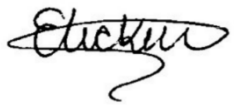

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Ebony Tucker

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Abstract

As the risk and prevalence of malnutrition is elevated in aged populations, more is being done to investigate the effects of poor nutritional status beyond morbidity and mortality. More recently, interest has turned to the relationship between malnutrition and quality of life (QoL) in aged populations. Minimal research, however, has investigated the relationship within aged care settings, where rates of malnutrition appear to be highest. The current study conducted a systematic review and meta-analyses to examine the relationship between nutritional status and QoL in aged individuals residing in aged care facilities. Relevant studies included those which measured nutrition and QoL, or QoL before and after a nutrition-based intervention. Upon searching the databases MEDLINE, PsycINFO, Emcare, and Embase, 19 studies in total were retrieved. Results from the first meta-analysis of cross-sectional studies revealed a small, but significant positive relationship between nutritional status and QoL. Whilst a meta-analysis of quasi-experimental studies demonstrated a significant improvement in participants' QoL following a nutrition intervention, a final meta-analysis of randomised controlled trials (RCTs) did not. Although the significant effects were small, these findings align with previous literature in other aged settings and indicate that increased nutritional status may help enhance QoL in residents of aged care. Due to the likely bidirectional nature of the relationship and non-significant RCT results, however, caution should be taken in the interpretation of these findings. Future research is needed to determine causality in the relationship and how other confounding factors in aged care may influence both nutritional status and QoL.

Keywords: aged care, elderly, nutrition, malnutrition, quality of life.

Is nutritional status impacting the quality of life of elderly residents residing in long-term care? A systematic review and meta-analysis.

Malnutrition is an under-appreciated but increasingly common problem in the aged (Isenring et al., 2012). As the population continues to age, with rates of aged individuals expected to triple by 2050, the need to better identify malnutrition and explore potential mitigating factors has become prominent (United Nations, 2013; Volkert, 2013). Aged individuals have been identified as a population at high risk of malnutrition for several decades (Kerstetter et al., 1992; Stratton et al., 2003). Despite this recognition and a well-established understanding of the adverse biological effects malnutrition can incite, the psychological consequences of malnutrition in the aged remains poorly examined (Rasheed & Woods, 2013; Stratton et al., 2003). From emerging literature which has examined the psychological ramifications of malnutrition in the aged, concerns over quality of life (QoL) appear to be rising. Such growing concern over QoL has stemmed from the adverse associations between malnutrition and sociability, capacity to undertake daily activities, comfort, mood, and several other aspects of well-being (Kvamme et al., 2010; Suzana et al., 2013; Vafaei et al., 2013). Researchers have identified a relationship in several aged settings, including the general community, rural areas, hospitals, and residential care (Rasheed & Woods, 2013). As residences in the aging population are growing in diversity, however, with several forms of assisted living now available, exploration on a setting-by-setting basis is timely and needed for the development of appropriate interventions (Department of Health, 2019). Of the different settings, aged care facilities present as a context in need of examination, with the Australian Government's recent inquiry into Aged Care Quality and Safety identifying malnutrition as a major concern (Commonwealth of Australia, 2020).

Defined as a state of deficiency, imbalance, or excess of nutrients which harms body composition, function and clinical outcome, malnutrition typically takes the form of undernutrition in aged populations (Lancker et al., 2012; Saunders & Smith, 2010). The risk and prevalence of malnutrition in the elderly is estimated to be as high as 97% and 85% respectively, with rates varying dependent on living circumstances (Bell, et al., 2013; Guigoz, et al., 2002). Assisted living homes, including residential care facilities and nursing homes, are among those living circumstances which are closely associated with an increased risk of malnutrition (Abbott, et al., 2013; Hickman & Tapsell, 2009). For instance, in a review of malnutrition across elderly settings, Stratton and colleagues (2003) reported that whilst prevalence of malnutrition in community-based individuals with severe and/or several diseases exceeded 10%, malnutrition in residential care exceeded 50%. An Australian based study additionally demonstrated the pervasiveness of malnutrition in aged care upon finding that malnutrition effected 20% more aged care residents compared to elderly hospital patients (Banks et al., 2007). Although not deemed to be an inevitable consequence of ageing, the aged are more vulnerable to nutritional deficits due to physical and psychosocial factors, including an over-reliance on pre-packaged foods, poor dentition, malabsorption of nutrients secondary to disease, and reduced appetite from smell and taste deficiencies (Hickson, 2006; Mann et al., 2006; Russell, 2001). These risk factors are compounded in long-term care settings by organisational factors which can hinder appetite and food enjoyment. The latter may include limited menu choices, unfamiliar foods and/or terms used to describe food items, and poor dining experiences (Agarwal, et al., 2016).

Malnutrition holds serious consequences for the affected individual, having the potential to predispose the onset of further disease, delay the recovery from illness, and

increase risk of mortality (Flegal et al., 2002). In addition to poor health-related outcomes, reductions in cognitive status and well-being have also been reported in aged individuals with poor nutritional status (Di Francesco et al., 2007; Vetta et al., 1999). As associations between malnutrition and poor psychological outcomes are increasingly identified, many studies are considering how poor nutritional status may be hindering QoL in aged populations (Amarantos et al., 2001; Rasheed & Woods, 2013; Vetta et al., 1999). QoL is defined by the World Health Organisation (WHO) (2020a) as an individual's perception of their life's position in the context of their culture and value systems, and in relation in their goals, expectations, standards and concerns. Whilst the literature examining the relationship between malnutrition and QoL in older populations remains scarce, available evidence suggests that poor QoL is associated with poor nutrition and inadvertent weight loss (Bernabeu-Wittel et al., 2010; Gombos et al., 2008). Although the effect of malnutrition on QoL cannot be definitively explained, the multifaceted effects of malnutrition on the human body generates repercussions which impact daily living (Amarantos et al., 2001). As malnutrition produces change in our homeostatic mechanisms through reduced muscle function, impaired cardio-respiratory function, and diminished immunity, changes are simultaneously made in how these mechanisms regulate our body and behaviour (Saunders & Smith, 2010). Eating behaviour, body composition, and health status are all factors adversely impacted by these changes, as those with malnutrition experience reduced enjoyment of food, increased dependence on healthcare, and increased use of medication (Amarantos et al., 2001; Drewowski & Evans, 2001; Vetta et al., 1999). Further risks to diminishing QoL may then be posed by subsequent indirect effects on sociability, daily activities, and sense of independence.

Although a relationship between malnutrition and QoL has been reported in the aged, the association is complex and causality remains unclear (Bernabeu-Wittel et al., 2010; Edington et al., 2004). A large majority of studies which have identified a relationship have not been able to clearly define the temporal order of nutritional status and self-reported QoL (Rasheed & Woods, 2013). In this way, whilst it is suspected that malnutrition damages QoL, QoL-related factors such as negative affect, lack of social desire, and discomfort may equally incite reduced appetite and food consumption (Vetta et al., 2009). Many studies have additionally not controlled for potential confounds known to influence both nutritional status and QoL. Loneliness, depression, disease, physical functionality, quality of food, and living environments, for instance, are all important elements which change with age and may affect how we eat and how we perceive our lives (Chen et al., 2008). Before further randomised, controlled, or longitudinal research can be conducted, however, the relationship between nutritional status and QoL in specific aged settings, as opposed to aged populations in general, must be clarified. Currently, there remains one review in the literature which attempts to explore the effect of nutrition on QoL in aged individuals in care-based homes (Donaldson et al., 2019). This review, however, lacks specificity of inclusion criteria and fails to examine the strength of the relationship, or consider nutrition focused interventions outside of protein supplementation. Further, as the review only contained three studies, the analysis revealed elevated heterogeneity levels and any conclusions regarding nutritional status and QoL were avoided. Accordingly, as appropriate focus on both nutrition and QoL within aged care settings has seldom been done or adequately reviewed, further exploration of this relationship is required. Such exploration can help establish the nature of the relationship in

aged care and promote organisational awareness, paving the way for more experimental research and appropriate support.

Whilst there is a growing investigation into the association between malnutrition and QoL in the aged, our understanding of this relationship has mostly derived from settings other than aged care (Bernabeu-Wittel et al., 2010; Gombos et al., 2008). Accordingly, although previous studies indicate that malnutrition is associated with poor QoL in older adults, it is unclear whether this remains the case for individuals in long-term residential care facilities. In order to help preserve and enhance the QoL of those elderly individuals then, a comprehensive review is needed to determine the true relationship between nutritional status and QoL in aged care settings. Given the recent Royal Commission into nutrition in the aged care sector, with QoL promotion underpinning much of the argument for a revised food and nutrition policy, a review into this relationship is timely (Dieticians Association of Australia, 2019). Such a public inquiry emphasises the significance of nutrition concerns in aged care settings and further highlights the necessity of a review to determine if such arguments based on QoL are justified. Further, with a multitude of measures available in the assessment of nutrition and QoL, exploration of the assessments implemented in aged care and whether these are successful is needed (Jones, 2002; Rasheed & Woods 2012).

A systematic review and meta-analyses will be conducted with an aim to determine, and if possible, quantify the interrelationship between malnutrition and QoL in aged care settings. For this to be achieved, the review will identify studies which have assessed the association between nutrition and QoL, as well as the impact of nutritional interventions on QoL in aged care samples.

The following question will be addressed: What is the strength and clinical significance of the relationship between nutritional status and quality of life in aged individuals residing in long-term care facilities?

Method

This study was conducted in adherence with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) and Meta-Analysis of Observational Studies in Epidemiology (MOOSE) guidelines (Moher et al., 2009; Stroup et al., 2000).

Search strategy

Relevant studies were identified through a systematic search in April 2020 utilising the electronic databases Medline, PsycINFO, Emcare, and Embase. Systematic searches were then supplemented by generic searches via Google Scholar to help certify coverage of pertinent studies by accounting for variability in indexing. In accordance with a systematic search method, subject headings relating to aged care, elderly/aged individuals, nutrition, and QoL were first identified and entered in each database's search engine. The following keywords were subsequently searched with their corresponding subject heading before being combined: (age* care OR residential care institution$ OR nursing home$ OR home$ for the aged), (ag?ing OR aged OR elderly OR aged, 65 and over), (nutrition* OR malnutrition* OR nutrition* deficiencies OR nutrition* assessment), (quality of life OR health related quality of life OR QOL or HRQoL) (See appendix A). Limitations placed on the databases ensured only those studies published in English appeared in the results.

Inclusion and exclusion criteria

In identifying only aged individuals, the present study referred to the WHO's classification for developed countries, which defines an aged/older person as someone who is aged 65-years or over (WHO, 2002). Studies were then included in the review if they i) measured nutrition, QoL, and/or their relationship, ii) obtained a sample whose mean age was 65-years or older, iii) were published as a journal article, iv) were published between 1995 and April 2020, v) obtained a sample residing in a residential care facility. Intervention studies which did not measure nutrition but conducted a nutrition intervention and measured QoL both before and after the intervention, were included in the review. For the purpose of the current study, a nutrition intervention was defined as any intervention which provided direct nutritional supplementation or support to participants. Such direct support could involve oral nutrition supplementation, appetite stimulant medication, and nutrition evaluation with subsequent meal alternations.

The decision to include only those papers published as journal articles consequently excluded publications such as theses, dissertations, monographs, conference proceedings, and government publications. Grey literature was additionally excluded from the current review. Further studies which were excluded were those which examined aged individuals residing in other living environments, such as hospitals or the community, or did not provide separate data between residential care participants and participants from other settings. Considering the current study's definition of a nutrition intervention, studies were also excluded if their proposed nutrition intervention was indirect in nature. This included any intervention in which participants were not explicitly experiencing increased appetite and food consumption, nutritional intake, or dietary guidance, such as those which altered the dining environment or meal delivery.

Data extraction

The following information was extracted from each included study: i) QoL measures, ii) nutrition assessment tools, iii) sample size, iv) mean age of participants, v) presence of disease in participants, vi) cognitive function of participants, vii) residential setting (e.g. nursing home or aged care facility), viii) participants sex, ix) country of study, x) study design, xi) the intervention, xii) QoL and nutrition outcomes. Citation details including authors and year of publication, and data which may be required in a meta-analysis software such as means, standard deviations, and *p*-values, were also extracted. As data extraction was completed by the primary reviewer (ET), 20% of recorded data was assessed by a secondary reviewer (KL) to ensure the recorded information was sufficient and accurate.

Quality assessment

The methodological quality of each study was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Tools, which include quality assessment checklists for several different study designs (Joanna Briggs Institute, 2020). The JBI Checklist for Analytical Cross-Sectional Studies, Quasi-Experimental Studies, and Randomised Controlled Trials, containing 9 to 13 items each, were utilised for this review (See appendix B, C, and D). All studies meeting the inclusion criteria upon full-text examination were included in the review irrespective of their overall quality appraisal. To help ensure reliability of quality assessment, 20% of completed checklists were cross-checked by a secondary reviewer (KL).

