Malnutrition self-screening by using MUST in hospital outpatients: validity, reliability, and ease of use

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ABSTRACT
Background: Although nutritional screening with a tool such as the Malnutrition Universal Screening Tool (MUST) is recommended for outpatients, universal screening (MUST) is recommended for outpatients, universal screening tools are under pressure to undertake a variety of other tasks. Little attention has been paid to the validity of patient self-screening with MUST.

Objective: This study in 205 outpatients with a mean (±SD) age of 55 ± 5 years (56% male) assessed the practicalities of self-screening, its agreement with screening undertaken by a trained health care professional (HCP), and its test-retest reliability.

Design: After the participants provided consent, screening was undertaken by the patients themselves and then by a trained HCP who was unaware of the self-screening results. All patients completed an ease-of-use questionnaire. Test-retest reliability of self-screening was established in a subset of 60 patients.

Results: A total of 19.6% of patients categorized themselves as “at risk” of malnutrition (9.8% medium, 9.8% high). For the 3-category classification of MUST (low, medium, high), agreement between self-screening and HCP screening was 90% (κ = 0.70; SE = 0.058, P < 0.001). For the 2-category classification (low risk, medium + high risk), agreement was 93% (κ = 0.78; SE = 0.057, P < 0.001). Disagreements were not systematically under- or overcategorized. Test-retest reliability was almost perfect (κ = 0.94, P < 0.001). Most patients (71%) completed self-screening in <5 min. Patients found the tool easy or very easy to understand (96%) and complete (98%), with 94% reporting that they were happy to screen themselves.

Conclusion: Self-screening involving MUST in outpatients is acceptable to patients, user-friendly, reliable, and associated with good agreement with HCP screening. This trial was registered at clinicaltrials.gov as NCT00714324.

INTRODUCTION

Because malnutrition is both common and costly, many national and international guidelines recommend undertaking a simple screening procedure to identify those at risk (1–5), and many screening tools are available (6–8). Despite this, malnutrition often remains underdetected and undertreated, because health care professionals (HCPs), who are often under pressure to perform a variety of tasks, do not undertake nutritional screening routinely. Indeed, in busy hospital outpatient clinics or in general practice, nutritional screening may not be undertaken at all. However, little attention has been paid to the possibility that patients can screen themselves (self-screening). If patients could reliably and accurately self-screen by using a simple valid procedure, they would reduce the workload of health care workers while becoming involved in their own management (9).

Although several questionnaires concerned with healthy eating have been developed to assess the need for health promotion and nutrition education in adults, including the elderly (10–12), only a few have been associated with self-screening for nutrition risk (13–17). Caution should be taken with such questionnaires because a care plan or guidance on action is not always obvious. This may mean that no action is taken when needed or inappropriate self-referral is made to health services. Concerns have also been raised about the validity of one of the self-administered screening tools in the community (18–21). Furthermore, tools for healthy eating and health promotion based on questionnaires may not be appropriate for disease-related malnutrition. There is a lack of information about self-administration of validated screening instruments that incorporate objective measurements, such as weight or BMI. An example of a validated screening tool that incorporates such measurements is the Malnutrition Universal Screening Tool (MUST) (5), which is the most commonly used screening tool in several countries with different health care systems (8, 22, 23). MUST is based on 3 criteria: BMI, unintentional weight loss, and the effect that acute disease can have in abolishing oral nutritional intake over >5 d. Because self-screening with MUST has not been explored previously, this study aimed to investigate the practicalities of implementing patient self-screening in busy hospital outpatient clinics. It also aimed to examine the test-retest reliability of self-screening and the extent to which it agrees with MUST screening undertaken by a trained HCP.

SUBJECTS AND METHODS

Ethical approval was obtained from Southampton and South West Hampshire Ethics Committee B. In an attempt to

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select a sample that as close as possible represents a random sample, the following procedure was instituted. When the HCP undertaking the study was available to recruit the next patient, the last person who had been checked into the clinic was invited to participate, and, over the study period, approximately every third person on the clinic list was recruited. Patients were excluded if they were <18 y of age, pregnant, inpatients, unable to complete MUST because of physical or mental incapacity, unable to comprehend the English language, or unable to give informed consent. Patients with a sensory impairment, such as poor hearing or eyesight, were not excluded. Reasons for nonparticipation were recorded. Age, sex, type of clinic, highest qualification achieved, and current or former occupations were collected for all patients. Their occupations were grouped by using a standard UK classification system (24).

