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Use of 3 Tools to Assess Nutrition Risk in the Intensive Care Unit

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Abstract

Background: Identifying patients at nutrition risk proves difficult in the intensive care unit (ICU) due to the nature of critical illness. No consensus exists on the most appropriate method to identify these patients. Traditional screens and assessments are often limited due to their subjective nature. The purpose of the quality improvement project was to compare proportions of ICU patients deemed at nutrition risk using 3 different tools. *Material and Methods*: A convenience sample of 294 patients admitted to the ICU was used. Patients were assessed using the institution's routine nutrition screening method, the Subjective Global Assessment (SGA), and the NUTrition Risk in Critically ill (NUTRIC) score. Information was collected on demographics, severity of illness, hospital and ICU length of stay (LOS), and disposition. Descriptive statistics were used to examine counts/proportions of risk categories; means ± SD were used to summarize demographic and clinical variables. *Results*: A total of 139 patients (47%) were deemed at nutrition risk or malnourished by at least 1 tool. Patients identified were older and had a lower body mass index, more weight loss, more fat and muscle wasting, more fluid accumulation, and lower average handgrips than those not at nutrition risk; they also had longer hospital and ICU LOS, higher rates of requiring further rehabilitation upon discharge, and higher mortality during hospitalization. *Conclusion*: Traditional screening and assessment tools did not uniformly identify patients as malnourished or at nutrition risk in the ICU and therefore may be inappropriate for use in this population. Inclusion of physical assessment, functional status, and severity of illness may be useful in predicting nutrition risk in the ICU. (*JPEN J Parenter Enteral Nutr*. 2015;39:28-33)

Keywords

adult; life cycle; outcomes research/quality; nutrition support practice; nutrition assessment; nutrition

Malnourished patients have worse clinical outcomes than their well-nourished counterparts; unfortunately, this relationship is often exacerbated in the intensive care unit (ICU) due to the hypermetabolic nature of critical illness.[1] Accurately identifying patients at risk for malnutrition is essential to decrease negative outcomes during hospitalization.[2] Recently, a consensus statement by Academy of Nutrition and Dietetics (AND) and American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.) recognized the importance of inflammation in the characterization of malnutrition and recommended an etiology-based definition categorizing patients with the presence of 2 or more of the following characteristics: insufficient energy intake, weight loss, loss of muscle mass, loss of subcutaneous fat, localized or generalized fluid accumulation, or decreased functional status in the context of acute illness or injury, chronic diseases or conditions, and starvation-related malnutrition.[3] However, there is no consensus on the best tool to identify these patients, particularly in the ICU.

A number of tools employing a variety of criteria are used to identify nutrition risk, including clinical diagnosis, laboratory data, physical examination, anthropometric data, food/nutrient intake, and functional assessment.[4-8] These indicators were primarily validated in outpatients or a general hospitalized population; they were not specifically designed for use in the ICU.[9] Many of these criteria may be difficult to obtain in critically ill patients. For example, because ICU patients may require mechanical ventilation or present with altered mental status, food intake histories are often challenging to obtain. Similarly, obtaining information on functional status and gastrointestinal (GI) symptoms prior to admission may also be difficult. If weight histories are available, changes in weight may actually be more reflective of fluid status than actual changes in weight, since many ICU patients are given large volumes of fluid to maintain hemodynamic stability.[2] Physical assessment and assessment of muscle tone can be used as a more objective tool, since it does not require patient interview or previous

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knowledge of body habitus. Fluid status can also be assessed through examination of areas where edema or ascites often occur.[7] In addition, muscle and fat wasting may be masked by severe edema or a patient's overall body habitus, as seen in cases of overweight and obesity. Many traditional tools do not provide information regarding inflammatory status. The NUTrition Risk in Critically ill (NUTRIC) score, a tool introduced by Heyland et al,[10] uses a unique scoring method for identifying patients who would most benefit from aggressive nutrition support in the ICU by linking starvation, inflammation, and outcomes. However, this tool includes no traditional markers of nutrition risk, such as body mass index (BMI), weight status, oral intake, or physical assessment, and may have limited clinical application due to its exclusion of nutrition history variables.

