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Research

Malnutrition risk of older people across district health board community, hospital and residential care settings in New Zealand

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Objective: *To determine the prevalence of malnutrition risk in older people across three settings.*

Methods: *Older people living in the community or newly admitted to hospital or residential care were assessed for malnutrition risk using the validated Mini-Nutritional Assessment – Short Form and dysphagia risk using the Eating Assessment Tool-10. Demographic, physical and health data were collected.*

Results: *Of 167 participants, 23% were malnourished and 35% were at high risk of malnutrition. Those recently admitted to residential care versus a hospital or living in the community had a higher prevalence of malnourishment (47% vs 23% and 2%) ($P < 0.001$). Risk of dysphagia differed with settings ($P < 0.001$) with highest risk in residential care. Hospitalised and residential care participants were significantly more likely to have ≥4 comorbidities, take ≥5 medications and have below normal cognition compared to community participants.*

Conclusion: *Choice of nutrition intervention is setting dependent.*

Key words: *aged, dysphagia, New Zealand, nutrition.*

Introduction

New Zealand's (NZ's) population is ageing, and by 2051, it is predicted there will be a greater proportion of people aged over 65 years, than under 15 years [1]. Māori, the indigenous people of NZ, are a much younger population than the overall population. The Māori ethnic group makes up 5.6% of the 65+ population [1], and there is a disparity in longevity of 7–8 years for Māori, which relates to the history of settlement in Aotearoa (NZ) [2]. However, demographic projections suggest that the Māori population is ageing faster than non-Māori, expanding the population of older Māori. Pacific peoples makes up 2.4% of the 65+ population [1] and have a life expectancy slightly higher than for Māori but lower than the NZ average.

Older people are known to be at disproportionate risk of malnutrition, with health conditions both contributing to having an inadequate food and nutrition intake and occurring as a consequence of an inadequate intake [3]. The NZ government's 'Ageing in Place' policy highlights the need to understand the factors that could lead to malnutrition among older people. Maintaining good nutritional status is important for remaining independent; yet far too often key aspects of food provision for older people are disregarded or taken for granted especially among those with health disparities.

In NZ, the prevalence of risk of malnutrition among community-living older people has been reported in the range of 31–49% [4,5], but the prevalence among older people who have been recently admitted to hospital Assessment, Treatment and Rehabilitation (AT&R) wards or residential care is largely unknown. In Australia, reports of malnutrition risk on admission to rehabilitation wards are variable: 49% of inpatients in New South Wales [6]; 33% of inpatients in Queensland (QLD) [7]; and 35–43% in people over 65 years in South Australia [8]. Rates are higher for new admissions to residential care facilities; 50% or more reported for malnutrition risk in QLD residents [7] consistent with the high rates reported from other overseas studies [9].

Elimination of particular foods or food groups from the diet due to chewing and swallowing difficulties aggravates the risk of malnutrition [10]. Furthermore, malnutrition in turn can contribute to dysphagia via deglutitive muscles undergoing atrophy from reduced food intake. This can compromise the integrity of the swallow and initiate a vicious cycle further decreasing food intake and exacerbating poor swallow function. Although deglutitive disorders may result in life-threatening problems such as aspiration, pneumonia, weight loss and death, older people may under-report swallowing problems and not seek assistance. Among older people over 65 years from an independent-living facility in the United States, 15% reported difficulties with swallowing; however, 23.4% believed this to be a normal part of ageing, although 37.4% did not [11].

Risk of malnutrition is a burden on older people and health-care facilities. In community-living older New Zealanders high malnutrition risk has been shown to

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impact health-related quality of life [5] and be associated with negative outcomes for older people, including higher infection rates, loss of muscle mass, strength and function [12], longer length of hospital stay [13] as well as increased morbidity and mortality [14].

The treatment of malnutrition first requires a malnourished or at risk patient to be identified via either screening or assessment. Screening for nutrition risk, using a validated tool such as the Mini-Nutritional Assessment – Short Form (MNA®-SF), provides a simple and rapid method to identify those at risk of becoming malnourished [3].

