CLINICAL MANAGEMENT extra

Development of a Nutrition Screening Tool for an Outpatient Wound Center

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PURPOSE:

To provide information on the development of a nutrition screening tool using variables believed to be predictive of malnutrition risk in the wound patient population.

TARGET AUDIENCE:

This continuing education activity is intended for physicians and nurses with an interest in skin and wound care.

OBJECTIVES:

After participating in this educational activity, the participant should be better able to:

1. Outline the variables present in patients with wounds taken into consideration when the MEAL tool was developed.
2. Identify the results of the MEAL tool pilot study.
3. List implications from this study for wound care practice.

ABSTRACT

OBJECTIVE: To construct a quickly and easily administered nutrition screening tool using variables believed to be predictive of malnutrition risk in the wound patient population.

DESIGN: A prospective pilot study assessed patients on a list of suspected variables, as well as the Scored Patient-Generated Subjective Global Assessment (PG-SGA), chosen as the criterion standard. Variables were analyzed to select the most appropriate items for inclusion on a new nutrition screening tool using preliminary bivariate correlations and χ^2 tests of association. Items significantly associated with malnutrition were dichotomized, and binary logistic regression analyses were performed to arrive at a final model. A sum score was computed, and receiver operating characteristic analysis was used to determine designation of risk.

SETTING: An outpatient wound center in Northeast Ohio.

PARTICIPANTS: The pilot study included a convenience sample of 105 outpatients with at least 1 active wound.

MAIN OUTCOME MEASURES: Malnutrition as assessed by the Scored PG-SGA.

MAIN RESULTS: The final nutrition screening tool, the MEAL Scale, is composed of 4 dichotomous elements: multiple wounds (number of wounds), eats less than 3 meals per day, appetite decrease (eats less than usual), and level of activity. These variables predicted 83.7% of the malnutrition cases assessed by the Scored PG-SGA. The receiver operating characteristic analysis showed an acceptable area under the curve (0.8581), and a cutoff score of 2 or greater was selected to indicate risk (median sensitivity = 91.4%, median specificity = 60.9%).

CONCLUSIONS: Although further studies of validity and reliability are necessary to establish the tool before widespread use, the MEAL Scale is a needed step toward nutrition screening in a wound patient population.

KEYWORDS: nutrition screening, malnutrition, chronic wounds and healing, Scored Patient-Generated Subjective Global Assessment, MEAL Scale

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INTRODUCTION

Wound healing is composed of a complicated progression of events that begins with an injury and continues through an orderly sequence to repair and regenerate tissues.[1] For many individuals, healing does not progress in a timely manner, leaving patients with open wounds for months or years and often with frequent recurrence, even after closure.[1,2] In order to better facilitate healing and prevent wounds from falling into a cycle of chronicity, factors contributing to a wound's development or inability to heal must be considered. Systemic factors associated with delayed healing include diabetes, certain medications (particularly glucocorticosteroids and nonsteroidal anti-inflammatory drugs), stress, obesity, alcohol consumption, smoking, and malnutrition.[3–7]

In the US population, 20% to 60% of home care patients are malnourished, as are 40% to 60% of hospitalized older adults and 40% to 85% of skilled nursing facility residents.[8] And the association between malnutrition and delayed wound healing is well known. Patients suffering from malnutrition, which is simply an excess or insufficient amount of the required nutrition, are at greater risk of wound healing delays; in addition, poor nutrition can contribute to the development of chronic wounds.[9] Increased energy, nutrients, vitamins, and minerals are necessary to proliferate cells, synthesize proteins, and carry out necessary biochemical reactions to repair and regenerate tissues.[1,9–12] Because even brief periods of malnutrition can negatively impact a wound's ability to heal, it is imperative that nutritional deficiencies are recognized and treated as early as possible.[1] Nutrition screening is a means of quickly determining the risk of malnourishment, usually with a brief questionnaire or evaluation; if positive, a more detailed assessment can be performed with specific recommendations to follow.