The use of traditional screening and assessment tools in the ICU may not provide accurate results in determining patients at risk for malnutrition. Clinical observations of the limitations of current tools in the ICU prompted a quality improvement project in an effort to identify the most appropriate tool for identifying nutrition risk or malnutrition in the ICU. While different tools measure different constructs (nutrition risk vs malnutrition), the purpose of the project was exploratory in nature; therefore, tools identifying both nutrition risk and malnutrition were used. The purpose of this quality improvement project was to describe the proportion of ICU patients deemed at increased nutrition risk or malnourished via the institution's routine screening method, the NUTRIC score, and the Subjective Global Assessment (SGA).

Methods

A convenience sample of 294 patients admitted to the medical, surgical, and neuroscience ICUs over a 3-month period in a large, urban academic medical center was used as part of a quality improvement project. Patients were not included if they were younger than 18 years or unable to communicate in English. The hospital's institutional review board approved the evaluation and use of outcomes from this quality improvement project; no informed consent was required due to the nature of the project.

At our institution, completing SGA on all ICU admittances is standard practice to identify malnutrition. The SGA was completed within 24 hours of admission. The 4 ICU dietitians have been previously trained according to a protocol described by Sheean et al.[11] No formal interrater reliability studies were performed. The SGA is composed of the following criteria: intake prior to admission (categorized as no change, decreased, or unable to eat), presence of GI symptoms (including anorexia, nausea, vomiting, and diarrhea), weight loss, physical assessment (including change in fat wasting, muscle wasting, and fluid accumulation defined as normal, mild to moderate, and severe), and functional assessment (defined as no change, decreased ability to complete activities of daily living, or bedridden) and low handgrip strength. Anthropometric data, including, height, weight, and BMI, were collected from the electronic medical record. Three consecutive hand dynamometer measurements were obtained from patients able and willing to participate using the patient's self-identified dominant hand while the patient was sitting up in bed or in a chair with the elbow bent at a 90° angle. Patients squeezed with maximum strength for 5 seconds; the highest force exerted was recorded for each of the 3 measurements and the average was calculated. Patients were classified as follows: normal (A), mild to moderate malnutrition (B), or severe malnutrition (C)[7]; for the purpose of analysis, patients with scores of B or C were classified as malnourished.

Patients were also deemed at nutrition risk via a nutrition screening tool used on non-ICU floors at the current institution. The institution's routine nutrition screen included the following criteria: recent unintentional weight loss (5% in 1 month, 10% in 6 months), BMI <18.5 or >40, presence of dysphagia/inadequate food intake prior to admittance, or use of enteral nutrition (EN)/parenteral nutrition (PN). Patients meeting at least 1 criterion were deemed at risk for malnutrition.

A NUTRIC score was calculated for each patient using age, number of comorbidities, days from hospital to ICU admission, and Acute Physiology and Chronic Health Evaluation II (APACHE II) and Sequential Organ Failure Assessment (SOFA) scores from admission. NUTRIC scores were calculated without using interleukin (IL)–6 values; the creators of the tool allow for exclusion of this variable when not clinically available. Therefore, patients were classified as having a high score if the sum was 5 or greater; these patients were classified as having a higher risk of malnutrition. Higher scores (≥5) have been associated with worse clinical outcomes; in addition, patients with a score ≥5 have been proposed to be most likely to benefit from aggressive nutrition therapy.

Additional information collected included: demographics (age, sex, and race), hospital and ICU length of stay (LOS), and disposition (defined as discharged to home, rehabilitation, or patient death).

Statistical Analysis

Descriptive statistics were used to examine counts/proportions of nutrition risk categories using the different screening and assessment tools; means ± standard deviations were used to summarize demographic and clinical variables. Patients may have been identified at nutrition risk by the institution's screening tool, malnourished by the SGA, and/or more likely to benefit from nutrition support by the NUTRIC score; because patients may belong to more than 1 group, statistical comparisons were not made between nutrition risk groups, since membership groups would violate the independence rule. Analysis was performed using SPSS version 18 (SPSS, Inc, an IBM Company, Chicago, IL).