In NZ, nutrition screening in the community or upon admission to hospital or residential care is not mandatory. The 2015 Australian and New Zealand Society for Geriatric Medicine revised position statement on undernutrition and the older person [15] does, however, s
uggest that screening needs to occur in all settings. In addition, it is recommended that all screening processes should lead into a care plan. Malnutrition and nutrition risk is therefore likely to be under-reported and poorly documented in NZ.

In the United Kingdom, the 2006 National Institute for Health and Clinical Excellence quality standard (QS24) [16] on nutrition support in adults proposes people in care settings are screened for the risk of malnutrition using a validated screening tool. The guidelines suggest screening should take place on initial registration at general practice surgeries, in all hospital inpatients and care homes on admission or when there is clinical concern in any setting.

Similarly, guideline recommendations for nutrition screening and assessment are provided by the American Society for Parenteral and Enteral Nutrition [17] and in the United States, the Joint Commission on Accreditation of Healthcare Organizations mandates nutrition screening within 24 hours of admission to an acute care centre [18].

In order to gain a greater understanding of malnutrition risk in this country, the aim of this study was to establish the prevalence of nutrition and dysphagia risk in three accommodation settings and to identify factors associated with high nutrition risk. Identification of risk and factors associated with risk may enhance awareness and provide useful insights for the importance of screening.

Methods

A descriptive multi setting cross-sectional study was undertaken within the Waitemata District Health Board (DHB) of Auckland. Waitemata is made up of a defined geographical region (North Shore City, Waitakere City and the Rodney district of Auckland) and provides services to the largest DHB population in NZ. The Northern A Health and Disability Ethics Committee of New Zealand granted ethical approval for the study in June 2014 (NTX/ 14/ NTA/70).

Eligibility and recruitment

Those aged ≥65 years (European ethnicity) or ≥55 years (Māori and Pacific), who were able to understand and give consent for the study, undertake a questionnaire and anthropometric measures were eligible. Younger Māori and Pacific participants were recruited as they have a lower life expectancy than the NZ European. Exclusion criteria included participants with any known dysphagia risk.

Community participants

Participants were recruited from the Primary Health Organisation (PHO) Comprehensive Care. As one of two PHOs funded by Waitemata DHB, Comprehensive Care supports 50 general practices across urban and rural settings. Eligible patients (368) enrolled in general practices that agreed to participate in the study were sent a letter of invitation on two separate occasions. The invitation letter contained an opt-out option and 10 days were allowed for the participant to respond. Those who did not respond were contacted by telephone. For participants who verbally agreed to take part in the study, a one-off interview was organised in their home at a time of convenience.

Hospital participants

Within five days of admission to the AT&R wards at North Shore and Waitakere hospitals, eligible patients were consecutively invited to participate in the study between April and July 2014.

Residential care participants

To recruit eligible participants newly admitted to residential care, an information flyer was sent out to 59 age-related residential care (ARRC) facilities in the Waitemata DHB region. The facilities were contacted on a weekly basis to ascertain new admissions. In addition, eligible participants who were soon to be admitted to an ARRC facility were identified by the Needs Assessment Service Coordination team.

A thorough explanation of the study was provided to all participants and their family members if applicable. Written informed consent was obtained before interviews were conducted in all settings.

Measures

Study measures were obtained from a structured face-to-face standardised questionnaire. Socio-demographic characteristics including age, sex, ethnicity, marital status and education were recorded. Education was ascertained by any primary, secondary and tertiary education attendance.

Physical assessments included measures of height, weight and calf circumference. Weight was recorded using

portable calibrated Wedderburn scales using standardised procedures or from weights recorded in the participants' clinical notes upon admission to the AT&R ward or ARRC facility. Height was calculated from demi-span measured to the nearest 0.5 cm where height was not recorded [19]. Calf circumference was measured in accordance with the (MNA®-SF) user guide [20].

Prescribed medications were recorded from the participants' clinical notes. Participant dentition was recorded as dentate (having one or more natural teeth) edentulous (no natural teeth) or with use of a dental appliance (removable dental prosthesis that substitutes for missing natural teeth) [21].

