

Adult malnutrition: prevalence and use of nutrition-related quality indicators in South African public-sector hospitals

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Objectives: The aim of this study was to describe the prevalence of malnutrition among adult hospitalised patients in three South African public hospitals and to determine the availability of nutrition-related quality indicators at ward and institutional level.

Method: A descriptive, cross-sectional, multi-centre study was used to determine the prevalence of malnutrition, whilst a descriptive exploratory design was used to determine the use of nutrition-related quality indicators for the identification and treatment of malnutrition. A total of 141 adult hospitalised patients in three public hospitals in an urban setting participated. Mid-upper arm circumference (MUAC), body mass index (BMI), and malnutrition universal screening tool (MUST) were used to determine the prevalence of malnutrition or malnutrition risk. A Hospital Nutrition Review Tool (HNRT) determined the use of nutrition-related quality indicators.

Results: The overall malnutrition risk according to MUST was 72.3% (48.2% high risk and 24.1% medium risk), whilst 45.4% were malnourished based on MUAC. No routine nutritional screening was conducted in any of the wards to identify patients at nutritional risk. The majority of nurses reported inadequate training or knowledge to calculate patients' BMI or percentage weight loss, or to perform nutritional screening.

Conclusion: Both malnutrition prevalence and malnutrition risk among adult hospitalised patients are high in the public sector. Inadequate resources may lead to delays in malnutrition identification and appropriate nutritional intervention, which may adversely affect both the patient and the institution. This study contributes to baseline data on adult malnutrition in the South African public hospital setting.

Keywords: Adults, hospitalised, malnutrition, hospitalised, nutrition-related quality indicators, prevalence, screening

Introduction

The prevalence of malnutrition in hospitalised adults has been extensively reported in the international literature and varies between 13% and 78% among acute-care patients.¹ In England, one in five patients on admission to one of four hospitals was considered malnourished.² A tertiary teaching hospital in Melbourne, Australia, reported that 23% of patients ($n = 275$) randomly assessed by Subjective Global Assessment (SGA) were malnourished on admission.³ European data also indicate similar rates, with a German study in 2006 reporting a 27% rate of malnutrition using SGA⁴ and a Danish group finding 40% of patients to be at malnutrition risk using the Nutrition Risk Screening (NRS), whilst 8% were malnourished.⁵

According to the British Association for Parenteral and Enteral Nutrition (BAPEN), 73% of patients in the United Kingdom (UK) were admitted to hospital from their own homes, of which 23% were at risk of malnutrition. This suggests that malnutrition prevalence in hospitals may originate in the community. However, this is not quantified in most studies and more research is needed.⁶ In India, 39.6% of intensive care unit (ICU) patients in a tertiary hospital were malnourished,⁷ whilst a study in Brazil reported a slightly higher prevalence of 45% as per SGA.⁸

Limited South African data exist concerning malnutrition prevalence in adult hospitalised patients and the use of nutrition-related indicators. The few existing studies are not recent and are

isolated within certain geographical areas (Cape Town, Durban and Zululand). Malnutrition prevalence in these studies ranged between 15 and 82%.^{9–13}

Risks associated with malnutrition in hospitalised patient include: delayed recovery and prolonged hospital stay, increased risk of morbidity and mortality, increased general practitioner visits, and a greater likelihood of admission to care homes or step-down facilities. Some studies have reported an increased length of stay (LOS) for malnourished patients. In other studies, it was observed that malnourished patients' LOS was approximately 4.5 days, which was 43% longer than the stay of the well-nourished patients.^{3,14} It was also reported that hospital costs for the care of patients at nutritional risk have been up to four times higher than the cost for those patients not at risk.¹⁵ In 2009, the health and social care costs associated with malnutrition in the UK were estimated to amount to at least £13 billion annually.¹⁶

There is often a lack of awareness and screening practices to identify and treat malnourished patients,¹ and many patients remain malnourished throughout their stay in hospital. In a Spanish multi-centre study, almost three-quarters (72%) of the 23.7% of patients presenting with malnutrition risk on admission were still malnourished at discharge.¹⁷

Nutritional screening is the first step in nutritional management. Many clinical practice groups (ASPEN, BAPEN and ESPEN)

currently recommend nutritional screening of acute care patients, either prior to admission or within 24–48 hours thereafter.^{1,18,19} It is imperative to identify malnourished patients promptly in order to prevent or reverse the associated negative clinical outcomes.²⁰ Currently physicians and nurses assess patients on admission to hospital, and it has been suggested that they are in an ideal position to screen patients for malnutrition.¹

