Original Article

Nutritional status of adults participating in ambulatory rehabilitation

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Aims: To assess the overall nutritional status of older adults participating in ambulatory rehabilitation and determine its association with relevant outcomes including physical function and quality of life. **Design:** Cross-sectional. **Setting:** Ambulatory rehabilitation service in the Southern region of Adelaide, Australia. **Subjects:** A total of 229 participants recruited as part of a RCT between June 2005 and June 2006, stroke (n=83), elective orthopedic procedure (n=44) and other medical condition (n=102). **Methods:** Nutritional status was measured using Mini Nutritional Assessment (MNA), Simplified Nutrition Appetite Questionnaire (SNAQ) and Body Mass Index. Functional performance was assessed using the Modified Barthel Index (MBI) and quality of life was measured using the Short Form-36 (SF-36). **Results**: Sixty-three percent of participants were malnourished or at risk of malnutrition according to the MNA and a third had a risk of ≥ 5% weight loss in the subsequent six months, according to the SNAQ. Participants with a diagnosis other than stroke or elective orthopedic procedure were the most vulnerable, with 53% (n=74/140) classified as at risk of malnutrition or malnourished and a longer length of stay in hospital. Functional performance was no different for participants assessed as at risk of malnutrition or malnourished compared to the well nourished, but the SF-36 mental component score was significantly higher for those who were well nourished (p=0.003). **Conclusion:** Findings emphasise the magnitude of the malnutrition problem in ambulatory rehabilitation settings. Further research is required to evaluate the resource implications against expected benefits of providing nutrition interventions at this point.

Key Words: ambulatory rehabilitation, older, malnutrition, quality of life, appetite

INTRODUCTION

Malnutrition in the elderly population is widespread, however it is often overlooked in clinical settings.[1,2] Globally the number of older adults is increasing and it is estimated that the proportion of Australians over 65 years of age will increase from 13% in 2002 to 27-30% of the total population by 2051.[2] Hence the absolute figures for malnourished persons or those at risk of becoming malnourished are also likely to rise.

Nutritional frailty in older people mainly occurs due to 'anorexia of aging'.[3] Anorexia of aging occurs if older adults have a decrease in food intake as a result of chronic disease, medication, altered gastrointestinal function and/or dysphasia, culminating in unintentional weight loss.[3] This process along with sarcopenia, which is the decline of lean body mass and muscle strength with increasing age,[4,6] consequently increases the risk of falls and other poor outcomes including increased infection rates, poor wound healing, frequent hospitalization, loss of independence and increased mortality.[4,7]

Ambulatory rehabilitation is a service routinely provided to older adults who are safe to return home but continue to require a therapy program for optimal recovery.[8] Ambulatory rehabilitation has been evaluated across a range of debilitating conditions including stroke[9], hip fracture,[10] in addition to the frail elderly[11] and those with physical disability.[12]

Improvements in terms of performing activities of daily living,[13] reduced outpatient visits,[13] less use of hospital beds[13] and improvement in depression[9] have all been reported as successful outcomes for ambulatory rehabilitation services.

There is no direct evidence that patients returning home from hospital with an ambulatory rehabilitation service are at risk of malnutrition and hence justification for provision of nutrition services has been problematic. However, there is evidence that malnutrition is a significant problem in both the acute care setting and the inpatient rehabilitation setting where the majority of referrals to ambulatory rehabilitation services originate. A recent cohort study in Sweden (n=127) looked at the prevalence of malnutrition of older adults living in the community.

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According to the MNA and anthropometric measurements, 32-38% of the study participants were classified as malnourished.[14]

Similar results were seen in an Australian study of community dwelling elderly (n=250) with nearly half of the participants classified as malnourished or at risk of malnutrition when assessed using MNA.[15] Adverse outcomes including admission to high level care, extended length of stay (LOS) and increased risk of falling within 12 months were also observed.[15]