Psychological health

Cognition was assessed using the Montreal Cognitive Assessment (MoCA) [22]. The MoCA assesses a variety of cognitive domains including attention and concentration, executive functions, memory, language, visuoconstructional skills, conceptual thinking, calculations and orientation [22]. The total score is 30 with scores > 26 indicative of normal cognitive function.

Dysphagia risk

The validated Eating Assessment Tool (EAT-10) questionnaire was used to assess risk of dysphagia [23]. Points are assigned for each of 10 items and are accumulative. EAT-10 scores ≥3 are indicative of problems with swallowing.

Nutrition risk

The validated MNA®-SF was used to assess nutrition risk [24]. The MNA®-SF comprises questionnaire items which include food intake over the past three months, weight loss over the past three months, weight loss, mobility, psychological stress or acute disease, neuropsychological problems and body mass index (BMI). Calf circumference was used in place of BMI if weight or height were not available. The maximum score is 14 points. Scores of 12–14 indicate normal nutrition status; 8–11 points risk of malnutrition and 0–7 points malnourished.

Statistical analysis

All study data were entered into Microsoft Excel spreadsheets, with subjects only identified by their unique study number. Statistical analyses were performed using SPSS Version 23. Descriptive analyses were completed for sociodemographic, physical measures and nutrition risk. Variables were tested for normality using the Kolmogorov–Smirnov, Shapiro–Wilk tests and normality plots. Normally distributed data are summarised as the mean (standard deviation, SD), non-normally distributed data as median (25th, 75th percentiles) and categorical data as frequencies.

Between-groups comparisons were made using one-way ANOVA for normally distributed data, Kruskal–Wallis test for non-normally distributed data or Pearson's chi-square (χ^2) test for categorical data. Where significant effects were found, post hoc tests (Tukey one-way ANOVA, Mann–Whitney Kruskal–Wallis, and comparing cells by row, using z tests and a Bonferroni correction χ^2) were used to identify where significant differences were. Differences were considered significant at $P < 0.05$.

Results

There were 167 participants in the study (70 men) with the mean age of 80 years (range 65–103). Community-living participants tended to be younger (mean age 73 years) compared to those recently admitted to hospital (82 years) or residential care (87 years) ($P < 0.001$). Most (120) of the participants were NZ European, 10 identified as NZ Māori, eight as Pacifica and 29 as of 'other' ethnicity. Nearly half (44%) of the participants were married or partnered and 42% were widowed. There was a significant relationship between education level and residential setting ($P < 0.001$), with 49% of the participants recently admitted to hospital receiving only a primary education compared to 14% of participants living in the community and 21% admitted to residential care. Participants living in the community had a significantly higher BMI ($P < 0.001$) and were more likely to have a BMI ≥ 25 (64%) than those recently admitted to hospital (44%) or residential care (15%).

There was a significant relationship between nutrition risk status and residential setting ($P < 0.001$), with 5.3% of community-living participants at nutrition risk (MNA®-SF scores 8–11) compared to participants newly admitted to hospital (57.9%) or residential care (43.4%). Similarly 1.8% of community-living participants were malnourished (MNA®-SF scores 0–7) compared to those newly admitted to hospital (22.8%) or residential care (47.2%) (Table 1).

Table 2 shows risk of dysphagia (EAT-10 score ≥3) was significantly higher among participants recently admitted to residential care (32.1%) compared to living in the community (3.5%). Participants recently admitted to residential care or hospital were also significantly more likely to have ≥4 comorbidities and lower cognitive function scores than those in a community setting. Participants recently admitted to hospital were significantly more likely to be taking five or more medications, [median 25th, 75th percentiles] 10 (7, 13.5) than those admitted to residential care, 7 (7–10) medicines or living in the community 3 (1–5) medicines $P < 0.001$.

The MNA®-SF nutrition risk factor items for participants in community, hospital and residential care settings are shown in Table 3. A significant relationship was found between experiencing psychological distress or acute disease and residential setting ($P < 0.001$), with hospitalised participants (78.9%) having a higher prevalence than residential care (56.6%) or community participants (10.5%).