Statistical analyses

Comprehensive Meta-Analysis (CMA) V3 was used to conduct random-effects meta-analyses with studies which contained sufficient data (Comprehensive Meta-analysis, 2020a). Data from cross-sectional studies and intervention trials were analysed separately. In the

analysis of correlational data, effect sizes were calculated by computing the Fisher's Z value and standard error (SE) of each study; a transformation where SE is determined by sample size alone. Effect sizes for intervention studies (Cohen's *d*) were generated by computing the bias-corrected standardised mean difference from means, standard deviations, and where necessary, *p*-values and *t*-values (Comprehensive Meta-analysis, 2020b). The combined effects, including 95% confidence intervals (CI) and statistical significance as determined by a *p* level of <.05, of each analysis were computed and illustrated in forest plots.

Heterogeneity and publication bias

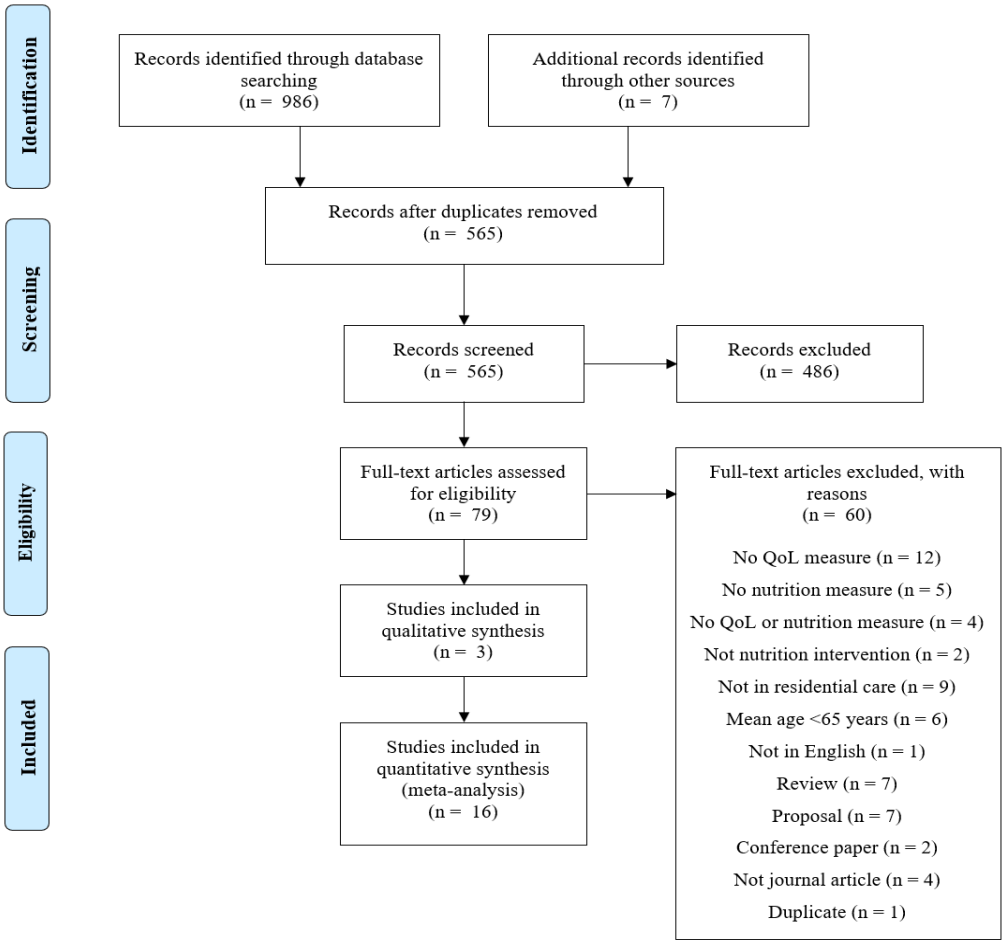
Heterogeneity was assessed using the CMA's software computed *Q* and I^2 statistic, reflecting the observed dispersion amongst the effects of studies. A *Q*-value equal to or less than the degrees of freedom (DF) indicates the variance in observed effects is due entirely to sampling error. In the case that a *Q*-value greater than the DF is observed, the I^2 statistic was interpreted using the scores suggested in the Cochrane Handbook guidelines (Deeks et al., 2019). Publication bias was additionally assessed through generation of a funnel plot and test for rank correlation, in which the presence of publication bias is represented by an asymmetric, clustered distribution and a significant Kendall's Tau (Comprehensive Meta-analysis, 2020b). It should be noted, however, that in meta-analyses with fewer than ten studies any assessment of publication bias lacks power (Dalton et al., 2017).

Results

Literature search and article selection

Initial database searches returned 993 results (986 from systematic searches, 7 from generic searches and snowballing), of which 428 were removed after screening for

duplicates. Upon full-text examination, a total of 19 articles met the full inclusion criteria and were included in the review. The selection process, which followed the PRISMA protocol stages of study identification, screening, eligibility assessment, and inclusion, including reasons for exclusion, is illustrated in Figure 1 (PRISMA, 2015).



Classification of articles

Nine observational studies were identified which measured both QoL and n

Nutritional status and were therefore included in the review. Due to insufficient data, however, only eight of these could be incorporated in a meta-analysis.

Ten studies in total included a nutrition-based intervention and both pre- and post-measures of QoL. Across the ten studies, the most common type of intervention included oral nutritional supplements (ONS). Other types of interventions included multidisciplinary nutrition support and the use of megestrol acetate (See appendix E). Of these studies, only five involved randomisation, to which a further one failed to report relevant detailed results. Accordingly, only four intervention studies were deemed appropriate to include in the meta-analysis for randomised controlled trials (RCTs). Likewise, only four of the five remaining intervention studies included adequate data and could be included in a separate meta-analysis for quasi-experimental studies. A summary of all included studies, irrespective of inclusion in a meta-analysis, is presented in Table 1.

Quality of life measures and nutritional assessment methods used in the studies

Ten of the nineteen studies included utilised a combination of anthropometric, biochemical, and/or nutrition questionnaire scales in their assessment of nutritional status. Of these indices, body mass index (BMI) appeared to be the most frequently utilised measure, followed by the Mini Nutritional Assessment scale, and (pre)albumin levels. The remaining nine studies that measured nutrition employed either anthropometric, biochemical, or nutrition questionnaires alone. In instances where studies included a combination of nutrition measures, the data from nutrition questionnaires, as opposed to anthropometric or biochemical indices, were used in the meta-analysis. This decision was made on the basis that

standardised nutrition questionnaires typically undertake a more comprehensive examination of nutritional status than individually used anthropometric and biochemical indices (Bharadwaj et al., 2016).

The most frequently used QoL measure was the EuroQoL-5-Dimensions (EQ-5D), employed by a total of six studies. Ten studies made use of other QoL specific scales, whilst three studies assessed QoL through the measurement of QoL-related indicators, such as well-being, enjoyment of life, and dependence in daily activities.

Table 1

Summary of studies included in the systematic review including: Author(s), Publication year, Design, Sample size, Mean age, QoL measure(s), and Nutrition measure(s).

Study	Design	N	Age in years *M* (SD)	QoL measure	Nutrition measure
Abizanda et al., 2015	Quasi-experimental	69	85.6 (5.6)	EQ-5D	MNA-SF BMI
†Beck et al., 2016	RCT	31	86.0 (8.4)	EQ-5D	Weight Handgrip strength
Beck & Damkjaer, 2008	Cross-sectional	430	86.3 (7.2)	MDS	BMI
*Carrier et al., 2009	Cross-sectional	395	CI: 83.6 (8.5) NCI: 65.6 (7.6)	QoL-D	BMI
Costan et al., 2012	Quasi-experimental	40	VF: 69.9 (5.2) VFX: 71.6 (7.2)	EQ-5D	N/A
Crogan et al., 2008	Quasi-experimental	61	T: 84.8 (7.3) C: 79.0 (8.0)	QoL-AD	BMI Serum albumin
*Crogan & Evans, 2009	Cross-sectional	40	84.8 (7.3)	QoL-AD	BMI Serum albumin
Crogan & Pasvogel, 2003	Cross-sectional	85	83.49 (7.8)	MDS	BMI
*Kostka et al., 2014	Cross-sectional	879	79.0 (7.9)	EQ-5D	MNA BMI
*Kuikka et al., 2009	Cross-sectional	55	MN: 83.7 (8.1) WN: 82.9 (8.3)	15-D	MNA
Martin et al., 2019	Quasi-experimental	154	84.2 (7.5)	EQ-5D	MNA

					BMI
†Parsons et al., 2017	RCT	70	88.5 (7.9)	EQ-5D	Dietary intake Weight
Rondanelli, et al., 2011	RCT	41	T: 83.5 (7.6) C: 79.9 (6.2)	SF-36	MNA BMI
*Salminen et al., 2020	Cross-sectional	486	83.0 (8.0)	15-D	MNA BMI
*Salminen et al., 2019	Cross-sectional	538	CDR1: 85.0 (7.0) CDR2: 84.0 (8.0) CDR3: 83.0 (7.0)	15-D	MNA Energy and protein intake
*Smoliner et al., 2009	Cross-sectional	114	84.6 (9.1)	SF-36	MNA BMI Arm circumference
†Stange et al., 2013	RCT	77	T: 87.0 (6.0) C: 86.0 (7.0)	QUALIDEM	MNA-SF BMI Arm circumference
Torma et al., 2015	Quasi-experimental	101	83.8 (7.4)	EQ-5D	MNA-SF
†Yeh et al., 2000	RCT	51	T: 76.0 (1.4) C: 76.3 (1.2)	Sense of well-being Enjoyment of life GDS	Energy intake counts Prealbumin and albumin

Note. †Studies included in the meta-analysis which were randomised-controlled trials.

*Studies included in the meta-analysis which were cross-sectional.

Studies with more than one mean age have reported mean age by groups within the study.

RCT = Randomised controlled trial, MDS = Minimum data set, QoL-D = Quality of Life Dementia Scale, EQ-5D = EuroQoL-5 Dimensions, SF-36 = Short Form 36, GDS = Geriatric Depression Scale, CI = Cognitively intact, NCI = Not cognitively intact, VF = With vertebral fractures, VFX = Without vertebral fractures, T = treatment group, C = Control group, MN = Malnourished, WN = Well nourished, CDR1 = Clinical dementia rating 1, CDR 2 = Clinical dementia rating 2, CDR3 = Clinical dementia rating 3, BMI =

Quality assessment of included studies

All studies included in the review were deemed to be of moderate to high quality by the primary and secondary reviewers. Within the included cross-sectional studies, the lowest percentage of quality assessment criteria met was 62.5%, in which two studies did not definitively meet three of eight items. Percentage of criteria met was relatively higher among RCT and quasi-experimental studies, in which the lowest percentage of criteria met was 77% and 78% respectively. Within these appraisals, one RCT study failed to meet three of thirteen items, and all quasi-experimental studies failed to meet two of nine checklist items.

Heterogeneity

In the meta-analysis of cross-sectional studies, after retrieving a *Q*-value of 11.4 from a DF of 8, an I^2 statistic of 29.59 (p = .182) was calculated. This indicated heterogeneity below the moderate range and not of concern. Heterogeneity was similarly not of concern in the analysis of intervention studies, yielding a *Q*-value below the DF and an I^2 statistic <.0 (I^2 = 0.00, p = .866). Moderate heterogeneity (I^2 = 56.90, p = .073), however, was discovered in the meta-analysis of RCTs, after receiving a *Q*-value of 6.1 from a DF of 3. As such, results from this analysis should be interpreted with caution.

In assessing publication bias, visual examination of each funnel plot revealed asymmetric, however, non-clustered distributions across each meta-analysis (Appendix F, G, H). Follow-up Begg and Mazumdar's rank correlation tests for the cross-sectional, RCT, and quasi-experimental meta-analyses were non-significant (p = .677, p = .497, p = 1.00, respectively), indicating absence of publication bias. Although conventionally acceptable, this conclusion should be interpreted with caution as analyses of bias with fewer than ten studies lack power to distinguish chance from true asymmetry.

Associations between malnutrition and quality of life

There were eight studies included in the cross-sectional meta-analysis which reported an associated between QoL and nutrition. The pooled analysis (Figure 2) revealed a small positive relationship between QoL and nutritional status, indicating that higher scores of nutritional status were significantly related to a higher level of QoL (r = .098; 95% CI: .057-.138, p<.001). This positive association was further reflected in the remaining observational study not included in the meta-analysis, in which four of nine QoL indicators were significantly related to a BMI >29. In this study, a BMI score over 29 served as an indicator of sufficient nutritional status (Beck & Damkjaer, 2008).

Effect of nutrition support on quality of life

There were four intervention studies in which participants were randomly allocated to receive either a nutritional intervention or routine care/placebo which could be included in a meta-analysis. A combined analysis (Figure 3) demonstrated that whilst participants who received a nutritional intervention showed better QoL outcomes compared to those who did not, this difference was not significant (Cohen's d = .320, 95% CI: -0.076-.717, p = .114). A significant difference was, however, demonstrated in the study not eligible for the meta-analysis, in which better mental and physical dimensions of QoL were exhibited in the intervention group (Rondanelli et al., 2011).