All patients untrained in the use of MUST gave written informed consent to participate. During the study, the patients always screened themselves before they were screened by the HCP. A screening tool was provided to the patients, which included a simple instruction sheet and simplified BMI and weight-loss tables that were consistent with MUST (Figure 1). Preliminary work had shown these charts (including the instructions and font size) to be user-friendly. All patients were made aware of the weighing scales (Marsden MS4202 medical digital grade 3) and

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**Self-Administered Nutrition Tool**

**Instructions**

This nutrition tool is for you to be able to measure your own nutrition category.

The nutrition tool has 5 steps. There are supporting charts to help you complete the nutrition tool.

To complete the nutrition tool, you will need to:

- Weigh yourself today
- Know your height
- Know if you have lost any weight without trying in the last 3 months.

Use the tool to enable you to calculate your nutrition category, when prompted please use the supporting charts to calculate your score.

**Nutrition Tool**

Please weigh yourself on the scales provided and record your weight here

Weight = kg

What is your height?

Height = Recalled or Measured Delete as applicable

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**FIGURE 1.** Example of the self-screening tool used by the patients within the trial. st, stone.
portable height measure (Seca Leicester stadiometer), which were available in the waiting room. No other instructions were given, including no information on weighing technique (eg, shoes off, coats off). Once the patients had completed the self-screening tool, they placed it in a sealed envelope and returned it to the HCP. This ensured that the results were not disclosed to the HCP who screened the patients after they had screened themselves.

Ease of use and time taken to complete self-screening

All patients completed an ease-of-use questionnaire (very easy, easy, difficult, very difficult). The time taken for each patient to complete the self-screening was recorded, with the use of a stopwatch, by the HCP undertaking the research.

Agreement between self-screening and HCP screening with MUST

To assess agreement after patient self-screening, the trained HCP screened the patient according to standard procedures with the use of the charts contained within the BAPEN MUST toolkit (www.bapen.org.uk). The same equipment (Marsden MS4202 medical grade 3 digital weighing scales, Seca Leicester stadiometer) was available to the patients undertaking self-screening.
and to the single HCP who was involved with screening throughout the full study. Weight was measured to the nearest 0.1 kg and height to the nearest 0.1 cm. The trained HCP documented the patients’ MUST score and risk category (low, medium, high) but did not disclose this information to the patient.

Test-retest reliability of self-screening

Test-retest reliability was assessed at a separate time in a separate group of randomly recruited outpatients. All patients untrained in the use of MUST gave written informed consent to participate in this smaller study. The patients were asked to screen themselves twice, once before and once after their clinic visit, which lasted a mean (±SD) of 51 ± 23 min. The same equipment (scales and stadiometer; see above) was used on each occasion. All patients placed the completed self-screening tools into a sealed envelope after each screening and returned them on each occasion to the HCP.

Statistical analysis

Agreement and chance-corrected agreement (κ) of malnutrition risk categorization were assessed, the latter by using the grading system of Landis and Koch (25) (κ=0.00, poor; 0.00–0.20, slight; 0.21–0.40, fair; 0.41–0.60, moderate; 0.61–0.80, substantial; 0.81–1.00, almost perfect). The binomial test was used to examine systematic under- or overcategorization (disagreements) of malnutrition risk between tools and between repeated screens (McNemar test). The results are presented for both the 2-category classification of MUST (low risk, medium + high risk) and the 3-category classification (low, medium, high risk). The power calculations (SamplePower 2; SPSS) suggested that, for a malnutrition prevalence of 10%, a sample size of at least 163 patients was needed to detect a chance-corrected agreement of κ = 0.75 against a null hypothesis of κ = 0.45 with 80% power and P = 0.05 (2-tailed) (26). For a malnutrition prevalence of 10%, a sample size of at least 92 patients was needed to detect a chance-corrected agreement of κ = 0.75 against a null hypothesis of κ = 0.45 with 80% power and P = 0.05 (2-tailed). All other statistical analyses were undertaken by using the SPSS statistical software package (version 15.0).