Table 1: Participant characteristics and nutrition risk status across Waitemata DHB community, hospital and residential care settings

	Total, $n = 167$	Community, $n = 57$	Hospital, $n = 57$	Residential care, $n = 53$	P-value†
Age (years)	80.4 ± 8.70	73 ± 6.36[a,b]	82.07 ± 6.92[a,c]	86.6 ± 6.65[b,c]	<0.0001
Range (years)	65.0–103.0	65.0–93.0	66.0–95.0	65.0–103.0	
Men	77 (46.1)	31 (54.4)	23 (40.4)	23 (43.4)	0.288
Women	90 (53.9)	26 (45.6)	34 (59.6)	30 (56.6)	
Ethnicity, *n* (%)					
NZ European	120 (71.9)	33 (57.9)	43 (75.4)	44 (83.0)	
NZ Maori	10 (6.0)	8 (14.0)	2 (3.5)	0	—
Pacifica	8 (4.8)	7 (12.3)	1 (1.8)	0	
Other	29 (17.4)	9 (15.8)	11 (19.3)	9 (17.0)	
Marital status, *n* (%)					
Married/partnered	73 (43.7)	34 (59.6)	22 (47.4)	17 (32.1)	
Widowed	70 (41.9)	15 (26.3)	25 (43.9)	30 (56.6)	—
Divorced/separated	14 (8.4)	6 (10.5)	4 (7.0)	4 (7.5)	
Never married	10 (6.0)	2 (3.5)	6 (10.5)	2 (3.8)	
Education, *n* (%)					
Primary	47 (28.1)	8 (14.0)[a]	28 (49.1)[a,c]	11 (20.8)[b,c]	
Secondary	79 (47.3)	33 (57.9)[a]	19 (33.3)[a]	27 (50.9)	0.001
Tertiary	41 (24.6)	16 (28.1)	10 (17.5)	15 (28.3)	
Weight (kg), $n = 164$	69.2 ± 18.4	78.6 ± 18.0[a,b]	69.8 ± 17.2[a,c]	58.8 ± 14.4[b,c]	<0.0001
Range (kg)	31.8–124.8	41–124.8	35.0–104.9	31.8–91.8	
BMI (kg/m^2), $n = 163$	24.9 ± 5.8	28.0 ± 5.52[a,b]	25.2 ± 5.70[a,c]	21.3 ± 3.93[b,c]	<0.0001
Range (kg/m^2)	12.8–45.8	19.0–45.8	16.0–40.0	12.8–30.7	
BMI groups, *n* (%)‡					
Underweight (<18.5)	18 (11.1)	0 (0)	6 (11.0)	12 (22.6)	
Normal (18.5–24.99)	77 (47.2)	20 (36.4)	25 (45.4)	33 (62.3)	—
Overweight/obese (≥25.0)	68 (41.7)	35 (63.6)	24 (43.6)	8 (15.1)	
Nutrition risk status, *n* (%)§					
Normal nutrition status MNA® SF (12–14)	69 (41.3)	53 (93.0)[a,b]	11 (19.3)[a]	5 (9.4)[b]	
At risk MNA®-SF (8–11)	59 (35.3)	3 (5.3)[a,b]	33 (57.9)[a]	23 (43.4)[b]	<0.0001
Malnourished MNA®-SF (0–7)	39 (23.4)	1 (1.8)[a,b]	13 (22.8)[a,c]	25 (47.2)[b,c]	

Data are presented as mean ± SD unless otherwise indicated. †Significant differences between residential settings; one-way ANOVA for continuous variables; Pearson's chi-square for categorical variables where valid. ‡Recognised cut-offs for BMI [25]. §Cut-offs from MNA®-SF [20]. [a]Significant difference ($P < 0.05$) between community and hospital care. [b]Significant difference ($P < 0.05$) between community and residential care. [c]Significant difference ($P < 0.05$) between hospital and residential care. –, not significant. BMI, body mass index; DHB, district health board; MNA®-SF, Mini-Nutritional Assessment – Short Form; NZ, New Zealand.