The combined analysis for the remaining four intervention studies (quasi-experimental) revealed a significant improvement in QoL after participants had undergone a nutrition intervention (Cohen's d = .210, 95% CI: .089-.331, p = .001). This significance was not found in the remaining intervention study excluded from the meta-analysis, in which

participants who received an intervention experienced only a small increase in QoL (Crogan et al., 2008).

Figure 2

Meta-analysis: individual and pooled results for cross-sectional studies.

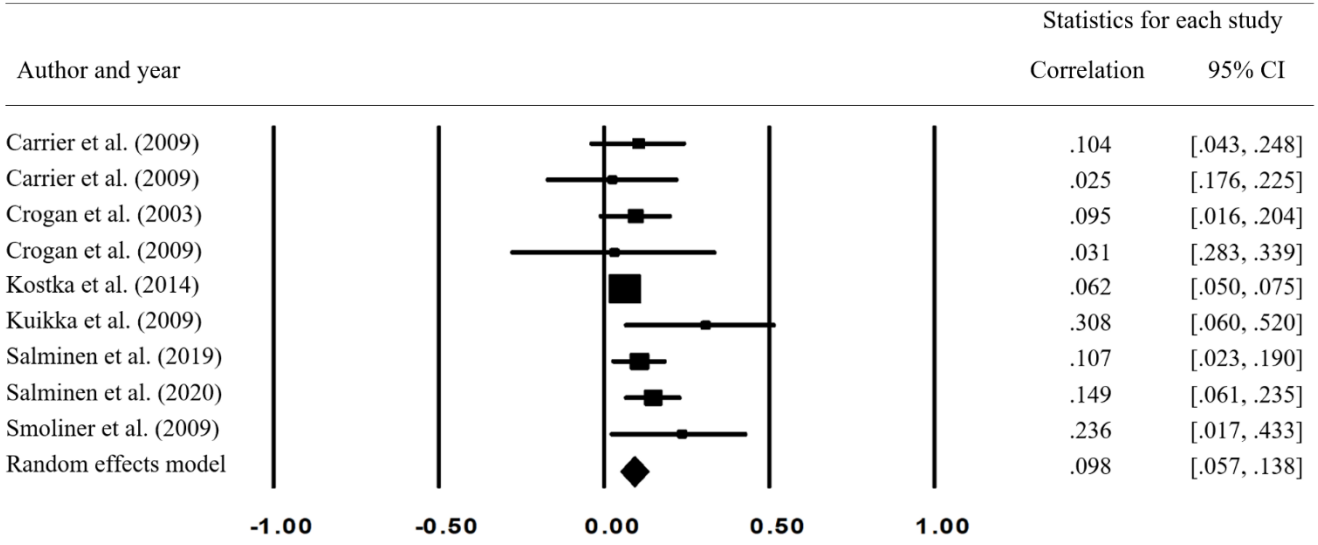


Figure 3

Meta-analysis: individual and pooled results for RCT's.

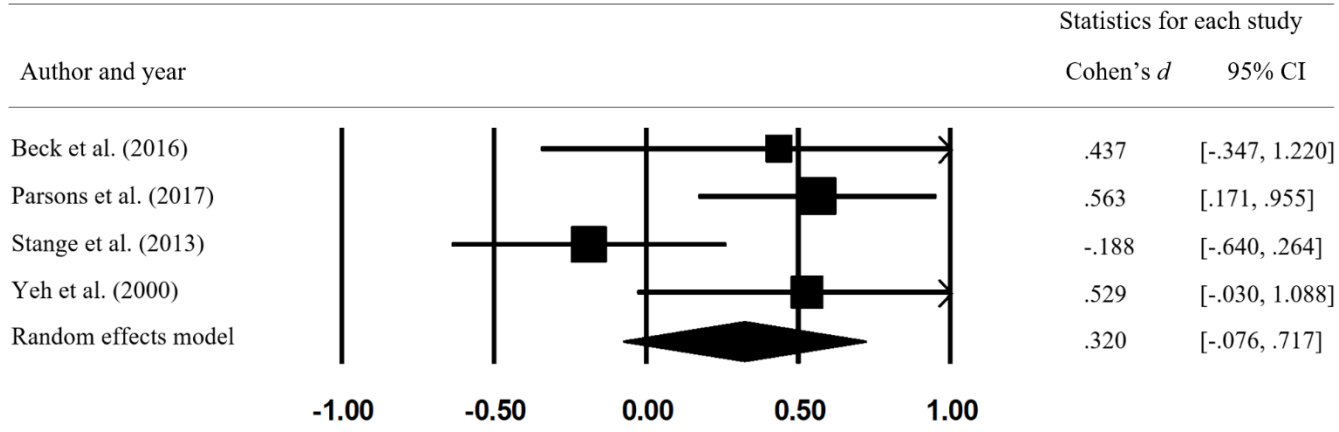
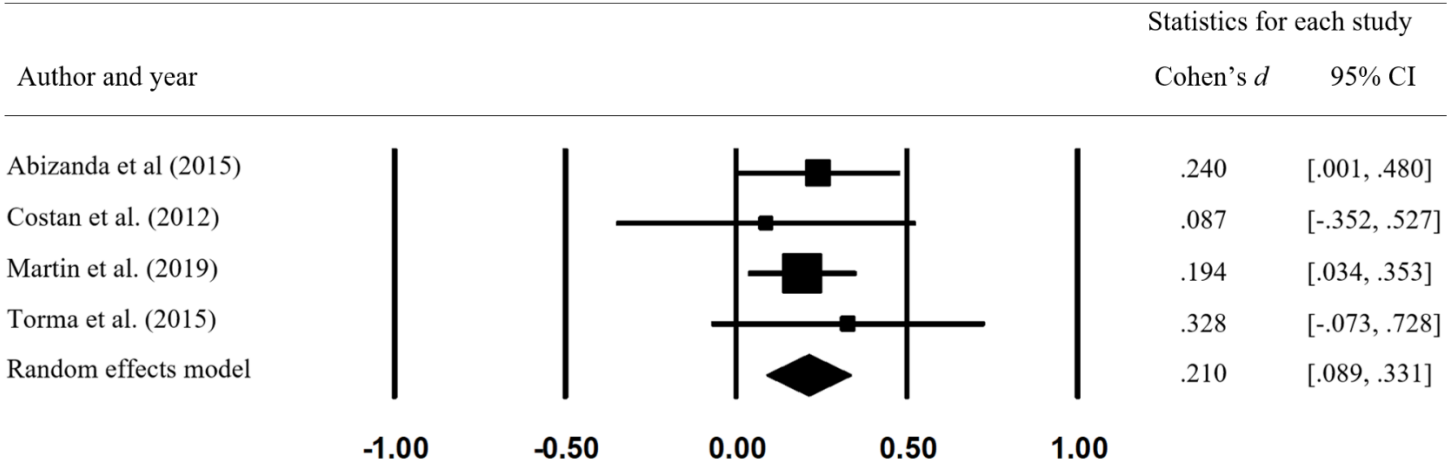


Figure 4

Meta-analysis: individual and pooled results for quasi-experimental studies.



Discussion

Summary of results

Through both quantitative and qualitative synthesis of data, the current systematic review and meta-analysis analysed a total of nineteen studies which examined the relationship between QoL and nutrition in aged care. Across the nine cross-sectional studies, in which eight could be analysed in a meta-analysis, nutritional status was found to be significantly associated with QoL. This analysis revealed a positive relationship, demonstrating that a higher nutritional status in participants is related to increased levels of QoL. Although the effect size was small, it remains as an important finding considering the prevalence of nutritional deficits in aged care settings. Consistent with this finding, in the meta-analysis of quasi-experimental studies it was discovered that participants who had undergone a nutritional intervention experienced significant improvements in QoL levels. Considering the items within the QoL assessment tool used in these studies, this finding suggests that residents who received a nutritional intervention perceived less pain, increased physical, social, and mental function, and better general health. In contrast to this, although revealing an improvement in QoL, the remaining quasi-experimental study found no significant difference in participants' QoL from baseline to post-intervention. A significant difference was additionally not discovered in the meta-analysis of RCTs, in which despite experiencing an improvement, participants receiving an intervention did not significantly differ from participants who received routine care or a placebo. This differed to the results from the remaining RCT not included in the meta-analysis, whereby participants who received nutritional support exhibited significantly better QoL outcomes compared to controls.

To the author's knowledge, this study is the first systematic review and meta-analysis to explore the relationship between nutritional status and QoL in aged care. Results from the present study coincide with findings from a similar review which investigated the relationship in older populations from community, hospital, and aged care settings (Rasheed & Woods, 2013). In this 2013 review, separate meta-analyses indicated that malnutrition was significantly related to poorer QoL in aged individuals, and that nutrition-based interventions led to significant improvements in aged participants QoL. Rasheed and Wood's (2013) analysis of intervention studies, however, consisted strictly of RCTs and accordingly, findings do diverge in that the present study failed to yield a significant result in the meta-analysis of RCTs. Whilst in this way findings from the current review conflict with findings from Rasheed and Woods (2013), a non-significant finding in the present study could be attributed to a small overall sample size. The current study, containing just four studies and 229 participants in total, is considerably smaller in sample size in comparison to Rasheed and Woods (2013) thirteen RCT studies, and total of 1,396 participants. Such an explanation for non-significance seems feasible given the similarity between the current study's and Rasheed and Woods' (2013) effect size for RCTs, with both ranging between small to medium (Rasheed & Woods, 2013).

In the comparison of the intervention-based meta-analyses, a difference in total sample size may additionally explain the difference in significant results. In this case, sample size in the RCT meta-analysis was smaller than in the meta-analysis of quasi-experimental studies, in which 95 less participants were obtained. This may perhaps explain why a non-significant result was found in the RCT analysis despite showing a larger effect size than the analysis of quasi-experimental studies. What may also be of importance in the examination

of the two differing results is the type of QoL measures used between each analysis. Across the studies included in the quasi-experimental meta-analysis, all four reported to have used the EQ-5D in their measurement of QoL, an instrument which has been validated across aged populations (Abizanda et al., 2015; Costan et al., 2012; Holland et al., 2003; Martin et al., 2019; Torma et al., 2015). In contrast to this, whilst two of the four studies in the meta-analysis of RCTs employed the EQ-5D in their measurement of QoL, the remaining two reported use of less validated measures (Beck et al., 2016; Parsons et al., 2017; Stange et al., 2013; Yeh et al., 2000). One of these studies averted from using a comprehensive QoL scale completely by instead employing three unvalidated scales thought to be indicative of QoL (Yeh et al., 2000). In this way, a non-significant effect in the RCT meta-analysis could additionally be attributed to use of invalid measures which lacked the sensitivity required to capture changes in the populations' QoL.

Considering how ONS were delivered in the RCT studies, a non-significant improvement may further be due to low adherence to nutrition intervention. In these studies, ONS were offered or made accessible to participants in the intervention group. In comparison, participants in the quasi-experimental studies appeared to have been directly provided their desired ONS intake, as opposed to being asked or required to retrieve for themselves. Whilst consumption is ultimately voluntary in both delivery forms, by offering or simply providing access to ONS, adherence may have reduced as participants were presented with increased opportunity to decline or forget. Poor adherence was acknowledged in one of these RCT studies, in which 33% of participants discontinued ONS consumption. Whilst remaining compliance equated to 72.9%, this was the study's reported median percentage, and rates as low as 23% were recorded; making the percentage of participants who maintained such high

adherence unclear (Stange et al., 2013). Contrastingly, in one of the meta-analyses quasi-experimental studies, adherence higher than 80% was noted in 63% of participants, and rates between 60 to 80% in 21% of participants (Abizanda et al., 2015). Given that both interventions entailed ONS and acquired similar sample sizes, differences in compliance do then suggest potential impediments in the way the intervention was delivered. The way in which ONS are administered to aged populations has been identified as a major determining factor in the acceptance and compliance of such interventions in previous literature (Hubbard et al., 2012; Rasheed & Woods, 2013; Stange et al., 2013). Factors including the variety of flavours, volumes, mode, and timing of distribution have all been identified to play an important role in the successfulness of ONS compliance (Hubbard et al., 2012; Rasheed & Woods, 2013; Stange et al., 2013).

The significant finding from the current study's analysis of quasi-experimental studies closely aligns with other intervention studies, both quasi-experimental and RCTs, conducted with aged individuals from other settings (Kwon et al., 2015; Rondanelli et al., 2016; Sugawara et al., 2010). In these previous studies, participants exhibited significant improvements in QoL after receiving a 12-week nutrition-focused intervention. The separate nutritional support and oral nutritional supplementation in these studies saw improvements in individuals who resided in both the community and rehabilitation facilities (Kwon et al., 2015; Rondanelli et al., 2016; Sugawara et al., 2010). Such findings may suggest that, despite the large lifestyle discrepancies expectedly present across the variety of aged settings, the adaptive effects of improved nutrition can ultimately enhance similar aspects of QoL. In this way, those lifestyle factors presumed to benefit from an improved nutritional status, such as medication use, dependence on healthcare, disease severity, and mobility, may reap similar benefits in older

aged across settings. These improved factors may then be enough to enhance the QoL domains of functional status, sociability, comfort, and self-care irrespective of the residential living circumstances of the aged individual.