Results

A total of 139 patients (47%) were deemed at nutrition risk or malnourished by at least 1 tool. Of these patients, a total of 63% were deemed at nutrition risk using the institution's routine screening method (87/139), 80% were malnourished according to the SGA (111/139), and 26% were deemed candidates for nutrition support with the NUTRIC score (36/139). Many patients met criteria for more than 1 tool and therefore may have been at nutrition risk using the institution's screening tool, malnourished using the SGA, and more likely to benefit from nutrition support using the NUTRIC score. Nutrition risk rates and associated demographic information are described in Table 1. Regardless of the tool used, patients who were at nutrition risk or malnourished were older and had a lower BMI, more weight loss, more fat and muscle wasting, more fluid accumulation, and lower average handgrip than those not at nutrition risk; of note, handgrips strength was collected from only 83% of patients (242/294) due to limitations in mental status. Patients at nutrition risk also had longer hospital and ICU LOS, higher rates of requiring further rehabilitation after discharge, and higher rates of mortality during hospitalization than those not at risk.

Because many patients met criteria for more than 1 tool, further investigation into risk classification was needed to accurately identify trends. Only 9 (6%) patients met criteria for all 3 tools (Figure 1). Rates of death, rehabilitation, and hospital and ICU LOS were evaluated among the further delineated risk groups.

Patients determined at nutrition risk using the NUTRIC score alone or in combination with any other tool had the highest rates of death. A larger proportion of patients requiring additional rehabilitation after discharge were seen with both NUTRIC and SGA scores classifying patients at risk. Patients identified as at nutrition risk or malnourished using both NUTRIC and SGA had the longest hospital LOS and ICU LOS (Figure 2). Patients at nutrition risk using only the institution's screening tool and NUTRIC had the shortest ICU LOS.

Discussion

There was a great deal of variability among the institution's routine screening tool, the SGA, and the NUTRIC score in identifying different groups of patients at risk for malnutrition; however, there was a great deal of overlap between groups. A much larger number were identified using the institution's routine screening tool (63%) and SGA (80%), compared with those identified using the NUTRIC score (26%). Interestingly, only 9 patients were deemed at nutrition risk and malnourished using all 3 screening tools. As a result of this project, the standard of care was changed in the ICUs. All patients admitted to an ICU are assessed by a dietitian using the SGA. While there are some limitations to the use of the SGA in the ICU, it was deemed the most valuable tool to assess nutrition status in this population.

Patients identified at nutrition risk using the NUTRIC score had the longest hospital and ICU LOS. This is likely because the NUTRIC score encompasses severity of illness, since these patients also had higher APACHE II and SOFA scores than did patients in other groups. Severity of illness has been shown to be a major contributing factor to LOS.[12] Accurate identification of these patients may allow for more appropriate and timely administration of nutrition support, thus decreasing LOS. In addition, all components of this tool can be objectively obtained through chart review without the necessity for a patient or family interview. Inclusion of severity of illness may be a necessary component in accurately identifying patients at nutrition risk in the ICU.

More patients classified as malnourished using the SGA alone or in combination with any other screening tool were discharged to a rehabilitation facility. This is likely due to the tool's inclusion of functional status in assessing overall nutrition status. Similarly, patients deemed malnourished using the SGA had the lowest average handgrip strength among those investigated. Decreased handgrip values have been associated with decreased functional status.[13] These patients also had the highest proportion of muscle and fat wasting of all the risk groups. Loss of muscle and fat mass often occurs as the result of a prolonged disease course, contributing to decreased grip strength and overall functional status. These patients may not have been deemed at nutrition risk using the NUTRIC score alone, since they may have lacked signs of acute severity of illness. Nonetheless, this population may benefit from aggressive nutrition intervention in an effort to attenuate the loss of lean body mass during hospitalization and prevent further loss of functional status. Although completing a patient's interview or obtaining a handgrip measurement may be difficult in the ICU, assessing functional status upon admission may better identify patients in need of aggressive nutrition support during hospitalization.

