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Title: The Malnutrition Screening Tool is a useful tool for identifying malnutrition risk in residential aged care.

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Contribution

EI performed the data analysis and was the primary author on the manuscript. JB supervised the nutritional components of the study and assisted in statistical interpretation and writing of the manuscript. MB assisted in writing the manuscript. DG was the chief investigator and assisted in the writing of the manuscript.

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The Malnutrition Screening Tool is a useful tool for identifying malnutrition risk in residential aged care.

Abstract

Background: The Malnutrition Screening Tool (MST) is a valid nutrition screening tool in the acute hospital setting but has not been assessed in residential aged care facilities. The aim of this secondary analysis was to determine whether the MST could be a useful nutrition screening tool when compared with a full nutrition assessment by Subjective Global Assessment (SGA) in the residential aged care setting.

Methods: Two hundred and eighty-five residents (29% male; mean age: 84 ± 9 years) from eight residential aged care facilities in Australia participated. A secondary analysis of data collected during a nutrition intervention study was conducted. The MST consists of two questions related to recent weight loss and appetite. While the MST was not specifically applied, weight loss and appetite information was available and an estimated MST score (0-5) calculated. Nutritional status was assessed by a research assistant trained in using SGA.

Results: Malnutrition prevalence was 42.8% (122 malnourished out of 285 residents). Compared to the SGA, the MST was an effective predictor of nutritional risk (sensitivity = 83.6%, specificity = 65.6%, positive predictive value = 0.65, negative predictive value = 0.84).

Conclusions: The components of the MST have acceptable sensitivity and specificity suggesting it can play a valuable role in quickly identifying malnutrition risk in the residential aged care setting. Further prospective research using the MST tool against a broader array of objective and subjective nutritional parameters is required to confirm its validity as a screening tool in aged care settings.

Key words: Dietetics, nutrition screening, malnutrition, residential aged care, nutrition

Introduction

Recent Australian studies have reported the prevalence of malnutrition in aged care residents as approximately 50% (Gaskill *et al.*, 2008; Banks *et al.*, 2007). International studies have reported malnutrition prevalence as 30-90% (Baldelli *et al.*, 2004; Saava and Kisper-Hint, 2002). This relatively high prevalence is of concern as malnourished older adults have poorer outcomes including increased risk of falls, pressure ulcers, poorer quality of life, less independence and increased mortality (Watson *et al.*, 2006; Donini *et al.*, 2004; Amarantos *et al.*, 2001). Older adults are at increased nutritional risk due to the aging process and a variety of factors including swallowing and chewing difficulties, comorbidities and polypharmacy (Pauly *et al.*, 2007; Watson *et al.*, 2006; Abbasi and Rudman, 1994). Residents with functional impairments and multiple medical conditions are further nutritionally compromised (Suominen *et al.*, 2005).

Early identification of malnutrition and appropriate nutrition intervention may lead to beneficial outcomes. Early recognition is considered to be one of the most important ways of preventing malnutrition (Ferguson *et al.*, 1999a) but relies on the use of appropriate tools to determine malnutrition risk. Measurement of nutritional status in older people generally includes medical history, biochemical indices, anthropometrics, dietary intake or a combination of these (Watson *et al.*, 2006). A number of instruments, including nutrition screening and assessment tools, have been developed and validated for use in older adults (Stratton *et al.*, 2004; Rubenstein *et al.*, 2001; Guigoz *et al.*, 1996). No single measurement, however, has emerged as a 'gold-standard' in assessing nutritional status, making a diagnosis of malnutrition challenging.

The purpose of nutrition screening is to identify those people who may be at risk of malnutrition, and where such a risk is determined, then a more comprehensive nutrition assessment and appropriate nutrition intervention is required (ADA 1994). Nutrition assessment for malnutrition is a more detailed process than screening and many assessment tools require training prior to administration. Nutrition assessment should ideally be carried out by an appropriately trained clinician, such as a dietitian or registered nurse. Nutrition assessment tools offer a more comprehensive review of nutritional status which may include investigation of medical and nutritional histories and a physical examination and/or anthropometric measures to determine whether an individual is well or malnourished (ADA 1994).

Subjective Global Assessment (SGA) (Detsky *et al.*, 1987) is a valid and reliable tool for assessing nutritional status in older adults (Christensson *et al.*, 2002; Duerksen *et al.*, 2000; Sacks *et al.*, 2000). However, nutrition assessment can be time consuming and requires nutritional expertise which makes it impractical for use on all residents. Nutrition screening, a very quick way of determining risk, is therefore a potentially feasible option for identifying residents at risk of malnutrition. All residents can be routinely screened and identified for appropriate nutrition assessment and/or nutrition intervention to allow for systematic identification rather than ad hoc referral and treatment. In the absence of nutrition screening, malnutrition may not be recognised or treated (Crogan and Evans, 2001).