Suggested quality indicators to support nutritional management in the acute setting include: internal institutional protocols for malnutrition treatment and prevention; and policy updates by relevant stakeholders.¹⁸ Effective nutritional management strategies include: appropriate weighing practices; documentation of weight fluctuations; monitoring of biochemical parameters and food intake; and clear malnutrition identification criteria through nutritional screening. Using nutritional experts and multidisciplinary nutritional teams is also recommended to help combat malnutrition. Tannen and Lohrmann (2013) recommend that information on malnutrition should be made available to inpatients (i.e. in the form of a flyer) and that staff training on malnutrition be done at least every two years.¹⁸

Currently there is no evidence that nutritional screening or other suggested quality indicators referred to are either voluntarily implemented or systematically enforced in South African public hospitals.

This study addresses the lack of current data on malnutrition prevalence in adult patients in South African public hospitals, and provides baseline data on the use of nutrition-related quality indicators in these institutions, which can be applied to further studies in other public hospitals and other sectors (e.g. primary health care clinics and private hospitals).

Malnutrition risk was determined through: obtaining appropriate anthropometric data, calculating body mass index (BMI), and using the validated Malnutrition Universal Screening Tool (MUST).²¹ Associations between demographics, medical diagnosis and malnutrition risk were determined to identify specific groups that may be at increased risk of malnutrition. A Hospital Nutrition Review Tool (HNRT) was developed for this study, which measured available resources and implementation practices of nutrition-related quality indicators.

Method

Study design

A descriptive, cross-sectional, multi-centre study design consisting of two simultaneous phases was used in one regional and two tertiary public hospitals in the same urban area within the Eastern Cape, South Africa.

The first phase determined malnutrition prevalence among hospitalised adult patients. Only certain wards were included in the first phase, owing to time constraints. The second phase determined the availability of nutrition-related quality indicators at ward level. For this purpose, an HNRT was developed in collaboration with a statistician. All adult wards in the three selected hospitals, with the exception of the maternity and urology wards, were included in the second phase. The maternity ward was excluded due to anthropometric changes during pregnancy. The urology ward formed part of the pilot study for Phase One, which included eight patients in one of the selected

hospitals. The HNRT (Phase Two) was also piloted in the same ward. Although only minor changes were required after the pilot study to improve the clarity of some questions, it was decided to exclude the urology ward from the main study, as this may have introduced bias in the results of the study.

Sampling

Four wards across the three participating public hospitals were purposively selected (Phase One). The study population included all elective and acute patients from the following wards: general medical (hospital one), general surgery and oncology wards (hospital two), and a cardiothoracic ward (hospital three). All patients in these wards who were present during the data collection period, met the inclusion criteria, and gave informed consent were included in the study until the minimum number of 35 patients per ward was obtained, resulting in a total study population of 141 patients. The precision of malnutrition prevalence, or malnutrition risk, was calculated at 8.3% with a 95% confidence. Groups were compared by means of χ^2 and a 95% level was used, which means that a p -value of < 0.05 was considered statistically significant.

For Phase Two, all 27 adult wards, excluding maternity and urology wards, were included across the three hospitals. Healthcare workers, consisting of nurses and doctors who were present on the selected wards, available for interaction with the researcher and gave informed consent were included in the study until all the required sections of the HNRT were completed.

Ethics

The study was approved by the ethical committee of the Nelson Mandela University and the Eastern Cape Department of Health Research Committee. Patient participation was voluntary and written informed consent was obtained from all patients included in the study. Confidentiality was maintained by the use of anonymous questionnaires and coded data sheets. For Phase 2 of the study, involving healthcare workers, participation was voluntary and anonymous; verbal informed consent was obtained from each participant.

Data collection

Anthropometrical variables and screening

A calibrated SECA scale, SECA stadiometer (SECA, Hamburg, Germany), and a non-stretchable measuring tape were used to obtain anthropometrical indices, including: weight; height; and mid-upper-arm circumference (MUAC). BMI, MUAC and MUST scores were used to identify malnutrition risk.^{21–23} Although BMI and MUST are more commonly used to determine malnutrition and malnutrition risk respectively, MUAC has increasingly been used to assess nutritional status and determine eligibility for nutrition support among adolescents and adults in low-resource settings.²³ Several studies have shown a strong association between a MUAC < 23 cm and a BMI of < 18.5 .^{24–27} In this study BMI (< 18.5) and MUAC (< 23 cm) were used to determine malnutrition prevalence and MUST to determine malnutrition risk prevalence. Demi-span or ulna length was used to determine height for non-ambulatory patients, using validated formulae.²² BMI was then estimated, from which the estimated actual body weight was extrapolated. To improve validity and reliability of the data obtained, all anthropometric measurements were obtained by the trained fieldworkers, using standard anthropometric techniques.²² The use of a validated screening tool (MUST) further improved the validity of the data.

