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Wright, Charlene; Shankar, Bhuwaneshwari; Marshall, Skye; Pearcy, Joshua; Somani, Ananya; Agarwal, Ekta

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A prospective observational nutritionDay study

Charlene Wright (MNutDietPrac, APD) [a, c, *], Bhuvaneshwari Shankar (PhD, RD) [b], Skye Marshall (PhD, APD) [a, d], Joshua Pearcy (MNutDietPrac) [c], Ananya Somani (MNutDietPrac, APD) [c], Ekta Agarwal (PhD, RD) [a, c]

[a] Bond University Nutrition and Dietetics Research Group, Faculty of Health Sciences and Medicine, Bond University, 2 Promethean Way, Robina, Queensland, Australia, 4226

[b] Apollo Hospitals, Chennai, Tamil Nadu 60006, India

[c] Bond University, 2 Promethean Way, Robina, Queensland, Australia, 4226

[d] Nutrition Research Australia, Sydney, New South Wales, Australia, 2000

* Corresponding author. Bond Institute of Health and Sport, 2 Promethean Way, Robina, QLD 4226, Australia. E-mail address: cmatthew@bond.edu.au (C. Wright).

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Abstract

Aim: Current literature regarding the prevalence and consequences of poor dietary intake and risk of malnutrition in older adults is limited to wealthier regions including USA, Europe, and Australasia. With a rapidly ageing population in India this prospective observational study aimed to evaluate hospital food intake and malnutrition risk and their impact on hospital length of stay, readmission rates, and in-hospital mortality of older adults in Indian hospitals.

Methods: Data collected during nutritionDay worldwide audits (2014-2016), in five urban, private hospitals in India included baseline demographic and clinical data on patients aged ≥60 years. Proportion of food consumed at one main meal was recorded and data on length of stay, readmissions, and in-hospital mortality were collected 30 days post-baseline.

Results: 262 participants (mean age: 69 ± 8 years; 65% males) were recruited. Mapped malnutrition risk (mMST score ≥2) on admission was 31% and increased to 44% during the course of hospitalisation. Over one quarter of participants consumed ≤50% of their meal (28%). Over half the participants were found to be eating poorly (59%) and those identified as at risk of malnutrition were not offered additional nutrition support. The median LOS was 8 days (range: 1-92), 30-day readmission rates were 7%, and in-hospital mortality was 0.4%. Malnutrition risk and poor food intake were not associated with health-related outcomes.

Conclusion: Older adults in Indian acute care hospitals have a noticeable prevalence of malnutrition risk and poor food intake. There is opportunity for future research to focus on identifying and managing nutritional issues.

Keywords Food intake, malnutrition risk, nutrition support, nutritionDay, older adults

Introduction

India's population is rapidly ageing, with the proportion of individuals aged over 60 years projected to double from the current 166 million to over 320 million by 2050,[1] heightening the importance of all aspects of food, nutrition and dietetics. Protein-energy malnutrition (herein referred to as 'malnutrition') is common in older adults due to physical, cognitive, and environmental changes.[2] Additional direct determinants exacerbating malnutrition in India include poor food intake and food insecurity.[3-5] Hospitalised older adults commonly have inadequate dietary intake due to a range of barriers and rationalise poor food intake due to illness, being unwell and hospitalised, reduced activity levels, fatigued, depressed and nutritional impact symptoms such as nausea and vomiting.[5,6] Food is often not perceived as priority and part of treatment by hospitalised older adults, or medical and other healthcare staff members.[7-9] A recent study in India evaluated the attitudes and confidence of metropolitan dietitians (n=56) and doctors (n=123) towards nutrition care, advocacy and leadership finding whilst both professions demonstrated positive attitudes towards nutrition care provision, they lacked confidence in skills relating to advocacy and leadership.[10] Another study found a number of factors influence the foodservice staff's delivery of a higher energy menu as planned.[11] To improve dietary intake and reduce risk of adverse clinical outcomes, increasing awareness of the importance of food for recovery among hospitalised older adults, healthcare and foodservice staff is a priority.