Table 2: Prevalence of dysphagia, comorbidities, medication use, cognition and dental status by setting

Dysphagia risk‡	Total, $n = 167$ *n* (%)	Community, $n = 57$ *n* (%)	Hospital, $n = 57$ *n* (%)	Residential care, $n = 53$ *n* (%)	P-value†
Dysphagia risk					
No risk (EAT-10 < 3)	139 (83.2)	55 (96.5)[b]	48 (84.2)	36 (67.9)[b]	<0.0001
At risk (EAT-10 ≥ 3)	28 (16.8)	2 (3.5)[b]	9 (15.8)	17 (32.1)[b]	
Comorbidities					
<4 comorbidities	58 (34.7)	44 (77.2)[a,b]	7 (12.3)[a]	7 (13.2)[b]	<0.0001
≥4 comorbidities	109 (65.3)	13 (22.8)[a,b]	50 (87.7)[a]	46 (86.8)[b]	
Medication use					
<5 medications	55 (32.9)	40 (70.2)[a,b]	4 (7.0)[a]	11 (20.8)[b]	<0.0001
≥5 medications	112 (67.1)	17 (29.8)[a,b]	53 (93.0)[a]	42 (79.2)[b]	
Cognition (MOCA)§					
Normal cognitive function (26–30)	24 (16.0)	17 (32.1)[a,b]	5 (11.4)[a]	2 (3.8)[b]	<0.001
Below normal cognitive function (<26)	126 (84.0)	36 (67.9)[a,b]	39 (88.6)[a]	51 (96.2)[b]	
Dental status¶					
Dentate	62 (37.1%)	24 (42.1)	15 (26.3)	23 (43.4)	
Edentulous	5 (3.0%)	3 (5.3)	0	2 (3.8)	—
Dental appliance	100 (59.9)	30 (52.6)	42 (73.7)	28 (52.8)	

†Significant differences between residential settings; Pearson's chi-square for categorical variables where valid. ‡Cut-offs from EAT-10 questionnaire [23]. §Cut-offs from MOCA questionnaire [22]. ¶Dental status definitions [21]. [a]Significant difference ($P < 0.05$) between community and hospital care. [b]Significant difference ($P < 0.05$) between community and residential care. [c]Significant difference ($P < 0.05$) between hospital and residential care. –, not significant. EAT, Eating Assessment Tool questionnaire; MOCA, Montreal Cognitive Assessment.

Discussion

Our findings demonstrate that malnutrition is higher among new admissions to residential care versus hospital AT&R wards or among older people living in the community with nearly half (47%) of residential care participants malnourished and 43% at high nutrition risk. Similarly malnutrition

Table 3: Mini-Nutritional Assessment – Short Form nutrition risk across community, hospital and residential care settings

	Total, $n = 167$ *n* (%)	Community, $n = 57$ *n* (%)	Hospital, $n = 57$ *n* (%)	Residential care, $n = 53$ *n* (%)
Food intake				
Severe decrease	14 (8.4)	1 (1.8)	1 (1.8)	12 (22.6)
Moderate decrease	45 (26.9)	5 (8.8)	19 (33.3)	21 (39.6)
No decrease	108 (64.7)	51 (89.5)	37 (64.9)	20 (37.7)
Weight loss				
Weight loss >3 kg	29 (17.4)	2 (3.5)	10 (17.5)	17 (32.1)
Does not know	7 (4.2)	1 (1.8)	1 (1.8)	5 (9.4)
Weight loss between 1–3 kg	35 (21.0)	3 (5.3)	17 (29.8)	15 (28.3)
No weight loss	96 (57.5)	51 (89.5)	29 (50.9)	16 (30.2)
Mobility				
Bed or chair bound	6 (3.6)	0 (0)	1 (1.8)	5 (9.4)
Able to get out of bed/chair but does not go out	80 (47.9)	5 (8.8)	57 (82.5)	28 (52.8)
Goes out	82 (48.5)	52 (91.2)	9 (15.8)	20 (37.7)
Psychological stress or acute disease				
Yes	81 (48.5)	6 (10.5)	45 (78.9)	30 (56.6)
No	86 (51.5)	51 (89.5)	12 (21.1)	23 (43.4)
Neuropsychological problem				
Severe dementia or depression	12 (7.2)	3 (5.3)	1 (1.8)	8 (15.1)
Mild dementia	38 (22.8)	4 (7.0)	10 (17.5)	24 (45.3)
No psychological problems	117 (70.1)	50 (87.7)	46 (80.7)	21 (39.6)
BMI ($n = 41$)				
BMI < 19	20 (14.2)	1 (2.3)	7 (12.7)	12 (27.9)
BMI 19 to < 21	13 (9.2)	3 (7.0)	3 (5.5)	7 (16.3)
BMI 21 to < 23	24 (17.0)	4 (9.3)	10 (18.2)	10 (23.3)
BMI 23 or >	84 (59.6)	35 (81.4)	35 (63.6)	14 (32.6)
Calf circumference ($n = 16$)				
CC < 31 cm	5 (17.9)	0 (0)	0 (0)	5 (50)
CC 31 or >	23 (82.1)	16 (100)	2 (100)	5 (50)