Strengths and limitations

The present study is the first systematic review and meta-analysis to investigate and draw conclusions on the relationship between nutritional status and QoL within aged care facilities. As living circumstances become particularly complex with increasing age, with many individuals transitioning to residential aged care, assisted living flats, or long-term hospital care, so too can the factors associated with nutrition and QoL. The current study is able to ascertain the relationship between nutritional status and QoL in a residential setting which may have otherwise been overlooked and grouped among other contexts. Whilst the first meta-analysis using correlational data merely indicates a positive relationship without clarification of the determining variable, the two further meta-analyses conducted help indicate sequential order. Although caution is to be made with the meta-analysis of RCTs considering the moderate heterogeneity level and a non-significant finding, the significant finding of the quasi-experimental meta-analysis demonstrates that nutrition support can improve QoL.

Considering the extent of diversity in nutrition and QoL measurement, and the challenges faced by aged samples, several methodological limitations pose concerns to the findings of the present study. In the measurement of QoL, four studies in the current review utilised proxies for participants who were deemed unable to sufficiently respond to questions. Although the use of proxies may present as the only appropriate avenue of data

collection due to cognitive or vocal deficits in some participants, issues concerning response accuracy and reliability ultimately arise. This reliance on responses from proxy individuals has presented as a methodological concern across a large majority of studies which have measured QoL in the aged (Edvardsson et al., 2013; Salminen et al., 2020; Torma et al., 2015). Whilst proxies are typically individuals who know the participant intimately, such as a family member or designated care worker, in many circumstances proxies can be general staff and level of familiarity with the participant is not clear. In this way, responses may overestimate the participants' true QoL in a reflection of social desirability and expectancy biases from proxies.

In the assessment of nutrition, a multitude of screening tools and techniques have been developed, which vary in modality, complexity, reliability, and validity (Jones, 2002). This variance has meant that researchers employ a variety of measurement tools in their assessment of nutrition, including questionnaires, observations, and/or physical examinations, which depend on information from both participants and researchers. Of these studies, many continue to rely on unstandardised and unreliable anthropometric or biochemical measures of nutrition, such as BMI, muscle circumferences, subcutaneous fat (fat residing under the skin), and (pre)albumin levels (Isenring et al., 2012). Although these measurements continue to be labelled as acceptable indicators of nutritional status in the literature and by government health organisations, such measures alone fail to encapsulate the breadth of nutritional status (Keller, 2019; Tsai et al., 2012; WHO, 2020b). Whilst the majority of included studies employed these measures together when used, when imputing data to calculate the association between nutritional status and QoL, only the data from one indicator can be used. In this manner, the current study was limited in the variety of

unstandardised nutrition indices used across studies. The use of such varying estimates impedes the quality of a combined analysis and the likelihood of finding a true effect.

A further limitation of the current study exists in the inability to explore or control for the potential confounds which may be influencing the nature of the nutrition and QoL relationship. As previously acknowledged, the relationship between nutritional status and QoL is complex and can be influenced by a range of individual factors, including general mood, dentition difficulties, disease, psychopathology, and food quality (Chen et al., 2008; Donini et al., 2008). Accordingly, with many of the included studies failing to measure, let alone control for potential confounds, the presence of these variables and their influence on the relationship remains unclear.

Clinical implications

The present study holds important implications for both aged care service providers and residents of aged care facilities, where feasible alternations in everyday life could make the difference between poor and enhanced QoL. By establishing that a positive relationship between nutritional status and QoL does exist in aged care, whereby increased nutritional status is related to increased QoL, the importance of nutrition examination is highlighted. Although the prevalence of malnutrition in aged populations and aged care settings has been underlined throughout the literature, many institutions continue to overlook the severity of the issue (Flanagan et al., 2012; Isenring et al., 2012). Such failure to recognise and manage nutritional deficits in aged care facilities could be explained by the organisations' lack of awareness concerning the repercussions of malnutrition. This study may then help aged care organisations acknowledge how nutritional deficits may be affecting their residents and incite

the regular use of nutrition screening tools. As nutrition screening, as opposed to nutrition assessment, is a simple procedure which identifies those at risk of malnutrition, special expertise is not required and thus implementation within an organisation is feasible (American Dietetic Association, 1994). Through screening and early identification, centres can explore which avenues of nutrition support may be most appropriate and how this can be introduced into the residents' routine. Early identification and implementation of nutrition-based support has been suggested to assist in terminating, or even reversing, the adverse outcomes associated with malnutrition (Banks et al., 2007). The use of ONS, appetite medication, and multidisciplinary support are all nutrition-focused interventions indicated by the present study to improve residents' QoL. Accordingly, through maintaining and improving nutritional status, residents may feel better able to engage in their self-care, pursue social activities, contribute to their social relationships, and experience less discomfort and negative affect.

Directions for future research

The current study has been able to highlight patent methodological concerns in the literature which need addressing if future research is to be conducted. Considering the large range of nutrition indicators with questionable reliability and validity currently being utilised, future research should consider the use of more comprehensive and standardised measures of nutrition. Although no one accepted gold-standard measure of nutrition currently exists, the current study recommends the use of tools with increased validity in aged populations which incorporate several nutrition indices. Tools such as the Mini Nutritional Assessment (MNA) and the Malnutrition Screening Tool (MST) have demonstrated suitable sensitivity and

specificity in aged populations and examine nutritional status more comprehensively than individual anthropometric measures (Agarwal et al., 2013; Frank et al., 2015; Isenring et al., 2012). The use of such tools not only provide facilitators with clear cut-offs of nutritional status, but assist in the comparison of findings across studies.

The current study additionally highlights the lack of RCTs currently present in the literature, with a need for future intervention studies to incorporate elements of randomisation and control if causation is to be established. Whilst ethical considerations make true placebo-control difficult to achieve with already malnourished participants, control could be implemented in individuals who are not malnourished and therefore not at risk of harm. In determining causality, studies should additionally consider whether QoL-based interventions could improve nutritional status, and if so, how this compares to nutrition interventions improving QoL. Further, more research is needed examining the potential confounding variables in aged care which may be impacting both residents' nutritional status and QoL. Whilst this may inevitably include more enduring factors such as psychopathology, disease, and physical disability, attention can be paid to the aspects of residents' lives which organisations can enhance. More recently, there has been a small but growing body of literature suggesting that the dining experience may have a powerful influence on both nutrition and QoL (Carrier et al., 2009; Evans et al., 2001; Herzberg, 1997). The dining experience, an often under-appreciated factor in nutrition research, encompasses aspects such as food quality, food presentation, and the eating/dining environment (Mathey, et al., 2001; Nijs et al., 2006). It would be valuable for future studies to examine such aspects of the dining experience and how these may be tailored to benefit both nutritional status and QoL.

Conclusion

Given the lack of research in aged care settings, the current study serves as an imperative step to understanding the relationship between nutritional status and QoL in aged care. Whilst results from the study's first correlational meta-analysis simply affirmed a positive relationship, combined analyses of intervention studies help to indicate the beneficial effects nutrition interventions can have on self-perceived QoL. Although caution should be taken in the meta-analysis of RCTs considering the analyses moderate heterogeneity and a non-significant result, the finding remains meaningful and may point to methodological issues as opposed to a lack of effect. Such methodological issues are palpably present across the literature, with inconsistencies across nutrition indices, use of proxies in QoL assessment, and lack of control over confounding variables all limiting the current review. Moving forward, to improve comparability and establishment of causation, more is needed in the use of standardised measures, RCTs, and exploration of pertinent influencing variables. With guidance from the current study's findings, further research can help clarify both the bidirectional relationship between nutritional status and QoL, and the importance of nutrition support in QoL maintenance in aged care.

References from Ebony Tucker Systematic Review

References marked with an asterisk indicate studies included in the meta-analysis

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Summary of interventions used in included quasi-experimental studies and randomised controlled trials of Ebony's Literature review

Study	Study design	Intervention
Abizanda et al. (2015)	Quasi-experimental	Participants given ONS (daily intake of 2 200mL bottles containing protein, fat, fibre, carbohydrate, calcium, vitamin D) for 12 weeks. Also included standardised physical exercise training consisting of flexibility, balance, and strengthening exercises 5 days/week.
Beck et al. (2016)	RCT	I: New model of multidisciplinary nutrition support involving a registered dietician, occupational therapist, and physiotherapist. Included specialists meeting once a week to discuss, evaluate, and adjust the support of each participant for 11 weeks. C: Before intervention, a nutrition education program was delivered to educate staff of the participating homes. Goal was to teach how to work with the eating validation scheme. Control also received standard care from each specialist.
Costan et al. (2012)	Quasi-experimental	Participants received one bread bun fortified with 800mg calcium carbonate (320mg elemental calcium) and 125g vitamin D in addition to their normal meals daily for one year.
Crogan et al. (2008)	Quasi-experimental	I: INRx Process: Interdisciplinary research team (registered nurse, nurse researcher, pharmacist, registered dietician) met weekly to review assessment findings for residents. Research based approaches determined and delayed to nursing home staff for implementation. Problems, approaches, and outcomes were recorded for each resident. C: Routine nutrition care.
Martin et al. (2019)	Quasi-experimental	Participants took diabetes-specific ONS (329kcal, 220mL, 12.5g protein, 28.05g carbs, 16.5g fat, 3.3g dietary fibre, 2.2g prebiotics, minerals, and vitamins) twice daily for 3 months.
Parsons et al. (2017)	RCT	I: Residents given access to a range of ONS; (drinks, soups, puddings), flavours, volume (125-200mL),

		energy density. Majority of participants (87%) received ready-made liquid ONS. Daily target provision of ONS was 600kcal and 16g protein. C: Residents given a specially designed diet sheet encouraging intake of high energy foods, drinks, and snacks.
Stange et al. (2013)	RCT	I: Residents offered 2 bottles of ONS with low volume (125mL) and high nutrient and energy density (2.4kcal/mL, 12g protein, and 300kcal per bottle) per day supplementary to regular meal for 12 weeks. ONS provided between meals to avoid a satiety effect on normal food intake. Staff were instructed to encourage residents to consume the amount offered, and different flavours and times offered to support compliance. C: Residents received usual care, which included provision of homemade snacks or ONS when prescribed by their physician or family.
Torma et al. (2015)	Quasi-experimental	I: 1-year multifaceted intervention involving feedback on baseline characteristics of residents, initial mealtime observations, and encouragement for critical inquiry regarding current nutritional practices. Facilitator met with practitioners every 3-4 weeks over a 1-year period. C: Educational outreach visit (EOV) involving personal visit by a trained person to healthcare professionals in their own setting. EOV was a 3hr lecture on 1 occasion about operationalised nutritional guidelines. Also included limited feedback on mealtime observations and clinical measurements of residents baseline results.
Yeh et al. (2000)	RCT	I: Megestrol acetate (MA) oral suspension, involving 800mg per day for 12 weeks. C: Placebo (unknown) 20mL. Both groups had their treatment each morning at 10:00AM (2 hours after breakfast).

Appendix 5: Narrative review on taste and age

TASTE AND AGE

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Abstract

An often under-appreciated factor contributing to malnutrition in older adults is the age-related change in taste perception. In this review we examine the factors that influence taste in older adults with a focus on findings from residential age care settings. The review includes an overview of the physiology of taste, age-related changes in taste, impact of disease and medication on taste, and emerging findings examining the impact of time-of-day and sleep on taste. The review summarises the factors reported to promote taste and, hence, appetite, and discusses the need to change the focus from nutrients to food delivery. We conclude that

strategies that improve food type, flavour perception, and the eating environment offer much promise in enhancing taste and, thereby, nutrition in older adults.

Introduction

Malnutrition is recognised health risk in older age [1]. This is especially evident in residential aged care affecting an estimated one in two older Australian [2]. The factors underpinning malnutrition in residential aged care are myriad, but can be broadly divided into institutional and clinical factors. Institutional factors include: the lack of knowledge about malnutrition, the low ranking of nutrition in the list of care priorities, the poor nutritional quality of food and inadequate staffing levels [3-5]. The clinical factors include: swallowing disorders, depression (affecting the motivation to eat), medication, dentition, dementia, gastrointestinal health and the impact of disease [6-11]. Of the latter a further and often under-recognised factor, but a problem often cited by older people in residential aged care is that food lacks taste [12]. A diminution in taste acuity or dysgeusia is a well-recognised feature of aging [13]. Taste acuity is known to be affected by salivary flow, odour perception, chemoreceptor sensitivity, oral health, dentition, mastication and oral texture perception, and a variety of medications [11]. However, two less well-appreciated influences on taste acuity include sleep and the timing of food. For example, the threshold for sour taste is elevated after sleep deprivation [14], while the threshold for salt taste demonstrates circadian rhythmicity with a raised threshold at night [15] and, similarly, appetite and food choice also demonstrate circadian rhythmicity with a lowered appetite and a preference for energy dense foods at night [16, 17]. Notably, sleep and circadian disorders are common in

aged care residents [18-20], but the consequences for taste acuity and food choice have yet to be mapped.