Despite evidence of malnutrition in the inpatient rehabilitation setting, the Australasian Faculty of Rehabilitation Medicine (AFRM) guidelines indicate referral for nutrition support only if deemed necessary and there are no criteria specified to guide how and who decides service needs.[16] In the absence of specific guidelines for ambulatory rehabilitation there is a trend to extrapolate the AFRM guidelines for inpatient rehabilitation to the ambulatory rehabilitation setting but it seems likely that this group have suffered greater nutritional declines as they warrant ongoing treatment.[4] These patients are known to be nutritionally at-risk due to poor appetite, low intakes of energy and protein, as well as physical and cognitive issues.[4] Furthermore, increased therapy and mobility upon returning to their home is likely to result in increased requirements compared to the inpatient setting where mobility is minimal and therapy is still progressing to maximum ability.[4]

The aim of this study was to assess the nutritional status of older adults participating in ambulatory rehabilitation and determine its association with relevant outcomes including quality of life (QOL) and physical function.

MATERIALS AND METHODS

Repatriation General Hospital (RGH) provides post acute rehabilitation service for Southern Adelaide Health Service and receives referrals primarily from the three public hospitals in the region (RGH, Flinders Medical Centre and Noarlunga Health Service). Repatriation General Hospital provides a home based rehabilitation service (Rehab in the Home: RITHOM) and a facility based rehabilitation service (Day rehabilitation). The facility based rehabilitation service has a capacity of 20 patients per day and for the duration of the study the RITHOM service had the equivalent of 20 beds. All patients identified for rehabilitation between June 2005 and June 2006 were considered for participation in a randomized controlled trial evaluating the benefits of Day rehabilitation compared to RITHOM, protocol number ACTRN1260 5000638639 Australia New Zealand Clinical Trials Registry. Participants were required to meet the following criteria for entry: resident in the southern metropolitan region of Adelaide, physically and cognitively able to participate in a rehabilitation program, able to mobilize with a frame and transfer with light assistance, a home environment suitable for rehabilitation and a general practitioner that agreed to provide medical supervision on discharge to the home. All eligible participants provided written informed consent prior to initiation of data collection. The study protocol was approved by the RGH Research and Ethics Committee and the Flinders Medical Centre Clinical Research and Ethics Committee. This paper describes the baseline nutrition data for participants involved in the randomized controlled trial.

Demographic data and medical history

Demographic data (age, gender, marital status, preadmission accommodation) and medical history (diagnosis, pre trial length of stay (LOS) for acute and/or inpatient rehabilitation) were recorded from the medical notes by research staff upon participant consent. Participants were broadly classified as having a diagnosis related to stroke (Total Anterior Circulation Stroke Syndrome (TACS), Lacunar Stroke Syndrome (LACS), Partial Anterior Circulation Stroke Syndrome (PACS), Posterior Circulation Stroke Syndrome (POCS)[17]; elective orthopedic surgery (total knee replacement) or other (fractured neck of femur, other trauma fracture, neurological injury, deconditioned) by research staff in accordance with information documented in case notes.

Measurement of nutritional status

Bioelectrical impedance (BIA) was used (QuadScan 4000, BodyStat, USA) to determine fat free mass (FFM) and fat mass (FM). FM in kg was calculated as the difference between body weight (measured using Propert Australia Pty Ltd, Sydney portable platform medical scales to the nearest kg with the participant in light clothing and without shoes) and FFM calculated from the equation of Dey *et al*.[18] This equation was selected because it was derived from a community dwelling elderly population (70-75 years) and demonstrated to be valid against a four compartment model ($R^2 = 0.91$; SEE = 2.6 kg).[18] Percent FFM was calculated as FFM (kg) upon body weight (kg) times 100 and percent FM was calculated by FM (kg) upon body weight (kg) times 100.[18]

Alternative methods of measuring height are advisable for older adults because of discomfort or inability to stand erect due to malnutrition or conditions such as kyphosis or osteoporosis.[19] Knee height was measured to the nearest 0.1 cm by trained research staff using a knee height calliper (Ross Laboratories, OH, USA) and the equation of Chumlea[20] was used to estimate standing height. Estimated Body Mass Index (eBMI; kg/m²) was calculated using height estimated from knee height and body weight. Studies have demonstrated that for older adults low BMI is an indicator of mortality[21,22] and current recommendations state that BMI values of 22-27kg/m² are considered desirable for this age group.[23] Mid-arm circumference and calf circumference were measured by trained research staff to the nearest 0.1 cm midway between the tip of the acromion and the olecranon with a steel metric tape (KDS, Tokyo, Japan) and these measurements were used in the MNA.