Various tools are available to screen outpatients for malnutrition. Some of the most common factors included on nutrition screening tools are weight, food intake, relevant illness, age, and body measurements. Although many nutrition screening tools exist, no tool has been designed specifically for wound patients or their unique nutritional requirements. Patients with persistent wounds possess special circumstances that often require different nutritional considerations than those of the general patient. These special circumstances include increased metabolic rates, protein and muscle breakdown, and loss of body water and protein through exudate.[3,9,13] Wound severity is likely to cause an increase in the nutritional requirements of a patient.[14] If severity is not accurately accounted for, the amount of nutritional supplementation provided to a patient with a thumbnail-sized wound may be the same as supplementation provided to another patient with 3 large tunneled pressure ulcers, which is unlikely to be sufficient for the latter patient.[15] Therefore, the goal of the current project was to construct a novel, quick, and easily administered nutrition screening tool (MEAL Scale) from a list of variables believed to be predictive of malnutrition risk in the wound patient population. By addressing the nutritional considerations of at-risk patients, overall health can be improved, and treatment time required for healing decreased.

METHODS

Selection of a Criterion Standard

When validating a screening tool, it is beneficial to find a trusted criterion standard assessment to which it can be compared.[16,17]

The Scored Patient-Generated Subjective Global Assessment (PG-SGA) was chosen for this purpose.[18] Although the Scored PG-SGA was originally created to address nutrition impact symptoms commonly experienced in oncology patients, the tool is not oncology-specific and has shown good reliability and validity in other patient populations.[19–24] The tool provides a numerical score for specific intervention recommendations, as well as a global categorical score (A = well nourished, B = moderate or suspected malnutrition, C = severe malnutrition). The patient completes sections 1 to 4, while the clinician performs a history and physical examination to complete the assessment. Tool implementers can be easily trained, and the Scored PG-SGA is relatively efficient compared with other, more cumbersome methods of malnutrition assessment using anthropometric measurements.

Item Selection

To ensure content and face validity, a literature search was conducted to determine factors related to malnutrition in the wound patient population. Once a preliminary list was compiled, a panel of dietitians, nurses, physicians, and researchers was assembled to provide expert opinion on which variables they considered important to determine malnutrition. This process created a list of suspected variables to pilot for inclusion on the final screening tool. A copy of the listed variables can be found in Table 1.

Pilot Study

The pilot study was approved by the hospital internal research review board. Data were collected from a convenience sample of wound outpatients to determine which of the proposed items were most strongly associated with malnutrition as assessed by the global categories on the Scored PG-SGA. Inclusion criteria for the study included age older than 18 years and receiving treatment for an active wound at Akron General Wound Center in Ohio, during the 2-month study period. Patients were excluded if they were unable to complete the patient-generated portion of the assessment, were younger than 18 years, were unwilling to participate, or were pregnant at the time of the study. Pregnant women were excluded because of their unique nutritional requirements.

Statistical Analyses

Statistical calculations were carried out using SPSS version 20.0 (IBM SPSS Statistics, Armonk, New York) and R version 3.0.1 (R Foundation for Statistical Computing, Vienna, Austria) with Package pROC version 1.5.4.[25] For all analyses, a $P = .05$ level of significance was used.

Development of the Final MEAL Scale

The Scored PG-SGA was administered by a research assistant trained by registered dietitians and an instructional DVD.[26]

Table 1.
ITEMS SELECTED FOR TESTING AND ANALYSIS IN A PILOT STUDY

BMI
Percentage of weight loss in 1 mo
Percentage of weight loss in 6 mo
Eats less than usual
Activity level
Age
Eats >2 servings of protein per day (meat, eggs, dairy, cheese)
Eats <3 meals per day
Eats fruit daily
Daily multivitamin
Current smoker or exposure
Institutionalized (group home, ECF, LTAC)
HbA1c (if diabetic)
Average blood glucose (if diabetic)
Wound infected
Exudate amount (none, scant, small, moderate, large, or copious)
No. of wounds
Total area of wound(s) in cm^2

Abbreviations: BMI, body mass index; ECF, extended care facility, LTAC, long-term acute care.

The Scored PG-SGA was administered first via written survey and physical examination; next, the list of proposed items was either administered verbally or obtained from the patient's medical record. Data were deidentified and entered into a spreadsheet for analysis.