Malnutrition is associated with longer hospital length of stay (LOS), higher readmission rates, and greater risk of in-hospital mortality which makes the implementation of the nutrition care process essential.[12-14] However, a recent systematic literature review suggests clinicians and healthcare managers are limited in their ability to make informed and cost effective treatment decisions due to evidence gaps in the care of malnourished hospitalised adults.[15] Best-practice

guidelines recommend screening and assessment of malnutrition to be conducted using validated screening and assessment tools, with consideration given to the setting in the selection of the most appropriate tool.[16,17] To the best of our knowledge, only one study has reported malnutrition in the older Indian acute care setting. Karmakar et al evaluated malnutrition in 76 older adults, both inpatients and outpatients, at a tertiary care centre in Eastern India.[18] Using Body Mass Index (BMI) to define malnutrition, the study identified over one-quarter of the participants were malnourished (n=21, 28%).[18] In a recent paper, Agarwal et al demonstrated malnutrition occurs at all BMI classifications and highlighted the limitations of using BMI as a nutrition screening and/or assessment tool.[12]

Factor such as gender, religion, SES and economic independence, present challenges for older adults to access health care in India.[19] Accumulatively, India is a more vulnerable region of the world and current literature is limited to wealthier regions including USA, Europe, and Australasia. With a rapidly ageing older adult population, who have a high risk of becoming malnourished,[6] it is important to evaluate the extent of this problem in older adults in the acute care setting in Indian hospitals using validated methods. Research from this region is important to serve as a reference for local health providers and a platform for future research. The primary aim of this prospective observational study was to determine the prevalence of malnutrition risk and poor food intake in older adults in Indian hospitals and the secondary aim, was to explore the association of nutritional issues with 30-day health-related outcomes namely LOS, readmission and in-hospital mortality. It was estimated the prevalence of malnutrition risk and poor food intake would be similar to values reported in other settings, and these nutritional issues would possibly worsen health-related outcomes.

Methods

This prospective observational study analysed data collected from annual nutritionDay audits from 2014 to 2016, in older adults aged ≥60 years admitted to five private urban Indian hospitals.

The annual nutritionDay audits commenced in 2006 as an initiative to address malnutrition in health care institutions including hospitals, nursing homes and intensive care units worldwide. On a specified day every year, data is obtained via standardised patient questionnaires (previously published and available from https://www.nutritionday.org)[20] and involves a 30-day follow up of hospital length of stay, hospital readmission rate and in-hospital mortality. Data collected from individual participating hospitals for nutritionDay Worldwide is pooled resulting in a dataset of several hundred thousand participants. Data in the present study were originally collected with the intention of adding to this collective data set. There was however also the opportunity to analyse the data in greater depth to allow for insights specific to the Indian sub-continent. nutritionDay in India provides the largest known dataset on hospital food intake, malnutrition risk and their impact on hospital length of stay, readmission rates and mortality in Indian hospitals. The included audits for this study were conducted on 6 November 2014, 19 November 2015, and 10 November 2016. Whilst all patients admitted in the hospital on these dates were surveyed with the standardised questionnaire, the focus of this prospective study is older adults. Therefore, age criteria was set at ≥60 years,[21] with further classification of 'young-old' and 'old-old' to describe those aged 60-79 and 80+ years respectively.[22] The nutritionDay audits at participating hospitals were conducted as per worldwide nutritionDay protocols with verbal consent obtained in a language the patient could understand and clearly communicate (English, Hindi, Tamil, Telugu or Bengali). Ethics for data collection were approved by the Institutional Ethics Committee for Clinical Studies at the primary participating hospital (AMH-002/07-17) and ethical clearance for data analysis and

reporting were provided by the Bond University Human Research Ethics Committee (EA00051). The study has been reported according to STROBE guidelines for cohort studies.[23]

Participants' self-reported food intake for one main meal on a single day using a visual plate diagram. The current study has dichotomised food intake responses as '≤50% meal intake' (i.e. nothing, one-quarter, one-half) and '100% meal intake' (i.e. about all). Poor food intake was defined as an intake of ≤50% of the offered meal.[24]

The Malnutrition Screening Tool (MST) is a validated screening tool used to identify malnutrition risk in older hospitalised patients. It asks three questions (1) "Have you recently lost weight without trying?"; (2) "If yes, how much weight have you lost?"; and (3) "Have you been eating poorly because of a decreased appetite?" Ferguson et al. defined 'eating poorly' as less than three-quarters of usual intake.[24] A score is generated to determine risk, with participants scoring ≥2 classified as 'at malnutrition risk' and <2 as 'not at malnutrition risk'.