The MNA is a simple tool for evaluating nutritional status among older adults by measuring 18 items.[24] It involves evaluation of four main components: anthropometric, global assessment, dietary assessment and subjective assessment.[25] The total score is used to classify participants as malnourished (score < 17 / 30), at risk (score 17-23.5 / 30) or well nourished ($\geq$ 24 / 30).[24] The MNA was selected as the assessment tool for assessing nutritional status in this study as it has been well validated in older adults[24] and has high sensitivity (96%) and

specificity (98%) when compared to anthropometric, biochemical, dietary and functional measures.[15,25] It has also been shown to be useful in identifying women with low body fat and men with low serum albumin and predict length of stay, admission to higher level care, physical function and quality of life.[26]

Appetite was assessed using the Simplified Nutrition Appetite Questionnaire (SNAQ) which is derived from the eight item Council on Nutrition Appetite Questionnaire.[27] The SNAQ consists of four questions (1, 2, 4 and 6 from the original questionnaire) and a score ranging from one to five is provided for each question. The total score is calculated by adding the numbers associated with the participant's response.[27] A SNAQ score $\leq$ 14/20 has been demonstrated to reflect significant risk of a least 5% weight loss within the subsequent six months.[27] The SNAQ was chosen for appetite assessment as it has obtained maximum sensitivity (82%) and specificity (84%) for 5% weight loss in the subsequent six months in community dwelling older adults.[27] The alpha coefficient for the SNAQ in older adults was found to be 0.74 and it is the first appetite assessment tool specifically validated for monitoring anorexia related weight loss in older adults in the United States.[27]

Measurement of Functional Performance and Quality of Life

The Modified Barthel index (MBI) was used to measure each participant's performance on 10 activities of daily living (ADL)[28] by an occupational therapist. The ADL items of the MBI include: personal hygiene, bathing, feeding, toileting, stair climbing, dressing, bowel control, bladder control, ambulation or wheelchair use, chair or bed transfer.[28] Scores range from 0 to 100 where 0 is absolute dependence and 100 denotes total independence.[28] The MBI has internal reliability of 0.90 and is a commonly applied assessment in the rehabilitation setting.[28]

Quality of life was assessed using the Short Form 36 (SF-36) which measures health conditions and issues involving physical functioning, role limitation because of physical difficulty, social functioning, mental health, bodily pain, vitality and general health. It has been reported as a valid instrument for older adults in countries including the United States, United Kingdom and Australia.[29] From the above listed eight components, an overall score for physical component score (SF-36 PCS) and mental component score (SF-36 MCS) was calculated and the scores for each of the components ranged from 0 (poor quality of life) to 100 (perfect quality of life).

Statistical methods

All data were analyzed using the SPSS statistical package (SPSS for Windows, version 12.0.1 2003). Data were expressed as mean (95% confidence interval) for normally distributed continuous data or median (95% confidence interval) for non continuous data that was not normally distributed. To compare participants who elected not to participate and the participants who consented, either the chi-square test of association was used (categorical data e.g. gender) or an independent t-test was used (continuous data e.g. age).

The number of participants classified as malnourished (MNA<17) was small (N=10) and these participants were grouped together with those classified as at risk of malnutrition (MNA 17-23.5) for statistical analyses (n=113). This is common practice in the literature [5,6] and is justified given that at risk patients are likely to require some form of nutrition support to prevent the transition to malnutrition. The relationship between nutritional status according to the MNA categories (<24 and ≥24) and MBI and SF-36 PCS; MCS was analyzed using independent samples t-tests. The Mann-Whitney U test was used for