RESULTS

Study population

The main study, undertaken between July 2008 and January 2009, involved 205 outpatients (56% male). The mean age of the patients was 55 y (18–87 y), and 45% were older than 60 y. Patients attending routine hospital outpatient clinics, which run during all days of the week, were invited by the recruiting HCP to take part in the study. The patients were recruited from a wide range of clinics, including gastroenterology (40%), surgical (20%), medical (18%), oncology (11%), and other smaller clinics such as urology and gynecology. Patients had a range of occupations, including managers and professionals (17%), technical and administrative (26%), skilled trade (15%), and sales and customer service (8%). Nearly half of all patients (46%) attained a higher academic qualification, with the remaining having either qualifications obtained from school (at 16 y) or no school qualifications. The study population represented 72% of the total sample of subjects who were invited to participate. The main reason for patients declining to take part in the study were the following: not willing/no reason (65%), anxious/not feeling well (7%), poor English/unable to read/no glasses (6%), inadequate time (patient asked to see doctor) (4%), or met one of the exclusion criteria (<18 y, pregnant, inpatient) (4%).

Ease of use of self-screening and time taken to complete self-screening

All patients (n = 205) were able to screen themselves, and only 5% reported difficulties undertaking the task—the main reasons being problems with eyesight and not having their glasses with them. Most patients (71%) reported that they were able to complete the self-screening in <5 min, and, overall, 98% were able to complete it in <10 min. The mean (±SD) recorded time for patients to complete screening, recorded by the researcher with a stopwatch, was 5 ± 1.9 min. Patients found the tool easy or very easy to understand (96%) and complete (98%). Most felt that they were able to complete the measures (77%) and tool themselves (83%) and had been provided with adequate instructions (99%). Most patients (65%) recalled their height but measured their weight by using the scales provided (96%). Most weighed themselves with their shoes on (67%); despite this, the mean weight recorded by the patient was not significantly higher (0.3 kg; P = 0.093) than that measured by the HCP, who weighed the patients as per standard methods (with shoes off). Nearly all of the patients (99%) were happy to answer questions about their nutrition and to screen themselves (94%). Most patients (80%) stated that there were no aspects of the tool that they believed could be improved, and some were unsure (11%). Only 14 patients said that improvements could be made to the form. This mainly included some explanation of the final score, eg, the meaning of low, medium, and high scores.

Prevalence of malnutrition assessed by patient self-screening

The prevalence of malnutrition (medium risk + high risk) assessed by patient self-screening was 19.6% (9.8% medium risk, 9.8% high risk); the remaining 81.4% were at low risk of malnutrition. Of those who assessed themselves to be at high risk of malnutrition (n = 20), most (85%) had a MUST score of 2; the remaining 15% had a score of 3 (5%) and 4 (10%). Of those who identified themselves as being at risk of malnutrition, 75% had either a low BMI alone (step 1; 30%) or unintentional weight loss alone (step 2; 45%). A smaller proportion scored themselves at step 3 (acute disease effect) (10%), steps 1 and 3 (2.5%), steps 1 and 2 (10%), and steps 2 and 3 (2.5%). No associations were found (chi-square test) between malnutrition risk established by patient self-screening and age categories (<65 y compared with >65 y), sex, type of clinic (gastrointestinal compared with other clinic), or educational qualifications (higher education compared with no higher education).