BMI, body mass index; CC, calf circumference.

(MNA score <17) and risk of malnutrition (MNA score 17–23.5) have been reported in 71% and 29%, respectively, of Swedish nursing home residents [26] and in 29% and 60% of 2114 eligible aged care residents in Finland [9]. Malnutrition has also been found to be present among 50% of more than 800 aged care residents in QLD using the Subjective Global Assessment tool [7]. The prevalence of malnutrition increases as the length of stay increases [9]; hence, identification of those at risk on admission to residential care or hospital is imperative so that effective nutrition care plans can be implemented.

Body mass index values <18.5 (underweight) were found in nearly a quarter (22.6%) of the residential care participants and in 11% of participants newly admitted to hospital. By contrast, community participants were more likely to have a higher body weight and BMI ≥25 than those recently admitted to hospital or residential care. Increased body weight is associated with better health outcomes for older people and those who are overweight may be at a healthy weight for their age and have greater nutritional reserves to draw upon when they become ill [27]. By contrast, among adults older than 70 years a very low BMI is associated with the highest mortality [28] suggestive of an increasingly U-shaped relationship between BMI and mortality in advanced age.

The risk of dysphagia (EAT-10 score ≥3) was significantly higher among participants recently admitted to residential care (32.1%) compared to living in the community (3.5%). Disordered deglutition is an ageing concern [29,30]. Older adults experience changes to the swallowing process brought on by physiological changes with advancing age, including reductions in muscle mass, muscle strength and tissue elasticity, leading to slower bolus transit times from mouth to the stomach. This may predispose older adults to increased risk of developing dysphagia, and as a consequence, nutritional issues such as decreased food intake leading up to malnutrition. In a population-based prevalence study of independently living older people over 70 years, dysphagia was more prevalent with increasing age (36.4% in 80 year olds, compared to 21.7% in 70–79 year olds) [29]. Furthermore, malnutrition or being at risk of malnutrition was independently associated with impaired efficacy of swallow. The finding of 'malnourished' participants being at a higher risk of dysphagia risk in the current study is therefore not unexpected. Previous literature supports an association between increased dysphagia risk and malnutrition [10,29,30]. Difficulty swallowing reduces food volume intake and results in food avoidance and anxiety over mealtimes. The three main swallowing issues, assessed from the EAT-10, were as follows: 'swallowing solids takes extra effort'; 'swallowing pills takes extra effort'; and 'when I swallow food sticks to my throat'. Although not further investigated in this study, these unpleasant experiences would likely result in changes in eating habits, most notably in the form of food

restriction [10]. The extra effort in swallowing and poor nutritional intake is a potential explanation for a malnourished or at risk of malnutrition state in patients at higher risk of dysphagia. In the study by Mann et al. [10], those with swallowing difficulties were found to be deficient in fibre, calcium, magnesium, zinc, vitamins D, E and K and folate. These deficiencies were on average 44.9% below recommended dietary intakes [10].