Conversely, patients identified at risk using the institution's routine institution screening had the shortest hospital and ICU LOS. This may have occurred because most of the information required for this tool is subjectively obtained; therefore, patients meeting the tool's criteria may have been missed due to the clinician's inability to obtain the information as a result of a patient's clinical status. Patients unable to complete nutrition interviews are often the most critically ill; exclusion of such patients may have potentially contributed to a higher proportion of patients with a shorter LOS.

Limitations of the study must be addressed. Data were obtained as part of a quality improvement project intended to investigate nutrition screening and assessment practices at 1 institution. Therefore, results may not apply to all institutions,

Table 1. Demographic Data Classified Using Routine Screening, the Subjective Global Assessment (SGA), and the NUTRIC Score.

Characteristic	Total Population (n = 294)	No Risk (n = 155)	Any Nutrition Risk (n = 139)		
			Risk With Routine Screening[a] (n = 87/139, 63%)	Malnourished With SGA[b] (n = 111/139, 80%)	Risk With NUTRIC Score[c] (n = 36/139, 26%)
Age, mean ± SD, y	59.0 ± 16.4	56.5 ± 16.4	61.0 ± 15.6	61.8 ± 15.0	69.5 ± 12.4
Sex, No. (%)					
Male	146 (50)	78 (50)	44 (51)	50 (45)	20 (56)
Female	148 (50)	77 (50)	43 (49)	61 (55)	16 (44)
Race, No. (%)					
White	142 (48)	88 (57)	38 (44)	41 (37)	11 (31)
Black	113 (39)	48 (31)	41 (47)	57 (51)	17 (47)
Hispanic	32 (11)	15 (10)	6 (7)	11 (10)	7 (19)
Other	7 (2)	4 (3)	2 (2)	2 (2)	1 (3)
BMI, mean ± SD, kg/m^2	28.6 ± 7.6	29.8 ± 7.4	26.3 ± 7.4	27.2 ± 8.1	27.1 ± 8.2
Weight loss, mean ± SD, %	3.1 ± 6.9	0.0 ± 0.2	10.4 ± 9.2	8.1 ± 9.3	3.5 ± 8.6
Fat wasting, No. (%)	49 (17)	2 (1)	33 (38)	46 (41)	10 (28)
Muscle wasting, No. (%)	62 (21)	2 (1)	38 (44)	59 (53)	15 (42)
Fluid accumulation, No. (%)	61 (21)	16 (10)	31 (36)	42 (38)	10 (28)
Average handgrip, mean ± SD	21.1 ± 12.0 (n = 242)	24.7 ± 11.1 (n = 133)	17.1 ± 12.3 (n = 62)	14.5 ± 10.0 (n = 89)	15.8 ± 12.1 (n = 30)
Hospital LOS, mean ± SD, d	8.5 ± 8.1	6.9 ± 6.7	10.7 ± 9.0	9.9 ± 8.6	12.1 ± 10.7
ICU LOS, mean ± SD, d	4.3 ± 4.3	3.7 ± 3.5	4.5 ± 4.2	5.4 ± 5.3	6.6 ± 7.2
APACHE score, mean ± SD	13.0 ± 6.2	10.9 ± 5.0	13.5 ± 6.1	15.0 ± 6.8	22.9 ± 4.3
SOFA score, mean ± SD	2.7 ± 2.6	2.2 ± 1.9	2.7 ± 2.7	3.0 ± 2.6	5.8 ± 3.8
NUTRIC score, mean ± SD	2.5 ± 1.5	2.0 ± 1.1	2.7 ± 1.6	2.8 ± 1.6	5.4 ± 0.6
Died, No. (%)	21 (7)	5 (3)	10 (11)	13 (12)	5 (14)
Discharged to rehabilitation, No. (%)	38 (13)	16 (10)	14 (16)	19 (17)	6 (17)

APACHE II, Acute Physiology and Chronic Health Evaluation II; BMI, body mass index; ICU, intensive care unit; LOS, length of stay; NUTRIC, NUTrition Risk in Critically ill; SGA, Subjective Global Assessment; SOFA, Sequential Organ Failure Assessment.