The nutritionDay questionnaires do not use the MST and do not directly measure malnutrition risk. However, recent study by Sauer et al extrapolated MST scores from nutritionDay data and the present study has replicated this methodology.[25] Three questions from the nutritionDay questionnaires were used (1) "Have you unintentionally lost weight within the last 3 months?"; (2) "If yes, how many kilograms did you lose?"; and (3) "How well have you eaten in the week before you were admitted to hospital?". Relevant responses were extrapolated and mapped to the Malnutrition Screening Tool to determine malnutrition risk. Additionally, the prevalence of malnutrition risk on admission was also extrapolated in a subset of participants admitted within two days prior to nutritionDay data collection.

Food intake and malnutrition risk were combined to broadly categorise 'nutritional issues'. Four categories were formed including 'not at malnutrition risk with ≤50% meal intake', 'not at malnutrition risk with 100% meal intake', 'at malnutrition risk with ≤50% meal intake', and 'at malnutrition risk with 100% meal intake'.

Hospital length of stay (LOS), hospital readmission (yes/no), and in-hospital mortality (yes/no) were informed from relevant codes and information on the nutritionDay outcome evaluation sheet.[20] LOS was calculated from date of admission to date of discharge.

Data were cleaned and analysed using Statistical Package for the Social Science 25 (SPSS Statistics). The distribution of continuous variables (age, BMI, LOS) were analysed. Age was normally distributed, categorised as young-old (60-79 years) and old-old (≥80 years) and reported as mean ± SD. Continuous variables not normally distributed (BMI, LOS) were reported using median (range). All categorical variables were reported as frequency (n) and total percentage including malnutrition risk and food intake; addressing the primary aim of prevalence. All percentages refer to the valid data that is available for the variable. Bivariate analysis of patient admission-related characteristics and 30-day health-related outcomes compared to nutritional issues was conducted. Chi-square test was used for categorical variables to test for the strength of associations; addressing the secondary aim of exploring associations between nutritional issues and 30-day health related outcomes. Fisher's exact test (two-sided) was used when results had ≥20% of cells with an expected count less than five. For normally distributed continuous variables (age), independent sample t-test were used and non-parametric data (BMI, LOS) were analysed using non-parametric equivalents. Significant difference and association were defined as $p<0.05$ (two-tailed). If no significance was found between contributing variables and outcomes, multiple regression was not warranted.

Results

A total of 262 participants aged ≥60 years from acute care wards from five private urban hospitals across India participated in the study (69 ± 8 years, 65% Male [n=170]). Admission related characteristics of participants are displayed in Table 1. Almost all participants were young-old (n=238, 91%) and of the old-old (n=24, 9%), 46% reported poor intake (n=11) (Table 1). The median BMI was 25kg/m^2 (range: 15-50) with 2% classified as underweight according to World Health Organisation classification (<18.5 kg/m^2)[26]. Majority of admissions were elective (n=94, 70%). On admission, 85% presented with comorbidities (n=209), the most frequent diagnoses related to the circulatory system (n=54, 40%) and majority were classed as not terminally ill (n=241, 98%). Of the entire sample (N=262), 28% reported ≤50% meal intake (n=68) and 16% had a decrease in food intake since admission. Participants with ≤50% meal intake had higher proportion of digestive system problems on admission (p=0.030) and reported a decrease in food intake since admission (p <0.001). Patients with 100% meal intake were more likely to rate their health as good or very good (n=76, 82%) compared to those with ≤50% meal intake (n=17, 18%) (p=0.022). Patients with a poor intake reported higher prevalence of fair or poor perceived health (Table 1).

Of the subset population admitted within two days of the annual nutritionDay audit (n=99, 38% of total sample), one-in-three were at malnutrition risk at the time of hospital admission (n=34, 31%). Mapped MST (mMST) results can be seen in Table 2. One-in-three reported unintentionally losing weight in the last 3 months (n=74, 30%), and the week prior to admission 30% ate less than three-quarters of usual intake (n=75). A total of 109 participants, nearly every one-in-two, were identified as at malnutrition risk with a mapped MST score ≥2 (44%), of which less than half received a standard diet without nutrition support (n=50, 46%).

Data regarding 30-day outcomes were available for 261 participants for readmissions (99.6%), 241 for LOS (92%), and 262 for in-hospital mortality (100%). No significant association was found between nutritional issues and readmissions (p=0.967), in-hospital mortality (p=0.121), or LOS (p=0.491) (Table 3). Participants with a LOS ≥90 days reported 100% meal intake regardless of malnutrition risk status.