Development of a Hospital Nutrition Review Tool

An HNRT (Table 1) was developed to determine the availability and use of nutrition-related quality indicators in each ward. Patient files were checked to determine whether weight and/or height of patients had been recorded either on admission or thereafter. The availability and calibration of ward scales and stadiometers was determined by direct observation.

Perceived ability of nurses and doctors and nurses to identify malnutrition risk

Nurses and doctors are the most likely healthcare professionals to refer patients to dietetic services, since they are in direct daily contact with hospitalised patients. The study aimed to determine the self-perceived ability of public service nurses and doctors at ward level to identify patients who present with malnutrition risk. One of the researchers completed the HNRT form for each of the 27 wards, by a combination of direct observation and interaction with healthcare workers (doctors and nurses), until all the sections of the form were completed (Table 1). This included direct observation by the researcher with regard to the availability and calibration of scales and stadiometers, availability of malnutrition-related material for patients (i.e. posters, leaflets), and practices with regard to weighing, height measurements and nutritional screening on the ward level. Information obtained from ward staff included self-perceived ability to

calculate BMI, percentage weight loss, and the appropriate classification thereof, knowledge of referral procedures to dietetics services, and barriers to the use of nutrition-related quality indicators on the ward level.

Statistical analysis

Statistica® (version 13) (TIBCO Software Inc, Palo Alto, CA, USA) was used to analyse data, which were summarised using descriptive statistics, including frequencies and percentages. The χ^2 test, *t*-tests, and the two-tailed Pearson correlations were used to determine associations, comparisons and correlations between the variables.

Results

Phase one: nutritional status data

Four wards in three hospitals were selected in this part of the study, which included a general medical ward (*n* = 35; 24.8%), a general surgical ward (*n* = 36; 25.5%), an oncology ward (*n* = 35; 24.8%), and a cardiothoracic ward (*n* = 35; 24.8%).

The mean age in this sample (*n* = 141) was 47.8 years (SD 14.7, age range 19–81 years) and 52.5% were female. The majority of the sample consisted of black patients (65.2%; *n* = 92); 29.1% (*n* = 41) were coloured and 5.7% (*n* = 8) were white.

Table 1: Hospital nutrition review tool (HNRT) of quality indicators (QI)

Ward review					
Hospital: Ward: Date:					
	Always	Sometimes	Never	Do not know	Reason/comment
Are patients weighed on admission?					
Are patients' height measured on admission?					
Are patients weighed after admission?					Frequency If no, why not
Does any routine nutritional screening occur on admission?					Specify screening tool Frequency
*Frequency to be specified as most/some/none.	BMI calculation	BMI classification		Percentage weight loss	Weight loss classification
*Differentiate between doctors and nurses.					
Have doctors and nurses been trained on malnutrition indicators?					
Differentiate between doctors and nurses	Most		Some	None	
Do doctors and nurses know how to refer patients who need nutritional support?					
State material used	Always	Sometimes	Never	Do not know	
Is any malnutrition-related material (i.e. leaflets/posters/talks given) available to patients whilst in hospital?					
Ward checklist	Yes		No	Number	
Ward scale available					
Scale calibrated					
Ward stadiometer available					
Screening tool available on ward					

Table 2: Prevalence and risk of malnutrition according to nutrition-related indicators

Prevalence of malnutrition according to mid-upper-arm circumference (MUAC) cut-offs		
	n	Percentage (%)
Normal (MUAC > 23 cm)	77	54.6
Malnutrition (MUAC ≤ 23 cm)	64	45.4
Total	141	100.0
Prevalence of malnutrition according to BMI		
Underweight (< 18.5 kg/m ²)	38	27.0
Normal weight (18.5–24.9 kg/m ²)	57	40.4
Overweight (25.0–29.9 kg/m ²)	26	18.4
Obesity (30.0–39.9 kg/m ²)	18	12.8
Morbidly obese (≥ 40 kg/m ²)	2	1.4
Total	141	100.0
Risk of malnutrition, using the Malnutrition Universal Screening Tool (MUST)		
malnutrition risk		
Low Risk (Score = 0)	39	27.7
Medium Risk (Score = 1)	34	24.1
High Risk (Score ≥ 2)	68	48.2
Total	141	100.0