[a]Routine nutrition screening included the following criteria: significant weight loss (5% in 1 month, 10% in 6 months), BMI <18.5 or >40, presence of dysphagia, or use of enteral/parenteral nutrition prior to admission. Patients meeting at least 1 criterion were deemed at risk for malnutrition

[b]Patients were classified as follows: normal (A), mild-moderate malnutrition (B), or severe malnutrition (C); for the purpose of analysis, patients with scores of B or C were classified as malnourished.

[c]NUTRIC scores were calculated without using interleukin-6 values. Therefore, patients were classified as having a high score if the sum was 5 or greater; these patients were classified as having a higher risk of malnutrition.

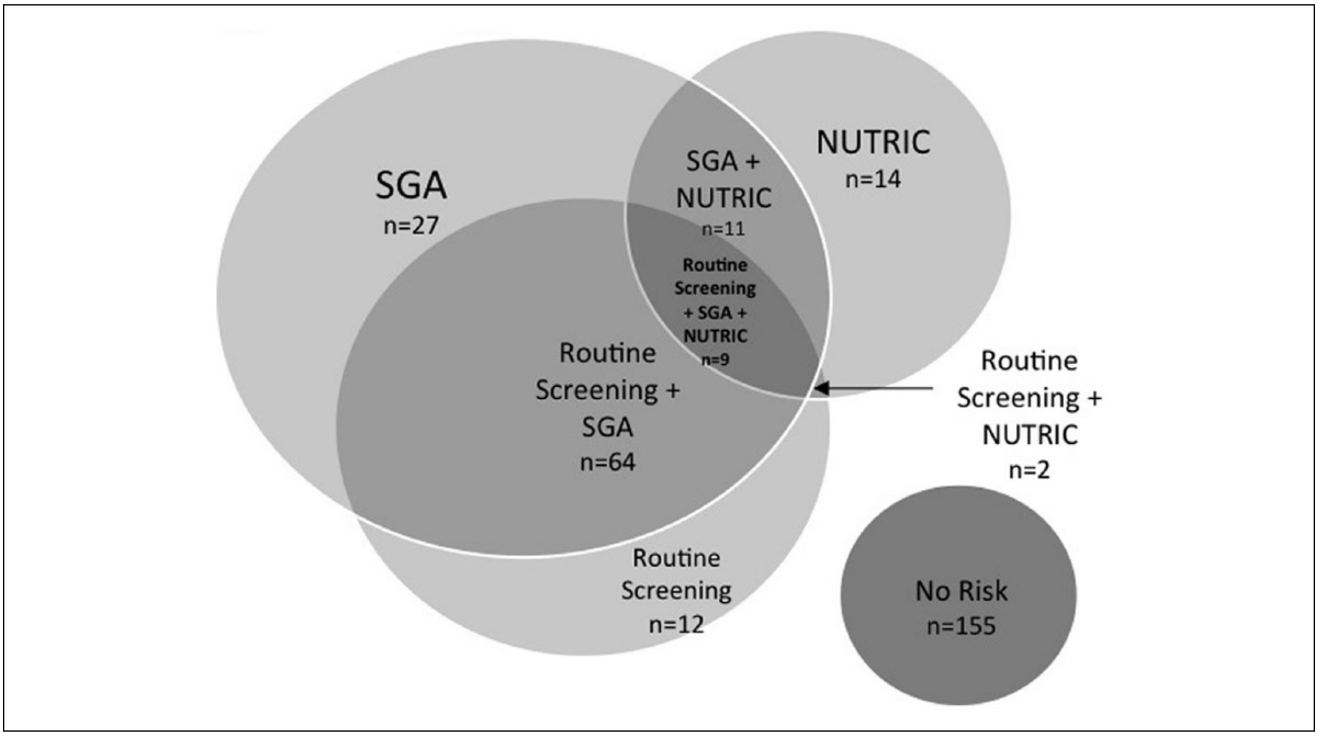

Figure 1. Venn diagram of patients determined at nutrition risk or malnourished using the Subjective Global Assessment (SGA), routine screening, and/or NUTrition Risk in Critically ill (NUTRIC) score.