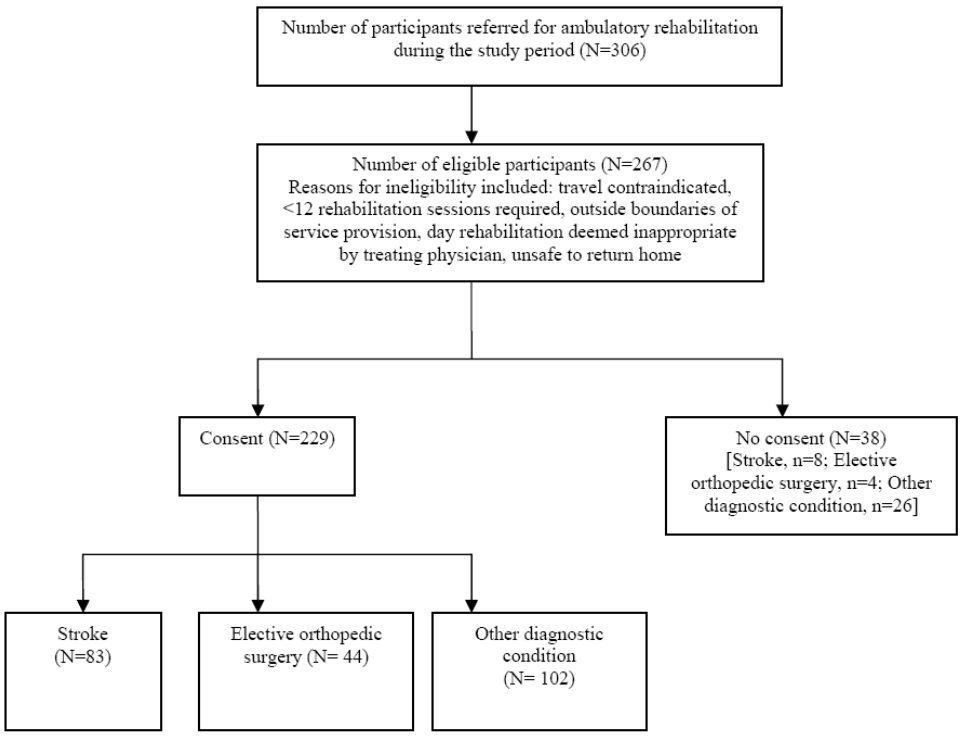

Figure 1. Recruitment Flow Chart

Table 1. Demographics, nutritional status, physical performance and quality of life for 229 participants attending ambulatory rehabilitation. All values are mean (95% CI) unless otherwise stated.

Characteristic	
Age, years	72 (70, 74)
Female, n (%)	120 (52)
Martial status, n (%)	
Married/de facto	112 (49)
Widowed	73 (34)
Others[†]	40 (17)
Pre trial length of stay, median (95% CI)	17 (15, 20)
Mini Nutritional Assessment, n (%)[‡]	
At risk of malnutrition/ malnourished (<24/30)	140 (63)
Simplified Nutritional Appetite Questionnaire, n (%)[§]	
<14 at risk of 5% weight loss within six months	73 (32)
eBMI[¶]	27 (26, 28)
Physical performance[††]	92 (92, 93)
Quality of life[‡‡]	
Physical component score	36 (35, 38)
Mental component score	48 (46, 49)

*95% CI, 95% confidence interval; MNA: Mini Nutritional Assessment; LOS: Length of stay; SNAQ: Simplified Nutritional Appetite Questionnaire; eBMI: estimated body mass index; MBI: Modified Barthel Index; SF-36: Short Form 36; PCS: physical component score of SF-36; MCS: mental component score of SF-36; [†]'Others' category include: single, separated and divorced.; [‡]Nutritional status assessed using MNA[24]; (N=223).; [§]Appetite assessed using SNAQ[27] ; (N=225).; [¶]eBMI; stature estimated from measurement of knee height[20]; (N=226).; [††] Physical performance assessed using the MBI[28]; (N=228).; [‡‡]Quality of life assessed using SF-36[40]; PCS[40]; (N=221); MCS[40] (N=224) were derived.

Table 2. Relationship between nutritional status according to Mini Nutritional Assessment (N=223) and function, pre-ambulatory rehabilitation length of stay and quality of life. All values are mean (95% CI) unless otherwise stated.