Discussion

This is the first multicentre study in acute care hospitals in India to report food intake, prevalence of malnutrition risk, and explore the association with 30-day health-related outcomes in older adults. An association between nutrition issues and health-related outcomes was not found. However, this study demonstrates malnutrition risk and poor food intake are prevalent amongst older adults in acute care hospitals in India. The prevalence of malnutrition risk (44%) is higher than reported by Karmakar et al in 2010 (28%),[18] which may be attributed to the use of the mapped MST in the present study. Whilst the accuracy would need to be tested in a separate study, we recommend the use of evidence-based nutrition screening tools to evaluate nutrition risk as opposed to BMI due to its inherent limitations as highlighted by Agarwal et al.[12]

This study also demonstrates patients with diseases of the gastrointestinal tract are at an increased risk of demonstrating nutritional issues. Further, an increment in malnutrition risk from one-in-three at the time of hospital admission to nearly one-in-two during the course of admission was identified. Although there was no association of nutritional issues with LOS, the median of eight days is two-fold that of patients under treatment at Apollo Hospitals in India of 4 days in the fiscal year 2018 recorded elsewhere.[27] The higher LOS may be attributed to the older adult sample and high prevalence of malnutrition risk.[6]

Studies from Australia and Europe have found an average 40% of the hospital population consumed ≤50% meal intake.[28,29] In the present study 28% of the population consumed ≤50% meal intake. The similarity in the finding of poor meal intake emphasises the need to provide adequate nutrition support to acute care patients. Consistent with international data, one-third of the participants had malnutrition risk on hospital admission. Despite this, only one-in-five participants received nutrition support (n=37, 19%). This finding highlights a potential anomaly in the implementation of the nutrition care process in Indian hospitals and may explain the increasing prevalence of malnutrition risk during hospitalisation as reported in this study. This is not just a unique issue to India, with large international studies reporting poor adherence and implementation of guidelines. Barriers have been identified at the organisation, healthcare personnel, and patient level; facilitators were reported as leadership support, multidisciplinary committee involvement and guidance, engaged front line staff throughout each stage, ongoing audits, and staff education.[30] A study by Bell et al demonstrated that when nutrition care was multi-modal and provided through a multidisciplinary team approach, it resulted in improved 24-hour energy and protein intake, reduced nutritional deterioration over admission, increased discharge directly back to the community setting and suggested a reduction in LOS.[8] Future projects in translating evidence to practice, in a contextually relevant way to India, are needed.

Worldwide nutritionDay audits have historically not used validated screening tools and/or assessment methods to measure participants' nutritional status. Whilst results have been extrapolated to determine malnutrition risk, it is recommended future studies incorporate nutritional screening via MST and nutritional assessment via the Subjective Global Assessment (SGA) tool.[31] For majority of participants, malnutrition risk has been reported as point

prevalence data. Although data regarding malnutrition risk on admission versus the development of malnutrition during admission was not recorded for all participants, the study has reported malnutrition risk on admission for over one-third of the cohort. Sample size was a statistical limitation of this study however clinically, this project provides a platform for future work. Identifying and diagnosing malnutrition will not directly improve patient outcomes however, a problem must first be identified in order to treat it. It is recommended future research evaluate prevalence and association through a sample size calculation in order to comprehensively understand the association between nutritional issues and 30-day health-related outcomes. Participation in nutritionDay was voluntary and it is possible participants who were more vulnerable, very ill or with dementia were unwilling to participate, and therefore it is likely this study has potentially underestimated malnutrition risk and poor food intake. Additionally, hospital food service, meal delivery and food from non-regulated foodservices,[32] may have impacted participants' intake. The participants in this study were admitted in urban and private hospitals therefore findings have limited generalisability in older adults from different socioeconomic status backgrounds across India.

The present study provides a snapshot of malnutrition risk and food intake across a sample of older adult patients from acute care wards in India. Serving as a valuable stepping-stone in providing a benchmark for nutritional status and processes to be evaluated in Indian acute care hospitals. Additionally, the study is novel in its methodology in mapping malnutrition risk to the MST.

This is the first study using nutritionDay audit data (2014-2016) to explore malnutrition risk and food intake in older adults in acute care in India. Older adults in Indian acute care hospitals have a noticeable prevalence of malnutrition risk and poor food intake. There is opportunity

for future research to focus on identifying and managing both nutritional issues along with investigate barriers to implementing evidence-based guidelines.