The Malnutrition Screening Tool (MST) is a quick and simple nutrition screening tool based on weight loss and appetite changes. It has been validated in the acute hospital (Ferguson *et al.*, 1999a) and ambulatory care settings (Isenring *et al.*, 2006; Ferguson *et al.*, 1999b), but not specifically in the residential aged care setting. The aim of this secondary analysis was to determine whether the MST could be a useful nutrition screening tool when compared with a full nutrition assessment by SGA in the residential aged care setting.

Methods

Study design and sample

This is a secondary analysis of data from a randomised pre-test and post-test designed study conducted in eight residential aged care facilities (RACF) in Southeast Queensland, Australia. The original study identified the malnutrition prevalence of residents (Gaskill *et al.*, 2008), and the impact of implementing a train-the-trainer nutrition program versus usual care on the nutritional status of residents after six months (Gaskill *et al.*, 2009).

Exclusion criteria included residents who were tube fed or those who were considered by the Director of Nursing (DON) to be seriously ill. The study proposal received approval from the Human Research and Ethics Committees of both the university and industry partner. Only 20% of the residents were considered to be cognitively capable of giving informed consent. For the remainder, consent was obtained from the DON on behalf of residents in five facilities and from the next of kin/legal guardian by research staff or care staff in the remaining three facilities.

Data collection

Demographic variables (gender, age, level of care) were collected from residents' medical charts. The level of care was defined according to the Resident Classification Scale (RCS). A RCS score between 1-4 is considered to be high level of care (Australian Institute of Health & Welfare, 2006).

As part of the intervention study, data was collected pre- (baseline) and post-test (six months later), as per Gaskill *et al.* (2008). Body weight was collected in a standardised manner using calibrated digital chair scales. All facilities were provided with a laminated "Weighing Checklist" to ensure comparable weighing procedures. Questions relating to dietary intake, appetite and other nutritional issues were obtained primarily from care staff as most residents were unable to offer this information.

SGA

The SGA is a validated nutrition assessment tool consisting of the resident's medical history (weight loss, dietary intake, gastrointestinal symptoms and functional capacity) and a physical examination (subcutaneous fat, muscle wasting and oedema) (Detsky *et al.*, 1987). Residents are assessed as well nourished (A), moderately malnourished (B) or severely malnourished (C) (Detsky *et al.*, 1987). A research assistant trained by one of the senior researchers (JDB) undertook all SGA, body weight and appetite assessments.

The post-test SGA (6 months) was used as the nutrition assessment comparator for the validation of the MST.

MST

The MST consists of two questions related to recent unintentional weight loss and eating poorly because of a decreased appetite. The MST provides a score between 0-5, with residents considered to be at risk of malnutrition if they score ≥ 2 (Ferguson *et al.*, 1999a) (Figure 1). Although the MST tool was not specifically applied during the study, the two components of the MST were obtained for this secondary analysis using pre and post-test data (6 months) Weight loss was calculated from the difference between the pre-test and post-test weight. Decreased appetite was determined at post-test from a question which rated appetite as good, fair or poor with the latter two responses classified as a decreased appetite. The relevant MST component scores were determined for both the weight loss and appetite questions; and added to give the overall MST score.

Data analysis

All data were entered into SPSS Version 16.0 software (Chicago, Ill, USA). A contingency table was used to determine the sensitivity (percentage of malnourished correctly identified as such), specificity (percentage of well-nourished correctly identified as such) and predictive value (likelihood that the tool correctly predicts the presence or absence of malnutrition) of the components of the MST in detecting patients at risk of malnutrition compared with the SGA assessment.

Results

Pretest SGA data were available for 346 residents (Gaskill *et al.*, 2008) and there was complete appetite and weight data at 6 months post-test for 285 residents. Of those with complete appetite and weight data, 71% ($n = 202$) were female and 29% ($n = 83$) were male. The mean age of residents was 84 years (SD = 9.0) and the majority were classified as high care (76% $n = 217$). While age and gender did not significantly differ between residents with complete weight and appetite data, more high care residents had missing data at 6 months than low care residents. Thus a greater proportion of high care than low care residents were lost to follow up (95% of those with missing data were high care vs 76.1% of those with complete weight and appetite data being high care; $X_2=11.1$; $P<0.001$).

According to SGA, 42.8% ($n = 122$) were malnourished. Compared to the SGA, the MST had a sensitivity of 83.6% (true positives); and a specificity of 65.6% (true negatives). This was equivalent to a 0.65 positive predictive value and a 0.84 negative predictive value (Table 1).