Outcomes of the nutritional status indicators (MUAC, BMI and MUST) are summarised in Table 2. Twenty-seven percent of participants were classified as underweight (BMI < 18.5 kg/m²), whilst a third (32.6%; *n* = 46) were classified as either overweight (BMI 25–29.9 kg/m²) or obese (BMI > 30 kg/m²). When stratified according to gender, male participants were significantly more undernourished (55%) than female participants (36.5%) based on MUAC cut-off values ($\chi^2 = 10.2$; *df* = 3; *p* < 0.05) with the statistical power calculated at 0.95. Similarly, statistically significant differences were found with regard to the BMI of males and females: 32.8% of males were underweight compared with 21.6% of females, whilst 19.4% of males and 44.6% of females were overweight or obese ($\chi^2 = 10.223$; *df* = 3; *p* < 0.05, with the statistical power calculated at 0.86).

The overall malnutrition risk according to MUST was 72.3% (48% high risk; 24.1% medium risk). The study found MUAC and MUST to identify a similar number of participants as malnourished or at high risk of malnutrition (48.2% vs. 45.4%) which was statistically

significant ($\chi^2 = 59.049$; *df* = 6; *p* < 0.05), with large practical significance (Cramer's *V* = 0.46). BMI on the other hand classified fewer patients as malnourished (27%) in comparison with MUAC or as at risk for malnutrition according to MUST. However, a statistically significant relationship was still found between BMI and MUAC ($\chi^2 = 105.13$; *df* = 9; *p* < 0.05) with large practical significance (Cramer's *V*-test 0.499), which suggests that both BMI and MUAC are appropriate to use as a nutritional screening tool to identify patients as malnourished or at risk for malnutrition.

As indicated in Figure 1, the cardiothoracic ward had the highest prevalence of malnutrition risk, with 60% of participants classified as at high risk for malnutrition. Almost half (54.3%) of participants in both the general medical and oncology wards and 25% on the general surgical ward had a high risk for malnutrition. In all the wards except for the general surgery ward, the prevalence of high malnutrition risk was approximately 50% or higher.

There was a statistically significant relationship between the risk of malnutrition (according to MUST) and the disease specialty ($\chi^2 = 12.71$; *df* = 6; *p* < 0.05). The power of the χ^2 test was calculated at 0.77 and Cramer's *V* (0.21) indicated that this finding is of medium practical significance. No statistically significant relationship existed between age or race and risk for malnutrition.

Phase two: use of nutrition-related quality indicators

The majority of wards (89%) had access to a scale; 74.1% had their own scales, and 15% shared scales. The shared scales were chained to walls, and could not be moved between wards. In all, 11% of wards had broken scales and 44% of the scales were uncalibrated (set to zero), hence could have provided inaccurate weights if not calibrated just before weighing. Almost three-quarters of the wards (74.1%) had access to stadiometers, with 59.3% having their own stadiometers and 14.8% sharing stadiometers.

Less than a fifth (19%, *n* = 4) of the wards always weighed patients on admission. Of the 23 wards that never (44%, *n* = 12) or only occasionally (37%, *n* = 10) weighed patients following admission, the main reason cited (57%, *n* = 13) was wards being understaffed. Some 30% (*n* = 7) only weighed patients on doctors' orders, whilst 13% (*n* = 3) perceived weighing patients as part of the dietitian's responsibilities. Most wards (88.9%, *n* = 24) never measured patients' height on admission.