Generalisability of these findings is limited by the small sample. Community-living participants recruited into this study were younger (mean age 73) compared to those recently admitted to hospital (82 years) or residential care (87 years). They had less comorbidity, took less medication, had better cognition and were more likely to be dentate; most (96.5%) had no risk of dysphagia. This study needs to be repeated in a larger sample size sufficient enough to ensure reliable conclusions. Body mass index is an integral part of the MNA-SF tool. Māori and Pacifica were younger than the NZ European participants and are more likely to have a higher BMI as in general they have a greater lean body mass compared to NZ European [31]. Although they compromised only a quarter (26.3%) of the community and 4.4% of the hospital participants, the proportion of those with a normal BMI or overweight and obese may have been altered. Hence, limitations should be considered when interpreting these results.

Nonetheless there are marked differences in nutritional risk and prevalence of dysphagia between older adults living in different social settings. Independently living older adults demonstrate the best nutritional profiles with nutrition risk and prevalence of dysphagia ten times lower than those admitted to either hospital or residential care facilities. Intuitively, these results may be expected; however, these data reveal the stark delineation between well older adults and those experiencing a slide in their health status and profile. With such clear differences in risk, we now need to pinpoint factors that determine this paradigm shift in eating and nutrition. In this way, we will be able to intervene prior to individuals experiencing irreversible decline in health and well-being.

Conclusion

This is the first New Zealand study to describe the prevalence of malnutrition risk in early admission to residential care and hospital AT&R wards. Malnutrition and swallowing difficulties significantly affect quality of life and are costly to individuals, families and the community. Screening for malnutrition risk needs to occur in all settings and the reasons for weight loss investigated. Simple intervention measures to manage undernutrition by an interdisciplinary team are recommended by the Australian and New Zealand Society for Geriatric Medicine [15], which can make a substantial difference to improve the nutritional health of older people. However, given the differences that we have identified by setting, a more targeted approach should be used to identify the optimum nutrition intervention for each setting, so that the nutrition status of all older adults is improved.

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References

1 Statistics New Zealand. *2013 Census QuickStats About People Aged 65 and Over*. New Zealand: Wellington, 2015.
2 Robson B, Harris R. *Hauora: Māori Standards of Health IV. A Study of the Years 2000–2005*. Dunedin: School of Medicine and Health Sciences, University of Otago, 2007.
3 Donini L, Savina C, Rosano A, Cannella C. Systematic review of nutritional status evaluation and screening tools in the elderly. *Journal of Nutrition Health and Aging* 2007; 11: 421–32.
4 Wham C, Carr R, Heller F. Country of origin predicts nutrition risk among community living older people. *The Journal of Nutrition, Health and Aging* 2011; 15: 253–258.
5 Wham C, Teh R, Moyes S et al. Health and social factors associated with nutrition risk: Results from life and living in advanced age: A cohort study in New Zealand (LILACS NZ). *Journal of Nutrition Health and Aging* 2015; 19: 637–645.
6 Beck E, Patch C, Milosavljevic M et al. Implementation of malnutrition screening and assessment by dietitians: Malnutrition exists in acute and rehabilitation settings. *Nutrition and Dietetics* 2001; 58: 92–97.
7 Banks M, Ash S, Bauer J, Gaskill D. Prevalence of malnutrition in adults in Queensland public hospitals and residential aged care facilities. *Nutrition and Dietetics* 2007; 64: 172–178.
8 Visvanathan R, Penhall R, Chapman I. Nutritional screening of older people in a sub-acute care facility in Australia and its relation to discharge outcomes. *Age and Ageing* 2004; 33: 260–265.
9 Suominen M, Muurinen S, Routasalo P et al. Malnutrition and associated factors among aged residents in all nursing homes in Helsinki. *European Journal of Clinical Nutrition* 2005; 59: 578–583.
10 Mann T, Heuberger R, Wong H. The association between chewing and swallowing difficulties and nutritional status in older adults. *Australian Dental Journal* 2013; 58: 200–206.
11 Chen PH, Golub JS, Hapner ER, Johns MM 3rd. Prevalence of perceived dysphagia and quality-of-life impairment in a geriatric population. *Dysphagia* 2009; 24: 1–6.
12 Wolfe R, Miller S, Miller K. Optimal protein intake in the elderly. *Clinical Nutrition* 2008; 27: 675–684.
13 Neumayer LA, Smout RJ, Horn HG, Horn SD. Early and sufficient feeding reduces length of stay and charges in surgical patients. *Journal of Surgical Research* 2001; 95: 73–77.
14 Middleton MH, Nazarenko G, Nivison-Smith I, Smerdely P. Prevalence of malnutrition and 12-month incidence of mortality in two Sydney teaching hospitals. *Internal Medicine Journal* 2001; 31: 455–461.
15 Australian and New Zealand Society for Geriatric Medicine. *Position Statement – Undernutrition and the Older Person*. Sydney: The Society, 2015.
16 National Institute for Health and Care Excellence. *Nutrition Support in Adults: Oral Nutrition Support, Enteral Tube Feeding and Parenteral Nutrition. Screening for the Risk of Malnutrition*. London: The Institute, 2006. Clinical Guideline No.: 32.
17 Mueller C, Compher C, Ellen DM. A.S.P.E.N. Clinical guidelines. *Journal of Parenteral and Enteral Nutrition* 2011; 35: 16–24.