Given its importance for appetite, strategies that promoting taste in residential aged care offer potential gains in health and life satisfaction. This review aims to summarise the literature examining taste acuity in older adults with a focus on findings from residential aged care settings. It will also expand on the physiology of taste, the factors contributing to dysgeusia in older adults with a particular focus on common diseases and medications, examine new findings in the sleep and circadian literature and discuss strategies that promote taste especially those examining the impact of food presentation, food texture, flavour enhancers, olfactory simulation and the dining environment.

Physiology of Taste

Taste is also known as chemosensory perception. As the word 'chemosensory' suggests, taste perceptions involve the detection of chemical compounds, which subsequently perceived as five widely accepted taste qualities namely sweet, sour, bitter, salty, and umami [21]. More recently, scientists have also discovered human's ability to taste fat [22] and non-sweet carbohydrate [23]. Chemical compounds that give rise to taste perception are also known as taste stimuli or tastants. The detection of tastants begins in (but not limited to) the oral cavity. Gustation, or the sensation of tasting, is a complex process that involves multiple organs, and the most important of all is arguably the tongue. Some scientists suggest that the human tongue serves as a 'gatekeeper' that not only guides food intake and selection [24] but also

allows humans to only select and consume foods that are safe. For example, sour taste warns the body of potential ingestion of spoiled foods while bitter taste suggests toxic compounds.

The tongue is able to detect and discriminate various taste qualities at very low concentrations because its unique anatomical features [25]. This is due to taste buds that are found in distinct gustatory papillae (small bumps) of the tongue namely circumvallate, foliate and fungiform papillae [26]. However, the density of taste buds is not uniform across these papillae and between individuals [27], hence similar concentration of tastants may be perceived as different intensities between individuals. Different taste cells can be found in each bulb-shaped taste bud. Of these, type I, II and III taste cells are elongated and have different types of microvilli apically that reach the pore of the taste bud, which allows taste cells to detect tastants. Taste cells possess transmembrane taste receptors or ion channels for specific taste. For example, type II cells are able to detect non-ionic sweet, bitter and umami tastants due to the presence of G-protein coupled receptors [28]; type III cell possess channels for ionic sour taste [29]; sodium can enter taste cells through epithelial sodium ion channels, thus invoke salty taste [30]. It should be highlighted that apart from the tongue, taste buds are also found in the epithelium of the palate, oropharynx, larynx and the upper oesophagus [31]. Sweet taste receptors have also been found outside of the oral region and throughout the gastrointestinal tract in humans, however the activation of sweet taste receptors outside of the oral cavity is not reported to affect the perception of sweet taste [32].

Two other important factors that affecting taste perception are saliva and the functioning of the neural networks innervating taste cells. Saliva plays a crucial role in facilitating the

tastants (chemical compounds) to be detected by taste receptors in taste cells. Eating, or to a lesser extent the smelling and sighting of foods alone [33], stimulates saliva production. Saliva plays a number of key roles in food ingestion such as breaking down of foods, assisting in the swallowing and digestion of food, tooth protection, as well as protection of oral mucosa [34]. Saliva also allows chemical compounds from the breakdown of foods (mechanically or via enzymatic reactions), i.e. tastants, to be dissolved, detected by the microvilli of taste cells to be perceived as taste qualities.

The second important factor affecting taste perception is the innervation of taste cells [35]. Chorda tympani branch of cranial nerve VII, cranial nerve IX [36], and cranial nerve X (vagus nerve) transmit signals to the nucleus of solitary tract and gustatory cortex of the brain [37]. In addition to taste the other elements that contribute to food flavour such as smell, temperature, chemical irritation (by alcohol, spicy foods, menthol, carbonation) and texture are also transmitted to the brain via the trigeminal nerve [38, 39]. These nerves are vulnerable to peripheral damage from multiple sources (e.g., otitis media, tonsillectomy, head injury, radiation treatment) impacting taste perception and other elements involved in food flavour [40, 41].

Older Adults and Taste Sensitivity

Taste sensitivity is well known to be diminished in older adults [42-44], especially older adults in acute care settings [45]. Moreover, there appears to be a gender difference with a greater loss of taste reported in older men [46]. However, not all elements of taste perception appear to change with age. Winkler et al. [47] in their review conclude that there is an age-related

decreases in the sensitivity to salty and bitter but not sweet and sour tastes. By contrast, more recent findings suggest that sour taste may be affected by age [48]. The mixed findings may be partly explained by the difficulty of disentangling the age-related changes in taste perception from the effect of disease (e.g. Alzheimer's disease, diabetes mellitus, obesity) [21, 49] and impaired olfactory function in older adults [50]. Both disease and impaired olfactory functioning in older adults are associated with impaired taste perception with negative implications for appetite and food enjoyment [51, 52]. As well as the latter confounds, methodological differences such as study design, inappropriate comparison groups may also underlie the mixed findings [53].

There are a number of possible explanations underlying blunted taste sensitivity in older adults. A major factor is thought to be the age-related reduction in taste bud density. The density of both the number of taste buds and, as well, the number of taste cells within taste buds are reported to be lower in older than younger individuals [54, 55]. Lower taste bud density is associated with reduced taste intensity perception [27, 56]. A further contributory factor may be age-related changes in the neural systems involved in the signalling of taste perception, but this possibility remains to be explored.

Another potential explanation for blunted taste sensitivity in older adults are the age-related changes in saliva. Aging is associated with a reduction in the secretory reserve capacity of salivary glands, reduced salivary flow rates (especially post-menopausal women [57] and those with select diseases or on certain medications [e.g. 58, 59]) and change in salivary composition towards higher concentrations of sodium and potassium [60-63]. A primary role of saliva is to dissolve and deliver tastants to taste cells. Adequate salivary flow is important

for maintaining the milieu of taste receptors and, in turn, appetite [64]. Higher concentrations of sodium and potassium are known to lead to gustatory adaptation and, as a consequence, higher salt taste threshold which can lead to excess salt intake in older adults with consequent risks for cardiovascular disease [65].

Interestingly, some of the effects of the age-related change in taste perception may be reversible. Shiffman et al. [52] discuss various techniques for improving salivary health including flavour intensification and strategies to stimulate smell and taste with positive effects on appetite. Abdel-Moemin et al. [66] discusses strategies that might better meet the needs of consumers who have sensory-taste deficits and recommends that the food science community begin designing food specifically for this client group.

Disease and Taste

Taste disorders are more prevalent in hospitalized and institutionalized older adults compared with those living in the community [45, 67]. Many diseases have been shown to be associated with altered gustatory function (Table 1). Many of which are commonly seen in the elderly population, particularly Alzheimer's disease, diabetes mellitus, obesity and heart disease [68, 69].

Alzheimer's disease is one of the most commonly diagnosed neurodegenerative disorders in Adults over the age of 65 years and results in losses in the orbitofrontal cortex and limbic cortex [70]. This is important in this context as afferent taste stimuli run through the limbic cortex on the path to the orbitofrontal cortex, suggesting taste sensitivity may be impacted by Alzheimer's disease due to processing within the brain [71]. Indeed consistent with this

hypothesis, Ogawa [71] has demonstrated decreased gustatory functioning but not taste thresholds in Alzheimer patients compared to age matched controls.

Table 1. Diseases associated with taste disruption [68, 69]

Disease Cluster	Disease
Infections/ Autoimmune disease	Sinusitis, upper respiratory infections, chronic hepatitis C
Neurological	Dementia, Alzheimer's disease, Parkinson disease, multiple sclerosis, epilepsy
Malignancy	Tumours
Endocrine/ Metabolic	Diabetes mellitus, hypothyroidism
Dental	Periodontal disease, dental caries, oropharyngeal candidiasis
Organ specific disease	Chronic kidney disease, heart disease, liver failure

A second common disorder in older adults is diabetes mellitus which has a well-described impact on gustatory function with an estimated more than one-third of adults with diabetes reporting a reduced ability to taste (i.e. hypogeusia) [68, 72, 73]. The reduction in taste perception may be secondary to the higher taste thresholds and lower density of fungiform papillae reported in older diabetics compared to age-matched controls [73]. Diabetes mellitus is also associated with a reduced sensitivity to sweet taste with potentially negative consequence for glycaemic control [74]. Hypogeusia is thought to underlie overeating and obesity in patients with diabetes [72]. Reduced taste sensitivity in patients with diabetes mellitus is also reported to affect adherence to dietary regimes resulting in poor glycaemic control with consequent negative effects on disease related comorbidities such as cardiovascular and chronic kidney disease [75].

Medication and Taste

In addition to the age-related decline in taste sensitivity in the elderly, various drugs commonly prescribed to this population have the potential to affect gustatory function. Altered taste is reported in as many as 75% of all adverse drug reactions between 1988 and 2008 [11]. Further to this, the effects of these drugs on taste can persist for months after cessation of the affecting drug [69]. Some of the regularly offending drugs include proton pump inhibitors, antiretroviral medications, and chemotherapeutic drugs used to treat various forms of cancer (most common in the elderly) [76]. Drugs, excreted in saliva via passive diffusion from the plasma or carrier-mediated transport, have the ability to disturb gustatory function by a number of different mechanisms including drug-receptor interaction, action potential propagation in cell membranes, and altered neurotransmitter function [52, 68]. Medications can also have an indirect effect on taste perception secondary to mucosal dryness and burning mouth syndrome [77, 78].

Sleep, Time-of-Day and Taste

To anticipate daily changes in the environment, humans evolved internal time-keeping or 'clocks' made up of cellular feedback loops [79]. These cellular clocks help to control various bodily functions including sensing (e.g. smell), activity, feeding, metabolism, sleep, cognitive function and immune function [80] and many follow a 24h or circadian rhythm (from the Latin circa, meaning "around", and diem, meaning "day"). These rhythms mean that we are more likely to want to eat certain foods at certain times of the day. Sensitivity to a particular taste may make particular foods more attractive or palatable in the morning vs the evening or vice versa.

Over all there has been very little research into the circadian rhythms of taste. Research using an animal model has found that the clocks regulating taste help the animal to restrict daily food consumption [81] and that gustatory physiology in general appears to be tuned to a higher level during daytime. This suggests that feeding is, in some animals, gated by taste. In humans it has been found that changes in mouth physiology that influence taste have a circadian rhythm such as oral temperature and salivary flow [82]. Both are highest in the late afternoon between 3pm and 5pm.

Several studies have examined recognition thresholds for salt and sweet tastes—i.e. the level at which a taste stimulus can not only be detected but also recognised. Both salt and sweet tastes have been found to exhibited time-of-day variations. Interestingly, they are opposite to each other. The salt threshold, when tested every 3-h for a 24-h period shows the sensitivity to salt is highest in the afternoon [15]; while the sweet threshold shows highest sensitivity in the morning around 8am [83]. However it appears that this diurnal variation is sweet-taste selective—it has not been observed in thresholds for other taste stimuli (such as citric acid, quinine, and monosodium glutamate) [83].

Changes to sleep and sleep loss have implications for health and increase the risk for weight gain [84]. A number of recent studies have found that this relationship is causal with reduced sleep times impacting glucose metabolism [85], increasing appetite for sweet foods [86], and increasing neural responses in brain regions involved in both gustatory and reward processing to images of palatable foods [87]. It has been hypothesised that sleep loss or disrupted sleep might change the way we perceived the taste of foods and, therefore, why we might seek out or crave certain types of foods when we are sleep deprived.

Results from studies on the impact of sleep duration on taste are mixed. Some studies have found that taste is impacted, while others have not. One study that did find a change with sleep duration examined sleep loss and taste for umami, sourness, and bitterness [88]. That group found that increasing sleepiness due to reduced sleep time was a significant factor in the perceived intensity of both umami and sour taste, with both rated as significantly higher with increasing sleepiness. Sleepier participants also reported a higher cravings for high fat sweet foods, perhaps leaving them vulnerable to overconsumption [88]. A number of studies have also reported no link between sleep loss and taste. These studies focused on perceptions of sweet or salty foods [89] and found that taste did not change with reduced sleep time. This suggests that altered processing of sweet tastes is an unlikely to be the mechanism by which sleep deprivation affects the hedonic control of eating.

Taken together there is emerging evidence suggests that there are time-of-day changes in how we taste sweet and salty food and that sleep loss and sleepiness can impact some aspects of taste—the savoury umami and sour flavours are increased, while others, the sweet and salty flavours remain unaffected. This is important when considering how people who may not sleep well might respond to certain foods and what kinds of food they might prefer in the morning versus the afternoon. It is important to keep in mind that all the sleep and time-of-day studies have been conducted in young healthy men and women. How circadian rhythms and sleep might impact taste in older populations is unknown and worthy of further research.

Promoting Taste and Appetite: Changing the Focus from Nutrients to Food Delivery

Food plays a profound role in one's life. The ability to choose what, when to eat as well as the eating environment all influence the pleasure associated with eating. There are differences in the way individuals perceive flavours that depend on physical differences, including genetics and differences in the tongue [90, 91]. One of the factors that influences when and how much we eat is our feelings of *satiation*, which tell us when to stop eating, and our *satiety*, which affects the interval between food consumption periods [92]. Satiation and satiety effects of foods are a product of our senses and our cognition. In addition to physical responses to foods governing how full we feel (e.g. gastric distension, hormonal cascades), we have anticipatory sensory and cognitive reactions to foods (e.g. how pleasurable we think consumption will be, other associations with the food) [92]. In this way, our preferences are strongly linked with lifetime experiences and traditions and removing the ability to decide on foods to eat can impact on overall quality-of-life [93]. The familiarity of foods that taste like home and remind them of their ethnic identity has been reported as being important [94]. These factors remain important as we age, yet in residential aged care settings these factors can be a challenge to manage [95].