Statement of Authorship:

This study was conceptualised by EA. Data were collected under the leadership of BS. CM collated, cleaned, and analysed the data and drafted the first version of the manuscript. All authors made significant contributions to the interpretation of results and drafting of the manuscript.

Conflict of Interest:

There are no conflicts of interest.

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Table 1. Admission-related characteristics of participants compared to nutritional issues (combined malnutrition risk and food intake) (N=262)

Characteristics	Overall results	Not at malnutrition risk (mapped MST score <2)		At malnutrition risk (mapped MST score ≥2)		p-value [c]
		≤50% intake [a] (n=30)	100% intake [b] (n=108)	≤50% intake (n=38)	100% intake (n=71)	
Age (years) mean ± SD [d]	69 ± 8	70 ± 8	70 ± 8	69 ± 9	68 ± 7	0.094
Age cohorts n (%)						
Young-old (60-79 years)	238 (91%)	25 (83%)	101 (94%)	32 (84%)	68 (96%)	0.053
Old-old (≥80 years)	24 (9%)	5 (17%)	7 (7%)	6 (16%)	3 (4%)	
Gender n (%)						
Male	170 (65%)	20 (67%)	66 (61%)	22 (58%)	51 (72%)	0.394
Female	92 (35%)	10 (33%)	42 (39%)	16 (42%)	20 (28%)	
Comorbidities present n (%)						
No	38 (15%)	4 (13%)	20 (19%)	7 (18%)	7 (10%)	0.416
Yes	209 (85%)	26 (87%)	88 (82%)	31 (82%)	64 (90%)	
Diagnosis at admission n (%)						

Circulatory System	54 (40%)	6 (40%)	22 (37%)	5 (28%)	21 (50%)	0.030*
Multimorbidity [e]	21 (16%)	1 (13%)	14 (24%)	2 (11%)	3 (7%)	
Other [f]	14 (10%)	3 (20%)	3 (5%)	5 (28%)	3 (7%)	
Digestive system	11 (8%)	2 (13%)	5 (9%)	3 (17%)	1 (2%)	
Musculoskeletal system/connective tissue	9 (7%)	0 (0%)	8 (14%)	0 (0%)	1 (2%)	
Genitourinary system	7 (5%)	1 (7%)	1 (2%)	0 (0%)	5 (12%)	
Nervous system	7 (5%)	0 (0%)	2 (3%)	2 (11%)	3 (7%)	
Infectious and parasitic diseases	7 (5%)	1 (7%)	2 (3%)	1 (6%)	3 (7%)	
Respiratory system	4 (3%)	0 (0%)	2 (3%)	0 (0%)	2 (5%)	
Calculated Body Mass Index (BMI) (kg/m^2) [g]						
Median (range)	25 (15 – 50)	25 (18 – 41)	25 (18 – 50)	24 (15 – 34)	25 (18 – 40)	0.068
World Health Organisation BMI classifications n (%)						
Underweight <18.5 kg/m^2	4 (2%)	1 (3%)	1 (1%)	1 (3%)	1 (1%)	0.186
Healthy 18.5 – 24.9 kg/m^2	121 (46%)	9 (30%)	46 (43%)	24 (63%)	35 (49%)	
Overweight 25 – 29.9 kg/m^2	100 (38%)	15 (50%)	43 (40%)	11 (29%)	25 (35%)	
Obese >30 kg/m^2	37 (14%)	5 (17%)	18 (17%)	2 (5%)	10 (14%)	

Admission type n (%)						
Elective	94 (70%)	9 (60%)	45 (76%)	10 (56%)	30 (71%)	0.301
Emergency	40 (30%)	6 (40%)	14 (24%)	8 (44%)	12 (29%)	
Terminal illness n (%)						
Terminally ill	6 (2%)	0 (0%)	0 (0%)	5 (13%)	1 (1%)	0.001*
Not terminally ill	241 (98%)	30 (100%)	108 (100%)	33 (87%)	70 (99%)	
Diet code n (%)						
Standard diet without nutrition support [h]	153 (78%)	21 (91%)	82 (87%)	13 (59%)	37 (65%)	0.001*
Standard diet with nutrition support [i]	37 (19%)	2 (9%)	9 (10%)	7 (32%)	19 (33%)	
Enteral or parenteral nutrition (± diet) [j]	6 (3%)	0 (0%)	3 (3%)	2 (9%)	1 (2%)	
Number of oral nutrition support (ONS) drinks n (%)						
Nil	112 (86%)	12 (92%)	49 (85%)	13 (77%)	38 (91%)	0.812
1 – 2	13 (10%)	1 (8%)	6 (10%)	3 (18%)	3 (7%)	
3 – 4	5 (4%)	0 (0%)	3 (5%)	1 (6%)	1 (2%)	
How well have you eaten in the week before you were admitted to hospital? n (%)						
Normal	169 (68%)	18 (60%)	88 (82%)	12 (32%)	51 (72%)	<0.001*