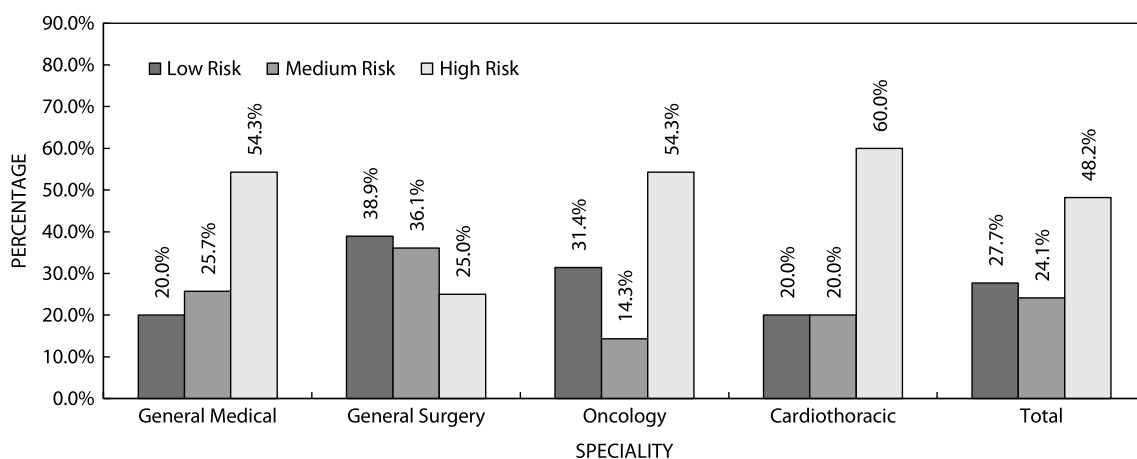
**Figure 1:** Malnutrition risk using MUST according to disease speciality.

Table 3: Healthcare worker perceptions of ability to calculate and classify BMI and percentage weight loss ($n = 27$).

Healthcare workers		Calculate BMI		Classify BMI		Calculate % weight loss		Classify % weight loss	
		<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Nurses	Most	1	3.7	1	3.7	0	0	0	0
	Some	9	33.3	7	25.9	1	3.7	1	3.7
	None	17	63	19	70.4	26	96.3	26	96.3
Doctors	Most	1	3.7	1	3.7	0	0	0	0
	Some	25	92.6	25	92.6	2	7.4	1	3.7
	None	1	3.7	1	3.7	25	92.6	26	96.3

Doctors and nurses reported having had inadequate training or knowledge in performing nutritional screening, or calculating and classifying BMI and percentage weight loss (Table 3)

There was no routine nutritional screening conducted in the wards evaluated, either on admission or thereafter. None of the wards had information on malnutrition available for patients.

Doctors and some nurses knew *how* to refer patients to the resident dietitian. However, the study did not investigate whether they knew *when* to refer, and if any specific criteria were used to initiate referrals to the dietetics department. This is an area that warrants further research.

Discussion

The results of the study indicate a high prevalence of malnutrition (as per BMI and MUAC), including both undernutrition and overnutrition, as well as a high prevalence of malnutrition risk (as per MUST) in three public sector hospitals studied in the Eastern Cape. The malnutrition risk (48.2% high risk and 24.1% medium risk as per MUST) was similar to the findings of a Brazilian study,⁸ which found that 48.1% of participants were malnourished and a further 12.5% were severely malnourished. The prevalence of malnutrition risk was, however, much higher compared with European studies: the BAPEN study⁶ found overall malnutrition risk was 27% (20% high risk and 7% medium risk) and an Austrian study¹⁸ found 24% were at increased risk (15.7% high risk and 3.7% low risk).

A higher proportion of study participants (27.3%) were underweight (BMI < 18.5 kg/m²) compared with the BAPEN⁶ (4%) and Austrian¹⁸ (6%) studies. Furthermore, 32.6% of study participants were overweight or obese, compared with 62% in the BAPEN⁶ study and 52.3% in the Austrian¹⁸ study. When compared with SANHANES-1²⁸ (2013) and the South Africa Demographic and Health Survey²⁹ (SADHS, 2016) the prevalence of malnutrition (BMI < 18.5) was higher in hospitalised patients in this study in comparison with non-institutionalised adults (males 32.8% in this study compared with 13.5% (SANHANES-1) and 6.8% (SADHS); females 21.6% compared with 5.2% (SANHANES) and 2.3% (SADHS), although a direct comparison was not possible as the age range differed (≥ 18 years in this study compared with ≥ 15 years SANHANES-1 and SADHS). The prevalence of overweight and obesity (BMI ≥ 25) on the other hand was lower in comparison with SANHANES-1 (males 19.4% in this study compared with 24.3% (SANHANES-1) and 25.6% (SADHS); females 44.6% compared with 63.5% (SANHANES-1) and 69.1% (SADHS).

MUST is the one of the screening tools that have been studied most extensively³⁰ and has been recommended for use by the

European Society for Clinical Nutrition and Metabolism (ESPEN).³¹ However, it has also been reported to be complex to use, requiring BMI calculation and percentage weight loss,³⁰ which has been shown to be a limited skill in this study, especially amongst nurses. MUST may therefore not be a realistic option as a nutritional screening tool at present for the South African public setting. This study found MUAC and MUST identified a similar number of participants as malnourished or at high risk of malnutrition; however, MUAC is a simpler screening tool to use, requires no calculations and may therefore be considered as a viable alternative to identify adult patients at nutritional risk in public South African hospitals.