A focus on food hygiene to reduce the risk of food-borne disease may limit the variety of foods available to residents in aged care facilities [96]. In addition, food availability is also limited by the need to ensure that foods and fluids are provided that meet the nutritional requirements for the residents to ensure nutritional status is optimised, and that malnutrition risk [97] and dehydration risk [98] are minimised. Yet, it is important to recognise that food choice is strongly linked with resident food service satisfaction [99]. Mealtimes represent more than

just an chance to provide nutrition; they may offer residents (and staff) the opportunity to develop important social relationships [100]. Furthermore, the environment that residents eat in will also impact on satisfaction associated with the food service [94].

These are critical concerns in the context of the well-documented phenomenon referred to as the “anorexia of aging” [92, 101]. As we get older, food consumption reduces. It has been estimated that between the ages of 40 and 70 years, energy intake reduces by about 25% [102]. In later life, we tend to eat more slowly, feel less hungry and thirsty, eat smaller meals, and eat less between meals [92]. Often, our reduction in energy expenditure is not sufficient to maintain energy balance, resulting in weight loss. In addition, as we age, our food perception and enjoyment is also influenced by changes in dental health, sensory changes (reductions in vision, taste, and smell), and changes in gut function. Alterations in cognition including dementia and mood disturbances also impact on our appetite and enjoyment of food [92, 101]. Perceptions of taste appear to be one of the main factors influencing energy intake in older adults [103, 104]. Therefore, when considering food provision for elderly people, especially in the context of aged care, it is important to go beyond a focus on nutrients to include consideration of food delivery. This includes thought regarding the types of foods offered, as well as the environmental, social, and sensory experience. These factors are summarised in Figure 1, and are the subject of elaboration in the following sections.

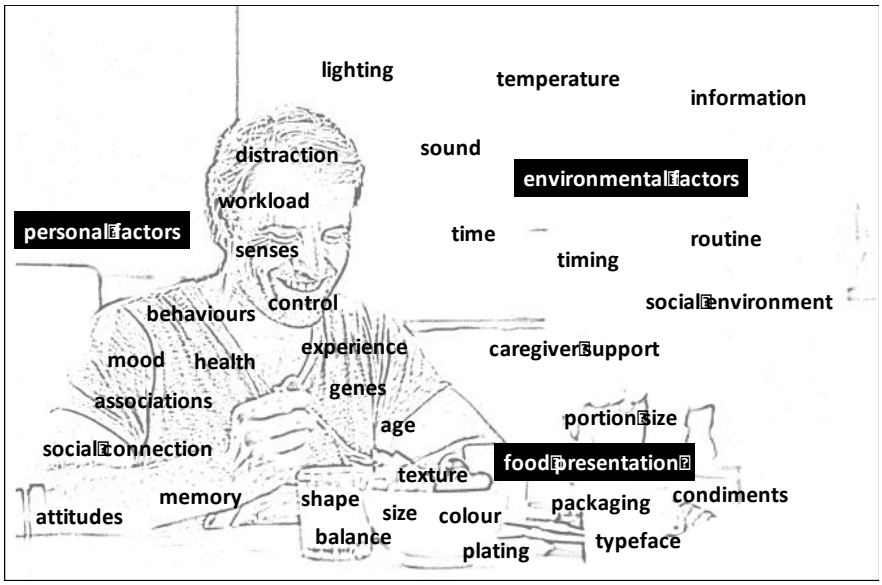

Figure 1. A summary of the personal, environmental and food presentation factors influencing the perception of taste and enjoyment of food.

Addressing Food Types in Older Adults

Older adults are more concerned about food texture compared to younger adults, as they commonly have difficulty consuming hard, crunchy, dry, and stringy textured foods [105]. When developing foods for older adults, consideration should be given to the increased requirements for specific macro- and micronutrients with age, especially protein, calcium, vitamin D, and vitamin B [105]. In addition, the quality of fat should be a factor in food provided. One recommendation has include offering nutrient density snack options that are rich in several of these key nutrients such as dairy [97] and nuts or nut butters [106].

Detection thresholds in older adults for basic tastes such as sweeteners, salt, acids, and bitter compounds, have been found to be 4 to 5 times higher than in comparison to younger adults [107]. This reduction in their ability to detect flavours in food may lead to a bland food

experience and to a move toward an increase in discretionary foods with more intense flavours, for example, those containing higher levels of sugar or salt [108]. When considering developing new foods it is essential to consider the nutrient quality but other aspects such as whether they are easily accessible, appealing, and with appropriate sensorial attributes (appearance, presentation, size, colour, flavour, texture, and consistency) that would be traditionally and frequently consumed [109, 110]

Flavour enhancers have been shown to increase food intake which can be of benefit when appetite is reduced [111, 112]. Incorporating natural ingredients rich in umami taste or intense flavour ingredients (such as tomatoes, sharp-aged cheese, shiitake mushrooms, soy and garlic, onion, concentrated fruit sauce or flavoured oils/vinegars, or spices with bolder aromas, that is, basil, chives, coriander, and sage rosemary) could also assist with enhancing appetite and pleasure associated with food consumption [105].

Addressing the Senses to Enhance Flavour Perception in Older Adults

There is also evidence that flavour perception can be altered by changing visual cues such as lighting, sounds, odours and texture of foods [113]. Not only the colour of an individual food, but also the variety and the arrangement of the differently-coloured components in a meal influence consumers' ratings of the pleasantness of a meal [114]. While in general, the variety of foods consumed decreases with age, voluntary consumption of food can be promoted by including an element of variety, even within very similar foods. For example, providing sandwiches with different fillings results in higher sandwich consumption in older adults [115]. Portion size is another important visual cue that influence taste perception and

enjoyment. Presenting small portion sizes, in particular, when the foods presented are high in energy density, results in increased energy intake in older adults [92].

Other visual factors that promote food consumption that have been studied in general (as opposed to specifically older) populations include: food that is arranged on a balanced way on the plate (i.e. not "asymmetric plating") [116]; and having a larger container for the food relative to the portion size [117, 118]. People have also been shown to associate visual properties of food with certain flavours. Referred to as "synaesthetic associations," these include relationships between roundness and sweetness, and angularity and bitterness [119]. People also more easily identify flavours that match with their typically associated colours [120]. Perceptions of food are also influenced by plate, bowl or package colour, graphics [121-124], shape and curvature [122, 125], naming of the food and information provided [126, 127], and even the typeface of the written food information [128].

Given the above discussion regarding the importance of colour and flavour, other studies have investigated the provision of condiments along with meals. Not only can condiments add colour and flavour to the main dish, but depending on the packaging, or serving system, they can add colour and interest to the table setting (reviewed in [129]).

The texture of foods offered presents a challenge to enjoyment; residents may have impairments in the ability to chew and swallow easily which can result in very restricted of very soft food. These are often not as palatable as foods with a broad range of textures [130] and can lead to a poor appetite [131]. A study by Endo et al. [132] reported that providing a

crunchy sound whilst adults consumed texture modified foods altered the perception of the food and improved satisfaction ratings.

Addressing the Eating Environment

The design of the dining room and the environment in the dining room can contribute to the dining experience. A supportive environment can provide a sense of familiarity, comfort, security, enjoyment, belonging and identity [133] and contribute to overall nutrition status by encouraging food consumption [134, 135]. Creating mealtime ambiance, through low temperatures, soft lighting, flowers, table-cloths, and full cutlery, is also reported to increase food consumption [92]. Nevertheless, not all studies report positive results. At least one study has reported that the amount of food consumed by aged care residents did not differ between those who had a positive compared to a negative view of the dining room environment [136].

Sound can impact on food consumption. For example, researchers have shown that food consumption goes up when music is played (reviewed in [137]). Studies have also suggested that sound level may impact differentially on different flavours. One study simulating airline cabin noise (>85 dB) reduced sweet taste intensity ratings, but augmented reports of umami flavours [138]. Research has also highlighted the importance of auditory feedback (e.g. crunching noise associated with biting) in perception of food texture [139].

The social aspects of meals are extremely important. Living alone and feeling socially isolated has been suggested to contribute to reduced food consumption, particularly for those who

are older, and particularly for men. In contrast, eating with other people increases the amount of food consume [92]. In the residential care or hospital environment, meal-time ambiance can be improved by staff sitting and eating with residents, and encouraging family members or friends to visit during mealtimes can encourage people to eat [92]. Minimising procedural interruptions (e.g. for medication administration) is preferred to maintain perceptions of the importance of mealtime, as well as to allow people to consume hot food before it cools, becoming less palatable. This also separates medical aspects from food consumption, 'de-medicalising' mealtimes [92]. Protected Mealtime Interventions have been defined as minimising "unnecessary and avoidable interruptions, providing an environment conducive to eating" (p544, [140]). Studies support the promise of Protected Mealtime Interventions, especially when combined with eating support, where necessary, from trained professionals [92, 140]. All of these considerations impact on the emotional state of the individual, which in turn, influences appetite and taste perception. Negative moods have been associated with higher intensity reports of bitter tastes, whereas positive moods are associated with enhanced sweeter tastes [141].

Practical recommendations from qualitative interviews with residents have included making the environment feel like home, offering food choices without using trays (e.g. use hot carts in dining rooms), serve the food family style (where people serve themselves form bowls of food at the table) and allow residents dining together to choose portion sizes and which foods they prefer, serving cultural or ethnic foods regularly, providing an opportunity for anonymous feedback on the food to allow residents to have a voice and make suggestions [94, 99, 142]. Further suggestions have included flexibility in the timing of meals [94], the use

of high visual contract tableware (e.g. bright red crockery) can help people with visual deficits [143]. A study by Hung et al. [133] suggested allowing staff to help residents see meal preparation. Another study in residents with dementia reported that including residents in the decision of how meals should be prepared added to the enjoyment of the meal and enhanced engagement in mealtime conversations [144].

A summary of the factors that influence taste perception and food intake in older adults is provided in Table 2, alongside related recommendations.

Table 2. A summary of factors that influence food intake in older adults, and associated recommendations.

	Influencing factors	Recommendations
Types of foods offered	Texture influences palatability We have changing nutritional requirements as we age Changes in senses and detection thresholds may lead to bland food experience	• Avoid hard, dry, or stringy foods • Where possible, include crunchy foods (not too hard) and foods with a broad range of textures tend to be more palatable • Make sure there is sufficient protein, calcium, vitamin D, vitamin B • Consider the quality of fats • Flavour enhancements may be of benefit • May be useful to include natural ingredients rich in umami taste or intense flavours

Senses and flavour perception of food	Flavour perception can be altered by visual cues	• Use a variety of foods that include a mix of vibrant colours
		• Use small portion sizes that are energy dense
		• Balanced plating for visual appeal
		• Consider
		  • container/plate/bowl size
		  • synaesthetic associations
		  • food naming and information provided
		  • package colour, graphics, shape
		• Provide condiments

Eating environment	Taste and flavour can be altered by ambiance	• Where possible, create a meal environment with a lower ambient temperature, softer lighting, flowers, table-cloths, cutlery

A supportive, familiar, environment improves meal-time experience	• Create feelings of security, comfort, enjoyment, belonging, and identity • Provide familiar foods with attention to cultural traditions • Serve food 'family style' and allow residents to control portion sizes • Provide opportunities for anonymous feedback
Sound influences flavour	• Play music - this can increase the amount of food eaten • Avoid areas that are too loud – this can influence taste perception and render individuals unable to hear auditory feedback while biting food (e.g. crunching noises) that can impact perception and enjoyment
The social aspects of meals are really important	• Create opportunities for people to eat with others • Encourage family and friends to visit during mealtimes • Encourage staff to eat at tables with clients
Interruptions can impact negatively on mealtime experiences, creating unintended negative associations	• Protect meal times • Keep medications separate from meal times to avoid 'medicalisation' of food • Provide eating support, where necessary, by people who have appropriate training, and who are also cognisant of the social aspect of interactions during the mealtime context

Conclusion

The realisation that taste changes with age is an unremarkable but often underappreciated fact-of-life. Taste and its importance for health and well-being have been reasonably well-described and especially the factors that affect nutrition in older age. To a lesser extent, however, the literature has addressed the social, psychological and cultural factors that influence food choice and, hence, nutrition in older adults [145] and, to a far lesser extent, how the latter factors interact with the age-related change in taste. One clear implication is the impact this has for food preparation in residential age care settings. An impact that may be more nuanced then is usually appreciated [146] and one which certainly adds a further layer of complexity to the already complex food management requirements faced by residential age care providers [147]. Much, however, may be gained by addressing food type, flavour perception, and the eating environment.