MNA[†]	n (%)	MBI[‡]	LOS[§]	SF-36[¶]	
				PCS[¶]	MCS[¶]
<24/30	140 (63)	92 (91, 93)	20 (16, 23)	36 (34, 38)	45 (44, 47)
≥24/30	83 (37)	93 (91, 94)	15 (11, 17)	37 (35, 39)	51 (50, 54)

95% CI: 95% confidence interval; MNA: Mini Nutritional Assessment; LOS: Length of stay: MBI: Modified Barthel Index; SF-36: Short Form 36; PCS: physical component score of SF-36; MCS: mental component score of SF-36.; [†]Nutritional status assessed using the MNA[24] (N=223). Participants were classified at risk of malnutrition/malnourished (<24/30) and well nourished (≥24/30).; [‡]MBI[28] (N=228); difference across the MNA categories (<24/30; ≥24/30) determined using independent t-test (p=0.819).; [§]Median (95% CI) pre trial LOS (N=229); difference across the MNA categories determined using the Mann-Whitney U-test (p=0.002).; [¶]Quality of life assessed using the SF-36[40]; difference across the MNA categories determined using independent t-test. Overall MCS[40] (**p<0.001); (N=224) and PCS[40] (p=0.458); (N=221) was calculated.

comparison of pre-trial LOS across the two MNA categories. Variables that were normally distributed (age, eBMI, FFM, FM, MBI, SF-36 MCS and SF-36 PCS) were compared across the three diagnostic groups using ANOVA with post-hoc Bonferroni comparisons. Pre-trial LOS was not normally distributed, and for this variable the diagnostic groups were compared using the Kruskal-Wallis test. Chi-square tests of association were used for categorical data (gender, marital status, MNA, SNAQ). A *P*-value of less than or equal to 0.05 was considered statistically significant throughout.

RESULTS

Recruitment

Recruitment of participants is illustrated in Figure 1. The total number of participants identified as requiring ambulatory rehabilitation was 306. The majority of the participants were admitted from the Flinders Medical Centre (n=95) and RGH (n=198). Two hundred and sixty seven patients were eligible to participate with 39 ineligible. Of the eligible patients, a further 38 were not randomised as they declined participation or were not approached at the request of the referring clinician. The overall eligibility rate was 87% and of those eligible, the consent rate was 86%. Participants were significantly younger than eligible patients who refused consent: 80 years vs. 72 years (95% CI: 70-74); (p=0.040). There was no significant difference in gender between participants and those that did not take part but were eligible (p=0.862).

Participant Characteristics

Participant characteristics are summarized in Table 1. The majority of participants were Australian (n=157); the remaining were from Europe (n=33), United Kingdom (n=29) and Asia or other countries (n=10). All participants previously lived independently in the community and 41% lived alone.

Nutritional status according to the MNA and eBMI is summarized in Table 1. Mean (95% CI) MNA of the 223 participants who completed the assessment was 22 (22-23) with 129 (58%) participants identified at risk of malnutrition and 11 (5%) malnourished. According to the SNAQ, one in three participants was at risk of experiencing 5% weight loss within the subsequent six months. The functional performance and quality of life of the participants is presented in Table 1.

Nutritional status and functional performance, quality of life and pre-trial LOS

The relationship between nutritional status, functional performance, quality of life and pre-trial LOS is summarized in Table 2. There was no difference in functional performance between those participants classified as at risk of malnutrition or malnourished compared to those classified as well nourished (p=0.819). The MCS of the SF-36 for participants classified as at risk of malnutrition or malnourished according to the MNA was 45 (95% CI: 44-47) and was significantly lower than those classified as well nourished (51; 95% CI: 50-54; p<0.001). However, there was no difference between those at risk of malnutrition or malnourished and well nourished for the PCS score of the SF-36 (p=0.458). Participants who were classified as at risk of malnutrition or malnourished had significantly longer hospital admissions (acute +/- inpatient rehabilitation) than those classified as well nourished (20 vs. 15 days, p=0.002).

Participants with a diagnosis of stroke on admission to ambulatory rehabilitation

Of 229 participants, 83 (36%) had stroke as the main diagnosis. Characteristics, nutritional status, functional performance and quality of life of these participants are presented in Table 3. The mean age was 73 (95% CI: 71-75) years and 37 (31%) were female. Participants were classified as having the following stroke diagnoses: Total Anterior Circulation Syndrome (n=4), Partial Anterior Circulation Syndrome (n=36), Posterior Circulation Syndrome (n=11) or Lacunar Syndrome (N=32). Mean (95% CI) MNA for participants with stroke was 23 (22-23) and for eBMI 26 (25-27) kg/m² respectively. According to the SNAQ, 22% (n=18) of participants with stroke had a 5% risk of weight loss within the subsequent six months.