Malnutrition prevalence according to patient self-screening across clinic types was mostly similar to the overall result, with the exception of the surgical clinic in which the prevalence was lower (5% at risk) and oncology, which was higher (31% at risk), although it should be noted that the numbers were small (Figure 2). The overall prevalence of malnutrition (medium + high
Agreement between self-screening and HCP screening with MUST

For the 3-category classification of MUST (low, medium, high risk), agreement between patient self-screening and HCP screening was 90%, and the chance-corrected agreement was 70% ($\kappa = 0.70$; within the range of 0.61 to 0.80, which indicates substantial agreement; $SE = 0.058$; $P < 0.001$) (Table 1). For the 3-category classification of MUST scores, there were 20 discrepancies between self-screening and HCP screening, 8 of which the HCP gave a MUST score higher than the patients gave themselves and vice versa for the remaining 12 discrepancies. Of these 20 discrepancies, 7 were associated with BMI score (step 1), 9 with the weight-loss score (step 2), 2 with the acute disease effect score (step 3), and 1 each with both acute disease and BMI, and acute disease and weight loss. The cause of these disagreements was explored further. For the BMI score, 3 disagreements between the HCP and patient were due to the BMI being near a cutoff [BMI (kg/m$^2$) <20, BMI <18.5], with the result being that the patient placed the BMI in one category and the HCP in the other. The remaining 4 discrepancies in BMI score were simply associated with the patient assigning a wrong score to the BMI they recorded. No such errors could be traced to the HCP. Furthermore, height measured by the HCP was strongly correlated with patient-recalled (self-reported) height ($R = 0.953$, $SEE = 0.028$, $P < 0.001$). The difference between these methods (recalled and measured) was found to be 0.9 ± 0.19 cm, which did not change significantly as height (mean of measured and recalled) increased. The mean bias (patient recall height minus HCP-measured height) after adjustment for age was 0.9 cm and was greater in men (1.4 ± 0.3 cm) than in women (0.4 ± 0.3 cm) ($P < 0.05$).

Disagreements in weight-loss score could not be fully explored because the patients did not record their previous weight during the procedure. However, the HCP scores for weight loss were tracked and found to be accurate. For the acute disease effect score, 4 patients gave themselves a score of 2 (although they did not fulfill the criteria), whereas the HCP scored them as zero. For the 2-category classification of MUST (low risk, medium + high risk), agreement between patient self-screening and HCP screening was 93%, and the chance-corrected agreement was 78% ($\kappa = 0.78$, within the range of 0.61 to 0.80, which indicates substantial agreement; $SE = 0.057$; $P < 0.001$) (Table 1). For the 2-category classification of MUST scores, there were 14 discrepancies between self-screening and HCP screening (Table 2): 5 were associated with BMI score (step 1), 7 were associated with weight-loss score (step 2), 1 was associated with acute disease effect score (step 3), and 1 was associated with both acute disease and BMI. The disagreements between the 2 methods (self-screening and HCP screening) were not systematically under- or overcategorized (Table 2). Overall agreement between self-screening and HCP screening was not significantly affected by sex, age, type of clinic, qualifications, or time the patient took to complete the patient tool.

Test-retest reliability of self-screening

This separate group of 60 outpatients with a mean (±SD) age of 55 ± 14 y (50% male) were recruited between November 2008 and February 2009 from a range of clinics, including gastroenterology (63%), surgical (13%), and other types of clinics (24%). For the 3-category classification of MUST (low,

![FIGURE 2. The prevalence of malnutrition (self-screening) according to the type of outpatient clinic (n = 205).](https://academic.oup.com/ajcn/article-abstract/96/5/1000/4576933)
Table 3

Cross-tabulation of test-retest reliability (self-screening)

<table>
<thead>
<tr>
<th>Patient MUST category 1</th>
<th>Low risk</th>
<th>Medium + high risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low risk [n (%)]</td>
<td>50 (83)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Medium + high risk [n (%)]</td>
<td>1 (2)</td>
<td>9 (15)</td>
</tr>
</tbody>
</table>

HCP, health care professional; MUST, Malnutrition Universal Screening Tool.