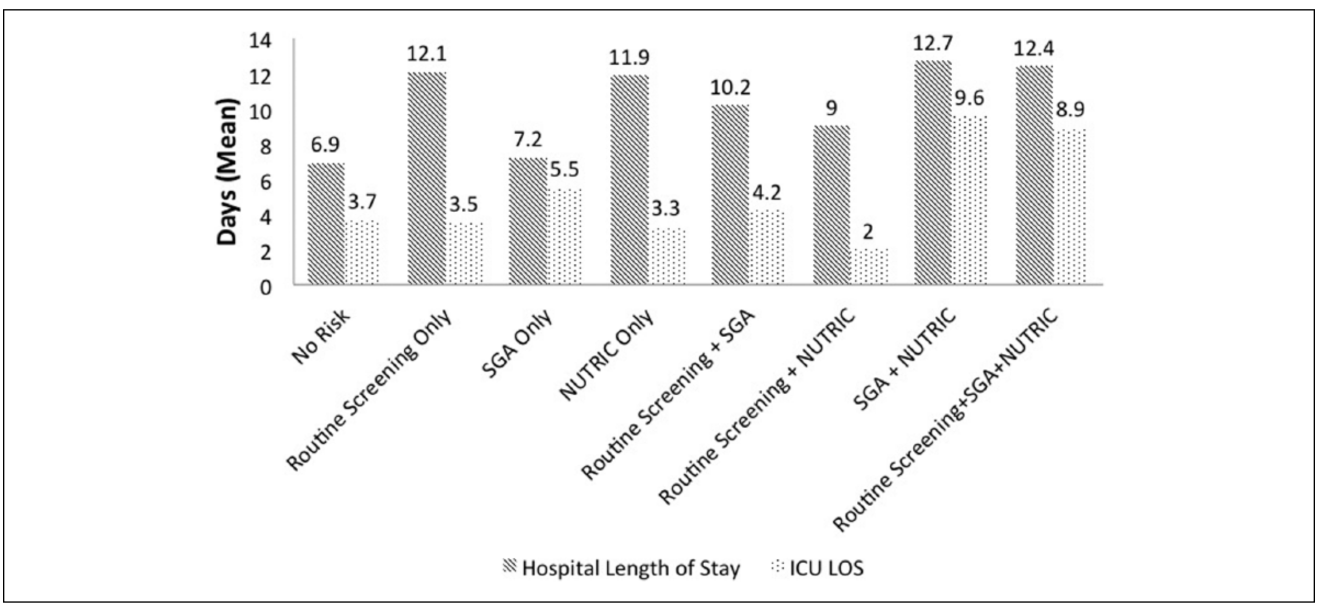

Figure 2. Hospital and intensive care unit (ICU) length of stay (LOS) categorized by nutrition risk tool. NUTRIC, NUTrition Risk in Critically ill; SGA, Subjective Global Assessment.

including those with trauma or burn units, since none of these patients were included. Results of the SGA between the 4 clinicians completing assessments may vary due to the subjective nature of the tool; assessment of fat and muscle wasting was limited by both body habitus and presence of edema. Examination of body composition through more objective measures, such as ultrasound or computed tomography, would be ideal but is limited by training and expertise needed. It should be noted, however, that all the clinicians were trained in a uniform manner and all assessments were completed according to institution protocol, thus limiting variability between assessments. Use of handgrip strength in this population was also limited due to patients' mental status and mechanical ventilation; this criterion requires additional examination prior to use in the ICU. In addition, due to the nature of statistical analysis, comparisons made should be discussed in terms of clinical differences, rather than statistical. Further research is warranted.