Participants with a diagnosis of elective orthopedic procedure on admission to ambulatory rehabilitation

All participants with a diagnosis of elective orthopedic procedure (n=44) were recovering from a total knee replacement (TKR). Characteristics, nutritional status, functional performance and quality of life of these participants are presented in Table 3. For this group mean (95% CI) for MNA was 24 (23-24) and eBMI, was 31 kg/m² (29-33) respectively. According to the SNAQ, 26% (n =19) of these participants had a 5% risk of weight loss within the subsequent six months.

Participants with a diagnosis other than stroke or elective orthopedic procedure on admission to ambulatory rehabilitation

Characteristics, nutritional status, functional and quality of life of this group (n=102) are presented in Table 3. Participants were classified as having a diagnosis of fractured neck of femur (n=12), neurological injury (n=17), other orthopedic injury (n=20), deconditioned (n=39) or other (n=14). Mean (95% CI) for MNA was 21 (21-22) and eBMI was 26 kg/m² (25-27). According to the SNAQ, half of these participants were at risk of achieving 5% weight loss within the subsequent six months.

Table 3. Comparison of demographics, nutritional status, physical performance and quality of life across the diagnostic groups: stroke (N=83), elective orthopedic (N=44), other than stroke or elective orthopedic (N=102). All values are mean (95% CI) unless otherwise stated.

Characteristic	Stroke	Elective orthopedic	Other
Age (years)	73 (71, 75)	68 (65, 74)	72 (69, 75)
Female, n (%)	31 (37)	30 (68)	59 (58)
Martial status, n (%)			
Married/de facto	53 (64)	21 (47)	38 (37)
Widowed	23 (28)	13 (30)	41 (40)
Other†	7 (8)	10 (23)	23 (23)
Pre trial LOS, median (95% CI)‡	18 (13, 26)	8 (7, 11)	22 (18, 25)
Mini Nutritional Assessment, n (%)§			
At risk of malnutrition/ malnourished (<24/30)	47 (33)	19 (14)	74 (53)
Simplified Nutrition Appetite Questionnaire, n (%)¶			
<14/20 at risk of 5% weight loss in six months	18 (25) [f]	19 (26)	36 (49)
eBMI (kg/m^2)††	26 (25, 27)	31 (29, 33)	26 (25, 27)
Physical performance‡‡	92 (91, 94)	93 (91, 94)	92 (91, 94)
Quality of life§§			
Physical component score	40 (38, 42)	32 (29, 35)	35 (33, 37)
Mental component score	46 (44, 49)	50 (47, 54)	47 (45, 49)

*95% CI, 95% confidence interval; eBMI, estimated body mass index; LOS, pre trial length of stay; MNA: Mini Nutritional Assessment; MBI: Modified Barthel Index; SF-36: Short Form 36; PCS: physical component score of SF-36; MCS: mental component score of SF-36.; †'Others' category include: single, separated and divorced; comparison across diagnostic groups calculated using chi-squared test of association.; ‡LOS, pre trial LOS was calculated using Kruskal-Wallis test across the three groups. The elective orthopaedic group had shorter LOS compared to stroke (**p<0.001) and other than stroke or elective orthopaedic group (**p<0.001).; §MNA[24]; comparison across diagnostic groups calculated using chi-squared test of association (N=223). Diagnosis other than stroke or elective orthopaedic group had significantly lower MNA score compared to stroke (*p=0.025) and elective orthopaedic (*p=0.001).; ¶SNAQ[27]; comparison across diagnostic groups calculated using chi-squared test of association (N=225). Stroke group performed better than elective orthopedic in terms of SNAQ[27] according to the chi-squared test of association (*p=0.023).; ††eBMI, stature estimated from measurement of knee height[20]; comparison across diagnostic groups calculated using ANOVA (N=226). Elective orthopedic group had higher eBMI compared to the other two groups (**p<0.001).; ‡‡ Physical performance assessed using the MBI[28] comparison across diagnostic groups calculated using ANOVA (N=228).; §§Quality of life assessed using Short Form Health Survey[40]; comparison across diagnostic groups calculated using ANOVA; physical component score (N=221); mental component score (N=224).