About 3/4 of normal	50 (20%)	6 (20%)	14 (13%)	13 (34%)	17 (24%)	
About 1/2 of normal	19 (8%)	6 (20%)	1 (1%)	9 (24%)	3 (4%)	
More than normal	4 (2%)	0 (0%)	4 (4%)	0 (0%)	0 (0%)	
About 1/4 to nearly nothing	5 (2%)	0 (0%)	1 (1%)	4 (11%)	0 (0%)	
Food intake change since admission n (%)						
Stayed the same	56 (42%)	5 (33%)	38 (64%)	3 (17%)	10 (24%)	<0.001*
Increased	45 (34%)	3 (20%)	14 (24%)	6 (33%)	22 (52%)	
Decreased	22 (16%)	6 (40%)	6 (10%)	6 (33%)	4 (10%)	
I do not know/not applicable/nil by mouth	11 (8%)	1 (7%)	1 (2%)	3 (17%)	6 (14%)	
Reason for not consuming full meal offered n (%)						
Not applicable as ate full meal	109 (74%)	0 (0%)	58 (100%)	0 (0%)	42 (100%)	<0.001*
Don’t have usual appetite	4 (3%)	3 (14%)	0 (0%)	1 (4%)	0 (0%)	
Not hungry at that time	13 (9%)	4 (18%)	0 (0%)	9 (35%)	0 (0%)	
Didn’t like the smell/taste	2 (1%)	0 (0%)	0 (0%)	2 (8%)	0 (0%)	
Exam, surgery, test and missed my meal	5 (3%)	4 (18%)	0 (0%)	1 (4%)	0 (0%)	
Other [k]	15 (10%)	9 (41%)	0 (0%)	6 (23%)	0 (0%)	

Were you able to eat without interruption today? n (%)						
Yes	106 (74%)	10 (63%)	49 (77%)	9 (45%)	38 (86%)	0.001*
No	33 (23%)	4 (25%)	15 (23%)	8 (40%)	6 (14%)	
I do not know/not applicable/nil by mouth	5 (4%)	2 (13%)	0 (0%)	3 (15%)	0 (0%)	
Did you get any help with eating today? n (%)						
Yes, from family	35 (27%)	7 (54%)	16 (28%)	9 (53%)	3 (7%)	<0.001*
Yes, from staff	3 (2%)	0 (0%)	0 (0%)	2 (12%)	1 (2%)	
No	86 (66%)	5 (38%)	40 (69%)	3 (18%)	38 (91%)	
I do not know/not applicable/nil by mouth	6 (5%)	1 (8%)	2 (3%)	3 (18%)	0 (0%)	
Identified as malnourished during episode of admission (uncontrolled measurement) n (%)						
Malnourished	10 (8%)	1 (8%)	2 (3%)	5 (29%)	2 (5%)	<0.001*
At risk	14 (11%)	4 (31%)	5 (9%)	5 (29%)	0 (0%)	
Not at malnutrition risk	106 (82%)	8 (62%)	51 (88%)	7 (41%)	40 (95%)	
Have you unintentionally lost weight in the last 3 months? n (%)						
Yes	74 (30%)	1 (3%)	0 (0%)	33 (87%)	40 (56%)	<0.001*
No	138 (56%)	29 (97%)	108 (100%)	1 (3%)	0 (0%)	

I do not know	35 (14%)	0 (0%)	0 (0%)	4(11%)	31 (44%)	
In general, how would you say your health is? n (%)						
Good / very good	93 (69%)	10 (67%)	47 (80%)	7 (39%)	29 (69%)	0.022*
Fair	39 (29%)	5 (33%)	12 (20%)	10 (56%)	12 (29%)	
Poor / very poor	2 (2%)	0 (0%)	0 (0%)	1 (6%)	1 (2%)	