The Global ratings from the Scored PG-SGA (A, B, C) were dichotomized to indicate nutritional status, with well-nourished individuals represented by category A and malnourished individuals represented by categories B + C. Initial χ^2 and bivariate correlations were used to determine which variables were significantly associated with malnutrition. The concept of a quick and easily administered screening tool with a yes/no format suggested that continuously measured variables be collapsed into dichotomous categorical variables. Therefore, continuous variables demonstrating a significant association with malnutrition were selected and subsequently dichotomized into 0 = no risk, 1 = risk of malnutrition. Cutoff values were determined with support from the literature, as well as by checking for best discrimination using crosstabs of various proposed values.

χ^2 analyses were conducted on the dichotomous variables chosen for modeling with logistic regression and estimation of

Table 2.
PILOT STUDY SAMPLE CHARACTERISTICS

Total Sample (N = 105)	n (%)	Mean (SD)
Sex (male)	51 (48.6)	—
Age, y	—	61.4 (16.7)
BMI, kg/m^2	—	34.5 (12.3)
"Malnourished" or "at risk" Scored PG-SGA (B + C)	58 (55.2)	—

Abbreviation: BMI, body mass index.

probabilities. Logistic regressions of significant items were used to create a final model. A sum score was computed, and receiver operating characteristic analysis was used to determine cutoff points for the final model, thereby yielding a finalized nutrition screening tool.

RESULTS

One hundred five patients fulfilled selection criteria and consented to participate in the study (Table 2). Roughly half (48.6%) were male, with an average participant age of 61.4 (SD, 16.7) years and an average body mass index of 34.5 (SD, 12.3) kg/m^2, which is considered obese. According to the Scored PG-SGA Global Ratings, 55% (n = 58) of the sample was considered malnourished or at risk of malnutrition. Initial χ^2 tests of association and bivariate correlations were performed on the initial list of items; significant results were obtained for 6 items:

- percentage of weight loss in 1 month,
- eats greater than or equal to 2 servings of protein per day,
- eats less than 3 meals per day,
- number of wounds,
- eats less than usual, and
- activity level.

Two additional items (percentage of weight loss in 6 months and age) approached significance (P = .051) and were included for further analysis.

Continuous variables demonstrating significance (percentage of weight loss in 1 month, percentage of weight loss in 6 months, age, number of wounds) and significant categorical variables with more than 2 categories (activity level) were dichotomized according to literature values and clinical expertise. With the rationale that malnutrition risk increases with age,[11,27] cutoff points of 65 and 70 years were considered for the age variable, as these are the ages most conventionally considered to be "older adult." Better discrimination was evidenced by cross-tabulation of age older than 70 years and malnutrition; therefore, this was the chosen cutoff value. Because all participants had at least 1 wound, a cutoff of more than 1 wound was used to indicate risk of malnutrition. As suggested by the literature,[28–30] percentage of weight loss in 1 month was dichotomized with a cutoff value of 5% and 10% for percentage of weight loss in 6 months. Both cutoff values yielded good distributions. Upon further consideration of the percentage weight loss variables, it was determined that these should comprise 1 item. These variables were combined to create a dichotomous item measuring percentage of weight loss in 1 month or 6 months; this would allow the administrator to use whichever is more readily recalled by the patient or is more easily accessible from the patient record; preference was not given for 1 response over another. In combining these variables, data for 6 participants were missing. Physical activity was also collapsed into 2 categories with the rationale that the first 2 responses (normal and not my normal self, but able to be up and about) were not as much cause for concern clinically as the remaining 3 categories, which were coded to identify risk.

χ^2 tests of association were conducted on the dichotomized variables (Table 3). Age and percentage of weight loss in 1 month or 6 months, which approached significance only as continuous variables, were no longer significantly associated with malnutrition as dichotomous items; however, these were kept for initial binary logistic regression analysis to see how they would perform. List-wise deletion was used to handle missing data. Age, percentage of weight loss in 1 month or 6 months, and eats 2 or more servings of protein per day were not significant in the initial model and were dropped from further analyses.