18 Joint Commission on Accreditation of Healthcare Organizations. *Comprehensive Accreditation Manual for Hospitals*. Chicago, IL: The Commission, 2007.

19 Hirani V, Mindell J. A comparison of measured height and demi-span equivalent height in the assessment of body mass index among people aged 65 years and over in England. *Age and Ageing* 2008; 37: 311–317.

20 Nestle Nutrition Institute. *A Guide to Completing the Mini Nutritional Assessment – Short Form (MNA®-SF)*. [Cited 16 November 2014.] Available from URL: http://www.mna-elderly.com/forms/mna_guide_english_sf.pdf

21 Ministry of Health. *Our Oral Health: Key Findings of the 2009 Oral Health Survey*. Wellington: Ministry of Health, 2010.

22 Nasreddine Z, Phillips N, Bedirian V et al. The Montreal Cognitive Assessment, MoCA: A brief screening tool for mild cognitive impairment. *Journal of the American Geriatrics Society* 2005; 53: 695–699.

23 Schindler A, Mozzanica F, Monzani A et al. Reliability and validity of the Italian eating assessment tool. *Annals of Otology, Rhinology and Laryngology* 2013; 122: 717–724.

24 Rubenstein L, Harker J, Salva A, Guigoz Y, Vellas B. Screening for undernutrition in geriatric practice: Developing the short-form mini-nutritional assessment (MNA-SF). *The Journals of Gerontology Series* 2001; 56: 366–372.

25 World Health Organization. *World Health Statistics*. Geneva: The Organization, 2007.

26 Saletti A, Lindgren EY, Johansson L, Cederholm T. Nutritional status according to mini nutritional assessment in an institutionalized elderly population in Sweden. *Gerontology* 2000; 46: 139–145.

27 Locher JL, Roth DL, Ritchie CS et al. Body mass index, weight loss, and mortality in community-dwelling older adults. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences* 2007; 62: 1389–1392.

28 Thinggaard M, Jacobsen R, Jeune B, Martinussen T, Christensen K. Is the relationship between BMI and mortality increasingly U-shaped with advancing age? A 10-year follow-up of persons aged 70–95 years. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences* 2010; 65A: 526–531.

29 Serra-Prat M, Hinojosa G, Lopez D et al. Prevalence of oropharyngeal dysphagia and impaired safety and efficacy of swallow in independently living older persons. *Journal of the American Geriatrics Society* 2011; 59: 186–187.

30 Wakabayashi H, Matsushima M. Dysphagia assessed by the 10-item Eating Assessment Tool is associated with nutritional status and activities of daily living in elderly individuals requiring long-term care. *The Journal of Nutrition, Health and Aging* 2015; 1–6.

31 Ministry of Health. *The Health of New Zealand Adults 2011/12: Key Findings of the New Zealand Health Survey*. Wellington: Ministry of Health, 2012.