Conclusion

Traditional screening and assessment tools identified different patients as malnourished or at nutrition risk in the ICU. Differences may have resulted from inability to obtain subjective data due to the nature of critical illness; therefore, these tools may be inappropriate for use in the ICU. Currently, no one tool encompasses severity of illness along with traditional markers of nutrition status. Tools using primarily objective measures may be the most useful in this population due to a frequent inability to obtain subjective information, such as weight history and changes in oral intake. Inclusion of physical assessment, functional status, and severity of illness may be useful in screening and assessing nutrition risk in the ICU due to their objective nature. Additional research is needed to determine if changes in the nutrition screening process affect outcomes in the critically ill.

References

1. Jensen GL, Bistrian B, Roubenoff R, Heimburger DC. Malnutrition syndromes: a conundrum vs continuum. *JPEN J Parenter Enteral Nutr*. 2009;33(6):710-716.
2. McClave SA, Martindale RG, Vanek VW, et al. Guidelines for the provision and assessment of nutrition support therapy in the adult critically ill patient: Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.). *JPEN J Parenter Enteral Nutr*. 2009;33(3):277-316.
3. White JV, Guenter P, Jensen G, Malone A, Schofield M. Consensus statement of the Academy of Nutrition and Dietetics/American Society for Parenteral and Enteral Nutrition: characteristics recommended for the identification and documentation of adult malnutrition (undernutrition). *J Acad Nutr Diet*. 2012;112(5):730-738.
4. Kruizenga H, Seidell J, De Vet H, Wierdsma N, van Bokhorst-de van der Schueren MAE. Development and validation of a hospital screening tool for malnutrition: the Short Nutritional Assessment Questionnaire (SNAQ©). *Clin Nutr*. 2005;24(1):75-82.
5. Guigoz Y, Vellas B, Garry PJ. Assessing the nutritional status of the elderly: the Mini Nutritional Assessment as part of the geriatric evaluation. *Nutr Rev*. 1996;54(1):S59-S65.
6. Ferguson M, Capra S, Bauer J, Banks M. Development of a valid and reliable malnutrition screening tool for adult acute hospital patients. *Nutrition*. 1999;15(6):458-464.
7. Detsky AS, McLaughlin JR, Baker JP, et al. What is subjective global assessment of nutritional status? *JPEN J Parenter Enteral Nutr*. 1987;11(1):8-13.
8. Buzby GP, Mullen JL, Matthews DC, Hobbs CL, Rosato EF. Prognostic nutritional index in gastrointestinal surgery. *Am J Surg*. 1980;139(1):160-167.
9. van Bokhorst-de van der Schueren MAE, Guaitoli PR, Jansma EP, de Vet HC. Nutrition screening tools: does one size fit all? A systematic review of screening tools for the hospital setting. *Clin Nutr*. 2014;33(1):39-58.
10. Heyland DK, Dhaliwal R, Jiang X, Day AG. Identifying critically ill patients who benefit the most from nutrition therapy: the development and initial validation of a novel risk assessment tool. *Crit Care*. 2011;15(6):R268.
11. Sheean P, Peterson S, Gurka D, Braunschweig C. Nutrition assessment: the reproducibility of subjective global assessment in patients requiring mechanical ventilation. *Eur J Clin Nutr*. 2010;64(11):1358-1364.
12. Higgins TL, McGee WT, Steingrub JS, Rapoport J, Lemeshow S, Teres D. Early indicators of prolonged intensive care unit stay: impact of illness severity, physician staffing, and pre-intensive care unit length of stay. *Crit Care Med*. 2003;31(1):45-51.
13. Norman K, Stobäus N, Gonzalez MC, Schulzke J, Pirlich M. Hand grip strength: outcome predictor and marker of nutritional status. *Clin Nutr*. 2011;30(2):135-142.