Turning to the physiology of taste, although the impact of age on taste is reasonably well understood gaps in our understanding remain. Especially the impact of age-related changes in the neural systems responsible for taste perception on taste and appetite. Strategies that promote taste perception and studies evaluating their effectiveness in residential age care settings offer exciting potential areas for future investigation. A further gap is the realisation that taste is impacted by time-of-day and sleep. This is an emerging area for future investigation.

To conclude, in this review we examined the age-related change in taste and, as well, strategies reported to enhance taste including: food type, flavour perception, and the eating

environment. Despite the gaps in our knowledge, we suggest that there exists sufficient evidence that taste can be enhanced in older adults and, thereby, appetite. The remaining challenge is how to promote best practice.

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145. Wright, O.R., et al., *Determinants of foodservice satisfaction for patients in geriatrics/rehabilitation and residents in residential aged care.* Health Expectations, 2013. **16**(3): p. 251-265.
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Appendix 6: Demographics of the collated papers provided by the working group

Title/Author/Journal	Country of Origin	Study Type	Sample Demographics	Keywords
Food and Nutrition in Aged Care				
Australian Setting				
Sossen L, Bonham M, & Porter J (2020). *Does a high-energy high-protein diet reduce unintentional weight loss in residential aged care residents?* Journal of Nutrition in Gerontology and Geriatrics, 39(1), pp. 56-68.	Australia	Observational	122 frail older adults with significant illness, loss of independence and dementia in AC. Mean age ONS group = 88yrs, mean age sHEHP group = 87 yrs).	Aged care; food first approach; food fortification; high-energy high-protein; oral nutritional supplements; unintentional weight loss
Grant C, Dorrian J, Banks S, Coates A, Tan S-Y & Lushington K (2019). *Taste perception: a contributing factor to malnutrition in older adults living in aged care facilities.* Under review.	Australia	Narrative review	N/A	Taste; aging; disease; circadian
Hugo C, Dwonczyk M, Skinner J & Isenring L (2018). *Improving the quality of life of aged care residents through the joy of food: The Lantern Project.* Australas J Ageing, 37(4), pp. 300 – 304.	Australia	Report	N/A	Aged; complexity; diet; food and nutrition; intersectoral collaboration; quality of life.
Bailey A, Bailey S & Bernoth M (2017). *'I'd rather die happy': residents' experiences with food regulations, risk and food choice in residential aged care. A qualitative study.* Contemporary Nurse, 53(6), pp. 567 – 606.	Australia	Qualitative	6 participants, aged 72 – 89 years. Participants length of stay at facility ranged from 6 mths – 7 years. Independent with eating, some assistance needed with ADLs.	Residential aged care; food regulation; risk taking; food choice; food preferences
Iuliano S, Olden A & Woods J (2013). *Meeting the nutritional needs of elderly residents in aged-care: are we doing enough?* J Nutr. Health Aging, 17(6), pp. 503-508.	Australia	Cross-sectional	199 residents (low-level AC facility). Mean age = 86.7 years, 76% female.	Aged-care; food intake; malnutrition; nutrient deficiencies
Nowson CA, Sherwin AJ, McPhee JG, Wark JD & Flicker, L (2003). *Energy, protein, calcium, vitamin D and fibre intakes from meals in residential care establishments in Australia.* Asia Pac J Clin Nutr, 12(2), pp. 172-177.	Australia	Cross-sectional	215 older adults (139 living in NH, 76 in hostels). 114 on full diet, 48 on soft/minced diet, 53 on puree diet. Mean age = 82yrs.	Australia; elderly; nursing homes; hostels; energy intake; protein, vitamin D; calcium; fibre; eating impairment
International Setting				
Nomura Y, Okada A, Kakuta E, Otsuka R, Sogabe K, Tamane K, Yamamoto T, Shigeta Y, Shigemoto S, Ogawa T & Hanada N (2019). *Consistency of supplied food and dentition status of the elderly in residential care homes.* BMC Oral Health, 19(74).	Japan	Cross-sectional, observational	276 elderly AC residents (Mean age = 87yrs).	Supplied food consistency; care level; tooth contact; removable denture
Dorner B & Friedrich EK (2018). *Position of the Academy of*	United States of America	Position paper	N/A	N/A

Nutrition and Dietetics: individualized nutrition approaches for older adults: long-term care, post-acute care, and other settings. J Acad Nutr Diet, 118(4), pp. 724-735.				
Palese A, Grassetti L, Bandera D, Zuttion R, Ferrario B, Ponta S, Hayter M & Watson R (2018). *High feeding dependence prevalence in residents living in Italian nursing homes requires new policies: Findings from a regionally based cross-sectional study.* Health Policy, 122(3), pp. 301-308.	Italy	Cross-sectional, retrospective analyses	8875 completed records (retrospective analysis) for NH residents. 20.7% = total feeding dependence (mean age = 83yrs); 36.1% partial feeding dependence (mean age = 86.5yrs), 43.2% totally independent (mean age = 83yrs).	Feeding dependence; elderly; health-care workforce; nursing home; policy; predictors
Pezzana A, Cereada E, Avagnina P, Malfi G, Paiola E, Frighi Z, Capizzi I, Sgnaolin E & Amerio ML (2015). *Nutritional care needs in elderly residents of long-term care institutions: potential implications for policies.* J Nutr Health Aging, 19(9), pp. 847-954.	Italy	Cross-sectional	1394 elderly residents in LTC (mean age = ~84yrs).	Long-term care; elderly; malnutrition; risk of malnutrition; treatment
Crogan NL, Evans B, Severtsen B & Schultz JA (2004). *Improving nursing home food service: uncovering the meaning of food through residents' stories.* J Gerontol Nurs, 30(2), pp. 29-36.	United States of America	Qualitative	9 participants (Aged 20 (n=1), 40 (n=2), 50 (n=1), >61 (n=5).	N/A
Nordenram G, Ryd-Kjellen E, Johansson G, Nordstrom G, Winblad B (1996). *Alzheimer's disease, oral function and nutritional status.* Gerodontology, 13(2).	Sweden	Case control	40 NH residents with Alzheimer's disease (age range 73-100 yrs); 40 community-dwelling age/gender-matched controls (age range 75-95 yrs)	Dementia; elderly; oral status; oral function; nutrition
Mealtime Experiences				
Australian Setting				
Milte R, Shulver W, Killington M, Bradley C, Miller M & Crotty M (2017). *Struggling to maintain individuality – describing the experience of food in nursing homes for people with dementia.* Arch Gerontol Geriatr, 72, pp. 52-58.	Australia	Qualitative	13 participants with diagnosis of dementia or CI (n = 10 in NH setting, n = 3 community-dwelling), 6 family members. Mean age = 78yrs.	Long-term care; quality of care; nutrition and feeding issues; qualitative research; dementia
Keller H, Beck A & Namasivayam A (2015). *Improving food and fluid intake for older adults living in long-term care: a research agenda*. J Am Med Dir Assoc, 16(2), pp. 93-100.	N/A	Research agenda	N/A	Food; fluid; intake; long-term care; consensus; research priorities
Kenny B (2015). *Food culture, preferences and ethics in dysphagia management.* Bioethics, 29(9), pp. 646-652.	Australia	Composite case study	Case: 68yrs old, born in Italy, suffered CVA, resulting in dysphagia, right-sided hemiplegia and dysarthria.	Clinical; dysphagia; food culture and preferences; speech pathology; shared decision-making

Bernoth MA, Dietsch E & Davies C (2014). *'Two dead frankfurts and a blob of sauce': the serendipity of receiving nutrition and hydration in Australian residential aged care.* Collegian, 21, pp. 171 – 177.	Australia	Qualitative	43 participants (families, carers or friends of residents living in AC facilities).	Nutrition; hydration; frail aged; elderly care; residential aged care.
International Setting				
Wu S, Morrison JM, Dunn-Ridgeway H, Vucea V, Iuglio S & Keller H (2018). *Mixed methods developmental evaluation of the CHOICE program: a relationship-centered mealtime intervention of long-term care.* BMC Geriatrics, 18.	Canada	Mixed methods developmental evaluation	64 residents (32 per home area, mean age = 85yrs); 25 staff in LTC facility.	Dining; complex intervention implementation; evaluation; program development; implementation science; mealtimes; long-term care; residential care; relationship-centered care; personal support workers
Chaudhury H, Hung L & Badger M (2013). *The role of physical environment in supporting person-centered dining in long-term care: a review of the literature.* Am J Alzheimers Dis Other Dementia, 28(5), pp. 491-500.	Canada	Literature review	N/A	Physical environment; mealtimes; dining; person-centered care
Hung L & Chaudhury H (2011). *Exploring personhood in dining experiences of residents with dementia in long-term care facilities.* J Aging Stud, 25(1), pp. 1-12.	Canada	Qualitative	10 residents per site (n=20), with diagnosis of dementia ranging from moderate to moderately severe. Mean age ~88yrs.	Personhood; mealtimes; nursing homes; dementia
Innovation in Food Service in Aged Care				
Australian Setting				
Cave DP, Abbey KL & Capra SM (2019). *Can foodservices in aged care homes deliver sustainable food fortification strategies? A review.* Int J Food Sci Nutr, 71(3), pp. 267 – 275.	Australia	Narrative review	17 studies included in data synthesis (6 quasi-experimental, 11 RCT).	Food fortification; foodservices; aged care; older adults
Hugo C, Isenring E, Miller M, Marshall S (2018). *Cost-effectiveness of food, supplement and environmental interventions to address malnutrition in residential aged care: a systematic review.* Age Ageing, 47(3), pp. 356-366.	Australia	Systematic review	62 participants with Alzheimer's disease (mean age = 75yrs)	Malnutrition; systematic review; cost; aged care; economic; older people
Hugo C, Isenring E, Sinclair D & Agarwal E (2018). *What does it cost to feed aged care residents in Australia?* Nutrition & Dietetics, 75, pp. 6 – 10.	Australia	Retrospective analysis	817 RACFs (64256 residential beds, 23 million bed-days nationally).	Aged, budgets, malnutrition, nursing homes.
Abbey KL, Wright ORL & Capra S (2015). *Menu planning in residential aged care – the level of choice and quality of planning of meals available to residents.* Nutrients, 5, pp. 7580 – 7592.	Australia	Mixed methods	247 RACFs in national menu survey; 161 menus in menu analysis; 36 RACFs in meal environment analysis.	Menu planning; choice; quality; aged care standards.

International Setting				
Ilhamto N, Anciado K, Keller KH & Duizer LM (2014). *In-house pureed food production in long-term care: perspectives of dietary staff and implications for improvement.* J Nutr Gerontol Geriatr, 33(3), pp. 210-228.	Canada	Qualitative	27 nutrition managers (0-30 yrs experience), 26 cooks (0-40 yrs experience) across 25 LTC homes.	Dysphagia; in-house production; long-term care; puree; texture modified food
Dunne JL & Dahl WJ (2007). *A novel solution is needed to correct low nutrient intakes in elderly long-term care residents.* Nutr Rev, 65(3), pp. 135-138.	Canada	Narrative review	N/A	Aged; deglutition disorders; elderly; fortified food; long-term care; malnutrition
Guidelines in Aged Care				
Australian Setting				
The Centre for Workforce Futures at Macquarie University and Skills IQ Limited on behalf of the Pathways and Tertiary Education Special Interest Committee (PATESIAC) and the Aged Services Industry Reference Committee (ASIRC) (2020). *Pathways and tertiary education in aged care.*	Australia	Discussion paper	N/A	Aged care; vocational and higher education; health professionals; career pathways; skills
Fleurke M, Voskuil DW & Beneken genaamd Kolmer DM (2020). *The role of the dietitian in the management of malnutrition in the elderly: a systematic review of current practices.* Nutr Diet, 77(1).	Australia, Canada, The Netherlands, UK, Austria, Germany	Systematic review	N/A	Aged; dietetics; malnutrition; professional role; systematic review
Cichero JAY, Lam P, Steele CM, Hanson B, Chen J, Dantas RO, Duivestein J, Kayashita J, Lecko C, Murray J, Pillay M, Riquelme L & Stanschus S (2016). *Development of international terminology and definitions of texture-modified foods and thickened fluids used in dysphagia management: the IDDSI framework.* Dysphagia, 32, pp. 293-314.	N/A	Discussion of framework development	N/A	Deglutition; deglutition disorders; swallowing; dysphagia diet; texture-modified; thickened fluid; food and fluid standards
Bennett MK, Ward EC & Scarinci NA (2015). *Mealtime management in Australian residential aged care: comparison of documented, reported and observed care.* Int J Speech-Lang, 17(5), pp. 451 – 459.	Australia	Mixed methods	14 resident files, 41 mealtime observations, 14 resident questionnaires and 29 staff questionnaires triangulated.	Aged care, dysphagia, speech-language pathology, mealtime care.
Beattie E, O'Reilly M, Strange E, Franklin S & Isenring E (2012). *How much do residential aged care staff members know about the nutritional needs of residents?* Int J Older People Nurs, 9, pp. 54 – 64.	Australia	Cross-sectional	76 participants, 50 provided demographic data: 90% female, 52% aged 45-60 years, 22% had completed bachelor's degree or higher, 32% postsecondary certificate or diploma.	Malnutrition; mealtime practices; nutrition knowledge; old age; residential care; staff
Isenring EA, Banks M, Ferguson M & Bauer JD (2011). *Beyond malnutrition screening: appropriate methods to guide*	Australia	Cross-sectional, observational	127 LTC residents (high care = 57.5%, low care = 42.4%), 48.8% with	Dietetics; nutrition screening; malnutrition; aged care; nutrition