Table 3.
χ^2 RESULTS OF DICHOTOMOUS VARIABLES SELECTED FOR BINARY LOGISTIC REGRESSION

Variable	Total Responses	"At-Risk" Responses	χ2	*P*
>5% weight loss in 1 mo or >10% weight loss in 6 mo	99	19	3.535	.060
Age >70 y	104	36	1.833	.176
Eats >2 servings of protein per day	104	62	5.036	.025[a]
Eats <3 meals per day	104	46	12.589	.000[a]
>1 wound	105	44	7.092	.008[a]
Eats less than usual	105	58	30.201	.000[a]
Activity is less than normal	105	59	6.428	.011[a]

[a]Significance reported at $P < .05$.

Table 4.
RESULTS OF FINAL BINARY LOGISTIC REGRESSION (N = 104)

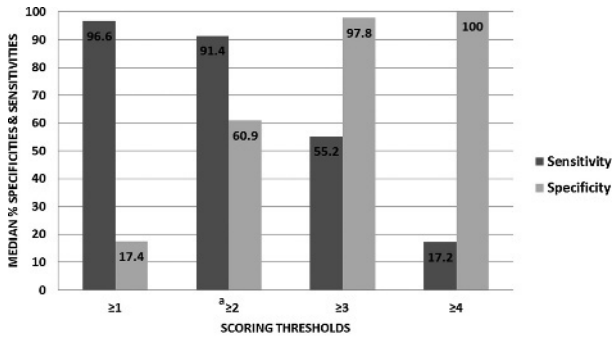
Variable	Wald	*P*	Odds Ratio	Confidence Interval
Eats <3 meals per day	5.757	.016[a]	3.867	1.281–11.673
No. of wounds >1	5.656	.017[a]	3.824	1.266–11.550
Eats less than usual	19.748	.000[a]	16.969	4.868–59.157
Activity is less than normal	8.636	.003[a]	6.379	1.854–21.952
Percentage of malnutrition predicted				83.7%

[a]Significance reported at $P < .05$.

Regression was performed with the remaining variables; results of this final model are shown in Table 4. Eats less than 3 meals per day, number of wounds, eats less than usual, and activity level were all significant items; these variables predicted 83.7% of the malnutrition cases assessed by the Scored PG-SGA.

A sum score was computed to generate a maximum of 4 points, with 1 point awarded for each variable. The sum score showed a normal distribution. Cutoff points were examined using a receiver operating characteristic curve; sensitivities and specificities for scoring thresholds 1 through 4 are shown in Table 5. Area under the curve was found to be 0.8581 with the highest sensitivity and specificity for detecting malnutrition as defined by the Scored PG-SGA evidenced between 2 and 3 points. Because of the relatively few negative consequences of false-positive results for nutrition screening in this population, higher sensitivity was desired, and a cutoff of 2 points or greater was chosen to indicate risk of malnutrition. Stratification of the participant responses for each item by sum score revealed relatively equal contributions by each item; therefore, positive responses for any 2 items indicate risk, and weights were not assigned. The final MEAL Scale is presented in Table 6. The MEAL acronym was developed from each of the 4 items for ease of recall: M for multiple wounds (number of wounds), E for eats less than 3 meals per day, A for appetite decrease (eats less than usual), and L for level of activity.

Table 5.
SENSITIVITIES & SPECIFICITIES AT POTENTIAL SCORING THRESHOLDS



[a]Malnutrition is screened at ≥2 points, giving a high sensitivity (91.4%) with acceptable specificity (60.9%).

DISCUSSION

The final MEAL Scale is a quick, 4-item tool that can be easily administered by clinicians in a busy environment. Items require no calculations, scoring is simple because items are not weighted, and it is feasible that patients could fill out the form themselves.

Table 6.
MEAL SCALE FOR MALNUTRITION IN CHRONIC WOUND PATIENTS

Multiple wounds		***Do you have >1 open wound?***
	0	No
	1	Yes
Eats <3 meals		***How many meals, not including snacks, do you eat in a typical day?***
	0	≥3 meals
	1	<3 meals
Appetite loss		***Thinking about your normal food intake, would you say you are eating about the same, more, or less than usual?***
	0	About the same or more than usual
	1	Less than usual
Level of activity		***Thinking about your normal level of activity, how would you consider your activity level over the past month?***
	0	Normal
	0	Not quite normal, but able to do most things
	1	Not feeling up to most things, in bed or chair less than half the day
	1	Able to do little activity and spend most of the day in bed or chair
	1	Pretty much bedridden, rarely out of bed
		Total points
	0–1	Not at risk
	2–4	At risk