Table 2

Cross-tabulation of malnutrition risk according to self-screening and HCP screening

<table>
<thead>
<tr>
<th>Patient (using charts in Figure 1)</th>
<th>Low risk</th>
<th>Medium + high risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low risk [n (%)]</td>
<td>159 (77.6)</td>
<td>6 (2.9)</td>
</tr>
<tr>
<td>Medium + high risk [n (%)]</td>
<td>8 (3.9)</td>
<td>32 (15.6)</td>
</tr>
</tbody>
</table>

Fourteen disagreements not systematically under- or overcategorized: McNemar test, \( P = 0.791 \). HCP, health care professional; MUST, Malnutrition Universal Screening Tool.

SELF-Screening with MUST

Table 3

Cross-tabulation of test-retest reliability (self-screening)

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HCP, health care professional; MUST, Malnutrition Universal Screening Tool.

DISCUSSION

This study indicates the feasibility of self-screening by using MUST—the most widely used validated nutrition screening tool in hospitals, mental health units, and care homes across several countries with different health care systems (Scotland, Northern Ireland, Wales, England, and Republic of Ireland) (22, 23, 27, 28). The study suggests that outpatients were able to self-screen by using a patient-friendly version of MUST, with minimal instruction from the HCP. Almost 75% of patients were able to screen themselves in <5 min and found the procedure to be easy or very easy. Patients were happy to answer questions about nutrition, including their height and weight. These encouraging findings mean that self-screening with MUST could be used to facilitate implementation of screening in outpatient clinics and other settings, such as general practice, as recommended by national guidelines (3).

Self-screening was found to have almost perfect test-retest agreement and substantial agreement with the screening undertaken by an HCP, which is not surprising given the short nature of the tool. The level of agreement between patient and the HCP was lower than the perfect or almost perfect agreement previously reported when MUST was applied to the same patients by 2 different HCPs (5). However, it is comparable with and in some cases even better than the agreement between 2 different HCPs applying the same screening tool (eg, Mini Nutritional Assessment, Subjective Global Assessment, and Nutrition Risk Screening—2002) to the same patients (8). In such studies, consideration should be given to the possible influence of one rater on the other. However, in the current study, this was unlikely to occur because the patients always screened themselves first and placed their results in a sealed envelope, which was opened only after the HCP had screened the patients and recorded the results.

Discrepancies in malnutrition risk between the HCP and patient screening by using MUST occurred in only a small proportion of cases: 9.7% in the 3-category classification (low, medium, high risk) and 6.8% in the 2-category classification (low risk, at risk). Some of the 3-category disagreements (15%) arose from BMI values that were very close to the cutoffs separating adjacent BMI categories. More disagreements occurred simply because patients assigned an incorrect score to the documented BMI. Although the largest source of discrepancy (40%) arose from step 2, the assignment of a score for unintentional weight loss, we were unable to fully explore the cause of this discrepancy. We were able to determine that the HCP scored the patients correctly with the data provided, but we were unable to fully assess the patients’ scores in the same way because the patients did not record their previous weight as part of the study. A small number of patients were considered to have given themselves an inappropriate score for acute disease effect (step 3). Such a score can be achieved only if the patient is acutely ill and there has been or is likely to be no nutritional intake for >5 d—a situation that did not apply to the patients studied and is unlikely to apply to nonhospitalized patients. Given these insights, at least 2 suggestions can be made to improve the reliability and accuracy of self-screening with MUST in nonhospitalized individuals. First, step 3 could be eliminated, not only because it is probably inappropriate for patients suffering from acute disease to make clinical judgments about their prospective nutritional intake but also because the elimination of this step is expected to make self-screening simpler, quicker, and more accurate in this nonhospital setting. Second, the main identifiable discrepancies were caused by patients giving themselves the wrong score, often after establishing the correct anthropometric indices (eg, BMI) from the raw measurements; this error could potentially be overcome by using an electronic self-screening tool in which the scores are automatically generated instead of the paper version of the screening tool for which the scores have to be generated by the patients themselves with the use tables (29).