nutrition care for aged care residents. J Acad Nutr Diet, 112(3), pp. 376-381.			dementia diagnosis, mean age = 82yrs.	
Coroners Act South Australia (1997). *An inquest taken on behalf of our Sovereign Lady the Queen at Adelaide in the State of South Australia, on the 7th day of April, and 8th day of May, 1997, before Wayne Cromwell Chivell, a Coroner for the said State, concerning the death of Giuseppe Maiolo.*	Australia	Legal report	Case: 67yr old male, left hemisphere CVA with swallowing problems.	Inquest; coroner; death; nursing home; asphyxiation; choking on food; nursing care – standard of.
International Setting				
Hansjee D (2018). *An acute model of care to guide eating & drinking decisions in the frail elderly with dementia and dysphagia.* Geriatrics (Basel), 3(4).	England	Mixed-methods developmental evaluation	Audit: 21 patients. Participants in study had diagnosis of dementia, admitted to hospital with aspiration pneumonia.	Aspiration; dysphagia; risk feeding; dementia
Pu D, Murry T, Wong MCM, Yiu EML, Chana KMK (2017). *Indicators of dysphagia in aged care facilities.* J Speech Lang Hear Res, 60(9), pp. 2416-2426.	Hong Kong	Cross-sectional	878 AC residents (mean age = 84yrs).	Older adults; dysphagia; aged care; cognitive function; dentition; oral performance; activities of daily living
Miles A, Watt T, Wong W-Y, McHutchinson L & Friary P (2016). *Complex feeding decisions: perceptions of staff, patients, and their families in the inpatient hospital setting.* Gerontol Geriatr Med, 2, pp. 1-7.	New Zealand	Qualitative study	1 nurse manager, 1 stroke ward specialist, 6 RNs, 3 dietitians, 3 speech pathologists, 3 house officers, 4 registrars, 5 consultants, 3 patients, 3 family members.	Risk feeding; dysphagia; PEG; interprofessional team; shared decision making
Wilson MG, Thomas DR, Rubenstein LZ, Chibnall JT, Anderson S, Baxi A, Diebold MR & Morley JE (2005). *Appetite assessment: a simple appetite questionnaire predicts weight loss in community-dwelling adults and nursing home residents.* Am J Clin Nutr, 82(5), pp. 1074-1081.	United States of America	Prospective cohort study	247 LTC residents (mean age = 79yrs), 868 community-dwelling adults (mean age = 53.5yrs).	Appetite; anorexia; weight loss; elderly; screening tools

Appendix 7: Additional papers

Prior to the release of this literature review, additional research papers were drawn to our attention.

Wang et al 2020

Wang D, Everett B, Brunero S, Northall T, Villarosa AR, Salamonson Y. Perspectives of residents and staff regarding food choice in residential aged care: A qualitative study. J Clin Nurs. 2020 Feb;29(3-4):626-637. doi: 10.1111/jocn.15115. Epub 2019 Dec 11. PMID: 31769898.

Abstract

Aims and objectives: To explore the experiences of food choice and meal service in residential aged care facilities and its impact on autonomy, self-determination and quality of life from the perspectives of both residents and staff.

Background: Globally, residential aged care is a principal provider of care for older people who can no longer live independently at home. Within this setting, lack of food choice has been identified as a significant factor impacting on residents' self-determination, sense of autonomy and quality of life.

Design: This study used an exploratory descriptive qualitative approach guided by self-determination theory.

Method: A total of 14 participants (seven residents and seven staff members) from two Australian residential aged care facilities were recruited through purposive and snowball sampling with assistance from one independent contact nurse at each facility. In-depth, semi-structured interviews were conducted, digitally recorded and transcribed. The COREQ checklist was used in this qualitative study.

Results: Three main themes were identified from the interview data provided by residents and staff, which were as follows: (a) catering for the masses; (b) organisational barriers to providing choice; and (c) food impacts well-being.

Conclusions: This study explored the experiences of food choice and service in residential aged care facilities, from the perspectives of both residents and staff. Results of interviews highlighted the importance of providing adequate food choice which has become an enduring issue that requires more attention and commitment to make a positive change for residents living in residential aged care facilities.

Relevance to clinical practice: Nurses and other staff working in residential aged care facilities need to be aware of the importance of providing adequate food choice, including for residents who require modified diets. As advocates for residents, nursing staff must address the persistent lack of food choice. However, this will require a radical change in organisational culture and strong leadership.

Keywords: assisted living facilities; food preferences; food services; free will; homes for the aged; nursing homes; personal autonomy; quality of life; residential facilities; self-determination.

Milte et al 2017

Milte R, Shulver W, Killington M, Bradley C, Miller M, Crotty M. Struggling to maintain individuality - Describing the experience of food in nursing homes for people with dementia. Arch Gerontol Geriatr. 2017 Sep;72:52-58. doi: 10.1016/j.archger.2017.05.002. Epub 2017 May 17. PMID: 28552702.

Abstract

Purpose of the study: To describe the food and dining experience of people with cognitive impairment and their family members in nursing homes.

Design and methods: Interviews and focus groups with people with cognitive impairment and their family members (n=19). Thematic analysis was undertaken using NVivo10 data analysis software package to determine key themes.

Results: The main themes identified tracked a journey for people with cognitive impairment in nursing homes, where they initially sought to have their individual needs and preferences recognised and heard, expressed frustration as they perceived growing barriers to receiving dietary care which met their preferences, and ultimately described a deterioration of the amount of control and choice available to the individual with loss of self-feeding ability and dysphagia.

Implications: Further consideration of how to incorporate individualised dietary care is needed to fully implement person-centred care and support the quality of life of those receiving nursing home care.

Keywords: Dementia; Long-term care; Nutrition and feeding issues; Qualitative research; Quality of care.

Farrer et al 2015

Farrer O, Yaxley A, Walton K, Healy E, Miller M. Systematic review of the evidence for a liberalized diet in the management of diabetes mellitus in older adults residing in aged care facilities. Diabetes Res Clin Pract. 2015 Apr;108(1):7-14. doi: 10.1016/j.diabres.2014.12.021. Epub 2015 Jan 21. PMID: 25656765.

Abstract

A systematic review of the literature was conducted to review and evaluate the evidence supporting a liberalized diet for the management of diabetes mellitus in aged care homes and examine the effect of this on glycaemia, nutritional status and diabetes comorbidity risk factors. A 3 step search of eight databases followed by independent data extraction and quality assessment by two authors was undertaken. Studies which compared therapeutic diets to a liberalized diet or observation studies reviewing the effects of therapeutic diets on glycaemia and nutritional status were included. Of the 546 studies identified, six met the inclusion criteria. Methodological quality of the studies was rated poor and the majority concluded no statistically significant change in diabetes management outcomes

with a liberalized diet, but modest increases in glycaemia were observed. Inadequate data was available to determine effects of diet change on nutritional status or diabetes risk factors. Overall studies were in support of a liberalized diet but due to the low quality of the evidence and a lack of significant findings it may not be appropriate to extrapolate these conclusions to inform dietetic practice.

Keywords: Aged care; Diabetes; Liberalized diet.

Farrer et al 2019(a)

Farrer O, Yaxley A, Walton K, Miller M. A scoping review of best practice guidelines for the dietary management of diabetes in older adults in residential aged care. Prim Care Diabetes. 2019 Aug;13(4):293-300. doi: 10.1016/j.pcd.2019.02.005. Epub 2019 Mar 11. PMID: 30871835.

Abstract

Over the last two decades guidelines have been published on the subject of the care and liberalised nutrition management of older adults with diabetes in residential aged care, recognising that they may have different needs to those older adults in their own home. This study aimed to scope and appraise these guidelines using the AGREE II tool. Overall physician developed guidelines were more robust, but there was discordance in their recommendations compared to guidelines developed by dietitians; particularly regarding the use of therapeutic diets. A lack of standardised approach has implications for optimal dietary management of diabetes in aged care.

Keywords: Diabetes mellitus; Diet; Guidelines; Older adult.

Farrer et al 2019(b)

Farrer O, Sasanelli L, Matwiejczyk L, Yaxley A, Miller M. The role of dietitians in residential aged care: How do cooks and chefs perceive their contribution? Australas J Ageing. 2019 Jun;38(2):85-90. doi: 10.1111/ajag.12584. Epub 2018 Sep 17. PMID: 30221813.

Abstract

Objective: This study aimed to explore how dietitians could work with cooks and chefs to contribute to best practice.

Methods: Data from interviews and focus groups comprising 38 chefs, cooks and food service managers were analysed. Inductive line-by-line coding of transcripts was conducted within a critical realist framework. Coding was completed independently by two authors before reaching consensus on themes.

Results: Four main themes emerged: (i) knowledge sharing; (ii) communication; (iii) collaboration; and (iv) accessibility. Participants praised dietitians' knowledge and expertise, but some raised concerns about inconsistency in the advice they received.

Conclusion: Dietitians working in residential aged care are ideally positioned to act as advocates for residents and food services. However, findings suggest that experiences of working with dietitians are mixed. Aged care menu guidelines and quality measures could assist, not only in promoting a consistent approach to dietetic advice, but also a system for benchmarking satisfaction and best practice.

Keywords: dietitian; food services; homes for the aged; residential facilities.

Miller et al 2018

Miller M, Hamilton J, Scupham R, Matwiejczyk L, Prichard I, Farrer O, Yaxley A. Development and Psychometric Testing of a Novel Food Service Satisfaction Questionnaire for Food Service Staff of Aged Care Homes. J Nutr Health Aging. 2018;22(2):205-215. doi: 10.1007/s12603-017-0885-4. PMID: 29380847.

Abstract

Background: Food service staff are integral to delivery of quality food in aged care homes yet measurement of their satisfaction is unable to be performed due to an absence of a valid and reliable questionnaire. The aim of this study was to develop and perform psychometric testing for a new Food Service Satisfaction Questionnaire developed in Australia specifically for use by food service staff working in residential aged care homes (Flinders FSSQFSAC).

Methods: A mixed methods design utilizing both a qualitative (in-depth interviews, focus groups) and a quantitative approach (cross sectional survey) was used. Content validity was determined from focus groups and interviews with food service staff currently working in aged care homes, related questionnaires from the literature and consultation with an expert panel. The questionnaire was tested for construct validity and internal consistency using data from food service staff currently working in aged care homes that responded to an electronic invitation circulated to Australian aged care homes using a national database of email addresses. Construct validity was tested via principle components analysis and internal consistency through Cronbach's alpha. Temporal stability of the questionnaire was determined from food service staff undertaking the Flinders FSSQFSAC on two occasions, two weeks apart, and analysed using Pearson's correlations.

Results: Content validity for the Flinders FSSQFSAC was established from a panel of experts and stakeholders. Principle components analysis revealed food service staff satisfaction was represented by 61-items divided into eight domains: job satisfaction (α=0.832), food quality (α=0.871), staff training (α=0.922), consultation (α=0.840), eating environment (α=0.777), reliability (α=0.695), family expectations (α=0.781) and resident relationships (α=0.429), establishing construct validity in all domains, and internal consistency in all (α>0.5) except for "resident relationships" (α=0.429). Test-retest reliability coefficients ranged from 0.276 to 0.826 dependent on domain, with test-retest reliability established in seven domains at r>0.4; an exception was "reliability" at r=0.276.

Conclusions: The newly developed Flinders FSSQFSAC has acceptable validity and reliability and thereby the potential to measure satisfaction of food service staff working in residential aged care homes, identify areas for strategic change, measure improvements and in turn, improve the satisfaction and quality of life of both food service staff and residents of aged care homes.

Keywords: Reliability; elderly; food; nursing home; questionnaire; satisfaction; validity.

Milte et al 2018

Milte R, Ratcliffe J, Chen G, Miller M, Crotty M. Taste, choice and timing: Investigating resident and carer preferences for meals in aged care homes. Nurs Health Sci. 2018 Mar;20(1):116-124. doi: 10.1111/nhs.12394. Epub 2018 Jan 5. PMID: 29314590; PMCID: PMC6635740.

Abstract

There has been little empirical investigation of the preferences of people living in aged care homes for food services. The aim of the present study was to elicit consumer preferences and their willingness to pay for food service in aged care homes. Current residents or their family members were invited to take part in the discrete choice experiment questionnaire administered via interview. Of the 109 eligible residents and 175 eligible family members approached for consent 121 (43%) participated, including 43 residents. Participant preferences were influenced by food taste, choice in relation to serving size, timing of meal selection, visual appeal, and additional cost. Participants indicated they would be willing to pay an additional $24 (US$18.42) per week for food which tasted excellent and $8 (US$6.14) per week to have choice in serving sizes. The study found that respondents were willing to pay a premium to receive food that met their expectations of taste, and for a high level of control over serving sizes, which has implications for the funding and provision of food and dining in long-term care in the future.

Keywords: consumer; discrete choice experiment; food service; informal carer; long-term care; service design.