Utilizing a cutoff point of 2 or more points to indicate risk of malnutrition, sensitivity was 91%, and specificity was 61%. Of note is that 10 of 10 patients assessed as severely malnourished by the PG-SGA were also screened as malnourished by the MEAL scale, suggesting an even higher sensitivity among severely malnourished patients. Greater sensitivity (probability of a positive test, given that malnutrition is present) was desirable because patients are unlikely to receive unnecessary or highly invasive testing as a result of a false positive; it is more important to identify anyone who may benefit from nutritional assessment to reach optimal wound healing outcomes. Greater specificity (probability of a negative test result, given that the patient is well nourished) could have been achieved through adjusting the cutoff point to 3 or greater; however, this would increase the number of false-negative results, thereby missing patients who need nutritional support for healing.

Regarding the items chosen for the final tool, only 1 of the wound variables (number of wounds) was significantly associated with malnutrition as assessed by the Scored PG-SGA. Interestingly, the number of wounds, rather than the total area of wounded tissue, showed a significant association with malnutrition. One possible explanation for this phenomenon is that the perimeter of active wound edges contains migrating and proliferating cells, which require more energy and thus may be of greater nutritional significance than the absolute area of wounded tissue. In addition, individuals with more wounds may already be malnourished, leading to further skin breakdown and new wounds appearing. The significant correlations observed between *eats less than usual* and *activity level* with malnutrition were expected because of their inclusion on the Scored PG-SGA; however, even as dichotomized variables, these were found to be strongly associated with malnutrition and thus very useful in their simplified form. The association with the item *eats less than 3 meals* and malnutrition was somewhat surprising as this was included at the suggestion of the clinical panel and had less robust evidence from the literature. Two of the included variables relate to the patients' eating habits: *eats less than usual* indicates a recent decrease in calories, whereas *eats less than 3 meals* can indicate either a recent or chronic calorie withholding. Interestingly, both of these involve food quantity rather than quality, confirming the importance of proper energy intake during healing.

Limitations to the development of this tool should be considered. Only 1 rater was available to administer assessments during the pilot study for variable selection. Use of only 1 rater limits feedback on the usefulness and design of the tool and precludes analyses of interrater reliability.

Ultimately, the validity and reliability must be further assessed before the MEAL scale is fully adopted, as well as to establish the tool in other settings (such as acute care or rehabilitation settings). Currently, use of the tool is limited to wound center outpatients. Future research should include enough participants by age group to conduct stratified analyses; such analyses would extend the validity of the tool to various subpopulations. Validation studies must also utilize additional raters to establish reliability of the screening tool.

Implications for Practice

Suggested implementation for the MEAL Scale is specific to outpatient wound clinic settings at this time. The wound care nurse or other qualified clinician should screen patients at the patient's initial visit and every 6 months thereafter to ascertain any change in risk. Suggested delivery of the screening instrument is verbal; however, the tool can also be printed in survey format for patients to complete on paper. Patients receiving a score of 2 or greater should be referred to a nutritionist or dietitian for a more detailed assessment and management plan, as necessary. For a score of 1, or if malnutrition is still suspected, the nurse or physician should address the issue with education during the patient's appointment.

CONCLUSIONS

Of the 18 factors suspected to associate malnutrition with chronic wounds, only 4 proved to be statistically significant: presence of multiple wounds, eating less than usual, eating less than 3 meals per day, and a low activity level. Although further studies of validity and reliability are necessary to establish the tool before widespread use, the MEAL Scale is a needed step toward nutrition screening in a wound patient population.

PRACTICE PEARLS

- Known factors associated with healing delays are diabetes, steroid and nonsteroidal anti-inflammatory medications, stress, older age, infection, obesity, alcohol consumption, smoking, and malnutrition.
- Malnutrition assessments are comprehensive and used for diagnosing malnutrition, whereas screening tools are quick and only used for categorizing level of risk.
- Factors included in this malnutrition screening tool include: (1) the presence of multiple wounds, (2) eating less than usual, (3) eating less than 3 meals per day, and (4) a low activity level.
- Malnutrition is a very common and preventable factor in the development of chronic wounds and is found in more than half of this patient population.

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