Comparisons according to diagnostic groups

Participants with a diagnosis other than stroke or elective orthopedics, had significantly lower MNA compared to stroke (p=0.025) and elective orthopedic (p<0.001). Elective orthopedic participants had higher eBMI than both groups (p<0.001). Quality of life according to the PCS was significantly better for participants who had a stroke diagnosis compared to participants who had either an elective orthopedic diagnosis (p<0.001) or other diagnosis (p=0.002). The MCS was not different across the three groups (p=0.165). Similar non significant findings were observed for functional performance (p=0.940). The pre trial LOS for the elective orthopedic group was shorter compared to the group of participants with a stroke diagnosis (p<0.001) and those with another diagnosis (p<0.001)**.**

DISCUSSION

The present study revealed that of the 229 ambulatory rehabilitation participants, MNA classified 58% (n=129) at risk of malnutrition, and an additional 5% (n=11) as malnourished. According to the SNAQ, one third of the study participants were at risk of losing 5% body weight within the subsequent six months. In addition, the results of this study revealed that participants at risk of malnutrition or malnourished, scored significantly lower on the SF36 MCS than those classified as well nourished and participants with a diagnosis other than stroke or elective orthopedic procedure appeared most nutritionally vulnerable.

These findings are consistent with local studies undertaken in the inpatient rehabilitation setting[5] and in a sample of patients receiving domiciliary care[15] where the prevalence of malnutrition ranged from 4.8% to 6% respectively. Studies of elderly people residing in settings like serviced apartments[7] and community residential homes[14] have reported a higher prevalence of malnutrition according to the MNA ranging from 20-30%.[7,14] The participants of these studies had a greater mean age than the present study (85 vs. 72 years),[7,14] had mixed disease conditions such as dementia and symptomatic heart failure[14] or received regular assistance from community care personnel and hence were considered functionally dependent.[7]

One in three study participants, according to the SNAQ, were classified as being at risk of losing at least 5% body weight within the subsequent six months. Anorexia is common in the elderly due to the process of ageing and disease[27] and has been shown to result in slow recovery and increased mortality.[30] More than half of the study participants were at increased risk of malnutrition or were already malnourished according to the MNA and further weight loss in these participants would be expected to worsen outcomes. Provision of nutrition services and support appears warranted for a significant proportion of ambulatory rehabilitation patients in order to determine individual risk factors, prevent further decline in nutritional status and implement strategies to optimize recovery.

The MCS score of the SF-36 for participants classified as at risk of malnutrition or malnourished was significantly lower than those classified as well nourished, however no statistical significance was observed for the PCS score. Evidence suggest that an extended waiting period for elective orthopedic surgery[31] and major surgical events are factors which dramatically alter the prognosis and level of independence of individuals who have had stroke[32] and other than stroke or elective orthopedic conditions.[33,34] This suggests a link between undernutrition, quality of life and also mental health. There is also a link between undernutrition and physical health,[34] however the finding in this study does not demonstrate this relationship.

Of the three groups, the group other than stroke or elective orthopedic procedure had the highest prevalence of malnourished participants or participants at risk of malnutrition and 49% of the study participants in this group was at risk of losing at least 5% body weight within the following six months. In this group, 38% (n=39) of participants were deconditioned. Prolonged LOS in hospital is associated with deconditioning[35] which is a complicated process frequently associated with hospitalization in the elderly and results from a period of immobility and extended period of bed rest.[35] A study by Lim *et al.*[36] demonstrated that 47% (n=65) of elderly patients were deconditioned during their hospital stay. The results of the present study were also comparable with studies of patients following a hip fracture[37] and other major orthopaedic surgery where malnutrition, according to a range of nutrition assessment tools, is estimated to be between 30-50%.[34] This group may be vulnerable due to the effect of an emergency surgical admission where post-operative confusion and poor dietary intake are commonly observed.[38] These patients also had the longest LOS (acute +/- inpatient rehabilitation) compared to the stroke or the elective orthopedic group, which may have facilitated a decline in nutritional status[38] and hence increased the number of malnourished or at risk of malnutrition participants within this group, on admission to ambulatory rehabilitation.[38]