Contingency table here

Discussion

Our secondary analysis indicates the MST could have a valuable role in identifying malnutrition risk when compared with a full nutrition assessment by

the SGA in aged care residents. The MST was shown to be a good predictor of nutritional risk relative to the SGA with high sensitivity (and negative predictive value), and acceptable specificity (and positive predictive values). The need to correctly classify all malnourished patients (sensitivity) takes precedence over misclassifying patients who are well-nourished (specificity)(Ferguson *et al.*, 1999a). These results are however slightly lower than previous MST validation studies performed in the acute and oncology outpatient settings where sensitivity varied from 92-100% and specificity ranged from 81-93% (Isenring *et al.*, 2006; Raja *et al.*, 2004; Ferguson *et al.*, 1999a; Ferguson *et al.*, 1999b). These higher sensitivity and specificity values reflect that the MST probably performs better in the acute setting, which is where it was originally developed. However these results also indicate that it may be more difficult to identify nutritional risk in a longer term / chronic setting, most likely due to the more gradual rate of change. The nutritional challenges of older adults are due to not only inadequate dietary intake, but also altered requirements and underlying disease (Watson *et al.*, 2006). None-the-less as a very simple screening tool this study suggests the MST is useful in identifying malnutrition risk in this population.

The malnutrition prevalence (122 malnourished out of 285 residents) was relatively high (42.8%) and compares with 49.5% for those with complete baseline data (171 malnourished out of 346 residents)(Gaskill *et al.*, 2008). This is similar to that reported by another Australian study (N=839) conducted in residential aged care using the SGA (approximately 50%) (Banks *et al.*, 2007). However, the prevalence is lower than an American study which used SGA to determine a malnutrition rate of 70% in 53 consecutive admissions to four long-term care facilities (Sacks *et al.*, 2000). This compares with 28-90% prevalence of malnutrition and malnutrition risk reported using the Mini Nutritional Assessment (MNA) in international studies (Baldelli *et al.*, 2004; Saava and Kisper-Hint, 2002). This may reflect that MNA detects more older adults at malnutrition risk than the SGA which is more useful for “diagnosing” established malnutrition (Christensson *et al.*, 2002). Malnutrition prevalence depends on the assessment tools used but these high malnutrition rates in long-term care facilities is of concern as it is known that malnourished residents have poorer quality of life and increased morbidity and mortality (Amarantos *et al.*, 2001; Abbasi *et al.*, 1994).

Most causes of malnutrition in older adults are modifiable and central to improving this is greater staff awareness, better assessment skills of care staff, and adequate overall management of nutritional care (Crogan and Evans, 2001; Abbasi *et al.*, 1994). There is a need to ensure that older adults are regularly screened for malnutrition risk and appropriate and timely interventions implemented. To be effective, a systematic multidisciplinary approach to the management of nutritional care in residential aged care facilities is essential. Staff education, support and adequate time allowance for the provision of daily care must be considered.

While many nutrition screening tools have been developed, few have been appropriately validated (Jones 2002). Common nutrition screening tools used in the Australian older adult population include the Mini Nutritional Assessment-Short Form (MNA-SF)(Rubenstein *et al.*, 2001) and the

Malnutrition Universal Screening Tool (MUST) (Stratton et al., 2004). While these screens have been validated and found to be useful, the MST has the advantage of being very quick and simple to use with no calculations which can be a burden and barrier to effective and routine nutrition screening. Due to its simplicity, the MST can be completed by nursing or administration staff, residents or their relatives. In addition the MST score of 2-5 indicating nutritional risk (the higher the MST score the greater the risk), can be used as a triage system to prioritise resources. The MST is used in many large Australian teaching hospitals so there is the further advantage of using the same screening tool across different settings.

The major limitation of this study was that it was a secondary analysis of available data from a nutrition intervention and hence the actual MST tool was not assessed. However, weight loss over six months and appetite questions were recorded and could be used to estimate a MST score. A potential limitation is that the same research officer collected the weight and appetite information as well as conducting the SGA assessment. However, the study was designed to investigate the effectiveness of a nutrition intervention and not to compare tools so any potential bias should have been limited. Another limitation was the substantial amount of missing data with 346 residents consenting to the study with complete pretest data, although only 285 residents had both appetite and weight loss data available six months post-test. While there were no differences in age and gender for this study and the larger sample, it does appear to be under-representative of high care residents. However, this missing data does not impact on the aim of this secondary analysis which was to compare the ability of the MST to predict nutrition risk when compared to the SGA. Further research using the actual MST tool against a broader array of objective and subjective nutritional parameters in a prospective study is required to confirm the validity of the MST in identifying residents at malnutrition risk in the aged care setting. Inter- and intra-rater reliability should also be investigated.

In conclusion, the components of the MST have acceptable sensitivity and specificity suggesting it can play a valuable role in quickly identifying malnutrition risk in the residential aged care setting. Further prospective research using the MST tool against a broader array of objective and subjective nutritional parameters is required to confirm its validity as a screening tool in aged care settings.

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Table 1: Contingency table of nutrition risk (MST) compared to nutritional status (SGA)

	Well nourished	Malnourished	Total
MST score (0,1) 'not at risk'	107	20	127
MST score (2-5) 'at risk'	56	102	158
Total	163	122	285

MST = Malnutrition Screening Tool (Ferguson *et al.*, 1999a)

SGA = Subjective Global Assessment (Detsky *et al.*, 1987)