Self-screening has been used in other areas of medicine (eg, palpation of breasts to detect lumps that might alert the individual to the risk of breast cancer, or the changing appearance of a mole on the skin surface, which might indicate a malignant melanoma). However, in the case of nutritional screening, there have been few other formal attempts to examine the value of self-screening, and these have typically involved tools about healthy eating that incorporate subjective questions rather than objective measurements. The DETERMINE Your Nutritional Health Checklist is a 10-question checklist that attempts to establish...
whether nutrition-related problems exist in older people (including how much people eat and drink, their dentition, and their capability to purchase food) and provides guidance about when additional professional screening in needed. SCREEN II, which primarily emerged from epidemiologic (SCREEN I) (30) rather than therapeutic considerations, is a 17-item nutrition-risk screening index (self- or interviewer-administered) for community-living older adults aged >50 y (14, 31). With SCREEN II, an increase in the risk of abnormal nutrition can occur from either weight gain or unintentional weight loss, which can make it difficult to use the final score to establish a common care pathway (14). The DETERMINE toolkit has been criticized on the basis of inadequate validity (18), and reservations have also been expressed about its use in elderly Europeans (32). However, both tools have their merits and can help to raise awareness of nutritional problems, although they are unsuitable for the detection and management of disease-related malnutrition. In contrast, other screening tools, including MUST, were developed for the purpose of detecting and treating malnutrition in both younger and older adults, across settings (6, 7, 27).

The current study indicates a high prevalence of malnutrition across a heterogeneous group of hospital outpatient clinics, with no significant difference between screening undertaken by self-screening with MUST (19.6%) and that by an HCP (18.6%) in the same patients. The prevalence is comparable with that reported previously in similar clinics in the same hospital (16%) (33) and in outpatients with chronic obstructive pulmonary disease (21%) (34); however, it is lower than that reported in gastroenterology outpatients (30%) (35). The overall results are universally higher than those previously reported in the United Kingdom for free-living older individuals in the community (12.5%) (36) and those residing in sheltered housing (∼13%) (37, 38).

Given that there is a large and increasing number of outpatient appointments in the United Kingdom, with as many as 67 million in 2007 (39), patient self-screening could help combat malnutrition by helping to identify people who are malnourished or at risk of malnutrition and in need of treatment that can be initiated at hospital outpatient clinics. Indeed, given that most malnutrition originates in the community, outpatient clinics (which involve 5–6 times more outpatient attendances than inpatient admissions) offer an important opportunity to bridge the gap between hospital and community care and between public health and clinical nutrition support (39, 40). This seems to be a particular problem in the United States, where there is no universal health care system (41). Despite a substantial evidence base for the clinical benefits associated with nutritional support in malnourished patients (42–46), disease-related malnutrition remains undetected and undertreated across health care settings, especially in the community (42, 47). Self-screening could help identify this problem and involve patients in their own care.

This study had some limitations that should be acknowledged. One of these is the short lapse in time between the start and end of the test-retest reliability phase of the study, which may have overestimated reliability, because patients may have simply remembered their previous score. Validation of subjects self-reporting weight loss was not part of this current trial, and little validation exists in adults (48), despite this being a key component in many nutrition screening tools for use by HCPs (Mini Nutritional Assessment, Malnutrition Screening Tool, Subjective Global Assessment, MUST) and by individuals themselves (SCREEN II, DETERMINE, Self Mini Nutritional Assessment). This highlights the need to validate this part of nutrition screening and is an area of further research. Another limitation of this trial was that self-screening could not be applied to the entire population, which means that it is not possible to assess whether the nutritional status of those who participated in the study was different from that of those who did not. However, only a small proportion of those who were invited to take part refused, mainly because they were unable to read or understand the instructions (6%; poor English, unable to read, no glasses). It should also be acknowledged that in certain types of clinics, such as dementia clinics and those involving patients with severe physical disabilities, the proportion of patients unable to screen themselves may be substantially higher. Finally, self-screening may not be applicable to all types of clinics, because it is likely to be unreliable in patients with confusion and dementia.

In conclusion, this study of patients attending hospital outpatient clinics shows that self-screening involving MUST is acceptable to patients, is user-friendly, and has good agreement with HCP screening. Further work is required to understand how self-screening and subsequent management might be effectively implemented into routine outpatients and the wider community. Further investigation should also be given to the possibility that electronic formats may further improve the accuracy and ease of use of self-screening.

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REFERENCES