It is suggested by Finestone[32] that nutritional status of stroke patients in rehabilitation declines and malnutrition is highly prevalent (49%) at the time of admission.[32] The present study demonstrates that the stroke group had a better nutritional status according to MNA and SNAQ compared to either the elective orthopedic procedure group or other group. However, the stroke group still had an extensive LOS in hospital (median=18 days) and 47 (34%) of the participants were at risk of malnutrition or were malnourished. The elective orthopedic group had a BMI greater than the desirable range (22-27kg/m²) and this trend has been observed in a previous study of older adults with osteoarthritis of the hip or knee.[39] Poor nutritional status, however, was observed irrespective of being overweight or obese, perhaps indicating the presence of sarcopenic obesity. The likely presence of sarcopenic obesity amongst elective orthopedic rehabilitation patients highlights the importance of a comprehensive assessment of nutritional status.

This study had some limitations that should be considered in the interpretation of these findings. There may have been selection bias as the patients who refused to participate were possibly at greater risk of being malnourished. A large proportion of those who declined were

from the group other than stroke or elective orthopedic procedure, the group which had the highest prevalence malnutrition and risk of malnutrition in the larger study. The study participants demographic data and medical history were recorded from the medical notes, thus also introducing the possibly of reporting bias, although most data were also confirmed through interview with the participants and/or caregiver. The group of patients with a diagnosis other than stroke or elective orthopedic procedure were heterogeneous and because of the relatively small sample size (n=102), it was deemed inappropriate to further sub classify this group. In contrast, this study is the first Australian study of nutritional health of older adults in ambulatory rehabilitation. In addition, the study achieved a high response rate (87%) and consent rate (86%) and recruitment was consecutive, all factors increasing the representative nature of the sample. The methods used for assessment of nutritional status and the range of outcomes measured were also strengths of this study.

In conclusion, the study findings emphasise the substantial prevalence of malnutrition and malnutrition risk in the ambulatory rehabilitation setting and this was associated with lower mental health scores. Given the likely increase in the demand for ambulatory rehabilitation as the population ages, involvement of nutrition expertise and support is hence warranted for a significant proportion of this expanding clinical group in order to determine individual risk factors, prevent further decline in nutritional status and implement strategies to optimize recovery. At the very least AFRM guidelines should incorporate a nutrition screening program to provide some objective indication of when dietetic services are required to ensure early intervention and optimal outcomes for the at risk or malnourished patients. The data presented in the present study could be used to advocate for improved staffing allocation for dietetic services in settings similar to that described in this study. Future research should focus on evaluating the resource implications against expected benefits

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AUTHOR DISCLOSURES

Supreet Kaur, Michelle D Miller, Julie Halbert, Lynne C Giles and Maria Crotty, no conflicts of interest.

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Original Article

Nutritional status of adults participating in ambulatory rehabilitation

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參加復健門診的成年人之營養狀況

目的：評估參與非臥床復健的老年人的整體營養狀況與其相關後果，包含身體功能及生活品質的相關性。設計：橫斷性研究。地點：在澳洲阿德雷德南區非臥床復健服務中心。研究對象：在 2005 年 6 月至 2006 年 6 月間總共納入 229 名參與者，包括中風者 83 位、矯形骨科手術者 44 位及其他醫療狀況 102 位。方法：營養狀況採用迷你營養評估(NMA)、簡易營養胃口問卷(SNAQ)及身體質量指數測量。採用修正的巴特爾指數(MBI)評估功能表現，採用 Short Form-36(SF-36)測量生活品質。結果：根據 MNA，有 63%的參與者為營養不足或有營養不足的風險；根據 SNAQ，在接下來的 6 個月，三分之一的人有體重減輕≥5%的危險性。經診斷非中風或矯形骨科手術的其他參與者，營養不足的風險較大，佔 53%，而且住院日期也較長。有營養不足或有營養不足風險者與營養充足的參與者相比，在功能表現上沒有差異，但是營養充分者的 SF-36 心理面向分數顯著較高(p=0.003)。結論：本研究之發現強調了復健門診病人的營養不良問題之嚴重性。在提供營養介入之前，需要更進一步的研究去評估可能與預期益處相抵觸的因子。

關鍵字：復健門診、老人、營養失調、生活品質、胃口。