Despite having reasonable access to scales and stadiometers, actual weighing and measuring of height in patients were poor in all three hospitals. About one in five (18.5%) wards always weighed patients, and a further 37% sometimes weighed patients, whilst only 11.1% of wards always or sometimes recorded height on admission. This is much lower than the BAPEN study,⁶ where 67% of all wards recorded weight and height on admission and a further 27% recorded weight and height on some wards. The Austrian study¹⁸ reported that 70.5% of patients were weighed on admission. The current study's findings were similar to the Brazilian study,⁸ which indicated that fewer than 18.8% of patient records contained nutrition-related information. The nurses in this study reported being understaffed as being the major reason for not conducting basic anthropometric measurements. Yet, according to the Eastern Cape Department of Health annual report³² (2014/2015), 91% of professional nurse posts were filled and 96% of staff nurse posts. The high percentage of filled posts may therefore not reflect an optimal staff ratio for nurses in the hospital setting to perform all the necessary duties, including nutrition-related functions.

Most nurses reported lacking adequate training or knowledge to perform nutritional screening or calculate and classify a patient's BMI and percentage weight loss. BMI compared well with MUST in this study in identifying patient as underweight, and can also identify patients that are overweight and obese in contrast to MUAC. This study showed that both under- and overweight are areas of concern in the Eastern Cape public hospitals. However, nurses would need further training prior to BMI being considered as a screening tool and/or a key nutrition indicator in the South African public hospital setting.

Conversely, some doctors felt adequately trained or knowledgeable (Table 3). No nutritional screening occurred on any of the wards, in comparison with the BAPEN⁶ study where 86% of patients were screened on admission and 69.3% in the Austrian study.¹⁸ The lack of anthropometric skills and screening practices identified in this study severely limits the accurate

identification of malnutrition risk in patients who may otherwise have benefited from nutritional intervention and support, thereby decreasing their risk of malnutrition-related adverse effects, as previously discussed.

Study limitations

Relatively small sample sizes were used in obtaining nutritional status data, hence the data cannot be extrapolated to represent the nutritional status of hospitalised patients in all public hospitals in South Africa. Convenience sampling was used to select nurses that were available on wards during data collection to complete an HNRT form for each ward. Therefore, the findings cannot be generalised as the perceptions of all doctors and nurses in public South African hospitals. Furthermore, no differentiation was made with regard to the rank of nurses and doctors, which may have had an influence on their knowledge and skills. Nonetheless, the findings provide important baseline data for South Africa.

Conclusion and recommendations

A high malnutrition prevalence was identified amongst the adult patients in three public hospitals in an urban setting, leading to potential adverse consequences for both the patient and the institution.

Owing to the lack of resources, knowledge and training identified in this study, malnutrition risk may be overlooked in the absence of regular weighing and nutritional screening practices of patients on admission or thereafter. To ensure that an adequate level of care is maintained as per the Batho Pele Principles³³ and the Patient Rights Charter,³⁴ it is recommended that obligatory institutional nutrition protocols on the prevention and/or treatment of malnutrition across all age groups be developed and enforced from high-level management downwards.³⁴ Nutritional status indicators for adults such as MUAC or BMI should be documented on admission to hospital, and form part of the Department of Health's key nutrition indicators.³⁵ In-service training on nutrition screening for nurses and doctors, as well as undergraduate nursing and medical students, should be strengthened to improve appropriate identification and management pathways for malnutrition. Provincial audits of training should be conducted, to ensure that training occurs regularly and nutritional screening is implemented. Nutritional screening should also form part of new employees' induction programme. Additional resources may be required to implement the recommended nutrition-related activities; therefore, appropriate evidence-based acceptable staffing levels for nurses, doctors and dietitians to provide sound nutrition care to malnourished or at-risk patients should be investigated.

Further research is needed to determine the extent of malnutrition in adult hospitalised patients in South Africa. The most appropriate screening tool that is quick and easy to use and appropriate for the South African context needs to be identified or developed. MUAC showed a statistically significant relationship with the use of the validated MUST with large practical significance, it is easier to use, and may be a starting point to identify nutritionally at-risk patients in African hospitals.

Disclosure statement

No potential conflict of interest was reported by the authors.

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