[%] All percentages refer to the valid data available for the variable

[a] ≤50% intake includes one-half meal eaten, one-quarter meal eaten, or nothing eaten

[b] 100% intake includes about all of the meal eaten

[c] p-value from bivariate analyses of Chi-square test (categorical variables) or Mann-Whitney test (continuous variables). Indicates association between admission-related characteristic and nutritional issues (merged malnutrition risk and food intake)

[d] Age calculated by year of admission minus date of birth

[e] Multimorbidity defined as the simultaneous presence of two or more chronic diseases

[f] Other includes neoplasms; blood and blood forming organs and the immune mechanism; endocrine, nutritional and metabolic diseases; mental health; eye and adnexa; ear and mastoid process; skin and subcutaneous tissue; pregnancy, child birth and the puerperium; conditions originating in the perinatal period; congenital / chromosomal abnormalities; symptoms, signs, abnormal clinical / lab findings, injury, poisoning; external causes of morbidity and mortality; factors influencing health status and contact with health services

[g] Body Mass Index (BMI) calculated by weight (kg)/height $(m)^2$. Whilst there is some evidence that BMI differs according to ethnicity, the cut-off points are not significantly different and hence the present study utilised the standard World Health Organisation BMI classifications. [26] Further allowing cross-country comparisons.

[h] Standard diet without nutrition support includes standard hospital food and special diets i.e. vegetarian, vegan, gluten free, low fat, lactose intolerance

[i] Standard diet with nutrition support includes standard hospital food or special diets plus fortified/enriched hospital food or protein/energy supplements i.e. oral nutrition support (ONS) drinks

[j] Enteral or parenteral nutrition (± diet) includes Enteral Nutrition (EN) or Parenteral Nutrition (PN) with or without standard hospital food or special diets

[k] Other includes I did not like the type of food offered; the food did not fit my cultural/ religious preferences; the food was too hot; the food was too cold; due to food allergy/ intolerances; I have problems chewing/ swallowing; I normally eat less than what was served; I had nausea/ vomiting; I was too tired; I cannot eat without help; I was not allowed to eat; I did not get requested food

* Significant difference set at p-value ≤0.05

Table 2. Scoring of nutritionDay questions against the mapped MST (mMST)

nutritionDay audit variable	Score	Result
Have you unintentionally lost weight within the last 3 months?		
No	0	138 (56%)
Unsure	2	35 (14%)
If yes, how many kg [kilograms] did you lose?		
1-5	1	0 (0%)
6-10	2	0 (0%)
5-11	3	0 (0%)
>15	4	0 (0%)
Unsure	2	74 (30%)
How well have you eaten in the week before you were admitted to hospital?		
More than normal	0	4 (2%)
Normal	0	169 (68%)
About ¾ of normal	1	50 (20%)
About ½ of normal	1	19 (8%)
About ¼ of normal	1	5 (2%)
Total mapped MST Score		
At malnutrition risk (mMST score ≥2)		109 (44%)

Table 3. Thirty-day health-related outcomes of participants compared to nutritional issues

30-day health-related outcomes	Overall results	Not at malnutrition risk [a] (mapped MST score <2)		At malnutrition risk [b] (mapped MST score ≥2)		p-value [c]
		≤50% intake [a] (n=30)	100% intake [b] (n=108)	≤50% intake (n=38)	100% intake (n=71)	
Readmissions n (%)						
Readmission	18 (6.9%)	2 (6.7%)	8 (7.4%)	2 (5.3%)	6 (8.7%)	0.967
No Readmissions	243 (93.1%)	28 (93.3%)	100 (92.6%)	36 (94.7%)	63 (91.3%)	
In-hospital mortality n (%)						
In-hospital mortality	1 (0.4%)	1 (3.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0.121
No in-hospital mortality	261 (99.6%)	29 (96.7%)	108 (100.0%)	38 (100.0%)	70 (100.0%)	
Length of stay						
Median days (range)	8 (1-92)	8 (2-62)	7 (1-92)	10 (1-44)	8.5 (2-41)	0.491

[a] ≤50% intake includes nil-by-mouth, 0%, 25% and 50% meal intake

[b] 100% intake includes all the meal being consumed

[c] p-value from bivariate analyses of Chi-square test (categorical variables) or Mann-Whitney test (continuous variables). Indicates association between nutritional issues (merged malnutrition risk and food intake) and 30-day health-related outcomes